LIGO VACUUM EQUIPMENT
FINAL DESIGN REPORT
VOLUME III
FABRICATION

LIGO-C960966-01-V

CONTRACT NO:	**PC 175730**
PSI DOCUMENT NO:	**V049-1-099**
PROGRAM I.D.	**LIGO VACUUM EQUIPMENT**
CDRL NO:	**03**
APPROVAL STATUS:	**A**

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581

CALIFORNIA INSTITUTE OF TECHNOLOGY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
LIGO PROJECT

FINAL DESIGN REPORT

VOLUME III

FABRICATION

CONTRACT NO:	**PC 175730**
PSI DOCUMENT NO:	**V049-1-099 Rev. 1**
PROGRAM I.D.	**LIGO VACUUM EQUIPMENT**
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SUBMITTED TO:

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FINAL DESIGN REPORT
CDRL 03
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REVISION 1
11/16/96

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- 4.2 80K Pump Fabrication Specification V049-2-096
- 4.3 80K Pump Quality Plan V049-2-098
- 4.4 80K Pump Testing / Inspections

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- 7.3 Component Washing Station
- 7.4 Clean Manufacturing Space

| = Indicates Revision To That Section

FDR VOLUME III

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Leak Testing Procedure	V049-2-014	1
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Component Bakeout Procedure	V049-2-019	0
Project Safety Plan	V049-2-023	1
Project Q.A. Plan	V049-2-029	1
Stress Relief Procedure (304 S.S.)	V049-2-046	0
Component Shop Conditioning/Test Plan	V049-2-047	0
Weld Procedures	V049-2-070	0
	V049-2-071	2
	V049-2-072	2
	V049-2-073	0
Weld Data Specifications	V049-2-084	3
Cleanliness Testing Procedure	V049-2-118	0
Contamination Control Plan	V049-2-119	1
Raw Material Handling Procedure	V049-2-120	0
Dimensional Verification Procedure	V049-2-121	0
Viton O-Ring Bakeout Procedure	V049-2-122	0
Component Packaging, Handling and Shipping Procedure	V049-2-123	0
Control of Non-Conformance	V049-2-124	0
Material Control Procedure	V049-2-125	0
Component RGA Test Procedure	V049-2-127	0
Visual Inspection Procedure	V049-2-128	1
Black Light Inspection Procedure	V049-2-130	0
Conflat Flange Assembly Procedure	V049-2-168	0
O-Ring Installation and Flange Assembly Procedure	V049-2-169	0

1.0 FABRICATION PLAN

1.1 General

The Fabrication Plan has been developed to efficiently execute the fabrication of LIGO Vacuum Equipment with minimum risk to project performance goals, project schedule and personnel safety.

The entire fabrication/testing program will be executed under strict quality assurance and safety requirements. Raw materials and finished components will be protected from contamination throughout the fabrication process.

Extensive testing has been conducted during the final design phase to validate manufacturing, ultra high vacuum (UHV) cleaning and testing techniques prior to releasing the main vacuum equipment for fabrication. Additional proactive risk management techniques will continue to be used during the entire fabrication program.

As part of the Final Design Effort, PSI has reviewed the manufacturing options for the vacuum equipment system. PSI has decided to manufacture and process all components from its Westborough, MA facility. Some components (BSC chambers and carbon steel support assemblies) will be mechanically fabricated by outside machine shop/fabrication contractors. Components fabricated by outside vendors will be shipped to PSI for final cleaning, leak checking, bakeout and preparation for shipment.

PSI is currently modifying its Westborough Manufacturing Facility to provide clean manufacturing space for the LIGO project. In addition, 10,000 sq. ft. of clean room/UHV test space has been leased 1/4 mile from the Westborough Manufacturing shop.

PSI is also building an automated UHV cleaning system to perform the final wash of the LIGO components. This automated system will ensure consistent cleaning to the required UHV levels.

As a final step in the fabrication process, LIGO components will be evacuated and wrapped for shipment to the site.

The remainder of this volume details the systems, procedures and resources that will be used to fabricate the LIGO Vacuum Equipment.

1.2 Material Control

Materials and items are inspected against the requirements of the purchase order during receipt inspections. Material identification and traceability are verified at this time.

After inspections, the materials or items are tagged either "Accept" or "Reject". When they are determined to be acceptable, they are transferred to the Material Control Department and maintained under their control until released to Manufacturing. All rejected material is marked and returned to the vendor. It is not stored with the accepted project material.

Where it is necessary to maintain permanent markings or identification on materials or components, they are visibly marked with a mark number either on the item or on an attached nameplate or tag. No marking is allowed on vacuum surfaces.

All components will be assigned a unique mark number and a serial number. See "Material Control Procedure" V049-2-125 for additional details.

1.3 Control Of Special Processes

All manufacturing special processes (welding, heat treating, etc.) are controlled by documented procedures issued through the Document Control Department. Special processes are numbered and called out on manufacturing drawings as applicable.

All required inspections and tests are performed utilizing properly calibrated measuring and test equipment. All calibrated test equipment has calibration stickers indicating when the calibration was done, when the next calibration is due and the initials of the person who performed the calibration. Each piece of equipment has a serial number which also appears on the calibration record for traceability to recognized National Standards.

1.4 Change Control

Controlled documents and drawings are issued to the Manufacturing Department. They are controlled (issued and recalled) by the Material Control Department. The documents and/or drawings issued are recorded on a log sheet maintained by the Material Control Department. When a new revision is issued, it is their responsibility to remove or mark "void" the out-of-date revision and issue the latest revision. All engineering copies of documents and drawings are issued as uncontrolled copies.

It is the responsibility of the Quality Assurance Department to check the issued documents and drawings in the manufacturing area to confirm that the latest revision of each is in use.

All requests for change initiated after the Final Design approval by LIGO will be controlled by PSI procedure SOP-006-001. This involves a formal "Request for Change" document with controlled review and approvals.

All outside fabrication vendors will be issued drawings and other engineering documents via the PSI Document Control Department. All transmittals are logged into the document control department data base which is available to PSI LIGO team members thru the PSI engineering network.

1.5 Project Quality Assurance Program

1.5.1 Q.A. Organization

The PSI Q.A. organization will monitor both in-house fabrication activities and outside fabrication contractors.

The quality assurance organization is headed by the PSI Quality Assurance Manager, who has a staff of Quality Assurance Engineers/Inspectors. The Receiving Inspection Department is made up of full-time inspectors also reporting to the QA Manager. The QA Manager has the authority and is responsible for implementing the quality program. In addition, he provides policy administrative guidance to the QA and Inspection Departments.

A lead Q.A. engineer has been assigned to the project for the life of the project. Other engineers and inspectors will be utilized as required.

1.5.2 Project Q.A. Plan

The LIGO Q.A. plan is detailed in V049-2-029. (See Attachment 12).

1.5.3 Supplier Q.A.

Suppliers of LIGO equipment and materials will be monitored for quality and technical performance by a combination of engineering and quality assurance personnel. For major equipment purchases, vendor kickoff meetings, in progress reviews and witnessed performance testing will be conducted.

1.5.4 Training/Qualification Program

The Q.A. department will ensure that all personnel performing special skill tasks (TIG welding, leak checks, etc.) on the LIGO project have been trained and qualified to perform their assigned duties.

1.6 Safety Program

All members of the LIGO Project Team (and associated contractors) are responsible for executing the project in a manner that minimizes risk to personnel, facilities and equipment.

The Project Safety Plan V049-2-023 (Attachment 13) details the safety organization, objectives of the safety program and plans for project execution.

"Confined Space" entry procedures will be strictly enforced at all times.

1.7 Contamination Control

LIGO components must be cleaned and maintained at UHV cleanliness levels to achieve vacuum equipment performance goals.

Each step in the manufacturing process has been designed to minimize contamination of raw materials, contamination of finished assemblies after cleaning and contamination during shipping. (See "Contamination Control Plan" V049-2-119 for additional details).

1.8 Training/Qualification

As part of the LIGO Project Execution, PSI will conduct personnel training and qualification in various specialty areas. The following is a list of the planned training/qualification activities:

PAW Welding Process

GTAW Welding Process

UHV Manufacturing

Cleanroom Protocol

UHV Cleaning

1.9 Schedule

The following is a summary schedule of the Vacuum Equipment Fabrication Schedule. The schedule has been planned to support the planned installation sequence.

MANUFACTURING SCHEDULE

See Monthly LIGO Vacuum Equipment Status Report For Up To Date Schedule Information.

2.1 BSC Fabrication Plan V049-2-080

Title: **FABRICATION PLAN FOR BEAM SPLITTER CHAMBERS (BSC)**

FABRICATION PLAN

FOR

BEAM SPLITTER CHAMBERS (BSC)

LIGO VACUUM EQUIPMENT

Hanford, Washington
and
Livingston, Louisiana

RAYMOND D. CIATTO STATE OF WASHINGTON REGISTERED PROFESSIONAL ENGINEER

STATE OF LOUISIANA
RAYMOND D. CIATTO
REG. No. 26750
REGISTERED
PROFESSIONAL
ENGINEER
IN
CIVIL ENGINEERING

Raymond D. Ciatto, PE
8/22/96

PREPARED BY: Phillip Faherd

QUALITY ASSURANCE: Alan L Bradbury

MANUFACTURING ENGINEER: Phillip Faherd

TECHNICAL DIRECTOR: D. O. McWilliams

PROJECT MANAGER: Richard Bagley

REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
1	REB 8/21/96	REB 8/23/96	RE-ISSUED FOR FABRICATION DEO # 0298
0	PEF 5/1/96 DMW		ISSUE PER DED 0161 FOR FDR

PROCESS SYSTEMS INTERNATIONAL, INC. | **SPECIFICATION**

INITIAL APPROVALS	PREPARED	DATE	APPROVED	DATE	Number A V049-2-080	Rev.
	PEF	5/1/96	REB	5/2/96		1

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ATTACHMENTS:

1. BSC Fabrication Documents
2. Fabrication Flow Chart
3. Fabrication Priority List

1.0 PURPOSE

The purpose of this procedure is to define design guidelines, specifications, and procedures to enable PSI to specify, purchase, inspect, fabricate, test and ship the BSC chambers per LIGO requirements.

2.0 GENERAL

All Beam Splitter Chambers (BSC) shall be fabricated per this fabrication plan. Each fabrication process shall be controlled via a written procedure. A "first article" approach will be used to validate all fabrication processes prior to release of the full vessel lot.

All vessels will be fabricated in accordance with the Quality Plan. Key points in the fabrication process shall be verified to ensure consistent results.

All vacuum equipment shall be fabricated in accordance with LIGO Project Contract PC175730 dated September 12, 1995, and subsequent change orders.

3.0 RESPONSIBILITY

The Manufacturing Department is responsible for the execution of this procedure, with input and monitoring by the Project Engineer, the Quality Assurance Department, and the Project Manager.

4.0 FABRICATION PLAN

4.1 A first article approach (i.e. BSC prototype) will be used to start the BSC manufacturing cycle to validate the manufacturing procedures and technique prior to the full production release.

4.2 The BSC chambers will be fabricated using an outside manufacturing shop. PSI will perform vessel cleaning, leak checking, bakeout and preparation for shipment.

4.3 All BSC will be fabricated and tested per documents listed in Attachment I "Fabrication Documents".

4.4 The BSC will be fabricated and tested per Attachment 2 BSC Fabrication Flow Chart.

4.5 The BSC Chambers will be fabricated according to the Fabrication Priority List Attachment 3.

4.6 Procurement

PSI will procure all S.S. plate and flange material and supply it with the selected fabrication vendor.

PSI will purchase vessel heads and supply them to the selected fabrication vendor.

4.7 Quality Assurance

The BSC Fabrication Process shall be monitored and control via the Quality Plan.

Outisde fabrication vendors will perform the quality plan inspections for their portion of the work. PSI will witness critical process inspections as detailed in the Quality Plan.

PSI will audit each major fabrication vendor's Q.A. Program after P.O. awards.

PSI and fabrication vendors will inspect all incoming materials to purchase documents.

4.8 Shop Conditioning/Testing

The Beam Splitter Chambers will be shop conditioned (cleaned, bakeout, etc.) per PSI Procedure V049-2-047.

4.9 Preparation For Shipment

The Beam Splitter Chambers will be prepared and shipped per PSI Procedure V049-2-123.

ATTACHMENT 1
BSC FABRICATION DOCUMENTS

1.	Spec. For Beam Splitter Chamber (BSC)	V049-2-117
2.	Spec. For Beam Splitter Chamber Quality Plan	V049-2-048
3.	Bill of Material	V049-4-101, V049-4-003
4.	Flanges	V049-2-040 & V049-2-042
5.	Heads	V049-2-039
6.	Raw Material Handling Procedure	V049-2-120
7.	Rolling/Maching Spec.	V049-2-136
8.	Weld Data Sheet Spec.	V049-2-084
9.	Weld Procedures	V049-2-070, V049-2-071, V049-2-072, V049-2-073
10.	Weld Repair Procedure	V049-2-074
11.	Cleaning Procedures	V049-2-015
12.	Painting Procedures	V049-2-077
13.	Stress Relief Procedures	V049-2-046
14.	Bakeout Procedure	V049-2-019
15.	Leak Test Procedure	V049-2-014
16.	Components Shop Conditioning/Test Plan	V049-2-047
17.	Dimensional Verification Procedure	V049-2-121
18.	Component Packing, Handling, and Shipping Procedure	V049-2-123
19.	PSI Drawings	
	BSC Assembly	V049-4-101
	BSC Weldment/Machining	V049-4-003
	Chamber Supports	V049-4-023
	60" Port Covers	V049-4-014, V049-4-All
	60 1/2" ID Flange (Grooved)	V049-4-019
	104.5" ID Flange (Grooved)	V049-4-022
	1.4.5" I.D. Flange (Flat Faced)	V049-4-041
	Floor Assembly	V049-4-036
	Annulus Tubing/Ion Pump Support	V049-4-025, 077 & 122

ATTACHMENT 2

BSC
FABRICATION PROCESS
SHT. 1 OF 2

LOWER SHELL
REF. DWG. V049-4-003 (4 SHTS)

LEGEND

NUMBERS=PSI MANUFACTURING ACTIVITY
LETTERS=MACHINE SHOP ACTIVITY (VENDOR)

PSI FINALIZES MACHINING DWGS. & ISSUES WITH SPECS. TO MACHINE SHOP

A — CHECK/VERIFY MACH. SHOP NOZZLE LOCATIONS

1 — •PSI FIXTURE-DESIGN/FAB. SHIP FIXTURE TO VENDOR
•PLATE/FORGINGS DROP SHIPPED TO MACHINE SHOP
•HEADS SHIP TO VENDOR

B — SPECIAL HANDLING/LIFTING REQUIREMENTS USED TO PREVENT SS/CS CONTACT (NO CONTAMINATES)

C — STITCH CUT 60"ø PORTS ON FLAT PLATE BEFORE ROLLING INTO SHELL

D — MEASURE PLATE THICKNESS BEFORE ROLLING SHELLS-CIRCUM. TOL.

E — • PREP LONG. SEAM AND ONE END FOR HEAD WELD
•PREBEND SEAM EDGES
•ROLL SHELL
•ROLL 60° NOZZLES WITH PROFILED ENDS

F — • INSTALL 104.5" SHELL FIXTURES

G — •TACK WELD SHELL
•WELD LONGITUDINAL SEAM
•INSPECT WELDS

H — •REROLL FOR ROUNDNESS AS NEEDED
•ADD INTERNAL FIXTURES

I — • WELD ON HEAD
•WELD ON UPPER STIFFENING RING
•INSPECT HEAD WELD

J — •WELD ON SUPPORT LEG REPADS
•ADD TEMP. LIFTING LUGS

K — • STABILIZE WITH INTERNAL BRACES
•CUTOUT 60"ø PORTS

L — ASSEMBLE FIXTURES FOR NOZZLE WELDING

M — • WELD 60° NOZZLE NECKS TO SHELL WITH PLAZMA ARC

N — WELD ON STIFFENING RINGS BETWEEN 60° NOZZLES

O — VERIFY NOZ. ALIGNMENT ±3mm.

P — THERMAL STRESS RELIEF WITH INTERNAL S/S FIXTURES

Q — MACHINE SQUARE & PREP ENDS OF 60"ø NOZZLES, PREP FLANGE END OF SHELL

R — • CUTOUT SMALL PORTS

STEAM CLEAN

S — WELD ALL SMALL NOZZLES

I — ASSEMBLE LOWER SHELL INTO FIXTURE

UPPER SHELL POINT "A" FROM SHT. 2 OF

U — •FIT UPPER AND LOWER FLANGES FOR ALIGNMENT WITH LOWER SHELL
•JOIN UPPER SHELL TO LOWER SHELL

V — • WELD 104" FLANGES TO SHELLS

W — •FIT & WELD 60" FLANGES TO NOZZLES

X — WELD INTERNAL SUPPORT MEMBERS AND LEG REPADS TO LOWER SHELL (PLAZMA ARC)

Y — • INSPECT WELDS DIM/FLATNESS ETC.

Z — STEAM CLEAN & SEAL UNIT SHIP TO PSI

2 — RECEIVE FROM MACH. SHOP

3 — •TEST ALIGNMENT JACK DEVICES

4 — •FIT FLOOR ASS'Y TO VESSEL

5 — • ADD 60° COVERS & TEST BLINDS
• ADD ALL REMAINING CF FLANGES

6 — • INSTALL ANNULUS TUBING, SUPPORTS MANIFOLD & AUX ION PUMP

7 — • CLEAN CHAMBER TO SPEC

LEG ASSEMBLY POINT "B"

8 — •TACK LEG ASSY TO SHELL
•WELD ON BASE PLATES USING HOLE LOCATION TEMPLATE

9 — •CHECK ALIGNMENT OF ALL NOZZLES WITH LASER LEVEL/TRANSIT

10 — •FINAL WELD LEG ASSY.

11 HE LEAK TEST
12 BAKE OUT
13 FINAL VAC TEST
14 TEST ALL EQUIPMENT
15 RECLEAN/PREP FOR SHIP

PRE FAB AUX. ION PUMP SUPPORT & MANIFOLD

OTHER MACHINE ITEMS:

I — •MACHINE 104.5" I.D. FLANGES
1-GROOVED
1-FLAT FACED

II — • MACHINE 60.5" I.D. FLANGES W/ GROOVES 4 REQ'D.
• MACHINE 60" FLGS. ON HEADS F.F. DEVELOP 14° CF NOZZLE NECKS PROFILE 8"&10" CF NOZZLES

III — • MACHINE 60"ø TEST BLINDS-2 REQ'D.
• MACHINE 60" NOZZLE FIXTURE FOR PSI

IV — •ROLL STIFFENING RINGS

V — • CUTOUT SUPPORT REPADS FROM DROPOUTS
• CUTOUT LIFTING LUGS FROM DROPOUTS
• CUTOUT "E" PORT REPADS FROM DROPOUTS

VI — • BASE PLATES-MACHINE HOLES

VII — • PREFAB LEG ASSEMBLY
• BLAST & PAINT

CAD FILE: I:\HV\LIGO\IN\LOWER

SHT 6

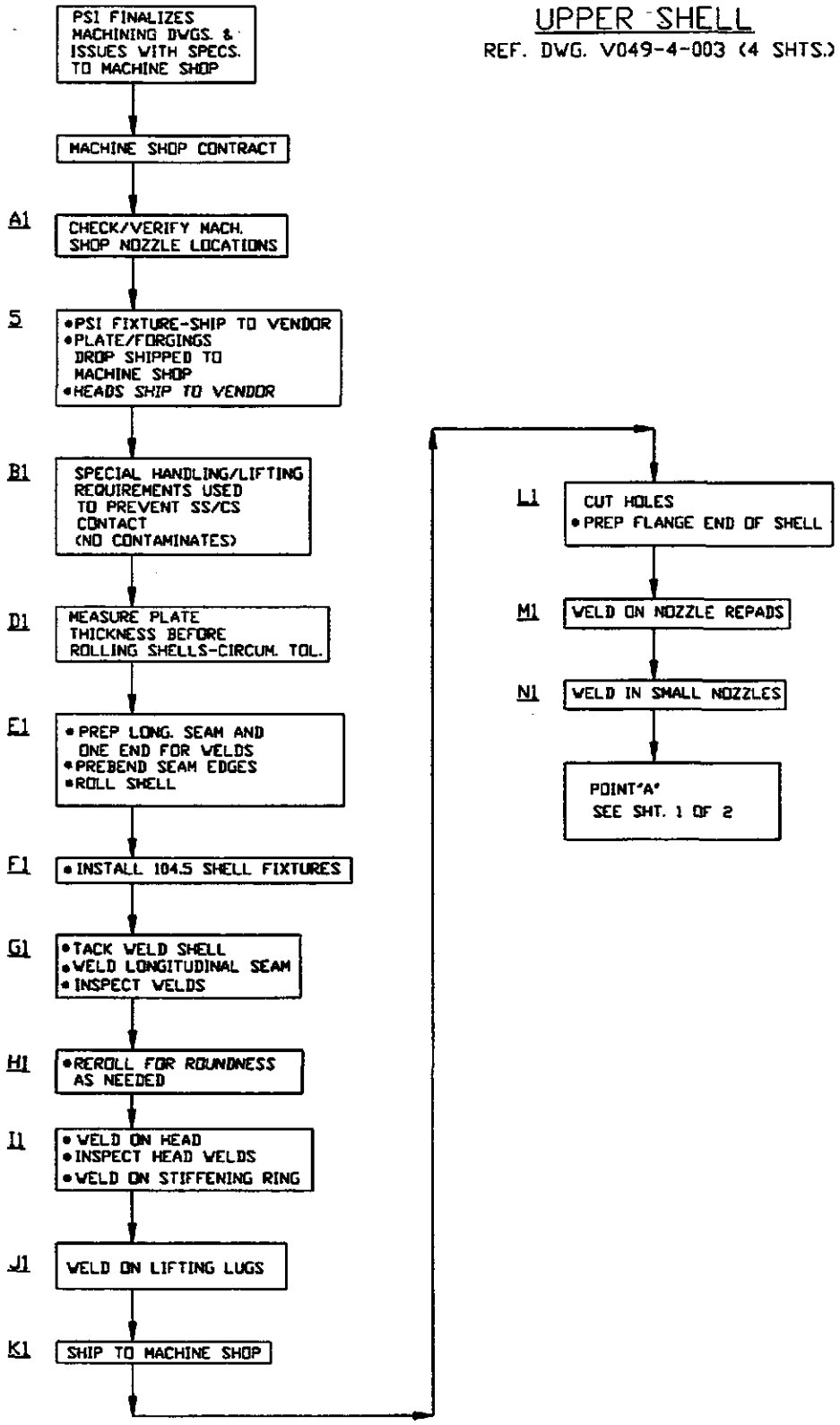
BSC

FABRICATION PROCESS

SHT. 2 OF 2

UPPER SHELL

REF. DWG. V049-4-003 (4 SHTS.)



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ATTACHMENT 3

BSC FABRICATION PRIORITY LIST

Prototype (Spare)

WBSC4	(CS)
WBSC7	(CS)
WBSC8	(CS)
WBSC1	(CS)
WBSC3	(CS)
WBSC2	(CS)
WBSC6	(LMS)
WBSC10	(LES)
WBSC5	(RMS)
WBSC9	(RES)

LBSC1	(CS)
LBSC3	(CS)
LBSC2	(CS)
LBSC5	(LES)
LBSC4	(RES)

2.2 BSC Fabrication Specification V049-2-117

Title: SPECIFICATION FOR BSC FABRICATION

Raymond D. Ciatto, PE
8/22/96

SPECIFICATION FOR

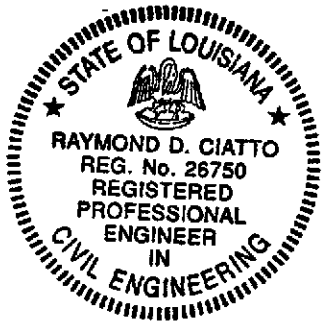
BSC FABRICATION

LIGO VACUUM EQUIPMENT

Hanford, Washington

and

Livingston, Lousiana



PREPARED BY: Phillip Ford

PROJECT ENGINEER: N/A

QUALITY ASSURANCE: Allan L Bradbook

MANUFACTURING ENGR: Phillip Ford

TECHNICAL DIRECTOR: D. O. McWilliams

PROJECT MANAGER: Richard Bagley

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
2	RZE 8/27/96	PFH/REB 8/28/96	REVISED AS NOTED RE-ISSUED FOR FABRICATION DEO# 0249.
1	RZE 8/21/96	RES	RE-ISSUED FOR FABRICATION DEO# 0248
ϕ	PEF 5/2/96	DMW 5-2-96	ISSUED PER DEO 0161 FOR FDR

PROCESS SYSTEMS INTERNATIONAL, INC.					SPECIFICATION	
INITIAL APPROVALS	PREPARED	DATE	APPROVED	DATE	Number A V049-2-117	Rev. 2
	PEF	5/2/96	RES	5/2/96		

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ATTACHMENTS:

1. BSC Fabrication Documents
2. BSC Fabrication Flow Chart
3. CNC Inspection Plan

1.0 SCOPE

1.1 This specification covers the minimum requirements of the manufacturing engineering, materials, fabrication, assembly, inspection, testing preparation for shipping, shipment and delivery of Beam Splitter Chamber (BSC) vacuum vessels for the LIGO vacuum system.

1.2 All attachments are incorporated herein by reference and made a part of this specification.

1.3 The specified equipment is intended for use as part of the Vacuum Equipment supplied for the Laser Interferometer Gravitational-Wave Observatory (LIGO). LIGO, which is operated by Caltech and MIT under an NSF grant, includes two sites (Hanford Reservation near Richmond, WA and Livingston, LA). Each site contains laser interferometers in an L shape with 4 km arms, a vacuum system of the sensitive interferometer components and optical beams, and other support facilities.

1.4 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.

1.5 The Buyer is defined as Process Systems International, Inc. The Vendor/Seller/Fabricator is the successful BSC weldment fabrication bidder.

1 6 It is the specific responsibility of the vendor to invoke all reference specifications as applicable on each subsupplier purchase order.

1.7 The Vendor may not subcontract any part of the work required herein without approval of the Buyer.

1.8 The Buyer will supply all 60 and 104 inch flanges (in raw machined state/final machining by the Buyer), conflat flanges, 304/304L plate, heads, 3/4 inch bolts/nuts, weld wire and one set of prototype fixtures. All other material and labor is to be supplied by the vendor.

1.9 The vendor scope of supply includes all labor for fabrication, machining, assembly, inspection, preparation for shipment, and shipment to PSI per drawing V049-4-003, except for the following:

Support lug holes for item 55 shall be drilled by PSI after receiving the vessel.

1.10 Vendor to install large flanges (60" and 104") as shown on drawing V049-4-101.

2.0 GENERAL REQUIREMENTS

2.1 The design and materials of fabrication shall be as shown on the Buyer's vessel weldment drawings.

2.2 The vessels shall be fabricated in accordance with drawings, standards, and specifications referred to or attached as part of this specification.

2.3 It shall be the responsibility of the Seller to call attention to any apparent conflicts between specifications, the Purchase Order, or Buyer's drawings and request an interpretation from the Buyer. The Seller is not to assume which instruction shall govern. In no case is the Seller to fabricate any component on the basis of Buyer's drawings or calculations if such drawings or calculations are in conflict with applicable code requirements.

2.4 If the Vendor uses PSI's design CAD files to program computer driven equipment, the vendor is responsible for a final check prior to the fabrication process.

2.5 The vessels covered by this specification are to be used in ultra-high vacuum service and require strict cleanliness and contamination prevention throughout the material handling, fabrication and shipping process. All storage and fabrication for this vessel shall be done in the area isolated (plastic room or equal) from other manufacturing areas. The area shall be purged with clean air to prevent contamination from adjacent areas.

2.6 Fixtures (spiders, roundup rings, etc.) shall be used to maintain vessel and nozzle roundness during fabrication (one set supplied by the Buyer from the prototype BSC/all other required fixtures shall be provided by the Buyer).

3.0 CODES AND STANDARDS

3.1 Priority Of Codes And Documents

1. This Specification
2. Fabrication drawings
3. Codes (highest priority - where applicable)

3.2 The following codes and standards shall be applicable to the fabrication of the equipment:

3.2.1 American Society of Mechanical Engineers (ASME)

a. ASME Boiler and Pressure Vessel Code, 1992 Edition Through 1994 Addenda.

Section II	Material Specifications
	Part A, Ferrous
	Part B, Nonferrous
	Part C, Welding Rods, Electrodes and Filler Metals
Section VIII	Pressure Vessels, Division I
Section IX	Welding and Brazing Qualification

3.3 Any apparent conflicts between the requirements given herein and the applicable ASME Specification shall be brought to the attention of PSI for clarification.

4.0 FABRICATION REQUIREMENTS

4.1 General

4.1.1 Mechanical design of the vessels shall be as shown on the Buyer's fabrication drawings. If additional drawing details are required, the vendor shall submit such details for approval prior to fabrication.

4.1.2 Vessels do not require ASME Code stamping or code inspection.

4.1.3 All vessels shall be furnished complete as shown on the Buyer's drawings, as required by the Purchase Order and as herein noted, and shall include all necessary hardware, such as bolts, washers, and nuts for attaching shipping covers. Tolerances shall be adhered to as specified on the detail drawings.

4.1.4 All vessels shall be fabricated (as a minimum) per PSI quality plan V049-2-048. The vendor is responsible for completing all plan requirements. PSI will audit the process at key points in the plan.

4.1.5 All conflat and flange sealing surfaces shall be protected from damage throughout the vendors manufacturing process.

4.2 Rolling Of Shells

4.2.1 Shells shall be rolled per Spec. V049-2-136.

4.3 Cleanliness

4.3.1 No grinding with abrasive wheels, cloth or stones is allowed on the internal vacuum surface unless specified in this specification. Grinding is allowed on weld preps as long as the entire ground area is cleaned up with a rotary carbide tool to remove 100% of the surface area that has been contaminated with grinding binders. This material is intended for use in a high vacuum application. Potential hydrocarbon contamination shall be prevented. Also, the material shall be wrapped and covered at all times the material is not being processed to minimize possible exposure to contaminants. The shells shall be cleaned (per 9.1) prior to shipment.

4.3.2 No iron, carbon steel or other contaminants (such as grease, oil or hydrocarbons) are to come in contact with the vessel interior surfaces during material handling and assembly. Machining fluids shall be water soluble and free of oil and sulfur.

4.3.3 Personnel shall wear as a minimum; cleanroom booties or clean boots when walking on/working in the interior surfaces.

4.3.4 Local areas may be passivated to remove certain types of markings. This can be done only when specifically specified by PSI.

4.4 Welding

4.4.1 All welding shall be performed in accordance with the applicable codes (Para. 3.2.1) and PSI procedures for design and fabrication.

4.4.2 If the Seller wishes to substitute their welding procedures and procedure qualifications, they shall be submitted to the Buyer for approval. Approval must be obtained prior to use.

4.4.3 All weld preparation shall be done by tungstan carbide cutters or per 4.3.1.

4.4.4 Welding Process

1. Critical vacuum boundary and attachment welds shall be made with the Plasma Arc process per PSI weld procedure WPS151 PAW. Critical welds are shown on vessel fabrication drawings. Shielding gas shall be a 75% Argon/25% Helium mixture, backing gas shall be 100% Argon and Plasma gas shall be 100% Argon. Hydrogen gas is not permitted. GTAW welds are acceptable for minor welds per PSI procedure WPS153 GTAW. Minor welds are considered as conflat nozzles and small internal brackets.

2. All weld repairs shall be performed per PSI procedure V049-2-074.

3. All attachments to the vessel shall be by plasma arc or GTAW.

4. All weld wire and weld preparation areas shall be cleaned with CO_2 scrubbing prior to welding per PSI procedure V049-2-070. Weld wire shall be handled only with clean gloves after cleaning and during welding.

4.4.5 All penetrations in the chamber shall be continuously welded on the inside per drawing details. Welds to be smooth but NOT FLUSH & NOT GROUND.

4.4.6 All welds at vacuum boundaries to be vacuum tight with a helium leak rate equivalent to a total of 1×10^{-9} torr liters/sec/chamber. PSI will leak test all vessel welds with a helium mass spectrometer.

4.5 Backing strips or rings shall not be used.

4.6 Longitudinal seams shall be positioned as shown on detail drawings.

4.7 Sharp edges are to be removed from all carbon steel areas where external painting is to be applied (by PSI).

4.8 Post Weld Heat Treatment

Post weld heat treatment shall be performed as stated below per Specification V049-2-046. Furnace shall be adjusted to provide furnace atmospheres of at least 5% excess oxygen.

Only the BSC lower shell requires heat treatment (one time).

5.0 MATERIALS

5.1 All vacuum boundary shell material shall meet the requirement of SA240 for both grades 304 and 304L. Vessel head and flange material shall be type 304L. All materials listed on the PSI bill of material will be provided by the buyer, except for shipping covers.

5.2 Deleted

5.3 The Seller shall issue receiving/inspection reports (vendor format) for all material received direct from PSI suppliers. PSI will inspect and accept all raw material.

6.0 IDENTIFICATION

6.1 Identification of the material shall be maintained through all manufacturing processes. All cutoff parts shall be marked with the heat number of the parent part as indicated below.

6.2 If material identity is lost, the plate shall be requalified by making all tests that were required by the material specification or as indicated in this specification at the sellers expense. CMTRS have been provided to PSI for the above material, traceability of all materials must be maintained.

6.3 Marking the finished materials with marking fluids, and/or electro-etching is not permitted. A vibratory tool with a minimum tip radius of .005" is acceptable for marking the outside only of the finished shell. All other marking methods must be approved by the purchaser prior to use. All parts shall be marked on outside surface only. Marking on interior boundary vacuum boundary surfaces is not allowed. The minimum marking is to be the heat/lot number. Low stress stamping is allowed.

6.4 Vendor to serialize each vessel with the top assembly number and a serial number (i.e. V049101-01). The serial number shall be referenced on all Q.A. documents.

7.0 REQUIRED DOCUMENTATION

Vendor shall furnish documentation in accordance with purchase order requirements. The following is a list of minimum documentation required.

7.1 General Requirements

7.1.1 Upon acceptance of the purchase order, the Vendor shall prepare any shop and working drawings in addition to the contract drawings, which are required by the seller to fabricate this equipment. These drawings shall be submitted to the Buyer for information. All weld seams other than those shown on the drawing, are to be identified and submitted to the Buyer for approval.

7.1.2 Manufacturing data which shall include the following:

1. Details of all weld preparations, welding processes, and welding materials. Welding symbols shall conform to AWS A2.4-79 "Symbols for Welding and Nondestructive Testing."
2. Heat treatment details, including temperature of PWHT and time at temperature, and furnace charts to be supplied, when applicable.
3. General remarks on fabrication, and assembly.
4. No dye penetrant shall be used.
5. Complete identification and materials used, including gaskets.

7.1.3 Vendor drawings which will supplement the general assembly or arrangement drawings shall contain the following information:

a. Full dimensions of all parts and subassemblies and, where applicable, the tolerances and finishing required.

b. Complete identification of materials used.

7.1.4 The Buyer's equipment name and number shall appear prominently in all drawing title blocks.

7.1.5 Two (2) copies shall be submitted to the Buyer for information.

7.2 Vendor Drawing Review

Drawing approval must be obtained from the Buyer before starting fabrication. The Buyer's review of the fabricator's drawings is of a general nature. Review of any drawings and/or calculations by the Buyer does not serve as approval of any errors or as approval of any deviation from these specifications, the Procurement Document, or instructions relating to the work. The fabricator shall call attention to any such deviations by a separate written notice when submitting the drawings for review. Unless specific written approval is obtained from the Buyer, any such deviations are not acceptable. Conformance to the applicable codes and legal requirements is the responsibility of the Seller.

7.3 Changes

If changes are made to any drawings, the fabricator shall furnish new copies to the Buyer showing all changes clearly identified on the drawing.

7.4 Test And Quality Assurance Documentation

The BSC vessel shall be fabricated per the attached quality plan V049-2-048.

Buyer requires two (2) copies of the following documentation for each vessel. This documentation shall be submitted by the Seller for the Buyer's review prior to shipment of the equipment.

1. Mill Test Reports (MTRS) for all vacuum boundary shell material purchased by the seller and certificates of compliance (C of Cs) for small stock pressure items purchased by the Seller.
2. Nondestructive test reports on all applicable NDE. (If optional x-ray is requested by the Buyer.)
3. Dimensional check report on a CNC machine verifying vessel dimensions are within tolerance per Attachemnt 3, "CNC Inspection Plan".
4. Signed off quality plan.

8.0 SHOP TESTING

8.1 The Vendor shall submit, for approval by the Buyer, a detailed procedure for shop weld inspection.

8.2 Leak testing shall be accomplished after shipment by PSI.

9.0 CLEANING AND PAINTING

9.1 Cleaning before shipment to PSI shall be per vendor's detergent steam cleaning procedure and Oakite "Impro Clean".

9.2 Final cleaning prior to testing at PSI shall be per specification V049-2-015 (by PSI).

9.3 Only carbon steel members are to be painted per specification V049-2-077 (by PSI).

10.0 STORING AND SHIPPING

10.1 All bolted connections shall be made up before final shipment to PSI, with gaskets.

10.2 The 104" flanges shall be bolted together with 1/8" thick, 1100 series aluminum. This aluminum must be clean and smooth, and cover the entire flange surface (supplied by the Vendor). This will take the place of o-rings.

10.3 Shipping covers shall be used on all double o-ring grooved flanged connections. Covers shall be suitable for protecting the connections from mechanical damage and preventing the entry of dirt into the equipment. Covers shall be a minimum 1/8" thick aluminum sheet (supplied by the Vendor). Covers to be clean and smooth and attached to the flanges with stainless hardware thru 25% of the flange bolt holes. Conflats will have plastic covers (supplied by the Vendor).

10.4 The vessels shall be wrapped in waterproof polyethylene and covered with a tarp immediately after cleaning operations have been completed to minimize contamination.

10.5 Finished flange surfaces must be covered with rolust plastic covers and protected during all fabrication steps and during shipment to PSI.

10.6 All shipping shall be on air ride trucks per Spec. V049-2-123.

10.7 Any fixture, lugs, etc. required for fabrication shall be removed prior to shipping.

11.0 INSPECTION AND QUALITY REQUIREMENTS

11.1 The Seller shall have in effect in their shops at all times, an inspection, testing and documentation program that will ensure that the equipment furnished under the specification will meet in all respects the requirements of the specification. The responsibility for inspection rests with the Seller. However, the Buyer reserves the right to inspect equipment at any time during fabrication to assure that the materials and workmanship are in accordance with this specification. The Buyer's inspector will need to personally witness that certain critical dimensions are within the specified tolerances while the fabricated parts are set-up and indexed in the vendor's computer controlled equipment.

11.2 The Seller shall notify PSI on the day of arrival of materials. PSI will inspect all heads for minimum thickness and contamination.

11.3 The Vendor shall notify the Buyer 24 hours prior to each Q.A. plan notification point.

11.4. PSI will inspect and accept all raw material (at PSI and the Vendor).

12.0 NON-ESCORT PRIVILEGES AND INSPECTION RIGHT

Non-escort privileges for Buyer, Owner, Government and Owner representatives to all areas of the facilities where the work is being performed shall be arranged. This will include access to all areas where material is being processed and stored.

The Seller shall cooperate with the Buyer's shop inspectors in establishing when the various inspections or tests will be performed during manufacture, testing, cleaning, and preparation for shipment. The Quality Plan designates which operations require to witness or verification The Seller will furnish an agreed upon amount of notification prior to the start of each. The shop inspector will warn the Seller at any time that he notices anything that may lead to rejection of the equipment or material when it is presented later for inspection and acceptance.

It is not intended that the Buyer's shop inspection shall relieve the Seller in any way whatsoever of his obligation to maintain an adequate test inspection and documentation program of his own, or of any other obligation under the specification. Furthermore, the fact that Buyer's shop inspector may inadvertently overlook a deviation from some requirement of this specification shall not constitute a waiver of that requirement or of the Seller's obligation to correct the condition when it is discovered, or any other obligation under the specification.

ATTACHMENT 1
BSC FABRICATION DOCUMENTS

			Application	
			Vendor	PSI
1.	Spec. For Beam Splitter Chamber Quality Plan	V049-2-048	X	X
2.	Bill of Material	V049-4-101 & V049-4-003	X	X
3.	Flanges	V049-2-040 & V049-2-134	X	X
4.	Heads	V049-2-039	X	X
5.	Raw Material Handling Procedure	V049-2-120	X	X
6.	Weld Data Sheet Spec.	V049-2-084	X	X
7.	Rolling/Machining Spec.	V049-2-136	X	X
8.	Weld Procedures	V049-2-070, V049-2-071, V049-2-072, V049-2-073	X	X
9.	Weld Repair Procedure	V049-2-074	X	X
10.	Cleaning Procedures	V049-2-015	X	X
11.	Painting Procedures	V049-2-077		X
12.	Stress Relief Procedures	V049-2-046	X	
13.	Bakeout Procedure	V049-2-019		X
14.	Leak Test Procedure	V049-2-014		X
15.	Components Shop Conditioning/Test Plan	V049-2-047		X
16.	Dimensional Verification Procedure	V049-2-121	X	X
17.	Component Packing, Handling, and Shipping Procedure	V049-2-123	X	X
18.	PSI Drawings			
	BSC Assembly	V049-4-101	X	X
	BSC Shell Weldment/Machining	V049-4-003	X	X
	Chamber Supports	V049-4-023		X
	60" Port Covers	V049-4-014, V049-4-All		X
	60 1/2" ID Flange (Grooved)	V049-4-019	X	X
	104.5" ID Flange (Grooved)	V049-4-022	X	X
	104.5 I.D. Flange (Flat Faced)	V049-4-041	X	X
	Floor Assembly	V049-4-036		X
	Annulus Tubing/Ion Pump Support	V049-4-025, 077, 122		X

LEGEND

NUMBERS=PSI MANUFACTURING ACTIVITY
LETTERS=MACHINE SHOP ACTIVITY (VENDOR)

ATTACHMENT 2.

SPEC. V049-2-117

TYPICAL BSC FABRICATION PROCESS

SHT. 1 OF 2

LOWER SHELL

REF. DWG. V049-4-003 (4 SHTS)

PSI FINALIZES MACHINING DWGS. & ISSUES WITH SPECS. TO MACHINE SHOP

A — CHECK/VERIFY MACH. SHOP NOZZLE LOCATIONS

1 — •PSI FIXTURE-DESIGN/FAB. SHIP FIXTURE TO VENDOR
•PLATE/FORGINGS DROP SHIPPED TO MACHINE SHOP
•HEADS SHIP TO VENDOR

B — SPECIAL HANDLING/LIFTING REQUIREMENTS USED TO PREVENT SS/CS CONTACT (NO CONTAMINATES)

C — STITCH CUT 60°ø PORTS ON FLAT PLATE BEFORE ROLLING INTO SHELL

D — MEASURE PLATE THICKNESS BEFORE ROLLING SHELLS-CIRCUM. TOL.

E — • PREP LONG. SEAM AND ONE END FOR HEAD WELD
•PREBEND SEAM EDGES
•ROLL SHELL
•ROLL 60° NOZZLES WITH PROFILED ENDS

F — • INSTALL 104.5" SHELL FIXTURES

G — •TACK WELD SHELL
•WELD LONGITUDINAL SEAM
•INSPECT WELDS

H — •REROLL FOR ROUNDNESS AS NEEDED
•ADD INTERNAL FIXTURES

1 — • WELD ON HEAD
• WELD ON UPPER STIFFENING RING
•INSPECT HEAD WELD

J — •WELD ON SUPPORT LEG REPADS
•ADD TEMP. LIFTING LUGS

K — • STABILIZE WITH INTERNAL BRACES
•CUTOUT 60°ø PORTS

L — ASSEMBLE FIXTURES FOR NOZZLE WELDING

M — • WELD 60° NOZZLE NECKS TO SHELL WITH PLAZMA ARC

N — WELD ON STIFFENING RINGS BETWEEN 60° NOZZLES

O — VERIFY NOZ. ALIGNMENT ±3mm.

P — THERMAL STRESS RELIEF WITH INTERNAL S/S FIXTURES

Q — MACHINE SQUARE & PREP ENDS OF 60°ø NOZZLES. PREP FLANGE END OF SHELL

R — • CUTOUT SMALL PORTS

STEAM CLEAN

S — WELD ALL SMALL NOZZLES

I — ASSEMBLE LOWER SHELL INTO FIXTURE

UPPER SHELL POINT "A" FROM SHT. 2 OF 2

U — •FIT UPPER AND LOWER FLANGES FOR ALIGNMENT WITH LOWER SHELL
•JOIN UPPER SHELL TO LOWER SHELL WITH ALUMINUM MAT'L. 1100 GASKET SEGMENTS

V — • WELD 104" FLANGES TO SHELLS

W — •FIT & WELD 60° FLANGES TO NOZZLES

X — WELD INTERNAL SUPPORT MEMBERS AND LEG REPADS TO LOWER SHELL (PLAZMA ARC)

Y — • INSPECT WELDS DIM/FLATNESS ETC.

Z — STEAM CLEAN & SEAL UNIT SHIP TO PSI

2 — RECEIVE FROM MACH. SHOP

3 — •TEST ALIGNMENT JACK DEVICES

4 — •FIT FLOOR ASS'Y TO VESSEL

5 — • INSTALL ANNULUS TUBING, SUPPORTS MANIFOLD & AUX ION PUMP

6 — • CLEAN CHAMBER TO SPEC

7 — • ADD 60° COVERS & TEST BLINDS
• ADD ALL REMAINING CF FLANGES

8 — •TACK LEG ASSY TO SHELL

9 — •CHECK ALIGNMENT OF ALL NOZZLES WITH LASER LEVEL/TRANSIT

10 — •FINAL WELD LEG ASSY.

11 HE LEAK TEST
12 BAKE OUT
13 FINAL VAC TEST
14 TEST ALL EQUIPMENT
15 RECLEAN/PREP FOR SHIP

OTHER MACHINE ITEMS:

AA — •MACHINE 104.5" I.D. FLANGES
1-GROOVED
1-FLAT FACED

BB — • MACHINE 60.5" I.D. FLANGES W/ GROOVES 4 REQ'D.
• MACHINE 60° FLGS. ON HEADS F.F. DEVELOP 14" CF NOZZLE NECKS PROFILE 8"&10" CF NOZZLES

CC — • ROLL STIFFENING RINGS

DD — • CUTOUT SUPPORT REPADS FROM DROPOUTS
• CUTOUT LIFTING LUGS FROM DROPOUTS
• CUTOUT "E" PORT REPADS FROM DROPOUTS

I — • BASE PLATES-MACHINE HOLES

II — • PREFAB LEG ASSEMBLY
• USE TEMPLATE TO LOCATE HOLES
• BLAST & PAINT

III — PRE FAB AUX. ION PUMP SUPPORT & MANIFOLD

NOTE: THIS DIAGRAM IS FOR INFORMATION ONLY, SEE SPECIFICATION FOR ALL REQUIREMENTS.

AUG. 26, 1996 REV. 2

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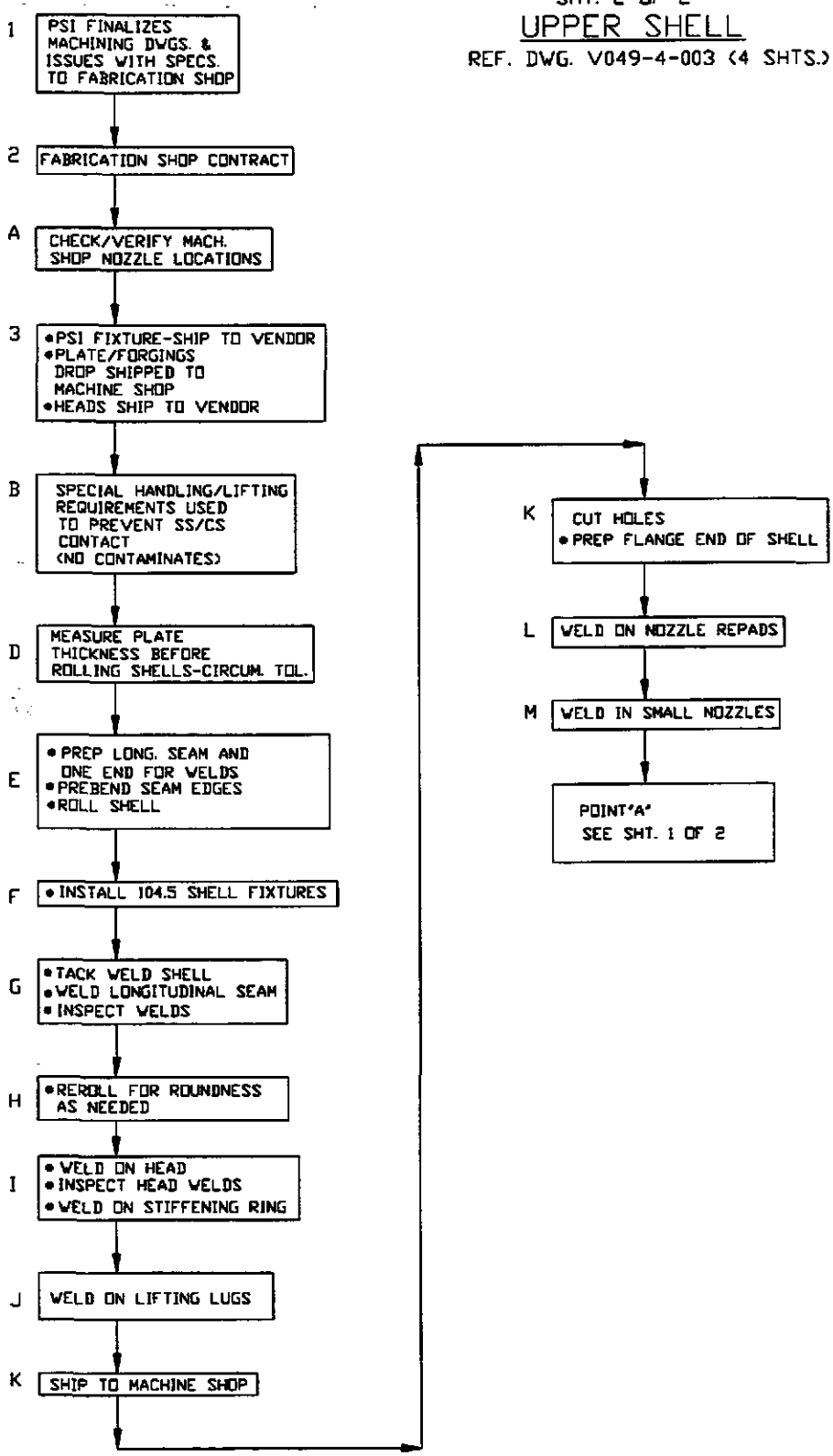
pg. 13 of 16

TYPICAL BSC
FABRICATION PROCESS
SHT. 2 OF 2
UPPER SHELL
REF. DWG. V049-4-003 (4 SHTS.)



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AUG. 26, 1996 REV. 2

ATTACHMENT 3

Dimensional Inspection

Drawing #V049-4-101

Section "A-A"

* 97" Dim on "D" nozzle
  * Flatness .015
  * Perpendicular to "A" .075"
  * Perpendicular to "C" .075"
  * Parallel to "B" .075"
* 48.437" dim on "D" nozzle

Section "A-A"

* 66" dim on "D" nozzles 4 places
  * Parallel to "A" .075
  * Perpendicular to "B" .075"
  * Parallel to "C" .075"
* 33" dim.

Elevation View

* Flatness of "A" .015"
* 44.50" dim of "D" nozzles to "B & C" nozzles ± .075"

On "B" nozzles
* 66 1/4" B.C.
* Parallel to "A" .030"
* Annulus point is rotated 48^0 to the left.

On "C" nozzles
* 66 1/4" B.C.
* Parallel to "A" .030"
* Annulus port is rotated 48^0 to the right

Plan View

113 3/4" dim for "B" nozzle

* Flatness .015"

* Parallel to "B" .030"

* Perpendicular to "A" .030"

* Perpendicular to "C" .030"

* 56 7/8" dim.

113 3/4" dim for "C" nozzles

* Flatness .015"

* Parallel to "C" .030"

* Perpendicular to "B" .030"

* Perpendicular to "A" .030"

* 56 7/8" dim.

* Annulus port is 45^0 off C nozzles with correct rotation.

* Overall check that welds are not ground flush but no more than 1/16" crown.

Drawing V049-4-003

Plan View Seciton "B-B"

*Verify leg repads and lugs are 45^0 from 60" nozzles 90^0 apart and at the correct height.

2.3 BSC Quality Plan V049-2-048

QUALITY PLAN

FOR

LIGO

BEAM SPLITTER CHAMBER (BSC)

REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
3	ARB 9/25/96	REB 9/27/96	REVISED PER DEO 272
2	ARB 8/23/96	REB 8/27/96	REVISED PER DEO 251
1	ARB 4/25/96	REB 4/25/96	REVISED PER DEO 0140
0	ARB 3/1/96	REB 3/14/96	RELEASED PER DEO 0091

Number

Rev

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED ARB	DATE 2/24/96	APPROVED REB	DATE 3/12/96	Number: A V049-2-048	Rev 3

APPLICABLE DRAWINGS

V049-4-001	Beam Splitter Chamber Assembly
V049-4-019	60-1/2" I.D. Flange Details
V049-4-022	104-1/2" I.D. Flange Details

APPLICABLE PROCEDURES

V049-2-071	Welding Plasma-Arc	P8-P8
V049-2-072	Welding GTAW	P8-P8
V049-2-046	Thermal Stress Relief	
V049-2-015	Cleaning	
V049-2-019	Bake-out	
V049-2-044	Vacuum Chamber Fabrication	
V049-2-047	Final Vacuum Test	
V049-2-014	Helium Leak Test	

(RANOR) SPECIFICATION V049-2-048 REV. 3

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO — JOB NO. V59049-
ITEM BEAM SPLITTER CHAMBER (BSC) DWG NO. V049-4-001
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 9
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RATIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW

QUALITY PLAN REVIEWED QA ARS AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	VENDOR INSPECTION SIGN/DATE	PSI INSPECTION SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
-LOWER ASSEMBLY-							VENDOR SURVEY PERFORMED 4/11/96
VERIFY SHELL FIXTURES	V-D			X			
G INSPECT FIT-UP LOWER ASSEMBLY LONG SEAM	V-D	V049-4-001		X			
G INSPECT WELDING LONG SEAM	V-D	V049-4-001		X	X		
H VERIFY ROUNDNESS OF SHELL	V-D	V049-4-001		X			
I INSPECT FIT-UP LOWER ASSEMBLY HEAD TO SHELL JOINT	V-D	V049-4-001		X	X		
I INSPECT WELDING ON STIFFENING RING AND	V-D	V049-4-001		X			
J SUPPORT LEG PADS AND LUGS	V-D	V049-4-001		X X			

SPECIFICATION V049-2-048 REV. 3

	QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	VENDOR INSPECTION SIGN/DATE	PSI INSPECTION SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
	-LOWER ASS'Y CONT-							
								3
L	INSPECT	V-D	V049-4-001		X			REF. V049-4-019
	CUTOUT 60" PORTS							
	60" NOZZLE NECKS				X			
	4-60" FLGS. (MACH)		V049-4-019		X			
N	INSPECT WELDING OF 60" NOZZLE NECKS TO SHELL	V-D	V049-4-001		X			
O	INSPECT WELDING OF STIFFENING RINGS	V-D	V049-4-001		X			
N								
P	VERIFY NOZZLE ALIGNMENT	D	V049-4-001		X	X		
Q	VERIFY CUTOUTS OF NON-CRITICAL NOZZLE PORTS.	D	V049-4-001		X			
R	INSPECT WELDING ON NON-CRITICAL PORTS	V-D	V049-4-001		X			

SPECIFICATION V049-2-048 REV. 3

	QUALITY PLAN REVIEWED QA CRB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	VENDOR INSPECTION SIGN/DATE	PSI INSPECTION SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
	-LOWER ASS'Y CONT.							
S	THERMAL STRESS RELIEF		V049-2-046		X	X		PSI TO VERIFY HEAT CHARTS AND OVEN CALIBRATION CERT.
T	INSPECT 60" NOZ. (MACH)	D	V049-4-001		X	X		
	SHELL FLG. (MACH)				X	X		
U	NOZ "D" CUTOUTS				X	X		

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SPECIFICATION V049-2-048 **REV.** 3

	QUALITY PLAN REVIEWED QA ARS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	VENDOR INSPECTION SIGN/DATE	PSI INSPECTION SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
	-UPPER ASSEMBLY-							
	VERIFY SHELL FIXTURES	D			X			
G1	INSPECT FITUP UPPER ASSEMBLY LONG SEAM	V-D	V049-4-001		X			
G1	INSPECT WELDING LONG SEAM	V-D	V049-4-001		X	X		
H1	VERIFY ROUNDNESS OF SHELL	D			X	X		
I1	INSPECT FITUP UPPER ASSEMBLY HEAD TO SHELL JOINT	V-D	V049-4-001		X	X		
I1	INSPECT WELDING ON STIFFENING RING AND	V-D	V049-4-001		X			
J1	LIFTING LUGS				X			
L1								

SPECIFICATION V049-2-048 REV. 3

	QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	VENDOR INSPECTION SIGN/DATE	PSI INSPECTION SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
	-UPPER ASSEMBLY- (CONT.)							
M1	INSPECT MACHINING NOZZLE CUTOUTS FLANGE END OF SHELL	D	V049-4-001		X	X		
	INSPECT WELDING OF NOZZLE	V-D	V049-4-001		X			
N1	REPADS AND							
O1	NOZZLE WELDS				X			
P1	FLANGES TO NOZZLES				X			

SPECIFICATION V049-2-048 **REV.** 3

	QUALITY PLAN REVIEWED QA CAB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	VENDOR INSPECTION SIGN/DATE	PSI INSPECTION SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
	-UPPER/LOWER- ASSEMBLY							
W	VERIFY SHELL FLANGE ALIGNMENT BETWEEN UPPER AND LOWER SHELL SECTIONS	D	V049-4-001		X	X		
X	INSPECT WELDING OF 104" FLANGE TO SHELL	V-D	V049-4-001		X			
Y	60" FLANGE TO NOZZLE				X			
AA	REMAINING FLANGES				X			
BB	NOZZLE "D". INSPECT MACHINING		V049-4-019		X	X		V049-4-022
Z	VERIFY WELDING ON LEG ASSEMBLY	V-D	V049-4-001			X		
EE	VERIFY ALIGNMENT OF ALL NOZZLES WITH LASER LEVEL / TRANSIT.	V-D	V049-4-001		X	X		FINAL INSPECTION AT RAWOR. VERIFICATION OF ALL VESSEL DIMENSIONS AND TOLERANCES PER DRAWING.
290	VERIFY TEST ON ALIGNMENT JACK DEVICES					X		

SPECIFICATION V049-2-048 REV. 3

	QUALITY PLAN REVIEWED QA ARS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	VENDOR INSPECTION SIGN/DATE	PSI INSPECTION SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
	-UPPER / LOWER - ASSEMBLY (CONT.)							
300	VERIFY FLOOR ASSEMBLY IN VESSEL	D	V049-4-001			X		
330	VERIFY FINAL CLEANING AT PSI	V	V049-2-015			X		
350	VERIFY BAKE OUT AT PSI	W	V049-2-019			X		
360	VERIFY FINAL VACUUM TEST AT PSI	W	V049-2-047			X		
380	VERIFY FINAL TESTING ON ALL EQUIPT. AT PSI	W				X		
390	VERIFY CLEANLINESS AND PREP FOR SHIPMENT	V				X		

2.4 BSC Testing/Inspections

Each BSC will be inspected at the Mechanical Fabrication contractor prior to release for shipment to PSI (see "Dimensional fabrication procedure V049-2-121 for additional details).

After shipment to PSI, the BSC will be leak checked, cleaned, baked out and prepared for shipment. (See "Component Shop Conditioning/Test Procedure" V049-2-047 and "Component Packaging, Handling and Preparation For Shipment" V049-2-123 for additional details).

3.1 HAM Fabrication Plan V049-2-081

Title: FABRICATION PLAN FOR HORIZONTAL ACCESS MODULES (HAM)

FABRICATION PLAN

FOR

HORIZONTAL ACCESS MODULES (HAM)

LIGO VACUUM EQUIPMENT

Hanford, Washington
and
Livingston, Louisiana

PREPARED BY:	Phillip Frland
QUALITY ASSURANCE:	Alan R Bradbury
MANUFACTURING ENGINEER:	Phillip Frland
TECHNICAL DIRECTOR:	D.C. McWilliams
PROJECT MANAGER:	Richard Bayly

REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
1	GS 10/10/96		Release for Fab Per DEO #0302
1	REB 8/21/96	REB 9/26/96	REISSUED FOR FABRICATION DEO #0250
0	PF 5/1/96	REB 5/2/96	ISSUED PER DEO 0161 FOR FDR

PROCESS SYSTEMS INTERNATIONAL, INC. — **SPECIFICATION**

INITIAL APPROVALS	PREPARED	DATE	APPROVED	DATE	Number	Rev.
	PEF	5/1/96	REB	5/2/96	A V049-2-081	1

TABLE OF CONTENTS

ATTACHMENTS:

1. HAM Fabrication Documents
2. Fabrication Flow Chart
3. Fabrication Priority List

1.0 PURPOSE

The purpose of this procedure is to define design guidelines, specifications, and procedures to enable PSI to specify, purchase, inspect, fabricate, test and ship the HAM per LIGO requirements.

2.0 GENERAL

All Horizontal Access Modules (HAM) shall be fabricated per this fabrication plan. Each fabrication process shall be controlled via a written procedure. A "first article" approach will be used to validate all fabrication processes prior to release of the full vessel lot.

All vessels will be fabricated in accordance with the Quality Plan. Key points in the fabrication process shall be verified to ensure consistent results.

All vacuum equipment shall be fabricated in accordance with LIGO Project Contract PC175730 dated September 12, 1995, and subsequent change orders.

3.0 RESPONSIBILITY

The Manufacturing Department is responsible for the execution of this procedure, with input and monitoring by the Project Engineer, the Quality Assurance Department, and the Project Manager.

4.0 FABRICATION PLAN

4.1 A first article approach will be used to start the HAM manufacturing cycle to validate the manufacturing procedures and technique prior to the full production release.

4.2 The HAM chambers will be fabricated at PSI's manufacturing shop. PSI will perform vessel cleaning, leak checking, bakeout and preparation for shipment.

4.3 The HAM will be fabricated and tested per documents listed in Attachment I "Fabrication Documents".

4.4 The HAM will be fabricated and tested per Attachment 2 HAM Fabrication Flow Chart.

4.5 The HAM vessels will be fabricted according to the Fabrication Priority List, Attachment 3.

4.6 Procurement

PSI will procure all S.S. plate and flange material and supply it with the selected fabrication vendor, for rolling and machining.

PSI will purchase vessel heads.

4.7 Quality Assurance

The HAM Fabrication Process shall be monitored and control via the Quality Plan.

PSI manufacturing will follow the quality plan inspection points for the entire fabrication work.

PSI will inspect all incoming materials to purchase documents.

4.8 Shop Conditioning/Testing

The HAM Vessels will be shop conditioned (cleaned, bakeout, etc.) per PSI Procedure V049-2-047.

4.9 Preparation For Shipment

The HAM Vessels will be prepared and shipped per PSI Procedure V049-2-123.

ATTACHMENT 1
HAM FABRICATION DOCUMENTS

1.	Spec. For HAM Fabrication	V049-2-078
2.	HAM Quality Plan	V049-2-087
3.	Bill of Material (Parent)	V049-4-009 & 013
4.	Flanges	V049-2-040 & V049-2-042
5.	Heads	V049-2-039
6.	Raw Material Handling Procedure	V049-2-120
7.	Rolling/Machining Spec.	V049-2-136
8.	Weld Data Sheet Spec.	V049-2-084
9.	Weld Procedures	V049-2-070, V049-2-071, V049-2-072, V049-2-073
10.	Weld Repair Procedure	V049-2-074
11.	Cleaning Procedures	V049-2-015
12.	Painting Procedures	V049-2-077
13.	Stress Relief Procedures	V049-2-046
14.	Bakeout Procedure	V049-2-019
15.	Leak Test Procedure	V049-2-014
16.	Components Shop Conditioning/Testing Plan	V049-2-047
17.	Dimensional Verification Procedure	V049-2-121
18.	Component Packaging, Handling, and Shipping Procedure	V049-2-123
19.	PSI Drawings - (See Next Page)	

ATTACHMENT 1, Continued
HAM FABRICATION DOCUMENTS

19. PSI Drawings

HAM Test/Shipping Assy. (with A4 Cover)	V049-4-009
HAM Test/Shipping Assy.	V049-4-013
HAM Assembly	V049-4-002
HAM Flange/Annulus Assy.	V049-4-054
HAM Chamber Support Saddle	V049-4-052
HAM Weldment	V049-4-128
60" Expansion Joint	V049-4-053
Bellows Tie Rod Assembly	V049-4-040
84 1/4" ID Flange (Grooved)	V049-4-021
60 1/2" ID Flange (FF)	V049-4-032
60 1/2" ID Flange (Grooved)	V049-4-031
60" End Cover (2 Sheets)	V049-4-A4
84 1/2" I.D. Access Cover	V049-4-127
HAM 75 Ion Pump Support	V049-4-123

ATTACHMENT 3

HAM FABRICATION PRIORITY LIST

WHAM1	(CS)
WHAM22	(CS)
WHAM11	(CS)
WHAM10	(CS)
WHAM7	(CS)
WHAM8	(CS)
WHAM9	(CS)
WHAM2	(CS)
WHAM3	
WHAM6	(CS)
WHAM5	(CS)
WHAM4	(CS)
WHAM13	(Spare)

LHAM1	(CS)
LHAM2	(CS)
LHAM3	(CS)
LHAM6	(CS)
LHAM5	(CS)
LHAM4	(CS)

HAM FABRICATION PROCESS DIAGRAM

ATTACHMENT 2
SHT. 1 OF 1

LEGEND

NUMBERS=PSI MANUFACTURING ACTIVITY
LETTERS=MACHINE SHOP ACTIVITY (VENDOR)

A PSI FINALIZES MACHINING DWGS. & ISSUES WITH SPECS. TO MACHINE SHOP

B CHECK/VERIFY MACH. SHOP NOZZLE LOCATIONS

C
- PSI FIXTURE-DESIGN/FAB. SHIP FIXTURE TO VENDOR
- PLATE/FORGINGS DROP SHIPPED TO MACHINE SHOP
- HEADS SHIP TO VENDOR

D SPECIAL HANDLING/LIFTING REQUIREMENTS USED TO PREVENT SS/CS CONTACT (NO CONTAMINATES)

E MEASURE PLATE THICKNESS BEFORE ROLLING SHELLS-CIRCUM. TOL.

F
- PREP LONG. SEAM AND ENDS FOR FLANGE WELD
- PREBEND SEAM EDGES
- ROLL SHELL-84.25" I.D.
- ROLL 60.5" I.D. NOZZLES WITH PROFILED ENDS

1 INSTALL 84.25" SHELL FIXTURES

2
- TACK WELD SHELL
- WELD LONGITUDINAL SEAM
- INSPECT WELDS

3
- REROLL FOR ROUNDNESS ?
- ADD INTERNAL FIXTURES

G
- STABILIZE 84.25 I.D. SHELL WITH INTERNAL BRACES AND MACHINE 84" END
- CUTOUT 60"ø PORTS

4 ASSEMBLE FIXTURES FOR NOZZLE WELDING

5 WELD 60" NOZZLE NECKS TO SHELL WITH PLAZMA ARC

6 WELD ON STIFFENING RINGS/ LIFTING LUGS BETWEEN 60" NOZZLES

7
- WELD ON SUPPORT LEG REPADS
- ADD TEMP. LIFTING LUGS/SUPPORTS

8 VERIFY NOZ. ALIGNMENT 60.5 I.D.

9
- CUTOUT NON CRITICAL PORTS AT P.S.I.

H THERMAL STRESS RELIEF WITH INTERNAL S/S FIXTURES

I MACHINE SQUARE & PREP ENDS OF 60"ø NOZZLES, PREP FLANGE END 84" OF SHELL

10 CUTOUT 4 CRITICAL "E" NOZZLES

11
- WELD 60.5" I.D. HEADS TO FLANGES
- WELD 84.25" I.D. HEADS TO FLANGES

12
- FIT 84.25" ID END FLANGES FOR ALIGNMENT

13
- WELD 84.25" FLANGES TO SHELLS

14
- FIT & WELD 60" FLANGES TO NOZZLES

15
- FIT & WELD EXPAN. JOINT SPOOL AND TIE ROD LUGS TO 60" NOZZLE & FLANGE

16 WELD INTERNAL SUPPORT MEMBERS TO SHELL (PLAZMA ARC)

17 WELD ALL SMALL NOZZLES

18
- FIT & WELD "E" NOZZLES & FLANGES WITH FIXTURE

19
- INSPECT WELDS DIM/FLATNESS ETC.

20
- CHECK ALIGNMENT OF ALL NOZZLES WITH HIGH TOL. EQUIPMENT

21 STEAM CLEAN & INSTALL TEMP NOZZLE COVERS

23 INSTALL ANNULUS TUBING

24
- CLEAN ALL CHAMBER FLANGE SEAL SURFACES
- CLEAN AND PROTECT ALL DOOR COVERS

25 FINAL CLEANING

26
- ADD 60" & 84" COVERS WITH TEST O-RINGS
- INSTALL C.F. FLANGES
- INSTALL 6" G.V FOR TURBO PUMP

27 MOVE INTO CLEAN ROOM

28
- FINAL ASSEMBLY
- INSTALL TEST/SHIPPING COVERS

29 WELD ON SUPPORT SADDLES

30 HE LEAK CHECK

31 BAKE OUT UNDER VACUUM

32 FINAL VACUUM TEST

33 PREP. FOR SHIPMENT UNDER VACUUM

OTHER MACHINE ITEMS:

I
- MACHINE 84.25" I.D. FLANGES
  2-GROOVED V049-4-021
  2-FLAT FACED V049-4-127

II
  1-GROOVED V049-4-031
  1-FLAT FACED V049-4-032

III
- PREFAB (2) VESSEL SUPPORT SADDLES DWG V049-4-052
- BLAST & PAINT

CAD FILE: I:\HVAC\LIGO\HAM\HAM

AUG. 30, 1996 REV. 1

3.2 HAM Fabrication Specification V049-2-078

Title: SPECIFICATION FOR HAM CHAMBER FABRICATION

EXP. 8/5/97

SPECIFICATION FOR

HAM CHAMBER FABRICATION

PREPARED BY:	R. E. Curtis
STRUCTURAL ENGINEER:	R. D. Ciatto 9/23/96
QUALITY ASSURANCE:	Allan L. Budlong
MANUFACTURING ENGR:	Phillip Ferland
TECHNICAL DIRECTOR:	D. A. McWilliams
PROJECT MANAGER:	Richard Bagley

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
Ø	GS 10/11/96		Release for Fab Per DEO #0302
0	RES 8/21/96	RES 9/26/96	ISSUED FOR FABRICATION DEO #0252
P1	RES 4-2-96		ISSUED FOR QUOTES DEO 0098

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED / DATE	Number A V049-2-078	Rev.
	R. Curtis 4-2-96	RES 4/3/96		0

Title

SPECIFICATION FOR HAM CHAMBER FABRICATION

TABLE OF CONTENTS

ATTACHMENTS:

Number

Rev.

SPECIFICATION

Number	Rev.
A V049-2-078	0

1.0 SCOPE

1.1 This specification covers the minimum requirements of the manufacturing engineering, materials, fabrication, assembly, inspection, testing, preparation for shipping, shipment and delivery of vacuum vessels for the LIGO vacuum system.

1.2 All attachments are incorporated herein by reference and made a part of this specification.

1.3 The specified equipment is intended for use as part of the Vacuum Equipment supplied for the Laser Interferometer Gravitational-Wave Observatory (LIGO). LIGO, which is operated by Caltech and MIT under an NSF grant, includes two sites (Hanford Reservation near Richmond, WA and Livingston, LA). Each site contains laser interferometers in an L shape with 4 km arms, a vacuum system of the sensitive interferometer components and optical beams, and other support facilities.

1.4 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.

1.5 PSI will fabricate all HAM vessels from vendor supplied flanges, 304/304L plate and heads.

1.6 In this specification, the term "Buyer" refers to PSI. The term "Seller" refers to PSI or a vendor who supplies materials or parts.

2.0 SCHEDULE

2.1 A "first article" chamber shall be manufactured and tested (per Section 8 of this specification) as early as possible to allow design changes to be incorporated into all the chambers. Additional chambers are not to be released for manufacture until PSI accepts the first article weldment assembly.

3.0 GENERAL REQUIREMENTS

3.1 The design and materials of fabrication shall be as shown on the PSI vessel weldment drawings.

3.2 The vessels shall be fabricated and tested in accordance with drawings, standards, and specifications referred to or attached as part of this specification.

3.3 The vessels covered by this specification are to be used in ultra-high vacuum service and require strict cleanliness and contamination prevention throughout the material handling, fabrication and shipping process. All storage and fabrication for this vessel shall be done in the area isolated (plastic room or equal) to prevent contamination from smoke, dust and oily vapors from other manufacturing areas. The area shall be purged with clean air to prevent contamination and adjacent areas.

3.4 Stainless steel fixtures (spiders, roundup rings, etc.) shall be used as required to maintain vessel and nozzle roundness during fabrication.

3.5 The vessel shall be fabricated per the attached PSI Quality Plan, and Fabrication Process Program in Attachments B & C.

4.0 CODES AND STANDARDS

4.1 Priority Of Codes And Documents

1. This Specification
2. Fabrication drawings
3. Codes (highest priority - where applicable)

4.2 The following codes and standards shall be applicable to the fabrication of the equipment:

4.2.1 American Society of Mechanical Engineers (ASME)

a. ASME Boiler and Pressure Vessel Code, 1992 Edition Through 1994 Addenda.

Section II	Material Specifications
	Part A, Ferrous
	Part B, Nonferrous
	Part C, Welding Rods, Electrodes and Filler Metals
Section VIII	Pressure Vessels, Division I (Stamp Not Required)
Section IX	Welding and Brazing Qualification

4.3 Any apparent conflicts between the requirements given herein and the applicable ASME Specification shall be brought to the attention of PSI engineering for clarification.

5.0 FABRICATION REQUIREMENTS

5.1 General

5.1.1 Vessels do not require ASME Code stamping or code inspection.

5.1.2 All vessels shall be furnished complete as shown on PSI drawings, and shall include all necessary hardware, such as bolts, washers, and nuts. Tolerances shall be adhered to as specified on the detail drawings.

5.2 Rolling Of Shells and Machining

5.2.1 See Spec. V049-2-136.

5.3 Cleanliness

5.3.1 No grinding with abrasive wheels, cloth or stones is allowed on the internal vacuum surface unless specified in this specification. This material is intended for use in a high vacuum application. Potential hydrocarbon contamination shall be prevented. Also, the material shall be wrapped and covered at all times the material is not being processed to minimize possible exposure to contaminants.

5.3.2 No iron, carbon steel or other contaminants (such as grease, oil or hydrocarbons, grinding dust, smoke, blast cleaning compounds, paint, solvents, etc.) are to come in contact with the shells. Machining fluids shall be water soluble and free of oil and sulfur. All fluids that come in contact with bellow shall not exceed the contaminant levels permitted as stated below.

Maximum Concentration Limits

Contaminant	Limit
Water Leachable Chlorides	100 ppm
Total Halogens (including Water Leachable Chlorides)	1000 ppm
Total Sulfur	1000 ppm

5.3.3 Personnel shall wear as a minimum; cleanroom booties or clean boots when walking on/working in the interior surfaces.

5.3.4 Local areas may be passivated to remove certain types of markings. This can be done only when specifically specified by PSI.

5.4 Welding

5.4.1 All welding shall be performed in accordance with the applicable codes (Para. 4.2.1) and PSI procedures for design and fabrication.

5.4.2 All weld joint preparation shall be done by tungsten carbide tooling if possible.

5.4.3 Welding Process

1. Vacuum boundary and attachment welds shall be made with the Plasma Arc process per PSI weld procedure WPS151 PAW. Shielding gas shall be a 75% Argon/25% Helium mixture, backing gas shall be 100% Argon and Plasma gas shall be 100% Argon. Hydrogen gas is not permitted. GTAW welds are acceptable for minor welds per PSI procedure WPS153 GTAW.

   Minor welds are considered as conflat nozzles and small interal brackets.

2. All weld repairs shall be performed per PSI procedure V049-2-071.

3. All attachments to the vessel shall be by plasma arc or GTAW.

4. All weld wire and weld joint preparation areas shall be cleaned with CO_2 scrubbing prior to welding per PSI procedure V049-2-070.

5.4.5 All penetrations in the chamber shall be continuously welded on the inside per drawing details. Internal weld surface to be smooth but NOT GROUND.

5.4.6 All welds at vacuum boundaries to be vacuum tight with a helium leak rate equivalent to a total of 1×10^{-9} torr liters/sec/chamber. PSI will leak test all vessel welds with a helium mass spectrometer.

5.5 Backing strips or rings shall not be used.

5.6 Longitudinal seams shall be positioned as shown on detail drawings.

5.7 Sharp edges are to be removed from all carbon steel areas where external painting is to be applied.

5.8 Post Weld Heat Treatment

Post weld heat treatment shall be performed per Specification V049-2-046. Furnace shall be adjusted to provide a furnace atmosphere of at least 5% excess oxygen.

6.0 MATERIALS

6.1 All vacuum boundary shell material shall meet the requirement of SA240 for both grades 304 and 304L. Vessel head and flange material shall be type 304L.

7.0 IDENTIFICATION

7.1 Identification of the material shall be maintained through all manufacturing processes. All cutoff parts shall be marked with the heat number of the parent part as indicated below on the exterior surface only (not on the vacuum boundary).

7.2 If material identity is lost, the plate shall be requalified by making all tests that were required by the material specification or as indicated in this specification. CMTRS have been provided to PSI for the above material, traceability of all materials must be maintained.

7.3 Marking the materials with marking fluids, die stamps, crayons, paints and/or electro-etching is not permitted. A vibratory tool with a minimum tip radius of .005" is acceptable for marking the outside only of the finished shell. All other marking methods must be approved by the purchaser prior to use. All parts shall be marked on outside surface only. Marking on interior boundary vacuum boundary surfaces is not allowed. The minimum marking is to be the heat/lot/MIC/number.

8.0 REQUIRED DOCUMENTATION

The following is a list of minimum documentation required.

8.1 General Requirements

a. Full dimensions of all parts and subassemblies and, where applicable, the tolerances and finishing required.

b. Complete identification of materials used.

If changes are needed to any drawings after drawing approval has been given, the manufacturing department shall furnish new copies to the Buyer showing all changes clearly identified on the drawing.

8.2 Test And Quality Assurance Documentation

a. Mill Test Reports (MTRS) for all vacuum boundary shell material purchased by the seller and certificates of compliance (C of Cs) for small stock pressure items purchased by the Seller.

b. Nondestructive test reports on all applicable NDE. Dye penetrant testing is not allowed.

c. Dimensional check report verifying vessel dimensions are within tolerance. This must be done on a CNC machine.

9.0 SHOP TESTING

9.1 Testing shall be per the Q.A. plan.

9.2 PSI reserves the right to spot x-ray each vessel.

10.0 CLEANING AND PAINTING

10.1 Only carbon steel members are to be painted per specification V049-2-077.

11.0 STORING AND SHIPPING

11.1 Expansion bellows shall be protected from mechanical damage during all phases of manufacturing, storing and shipping.

11.2 Shipping covers shall be used on all flanged connections. Covers shall be provided for protecting the connections from mechanical damage and preventing the entry of dirt into the equipment. The use of tape or plastic sheet alone as a shipping cover is not acceptable.

11.3 The vessels shall be wrapped in waterproof polyethylene and covered with a tarp immediately after cleaning operations have been completed to minimize contamination.

11.4 Finished flange surfaces must be covered and protected during all fabrication steps and during shipment to PSI.

11.5 The vessels shall be shrink wrapped and covered with waterproof tarps during shipment to PSI from machining operations.

12.0 INSPECTION AND QUALITY REQUIREMENTS

12.1 The Seller (as applicable) and/or PSI shall have in effect at all times, an inspection, testing and documentation program that will ensure that the equipment furnished under the specification will meet all requirements of this specification. PSI's inspector shall personally witness that certain critical dimensions are within the specified tolerances while the fabricated parts are set-up and indexed in the vendor's computer controlled equipment.

13.0 NON-ESCORT PRIVILEGES AND INSPECTION RIGHT

Non-escort privileges for Buyer, Owner, Government and Owner representatives to all areas of the facilities where the work is being performed shall be arranged. This will include access to all areas where material is being processed and stored.

The Seller shall cooperate with the Buyer's shop inspectors in establishing when the various inspections or tests will be performed during manufacture, testing, cleaning, and preparation for shipment. The Quality Plan designates which operations require to witness or verification The Seller will furnish an agreed upon amount of notification prior to the start of each. The shop inspector will warn the Seller at any time that he notices anything that may lead to rejection of the equipment or material when it is presented later for inspection and acceptance.

It is not intended that the Buyer's shop inspection shall relieve the Seller in any way whatsoever of his obligation to maintain an adequate test inspection and documentation program of his own, or of any other obligation under the specification. Furthermore, the fact that Buyer's shop inspector may inadvertently overlook a deviation from some requirement of this specification shall not constitute a waiver of that requirement or of the Seller's obligation to correct the condition when it is discovered, or any other obligation under the specification.

ATTACHMENT "A"

LIGO QUALITY ASSURANCE REQUIREMENTS SUMMARY

LIGO VACUUM EQUIPMENT	VENDOR: V59049	JOB NO.: V59049
EQUIPMENT: Vacuum Vessel Fabrication - HAM	VENDOR ENG. OFFICE:	DWG. NO.:
PSI P.O. NO:	VENDOR FACTORY:	SPEC NO.: V049-2-078

TESTING INSPECTION AND DOCUMENTATION RECORD	Submittal After P.O.	Witnessed by PSI	Approval by PSI	Copies Req'd for PSI Files	Record in Mfr's File	Remarks:	Inspector: Date:
MILESTONE SCHEDULE			X	2	X		
VENDOR Q.A. PLAN			X	2	X		
CLEANING PROCEDURE			X	2	X		
PREP FOR SHIPMENT PROCEDURE			X	2	X		
WELDING PROCEDURES			X	2	X		
SHOP DRAWINGS			X	2	X		
DESIGN REVIEW							
CERTIFIED MATERIAL TEST REPORTS			X	2	X		
IN-PROCESS INSPECTIONS				2	X		
OPERATION & MAINTENANCE MANUALS							
SHOP TEST PLAN			X	2	X		
SHOP TEST (WITH REPORT)				2	X		
SHOP DIMENSIONAL INSPECTION			X	2	X		

ATTACHMENT B
SHT. 1 OF 1

HAM FABRICATION PROCESS DIAGRAM

LEGEND

NUMBERS=PSI MANUFACTURING ACTIVITY
LETTERS=MACHINE SHOP ACTIVITY (VENDOR)

A PSI FINALIZES MACHINING DWGS. & ISSUES WITH SPECS. TO MACHINE SHOP

B CHECK/VERIFY MACH. SHOP NOZZLE LOCATIONS

C
- PSI FIXTURE-DESIGN/FAB. SHIP FIXTURE TO VENDOR
- PLATE/FORGINGS DROP SHIPPED TO MACHINE SHOP
- HEADS SHIP TO VENDOR

D SPECIAL HANDLING/LIFTING REQUIREMENTS USED TO PREVENT SS/CS CONTACT (NO CONTAMINATES)

E MEASURE PLATE THICKNESS BEFORE ROLLING SHELLS-CIRCUM. TOL.

F
- PREP LONG. SEAM AND ENDS FOR FLANGE WELD
- PREBEND SEAM EDGES
- ROLL SHELL-84.25" I.D.
- ROLL 60.5" I.D. NOZZLES WITH PROFILED ENDS

1 INSTALL 84.25" SHELL FIXTURES

- TACK WELD SHELL
- WELD LONGITUDINAL SEAM
- INSPECT WELDS

3
- REROLL FOR ROUNDNESS ?
- ADD INTERNAL FIXTURES

G
- STABILIZE 84.25 I.D. SHELL WITH INTERNAL BRACES AND MACHINE 84" END
- CUTOUT 60"Ø PORTS

4 ASSEMBLE FIXTURES FOR NOZZLE WELDING

5
- WELD 60" NOZZLE NECKS TO SHELL WITH PLAZMA ARC

6 WELD ON STIFFENING RINGS/ LIFTING LUGS BETWEEN 60" NOZZLES

7
- WELD ON SUPPORT LEG REPADS
- ADD TEMP. LIFTING LUGS/SUPPORTS

8 VERIFY NOZ. ALIGNMENT 60.5 I.D.

9
- CUTOUT NON CRITICAL PORTS AT P.S.I.

H THERMAL STRESS RELIEF WITH INTERNAL S/S FIXTURES

I
- MACHINE SQUARE & PREP ENDS OF 60"Ø NOZZLES. PREP FLANGE END 84" OF SHELL

10 CUTOUT 4 CRITICAL "E" NOZZLES

11
- WELD 60.5" I.D. HEADS TO FLANGES
- WELD 84.25" I.D. HEADS TO FLANGES

12
- FIT 84.25" ID END FLANGES FOR ALIGNMENT

13
- WELD 84.25" FLANGES TO SHELLS

14
- FIT & WELD 60" FLANGES TO NOZZLES

15
- FIT & WELD EXPAN. JOINT SPOOL AND TIE ROD LUGS TO 60" NOZZLE & FLANGE

16 WELD INTERNAL SUPPORT MEMBERS TO SHELL (PLAZMA ARC)

17 WELD ALL SMALL NOZZLES

18
- FIT & WELD "E" NOZZLES & FLANGES WITH FIXTURE

19
- INSPECT WELDS DIM/FLATNESS ETC.

20
- CHECK ALIGNMENT OF ALL NOZZLES WITH HIGH TOL. EQUIPMENT

21 STEAM CLEAN & INSTALL TEMP NOZZLE COVERS

23 INSTALL ANNULUS TUBING

24
- CLEAN ALL CHAMBER FLANGE SEAL SURFACES
- CLEAN AND PROTECT ALL DOOR COVERS

25 FINAL CLEANING

OTHER MACHINE ITEMS:

I
- MACHINE 84.25" I.D. FLANGES 2-GROOVED V049-4-021 2-FLAT FACED V049-4-127

II 1-GROOVED V049-4-031 1-FLAT FACED V049-4-032

III
- PREFAB (2) VESSEL SUPPORT SADDLES DWG V049-4-052
- BLAST & PAINT

26
- ADD 60" & 84" COVERS WITH TEST O-RINGS
- INSTALL C.F. FLANGES
- INSTALL 6" G.V FOR TURBO PUMP

27 MOVE INTO CLEAN ROOM

28
- FINAL ASSEMBLY
- INSTALL TEST/SHIPPING COVERS

29 WELD ON SUPPORT SADDLES

30 HE LEAK CHECK

31 BAKE OUT UNDER VACUUM

32 FINAL VACUUM TEST

33 PREP. FOR SHIPMENT UNDER VACUUM

CAD FILE: I:\HVL\IGDN\NJ\HAM

AUG. 30, 1996 REV. 1

3.3 HAM Quality Plan V049-2-087

Title: QUALITY PLAN FOR HORIZONTAL ACCESS MODULE (HAM)

QUALITY PLAN FOR LIGO

FOR

LIGO

HORIZONTAL ACCESS MODULE (HAM)

Serial No. V0494128-01 thru 19

REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
1	GS 10-15-96		Release Per DEO No. 0302
ϕ	ARB 4/8/96	REB	released per DEO 0114

PROCESS SYSTEMS INTERNATIONAL, INC.

SPECIFICATION

INITIAL APPROVALS	PREPARED	DATE	APPROVED	DATE	Number	Rev.
	ARBudlonk	4/8/96	R. Bay	4/17/96	V049-2-087	1

APPLICABLE DRAWINGS

V049-4-054 HAM Flange/Annulus Tubing Assembly

V049-4-128 HAM Shell Weldment Assembly

V049-4-002 Horizontal Accesss Module Chamber Assembly

V049-4-031 60-1/2" I.D. Flange Detail (Grooved)

V049-4-032 60-1/2" I.D. Flange Detail (Flat Face)

V049-4-021 84-14" I.D. Flange Detail (Grooved)

V049--4-027 60-1/2" I.D. Flange Face (Detail)

V049-4-0A4 60" End Cover

V049-4-052 HAM Chamber Support Saddle

V049-4-053 60-1/2" I.D. Expansion Joint

V049-4-127 84-1/4" Access Cover

V049-4-040 HAM Tie Rod Assembly

APPLICABLE PROCEDURES

V049-2-072 Welding GTAW (PWHT) P8-P8

V049-2-071 Welding PAW (PWHT) P8-P8

V049-2-074 General Repair Procedure

V049-2-046 Thermal Stress Relief

V049-2-078 Ham Chamber Fabrication

Serial No. V0494128-01

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Horizontal Access Module (HAM) DWG NO. V049-2-128
APPLICABLE CODE ASME Sect VIII Div. 1 PG 3 OF 97
(Unless Applicable)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA CS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures in Shell & 60" Nozzles							

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Serial No. V0494128-01

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	U	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

Serial No. V049-4128-01

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT **√** = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-01

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Supports to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V0494128-01

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN

LEGEND:
- **D** = DIMENSIONAL
- **V** = VISIUAL
- **RT** = RADIOGRAPHY
- **PT** = LIQUID PENETRANT
- **MT** = MAGNETIC PARTICLE
- **ET** = EDDY CURRENT
- **LT** = LEAK TEST
- **UT** = ULTRASONIC
- **W** = WITNESS
- **X** = HOLD POINT
- √ = APPROVED
- **R** = REVIEW
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QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Installation of Bellows Tie-Rod	V	V049-4-040	V049-2-072	X			
Verify Installation of Annulus Tubing	V	V049-4-054					
Verify Installation & Alingment of Support Saddles	V-D	V049-4-052 V049-4-002	V049-2-072 V049-2-071	X			
Steam Clean complete Vessel Inside & Out				X			
Verify final Cleaning at PSI	V						
Verify final Bakeout at PSI	V	V049-2-019					
Verify final Vac. & He Leak Test at PSI	V	V049-2-014					
Shipment to LIGO							

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Serial No. V0494128-02

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect VIII Div. 1 (Where Applicable)

JOB NO. V59049
DWG NO. V049-2-128
PG 8 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA CS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures On Shell & 60" Nozzles							

Serial No. V0494128-02

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

Serial No. V0494128-02

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA BS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	U-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	U-D	V049-4-128		X			
Inspect Welding Of 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding Of 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-02

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Sabre to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V0494128-02

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY																
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS		
Verify Installation of Bellows Tie-Rod	V	V049-4-040		V049-2-072		X											
Verify Installation of Annulus Tubing	V	V049-4-054															
Verify Installation & Alignment of Support Saddles	V-D	V049-4-052 V049-4-002		V049-2-072 V049-2-071		X											
Steam Clean complete Vessel Inside & Out						X											
Verify final Cleaning at PSI	V																
Verify final Bakeout at PSI	V	V049-2-019															
Verify final Vac. & He Leak Test at PSI	V	V049-2-014															
Shipment to LIGO																	

SPECIFICATION V049-2-087 REV. 1

Serial No. V0494128-03

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Horizontal Access Module (HAM) DWG NO. V049-2-128
APPLICABLE CODE ASME Sect VIII Div. 1 PG 13 OF 97
(Ushore Applicable)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA CS AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures On Shell & 60" Nozzles							

Serial No. V0494128-03

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL NOZZLES)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

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Serial No. V0494128-03

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA: BS AI:	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-03

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Supports to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V0494128-03

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY														
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS
Verify Installation of Bellows Tie-Rod	V	V049-4-040	V049-2-072	X									
Verify Installation of Annulus Tubing	V	V049-4-054											
Verify Installation & Alignment of Support Saddles	V-D	V049-4-052 V049-4-002	V049-2-072 V049-2-071	X									
Steam Clean Complete Vessel Inside + Out				X									
Verify final Cleaning at PSI	V												
Verify final Bakeout at PSI	V	V049-2-019											
Verify final Vac. & He Leak Test at PSI	V	V049-2-014											
Shipment to LIGO													

Serial No. V0494128-04

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Horizontal Access Module (HAM) DWG NO. V049-2-128
APPLICABLE CODE ASME Sect III Div. 2 PG 18 OF 97
(Where Applicable)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA CS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures in Shell & 60" Nozzles							

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Serial No. V0494128-04

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY													
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071										
Inspect Welding of 60" Nozzles	V	V049-4-128											
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128											
Verify Steam Cleaning of Vessel				X									
Thermal Stress Relief Vessel		V049-2-046		X									

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Serial No. V0494128-04

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4 Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding Of 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding Of 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-04

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Supports to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

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Serial No. V0494128-04

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY																
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.		PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS	
Verify Installation of Bellows Tie-Rod	V		V049-4-040		V049-2-072		X										
Verify Installation of Annulus Tubing	V		V049-4-054														
Verify Installation & Alignment of Support Saddles	V-D		V049-4-052 V049-4-002		V049-2-072 V049-2-071		X										
Steam Clean Complete Vessel Inside + Out							X										
Verify final Cleaning at PSI	V																
Verify final Bakeout at PSI	V		V049-2-019														
Verify final Vac. & He Leak Test at PSI	V		V049-2-014														
Shipment to LIGO																	

Serial No. V0494128-05

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect VIII Div 1 (Whole Applicable)
JOB NO. V59049
DWG NO. V049-2-128
PG 23 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA: CS AI: N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures on Shell & 60" Nozzles							

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Serial No. V0494128-05

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	**TYPE INSP.**	**PROCEDURE OR DRAWING**	**WELDING PROCEDURE**	**PSI** Inspection SIGN/DATE	**AUTHORIZED INSPECTOR** SIGN/DATE	**CUSTOMER QA** SIGN/DATE	**REMARKS**
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 6" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

Serial No. V0494128-05

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA BS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-05

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Exspansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Support to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify ALingnment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V0494128-05

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY																
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.		PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS	
Verify Installation of Bellows Tie-Rod	V		V049-4-040		V049-2-072		X										
Verify Installation of Annulus Tubing	V		V049-4-054														
Verify Installation & Alignment of Support Saddles	V-D		V049-4-052 V049-4-002		V049-2-072 V049-2-071		X										
Steam Clean complete Vessel Inside & Out							X										
Verify final cleaning at PSI	V																
Verify final Bakeout at PSI	V		V049-2-019														
Verify final Vac. & He Leak Test at PSI	V		V049-2-014														
Shipment to LIGO																	

Serial No. V0494128-06

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Horizontal Access Module (HAM) DWG NO. V049-2-128
APPLICABLE CODE ASME Sect VIII Div. 1 PG 28 OF 97
(Where Applicable)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA CS AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures in Shell & 60" Nozzles							

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Serial No. V0494128-06 **SPECIFICATION** V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	U	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

Serial No. V0494128-06

SPECIFICATION V049-2-057 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA BS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4 Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

SPECIFICATION V049-2-087 REV. 1

Serial No. V0494128-06

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Supports to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

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Serial No. V0494128-06

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY																	
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS		
Verify Installation of Bellows Tie-Rod	V	V049-4-040		V049-2-072		X											
Verify Installation of Annulus Tubing	V	V049-4-054															
Verify Installation & Alignment of Support Saddles	V-D	V049-4-052 V049-4-002		V049-2-072 V049-2-071		X											
Steam Clean complete Vessel Inside + Out						X											
Verify final Cleaning at PSI	V																
Verify final Bakeout at PSI	V	V049-2-019															
Verify final Vac. & He Leak Test at PSI	V	V049-2-014															
Shipment to LIGO																	

Serial No. V0494128-07

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect VIII Div 1 (Where Applicable)
JOB NO. V59049
DWG NO. V049-2-128
PG 35 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures On Shell & 60" Nozzles							

Serial No. V04941 28-07

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

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Serial No. V0494128-07

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-07

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY																	
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.		PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS		
Verify 60" Flange Straightness & Flatness	V-D		V049-4-054				X											
Inspect Welding of Expansion Joint to 60" Nozzle	V		V049-4-054 V049-4-053		V049-2-071		X											
Inspect Welding of Internal Supports to Shell	V		V049-4-128		V049-2-071		X											
Inspect Welding of ALL Non-Critical Flanges	V		V049-4-128		V049-2-071		X											
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V		V049-4128		V049-2-071		X											
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D		V049-4-128				X											

Serial No. U0494128-07

SPECIFICATION U049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Installation of Bellows Tie-Rod	V	U049-4-040	U049-2-072	X			
Verify Installation of Annulus Tubing	V	U049-4-054					
Verify Installation & Alignment of Support Saddles	V-D	U049-4-052 U049-4-002	U049-2-072 U049-2-071	X			
Steam Clean complete Vessel Inside & Out				X			
Verify final Cleaning at PSI	V						
Verify final Bakeout at PSI	V	U049-2-019					
Verify final Vac. & He Leak Test at PSI	V	U049-2-014					
Shipment to LICO							

Serial No. V0494128-08

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect VIII Div 1 (Where Applicable)

JOB NO. V59049
DWG NO. V049-2-128
PG 38 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED
QA CS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures On Shell & 60" Nozzles							

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Serial No. V0494128-08

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

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Serial No. V0494128-08 **SPECIFICATION** V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	U-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	U-D	V049-4-128		X			
Inspect Welding Of 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify F Lange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-08

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Supports to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

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SPECIFICATION V049-2-087 **REV.** 1

Serial No. V0494128-08

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Installation of Bellows Tie-Rod	V	V049-4-040	V049-2-072	X			
Verify Installation of Annulus Tubing	V	V049-4-054					
Verify Installation & Alingment of Support Saddles	V-D	V049-4-052 V049-4-002	V049-2-072 V049-2-071	X			
Steam Clean complete Vessel Inside & Out				X			
Verify Final Cleaning at PSI	V						
Verify Final Bakeout at PSI	V	V049-2-019					
Verify Final Vac. & He Leak Test at PSI	V	V049-2-014					
Shipment to LIGO							

Serial No. V0494128-09

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect VIII Div. 1 (where Applicable)

JOB NO. V59049
DWG NO. V049-2-128
PG 43 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED
QA CS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures in Shell & 60" Nozzles							

Serial No. V0494128-09

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

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Serial No. V049-128-09

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-09

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Support to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V0494128-09

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY															
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS	
Verify Installation of Bellows Tie-Rod	V		V049-4-040		V049-2-072	X										
Verify Installation of Annulus Tubing	V		V049-4-054													
Verify Installation & Alignment of Support Saddles	V-D		V049-4-062 V049-4-002		V049-2-072 V049-2-071	X										
Steam Clean complete Vessel Inside + Out						X										
Verify final cleaning at PSI	V															
Verify final Bakeout at PSI	V		V049-2-019													
Verify final Vac. & He Leak Rate at PSI	V		V049-2-014													
Shipment to LIGO																

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Serial No. V0494128-10

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect III Div. 1 (Where Applicable)

JOB NO. V59049
DWG NO. V049-2-128
PG 48 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA CS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures On Shell & 60" Nozzles							

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Serial No. V0494128-10

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

Serial No. V049128-10

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4 Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding Of 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding Of 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-10

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Supports to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V0494128-10

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY														
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS
Verify Installation of Bellows Tie-Rod	V		V049-4-040		V049-2-072	X									
Verify Installation of Annulus Tubing	V		V049-4-054												
Verify Installation & Alignment of Support Saddles	V-D		V049-4-052 V049-4-002		V049-2-072 V049-2-071	X									
Steam Clean complete Vessel Inside + Out						X									
Verify final Cleaning at PSI	V														
Verify final Bakeout at PSI	V		V049-2-019												
Verify final Vac. & He Leak Test at PSI	V		V049-2-014												
Shipment to LIGO															

SPECIFICATION V049-2-087 REV. 1

Serial No. V049-128-11

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect VIII Div. 1 (Where Applicable)

JOB NO. V59049
DWG NO. V049-2-128
PG 53 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures in Shell & 60" Nozzles							

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Serial No. V0494128-11

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY; PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT; LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS; X = HOLD POINT, √ = APPROVED, R = REVIEW; VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of "Go" Nozzles	V	V049-4-128					
Verify Nozzle Alingnment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
thermal Stress Relief Vessel		V049-2-046		X			

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Serial No. V0494128-11

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-11

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Supports to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	√	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	√-D	V049-4-128		X			

Serial No. U0494128-11

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY														
QUALITY PLAN REVIEWED QA: GS AI:	TYPE INSP.		PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS
Verify Installation of Bellows Tie-Rod	V		V049-4-040		V049-2-072		X									
Verify Installation of Annulus Tubing	V		V049-4-054													
Verify Installation & Alignment of Support Saddles	V-D		V049-4-052 V049-4-062		V049-2-072 V049-2-071		X									
Steam Clean complete Vessel Inside + Out							X									
Verify final Cleaning at PSI	V															
Verify final Bakeout at PSI	V		V049-2-019													
Verify final Vac. & He Leak Test at PSI	V		V049-2-014													
Shipment to LIGO																

Serial No. V0494128-12

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
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(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect VIII Div. 1 (Where Applicable)

JOB NO. V59049
DWG NO. V049-2-128
PG 58 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA CS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures In Shell & 60" Nozzles							

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Serial No. U0494128-12 **SPECIFICATION** V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

Serial No. V049-4128-12

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA BS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4 Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges to Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-12

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Support to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V0494128-12

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY																
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS		
Verify Installation of Bellows Tie-Rod	V	V049-4-040		V049-2-072		X											
Verify Installation of Annulus Tubing	V	V049-4-054															
Verify Installation & Alignment of Support Saddles	V-D	V049-4-052 V049-4-002		V049-2-072 V049-2-071		X											
Steam Clean Complete Vessel Inside & Out						X											
Verify final Cleaning at PSI	V																
Verify final Bakeout at PSI	V	V049-2-019															
Verify final Vac. & He Leak Test at PSI	V	V049-2-014															
Shipment to LIGO																	

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Serial No. V0499128-13

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect VIII Div. 1 (Ushore Applicable)
JOB NO. V59049
DWG NO. V049-2-128
PG 63 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA CS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures On Shell & 60" Nozzles							

Serial No. V0494128-13

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alingnment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
thermal Stress Relief Vessel		V049-2-046		X			

Serial No. V0494128-13

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	U-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	U-D	V049-4-128		X			
Inspect Welding Of 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding Of 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-13

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY																	
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.		PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS		
Verify 60" Flange Straightness & Flatness	V-D		V049-4-054				X											
Inspect Welding of Expansion Joint to 60" Nozzle	V		V049-4-054 V049-4-053		V049-2-071		X											
Inspect Welding of Internal Support to Shell	V		V049-4-128		V049-2-071		X											
Inspect Welding of ALL Non-Critical Flanges	V		V049-4-128		V049-2-071		X											
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V		V049-4128		V049-2-071		X											
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D		V049-4-128				X											

Serial No. V0494128-13

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Installation of Bellows Tie-Rod	V	V049-4-040	V049-2-072	X			
Verify Installation of Annulus Tubing	V	V049-4-054					
Verify Installation & Alignment of Support Saddles	V-D	V049-4-052 V049-4-002	V049-2-072 V049-2-071	X			
Steam Clean complete Vessel Inside & Out				X			
Verify final Cleaning at PSI	V						
Verify final Bakeout at PSI	V	V049-2-019					
Verify final Vac. & He Leak Test at PSI	V	V049-2-014					
Shipment to LIGO							

SPECIFICATION V049-2-087 REV. 1

Serial No. V0494128-14

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Horizontal Access Module (HAM) DWG NO. V049-2-128
APPLICABLE CODE ASME Sect III Div. 1 PG 68 OF 97
(Where Applicable)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA CS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures in Shell & 60" Nozzles							

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SPECIFICATION V049-2-087 **REV.** 1

Serial No. V0494128-14

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA: GS AI:	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alingnment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

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Serial No. V0494128-14

SPECIFICATION V049-2-057 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-14

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY														
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS
Verify 60" Flange Straightness & Flatness	V-D		V049-4-054			X									
Inspect Welding of Expansion Joint to 60" Nozzle	V		V049-4-054 V049-4-053		V049-2-071	X									
Inspect Welding of Internal Supports to Shell	V		V049-4-128		V049-2-071	X									
Inspect Welding of ALL Non-Critical Flanges	V		V049-4-128		V049-2-071	X									
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V		V049-4128		V049-2-071	X									
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D		V049-4-128			X									

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Serial No. V0494128-14

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Installation of Bellows Tie-Rod	V	V049-4-040	V049-2-072	X			
Verify Installation of Annulus Tubing	V	V049-4-054					
Verify Installation & Alignment of Support Saddles	V-D	V049-4-052 V049-4-002	V049-2-072 V049-2-071	X			
Steam Clean complete Vessel Inside + Out				X			
Verify final cleaning at PSI	V						
Verify final Backout at PSI	V	V049-2-019					
Verify final Vac. & He Leak Test at PSI	V	V049-2-014					
Shipment to LIGA							

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Serial No. V0494128-15

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect III Div. 1 (Where Applicable)
JOB NO. V59049
DWG NO. V049-2-128
PG 73 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA CS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures in Shell & 60" Nozzles							

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Serial No. V0494128-15

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

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Serial No. V0494128-15

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA BS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-15

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Baffle to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V04941 28-15

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	**TYPE INSP.**	**PROCEDURE OR DRAWING**	**WELDING PROCEDURE**	**PSI** *Inspection* **SIGN/DATE**	**AUTHORIZED INSPECTOR SIGN/DATE**	**CUSTOMER QA SIGN/DATE**	**REMARKS**
Verify Installation of Bellows Tie-Rod	V	V049-4-040	V049-2-072	X			
Verify Installation of Annulus Tubing	V	V049-4-054					
Verify Installation & Alingment of Support Saddles	V-D	V049-4-052 V049-4-002	V049-2-072 V049-2-071	X			
Steam Clean complete Vessel Inside & Out				X			
Verify final Cleaning at PSI	V						
Verify final Bakeout at PSI	V	V049-2-019					
Verify final Vac. & He Leak Test at PSI	V	V049-2-014					
Shipment to LIGO							

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Serial No. U0494128-16

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect III Div. 1 (where Applicable)
JOB NO. V59049
DWG NO. V049-2-128
PG 78 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED
QA CS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures in Shell & 60" Nozzles							

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Serial No. V0494128-16

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT **√** = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of "Go" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

Serial No. V0494128-16

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	U-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	U-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

SPECIFICATION V049-2-087 REV. 1

Serial No. V0494128-16

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Supports to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V0494128-16

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY															
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS	
Verify Installation of Bellows Tie-Rod	V	V049-4-040		V049-2-072		X										
Verify Installation of Annulus Tubing	V	V049-4-054														
Verify Installation & Alignment of Support Saddles	V-D	V049-4-052	V049-4-002	V049-2-072	V049-2-071	X										
Steam Clean complete Vessel Inside + Out						X										
Verify final Cleaning at PSI	V															
Verify final Bakeout at PSI	V	V049-2-019														
Verify final Vac. & He Leak Test at PSI	V	V049-2014														
Shipment to LIGO																

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SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect III Div. 1 (Where Applicable)

JOB NO. V59049
DWG NO. V049-2-128
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ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures in Shell & 60" Nozzles							

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Serial No. V0494128-17

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

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SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-17

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Support to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V8494128-17

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY															
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING		WELDING PROCEDURE		PSI Inspection SIGN/DATE			AUTHORIZED INSPECTOR SIGN/DATE			CUSTOMER QA SIGN/DATE			REMARKS	
Verify Installation of Bellows Tie-Rod	V	V049-4-040		V049-2-072		X										
Verify Installation of Annulus Tubing	V	V049-4-054														
Verify Installation & Alignment of Support Saddles	V-D	V049-4-052 V049-4-002		V049-2-072 V049-2-071		X										
Steam Clean manifolds Vessel Inside & Out						X										
Verify final cleaning at PSI	V															
Verify final Bakeout at PSI	V	V049-2-019														
Verify final Vac. & He Leak Test at PSI	V	V049-2014														
Shipment to LIGO																

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SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
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Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect VIII Div. 1 (Where Applicable)

JOB NO. V59049
DWG NO. V049-2-128
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ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA CS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures on Shell & 60" Nozzles							

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SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY							
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of 60" Nozzles	V	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

Serial No. U0494128-18

SPECIFICATION U049-2-057 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA: BS AI:	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	U049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	U049-4-128		X			
Inspect Welding OF 84" Flanges To Shell	V	U049-4-054	U049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	U049-4-054		X			
Inspect Welding OF 60" Flanges to Nozzle Neck	V	U049-4-054	U049-2-071	X			

Serial No. V0494128-18

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Supports to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V0494128-18

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Installation of Bellows Tie-Rod	V	V049-4-040	V049-2-072	X			
Verify Installation of Annulus Tubing	V	V049-4-054					
Verify Installation & Alingment of Support Saddles	V-D	V049-4-052 V049-4-002	V049-2-072 V049-2-071	X			
Steam Clean complete Vessel Inside & Out				X			
Verify final Cleaning at PSI	V						
Verify final Bakeout at PSI	V	V049-2-019					
Verify final Vac. & He Leak Test at PSI	V	V049-2-014					
Shipment to LIGO							

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Serial No. V0494128-19

SPECIFICATION V049-2-087 **REV.** 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Horizontal Access Module (HAM)
APPLICABLE CODE ASME Sect VIII Div. 1 (Where Applicable)

JOB NO. V59049
DWG NO. V049-2-128
PG 93 OF 97

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED
QA CS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Acceptance of Materials	X			X			
Inspect Welding Long Seam/Lower Shell	V	V049-4-128	V049-2-071	X			
Verify Roundness of Shell	V-D	V049-4-128		X			
Inspect Welding Long Seam 60" Nozzles	V	V049-4-128	V049-2-071	X			
Verify Roundness of 60" Nozzles	V-D	V049-4-128					
Verify Fixtures in Shell & 60" Nozzles							

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Serial No. U0494128-19

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY								
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Welding and Location of Saddle Support Plates and Lift Lugs	V-D	V049-4-128	V049-2-071				
Inspect Welding of "Go" Nozzles	U	V049-4-128					
Verify Nozzle Alignment and Dimensions (ALL Nozzles)	V-D	V049-4-128					
Verify Steam Cleaning of Vessel				X			
Thermal Stress Relief Vessel		V049-2-046		X			

Serial No. V0494128-19

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT **√** = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GE AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Nozzle End Dimensions after Machining	V-D	V049-2-046		X			
Verify Cutout Location of the 4-Critical "E" Nozzles	V-D	V049-4-128		X			
Inspect Welding Of 84" Flanges To Shell	V	V049-4-054	V049-2-071	X			
Verify Flange (84") Straightness and Flatness	V-D	V049-4-054		X			
Inspect Welding Of 60" Flanges to Nozzle Neck	V	V049-4-054	V049-2-071	X			

Serial No. V0494128-19

SPECIFICATION V049-2-087 **REV.** 1

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QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify 60" Flange Straightness & Flatness	V-D	V049-4-054		X			
Inspect Welding of Expansion Joint to 60" Nozzle	V	V049-4-054 V049-4-053	V049-2-071	X			
Inspect Welding of Internal Supports to Shell	V	V049-4-128	V049-2-071	X			
Inspect Welding of ALL Non-Critical Flanges	V	V049-4-128	V049-2-071	X			
Inspect Welding of Critical "E" Nozzles and Flanges (with fixtures)	V	V049-4-128	V049-2-071	X			
Verify Alignment Straightness & Flatness of "E" Nozzles	V-D	V049-4-128		X			

Serial No. V0494128-19

SPECIFICATION V049-2-087 **REV.** 1

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Installation of Bellows Tie-Rod	V	V049-4-040	V049-2-072	X			
Verify Installation of Annulus Tubing	V	V049-4-054					
Verify Installation & Alignment of Support Saddles	V-D	V049-4-052 V049-4-002	V049-2-072 V049-2-071	X			
Steam Clean complete Vessel Inside & Out				X			
Verify final cleaning at PSI	V						
Verify final Bakeout at PSI	V	V049-2-019					
Verify final Vac. & He Leak Test at PSI	V	V049-2-014					
Shipment to LICO							

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3.4 HAM Testing/Inspections

Each HAM will be inspected at the Mechanical Fabrication contractor prior to being released for shipment to PSI (See "Dimensional Fabrication Procedure" V049-2-121 for additional details).

After shipment, to PSI the HAM will be leak checked, cleaned, baked out and prepared for shipment. (See "Component Shop Conditioning/Test Procedure" V049-2-047 and "Component Packaging, Handling and Preparation for Shipment" V049-2-123 for additional details).

4.1 80K Pump Fabrication Plan V049-2-082

Title: **FABRICATION PLAN FOR CRYOPUMPS**

FABRICATION PLAN

FOR

80K CRYOPUMPS

LIGO VACUUM EQUIPMENT

Hanford, Washington
and
Livingston, Louisiana

PREPARED BY: Phillip F Glover

QUALITY ASSURANCE: Alan R Bradbrook

MANUFACTURING ENGINEER: Phillip F Glover

TECHNICAL DIRECTOR: D. C. McClean

PROJECT MANAGER: Richard Bagley

REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
0	PF 5/1/96	RBS 5/2/96	ISSUED PER ECO 0161 FOR FDR

PROCESS SYSTEMS INTERNATIONAL, INC.					SPECIFICATION	
INITIAL APPROVALS	PREPARED	DATE	APPROVED	DATE	Number A V049-2-082	Rev.
	PEF	5/1/96	RBS	5/2/96		0

TABLE OF CONTENTS

ATTACHMENTS:

1. Cryopump Fabrication Documents
2. Fabrication Flow Chart
3. Fabrication Priority List

1.0 PURPOSE

The purpose of this procedure is to define design guidelines, specifications, and procedures to enable PSI to specify, purchase, inspect, fabricate, test and ship the 80K Cryopumps per LIGO requirements.

2.0 GENERAL

All Cryopumps shall be fabricated per this fabrication plan. Each fabrication process shall be controlled via a written procedure. A "first article" approach will be used to validate all fabrication processes prior to release of the full vessel lot.

All vessels will be fabricated in accordance with the Quality Plan. Key points in the fabrication process shall be verified to ensure consistent results.

All vacuum equipment shall be fabricated in accordance with LIGO Project Contract PC175730 dated September 12, 1995, and subsequent change orders.

3.0 RESPONSIBILITY

The Manufacturing Department is responsible for the execution of this procedure, with input and monitoring by the Project Engineer, the Quality Assurance Department, and the Project Manager.

4.0 FABRICATION PLAN

4.1 A first article approach will be used to start the Cryopump manufacturing cycle to validate the manufacturing procedures and technique prior to the full production release.

4.2 The Cryopumps will be fabricated at PSI. PSI will perform vessel cleaning, leak checking, bakeout and preparation for shipment.

4.3 The Cryopumps will be fabricated and tested per documents listed in Attachment I "Fabrication Documents".

4.4 The Cryopumps will be fabricated and tested per Attachment 2 Cryopump Fabrication Flow Chart.

4.5 The Cryopumps will be fabricated according to the Fabrication Priority List Attachment 3.

4.6 Procurement

PSI will procure all S.S. plate and flange material.

PSI will purchase vessel heads.

4.7 Quality Assurance

The Cryopump Fabrication Process shall be monitored and control via the Quality Plan V049-2-098.

PSI will inspect all incoming materials to the purchase documents.

4.8 Shop Conditioning/Testing

The Cryopumps will be shop conditioned (cleaned, bakeout, etc.) per PSI Procedure V049-2-047.

4.9 Preparation For Shipment

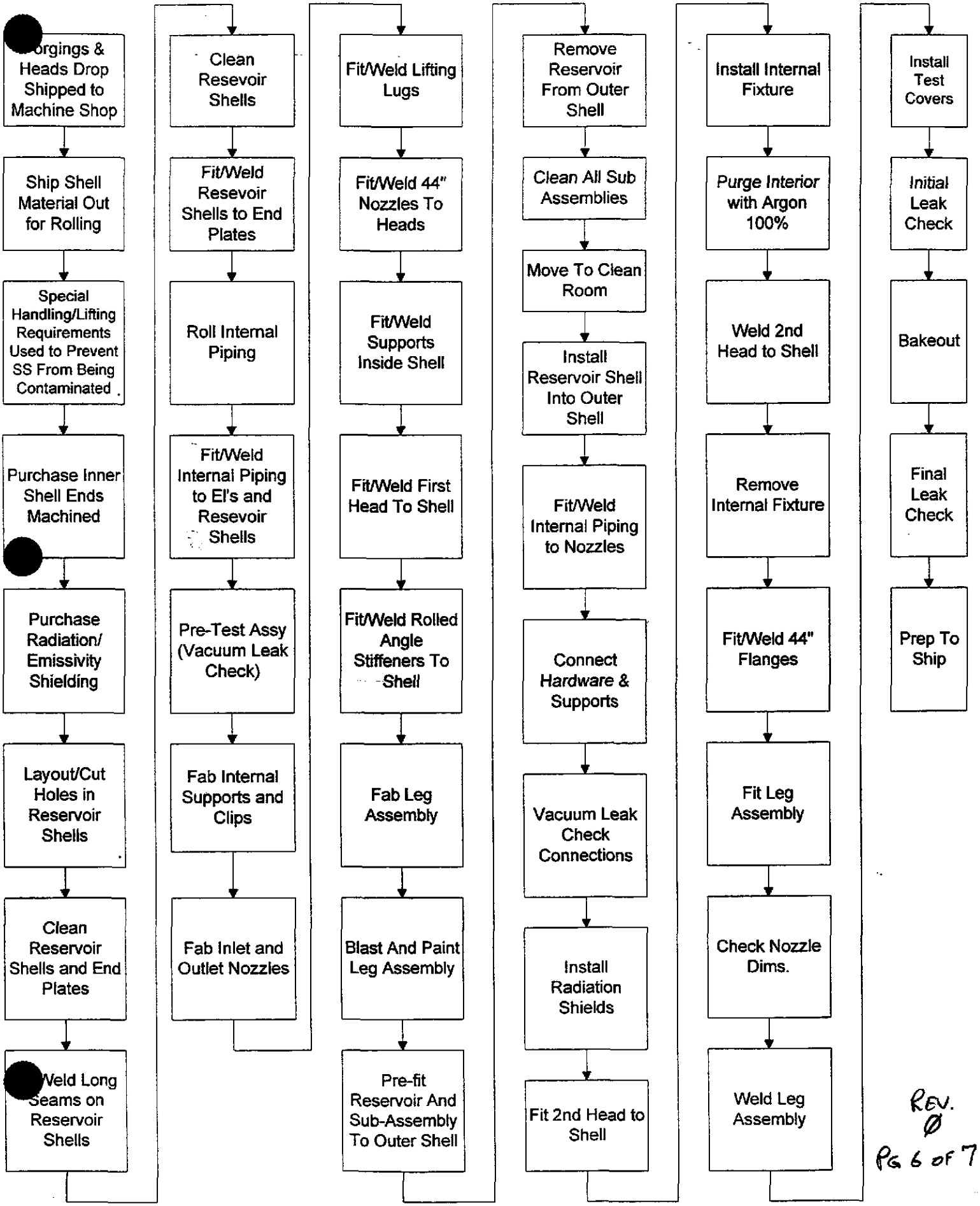
The Cryopumps will be prepared and shipped per PSI Procedure V049-2-123.

ATTACHMENT 1

CRYOPUMP DOCUMENTS

1.	Spec. For Cryopump Fabrication	V049-2-096
2.	Cryopump Quality Plan	V049-2-098
3.	Bill of Material	V049-4-004, V049-4-005
4.	Flanges	V049-2-040 & V049-2-042
5.	Heads	V049-2-039
6.	Raw Material Handling Procedure	V049-2-120
7.	Weld Data Sheet Spec.	V049-2-084
8.	Weld Procedures	V049-2-070, V049-2-071, V049-2-072, V049-2-073
9.	Weld Repair Procedure	V049-2-074
10.	Cleaning Procedures	V049-2-015
11.	Painting Procedures	V049-2-077
12.	Components Shop Conditioning/Test Plan	V049-2-047
13.	Bakeout Procedure	V049-2-019
14.	Leak Test Procedure	V049-2-014
15.	Dimensional Verification Procedure	V049-2-121
16.	Component Packaging, Handling, and Shipping Procedure	V049-2-123
17.	PSI Drawing	
	80K Cryopump - Long	V049-4-004
	80K Cryopump - Short	V049-4-005
	44 5/8" ID Flange Detail (Grooved)	V049-4-017

ATTACHMENT 2
80K CRYOPUMP FABRICATION PROCESS DIAGRAM



REV. Ø

Pg 6 of 7

ATTACHMENT 3

80K CRYOPUMP FABRICATION PRIORITY LIST

WCP1	(CS)
WCP2	(CS)
WCP3	(LMS)
WCP4	(LMS)
WCP7	(LES)
WCP5	(RMS)
WCP6	(RMS)
WCP8	(RES)
LCP1	(CS)
LCP2	(CS)
LCP3	(LES)
LCP4	(RES)

4.2 80K Pump Fabrication Specification V049-2-096

Title: SPECIFICATION FOR 80K CRYOPUMP FABRICATION

SPECIFICATION FOR

80K CRYOPUMP FABRICATION

PREPARED BY: R.E. Curtis 4/26/96

STRUCTURAL ENGINEER: R D. Gatto

QUALITY ASSURANCE: O K Bradbrook

MANUFACTURING ENGR: Phillip Feland

TECHNICAL DIRECTOR: D. A. McWilliams

PROJECT MANAGER: Richard Bay

REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
2	GS 10/10/96		Release for Fab Per DEO #0302
2	DM 9/18/96	REB 9/15/96	REVISED PER DEO 0271
1	DM 5/6/96	REB 5/6/96	REVISED PER DEO 0174
0	REG 4/26/96	REB 5/2/96	RELEASED PER DEO 0148 FOR EDR

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED DATE REG 4/26/96	APPROVED DATE REB 5/2/96	Number A V049-2-096	Rev. 2

TABLE OF CONTENTS

ATTACHMENTS:

1. Cryopump Fabrication Documents
2. Fabrication Flow Chart
3. Fabrication Priority List

1.0 SCOPE

1.1 This specification covers the minimum requirements of the manufacturing engineering, materials, fabrication, assembly, inspection, testing, preparation for shipping, shipment and delivery of vacuum vessels for the LIGO vacuum system.

1.2 All attachments are incorporated herein by reference and made a part of this specification.

1.3 The specified equipment is intended for use as part of the Vacuum Equipment supplied for the Laser Interferometer Gravitational-Wave Observatory (LIGO). LIGO, which is operated by Caltech and MIT under an NSF grant, includes two sites (Hanford Reservation near Richmond, WA and Livingston, LA). Each site contains laser interferometers in an L shape with 4 km arms, a vacuum system of the sensitive interferometer components and optical beams, and other support facilities.

1.4 Fabrication and material procurement will be by PSI.

2.0 SCHEDULE

2.1 Chamber delivery shall be as follows:

Quantity/Size	Delivery Site	Dates	Production Lots
1-Long	PSI, Westborough	1 Aug. 1996	1 (First Article)
1-Long	PSI, Westborough	1 Nov. 1996	2
2-Long	PSI, Westborough	1 Feb. 1997	3
3-Short	PSI, Westborough	15 April 1997	4
1-Long	PSI, Westborough	15 June 1997	5
2-Long	PSI, Westborough	1 Oct. 1997	6
2-Short	PSI, Westborough	1 Dec. 1997	7
12 Total			

3.0 GENERAL REQUIREMENTS

3.1 The design and materials of fabrication shall be as shown on the PSI vessel weldment drawings.

3.2 The vessels shall be fabricated and tested in accordance with drawings, standards, and specifications referred to or attached as part of this specification.

3.3 The vessels covered by this specification are to be used in ultra-high vacuum service and require strict cleanliness and contamination prevention throughout the material handling, fabrication and shipping process. All storage and fabrication for this vessel shall be done in the area isolated (plastic room or equal) to prevent contamination from smoke, dust and oily vapors from other manufacturing areas. The area shall be purged with clean air to prevent contamination and adjacent areas.

3.4 Stainless steel fixtures (spiders, roundup rings, etc.) shall be used as required to maintain vessel and nozzle roundness during fabrication.

3.5 The vessel shall be fabricated per the attached PSI Quality Plan, and Fabrication Flow Chart - Attachment 2.

4.0 CODES AND STANDARDS

4.1 Priority Of Codes And Documents

1. This Specification
2. Fabrication drawings

4.2 The following codes and standards shall be applicable to the fabrication of the equipment:

4.2.1 American Society of Mechanical Engineers (ASME)

a. ASME Boiler and Pressure Vessel Code, 1992 Edition Through 1994 Addenda.

Section II	Material Specifications
	Part A, Ferrous
	Part B, Nonferrous
	Part C, Welding Rods, Electrodes and Filler Metals
Section VIII	Pressure Vessels, Division I (Stamp Not Required)
Section IX	Welding and Brazing Qualification

5.0 FABRICATION REQUIREMENTS

5.1 General

5.1.1 Mechanical design of the vessels shall be as shown on the PSI's fabrication drawings.

5.1.2 Vessels do not require ASME Code stamping or code inspection.

5.1.3 All vessels shall be furnished complete as shown on the PSI's drawings, as required, bolts, washers, and nuts. Tolerances shall be adhered to as specified on the detail drawings.

5.2 Rolling Of Shells

5.2.1 Carbon steel rollers shall be covered with heavy (paper or carpet) or S/S during the rolling process to prevent carbon steel contamination of the stainless steel vacuum shell and the aluminum reservoir shells.

5.2.2 The seam edges of plates to be rolled are to be preworked to assure roundness of the final cylinder.

5.3 Cleanliness

No grinding with abrasive wheels, cloth or stones is allowed on the internal vacuum surface unless specified in this specification. This material is intended for use in a high vacuum application. Potential hydrocarbon contamination shall be prevented. Also, the material shall be wrapped and covered at all times the material is not being processed to minimize possible exposure to contaminants. The shells shall be cleaned (per 9.1) prior to shipment.

No iron, carbon steel or other contaminants (such as grease, oil or hydrocarbons) are to come in contact with the vessel interior surfaces during material handling and assembly. Machining fluids shall be water soluble and free of oil, sulfur and chlorides.

5.4 Welding

5.4.1 All welding shall be performed in accordance with the applicable codes (Para. 4.2.1) and PSI procedures for design and fabrication.

5.4.2 The PSI fitup tack welding procedures and procedure qualifications shall be used.

5.4.3 All weld joint preparation shall be done by tungsten carbide tooling if possible.

5.4.4 Welding Process

1. Vacuum boundary and attachment welds shall be made with the Plasma Arc process per PSI weld procedure WPS151 PAW. Shielding gas shall be a 75% Argon/25% Helium mixture, backing gas shall be 100% Argon and Plasma gas shall be 100% Argon. Hydrogen gas is not permitted. GTAW welds are acceptable for minor welds per PSI procedure WPS153 GTAW.

2. All weld repairs shall be performed per PSI procedure V049-2-074.

3. External support structures may be welded using GMAW process. All attachments to the vessel shall be by plasma arc or GTAW.

4. All weld wire and weld joint preparation areas shall be cleaned with CO_2 scrubbing prior to welding per PSI procedure V049-2-070.

5.4.5 All penetrations in the chamber shall be continuously welded on the inside per drawing details. Internal weld surface to be smooth but NOT GROUND.

5.4.6 All welds at vacuum boundaries to be vacuum tight with a helium leak rate equivalent to a total of 1×10^{-9} torr liters/sec/chamber. PSI will leak test all vessel welds with a helium mass spectrometer.

5.5 Backing strips or rings shall not be used.

5.6 Longitudinal seams shall be positioned as shown on detail drawings.

5.7 Sharp edges are to be removed from all carbon steel areas where external painting is to be applied.

5.8 Post Weld Heat Treatment - Not Required

6.0 MATERIALS

6.1 All vacuum boundary shell material shall meet the requirement of SA240 for both grades 304 and 304L. Vessel head and flange material shall be type 304L. All materials listed on the PSI bill of material will be provided by PSI.

7.0 IDENTIFICATION

7.1 Identification of the material shall be maintained through all manufacturing processes. All cutoff parts shall be marked with the heat number of the parent part as indicated below on the exterior surface only (not on the vacuum boundary).

7.2 If material identity is lost, the plate shall be requalified by making all tests that were required by the material specification or as indicated in this specification at the sellers expense. CMTRS have been provided to PSI for the above material, traceability of all materials must be maintained.

7.3 Marking the materials with marking fluids, die stamps, crayons, paints and/or electro-etching is not permitted. A vibratory tool with a minimum tip radius of .005" is acceptable for marking the outside only of the finished shell. All other marking methods must be approved by the purchaser prior to use. All parts shall be marked on outside surface only. Marking on interior boundary vacuum boundary surfaces is not allowed. The minimum marking is to be the heat/lot number.

8.0 SHOP TESTING

8.1 Testing of the external shell of the cryopump shall be per the Q.A. plan (V049-2-098) and Shop Conditioning/Test (V049-2-047). The reservoir shop testing shall be a pneumatic test at 38 psig, followed by a cold shock with liquid nitrogen, and finally helium leak testing. The cold shock is simply the introduction of liquid nitrogen into the reservoir until liquid nitrogen is observed discharging from the vent. Helium leak testing of the reservoir shells shall be as follows:

The specification requires all leaks greater than 1x10E-9 torr-l/sec of helium to be repaired in accordance with LIGO approved procedures. In the case of the 80K pump, the reservoir assembly must be leak checked prior to its installation into the pump vacuum chamber. The assembly consists of the annular reservoir and that attached piping which must be welded to the reservoir prior to its installation in the pump chamber. Welds on attached piping made subsequent to installation of the reservoir must be tested separately. All leak testing and calibration of test equipment shall conform to ASTM E498, Test Method A. The results of the leak testing shall be documented by PSI Quality Assurance personnel in a brief test report.

Since the volume of the reservoir is large, in order to pump it down in a reasonable time, it will be necessary to use an auxiliary roughing pump in conjunction with the mass spectometer leak detector. A cold trap shall used to ensure that no oil from the roughing pump enters the reservoir. The leak detector and auxiliary pump shall be connected to the gaseous nitrogen vent nozzle on the reservoir. Other nozzles on the reservoir must be temporarily welded closed. Following the method in ASTM E498, proceed as follows:

1) Rough down the reservoir to the lowest pressure that the roughing pump is capable of - preferably 50 microns or less.

2) Open the valve to the leak detector and close the valve to the roughing pump.

3) Probe with helium around all welds to check for leaks. All welds are to be leak tight to 1x10E-9 torr-l/sec or less.

4) In the event that any weld fails, the test shall be repeated to verify that it is an actual failure rather than a false indication.

5) In the event that a weld fails to pass, it shall be repaired, and subjected to another leak test.

6) After all leaks have been found and repaired, the entire reservoir assembly shall be enclosed in a plastic enclosure into which helium is admitted to determine the entire reservoir assembly integrity.The reservoir shall be held in the enclosure containing helium for 5 minutes prior to testing with the leak detector. The entire assembly must be leak tight to 1x10E-9 torr-l/sec. If the assembly fails, the test shall be repeated to verify that the failure is real, and not just a false indication.

9.0 CLEANING AND PAINTING

9.1 Cleaning before shipment to be per PSI Specification V049-2-015.

9.2 Only carbon steel members are to be painted per specification V049-2-077.

10.0 STORING AND SHIPPING

10.1 Shipping covers shall be used on all flanged connections. Covers shall be used for protecting the connections from mechanical damage and preventing the entry of dirt into the equipment. The use of tape or plastic sheet alone as a shipping cover is not acceptable.

10.2 The vessels shall be wrapped in waterproof polyethylene and covered with a tarp immediately after cleaning operations have been completed to minimize contamination.

10.3 Finished flange surfaces must be covered and protected during all fabrication steps.

10.4 The Cryopump shall be prepared and shipped per PSI Procedure V049-2-123.

11.0 INSPECTION AND QUALITY REQUIREMENTS

11.1 PSI shall have in effect at all times, an inspection, testing and documentation program that will ensure that the equipment furnished under the specification will meet in all respects the requirements of the specification. The responsibility for inspection rests with the Q.A. Department.

11.2 PSI is to inspect the materials in a timely manner and the materials shall be stored indoors in a clean dry storage space after delivery.

12.0 NON-ESCORT PRIVILEGES AND INSPECTION RIGHT

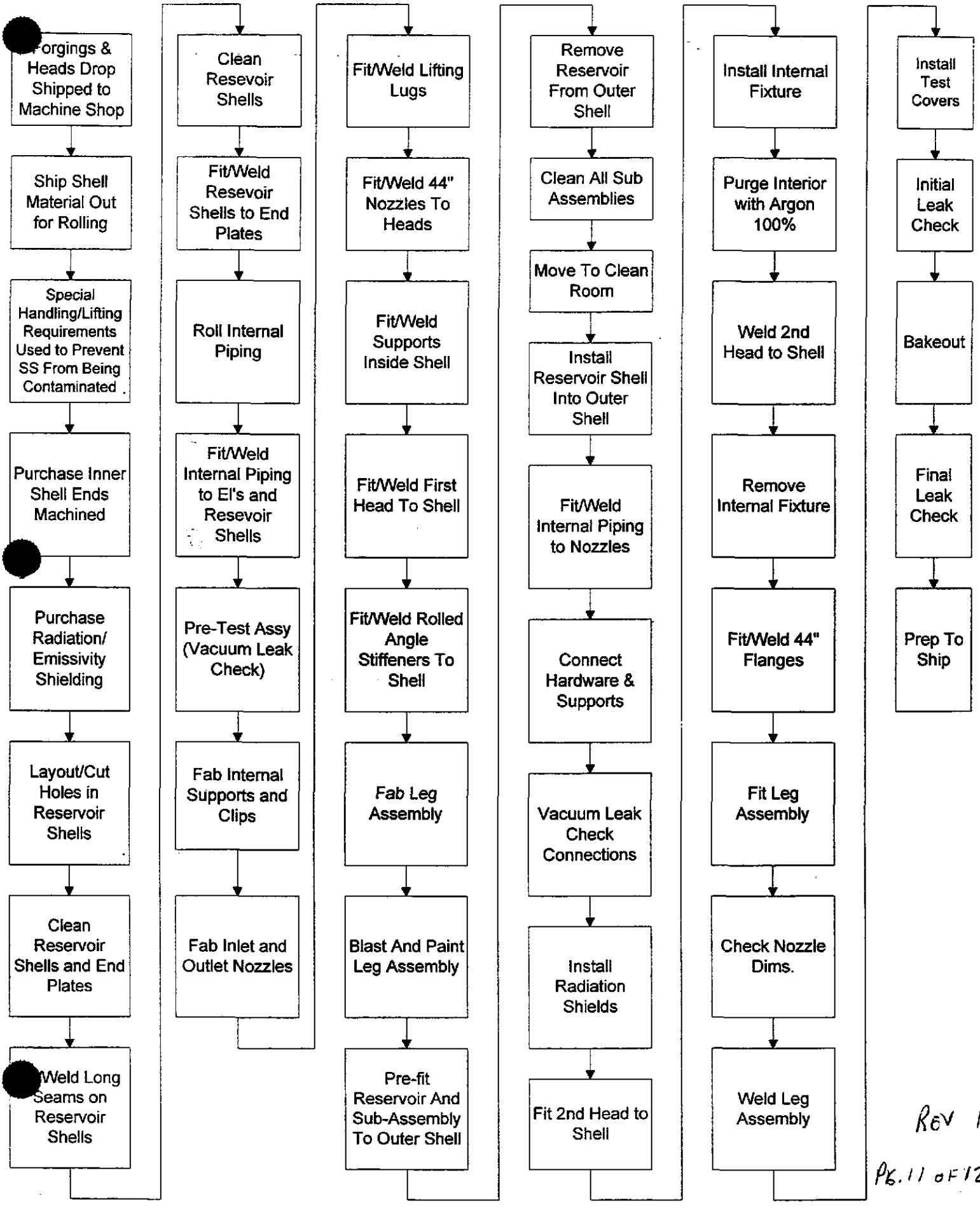
Non-escort privileges for LIGO or Government and LIGO representatives to all areas of the facilities where the work is being performed shall be arranged. This will include access to all areas where material is being processed and stored.

ATTACHMENT 1

CRYOPUMP DOCUMENTS

1.	Spec. For Cryopump Fabrication	V049-2-096
2.	Cryopump Quality Plan	V049-2-098
3.	Bill of Material	V049-4-004, V049-4-005
4.	Flanges	V049-2-040 & V049-2-042
5.	Heads	V049-2-039
6.	Raw Material Handling Procedure	V049-2-120
7.	Weld Data Sheet Spec.	V049-2-084
8.	Weld Procedures	V049-2-070, V049-2-071, V049-2-072, V049-2-073
9.	Weld Repair Procedure	V049-2-074
10.	Cleaning Procedures	V049-2-015
11.	Painting Procedures	V049-2-077
12.	Components Shop Conditioning/Test Plan	V049-2-047
13.	Bakeout Procedure	V049-2-019
14.	Leak Test Procedure	V049-2-014
15.	Dimensional Verification Procedure	V049-2-121
16.	Component Packaging, Handling, and Shipping Procedure	V049-2-123
17.	PSI Drawing	
	80K Cryopump - Long	V049-4-004
	80K Cryopump - Short	V049-4-005
	44 5/8" ID Flange Detail (Grooved)	V049-4-017

ATTACHMENT 2
80K CRYOPUMP FABRICATION PROCESS DIAGRAM



Rev 1

ATTACHMENT 3

80K CRYOPUMP FABRICATION PRIORITY LIST

WCP1	(CS)
WCP2	(CS)
WCP3	(LMS)
WCP4	(LMS)
WCP7	(LES)
WCP5	(RMS)
WCP6	(RMS)
WCP8	(RES)
LCP1	(CS)
LCP2	(CS)
LCP3	(LES)
LCP4	(RES)

4.3 80K Pump Quality Plan V049-2-098

Title: QUALITY PLAN FOR LIGO - 80K CRYOPUMP

QUALITY PLAN

FOR

LIGO

80K CRYOPUMP

SERIAL NO. V0494118-01&02

1	GS 10-10-96		Release Per Deo# 0302
REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE

PROCESS SYSTEMS INTERNATIONAL, INC.			**SPECIFICATION**	
INITIAL APPROVALS	PREPARED DATE GS 10-10-96	APPROVED DATE	Number V049-2-098	Rev. 1

APPLICABLE DRAWINGS

V049-4-004	**80K Cryo Pump Long Assy.**
V049-4-118	**80K Cryo Pump Long Weldment**
V049-4-146	**80K Head/Nozzle Details**
V049-4-095	**Reseveir Support Assy.**

APPLICABLE PROCEDURES

V049-2-070	WELDING PLASMA-ARC	P8-P8
V049-2-073	WELDING GTAW	P8-P8
V049-2-015	CLEANING	
V049-2-019	BAKEOUT	
V049-2-047	FINAL VACUUM TEST	
V049-2-014	HELIUM LEAK TEST	
V049-2-096	80K PUMP FABRICATION SPEC	

Number

Rev.

SPECIFICATION

Number A V049-2-098 Rev. 1

Serial No. V0494118-01 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049-
ITEM BOK CRYO PUMP (LONG) DWG NO. V049-4-118
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 8
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RATIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW

QUALITY PLAN REVIEWED QA ARB AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE			X			
OF MATERIALS						
VERIFY DIA. & CIR.			X			SHELL HT#
OF HEADS & SHELLS						Heads HT#
VERIFY ROUNDNESS			X			
OF SHELL AFTER						
ROLLING.						
VERIFY ROUNDNESS			X			
OF HEADS						
INSPECT FIT-UP		V049-2-070	X			
& WELDING OF		V049-2-073				
FOLLOWING NOZZ						
- LONG SEAM SHELL			X			
- 1ST HEAD TO SHELL			X			

Serial No. V0494118-01

SPECIFICATION V049-2-098 REV. 1

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP & WELDING OF NOZZLES:			V049-2-070 V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
~~ELECTRICAL~~				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD		V049-4-146		X			
45° NOZ. TO HEAD		V049-4-146		X			
INSPECT FIT-UP & WELDING OF:	D	V049-4-095	V049-2-070 V049-2-073				
INTERNAL LN2 RESERVOIR				X X			
LEG SUPPORTS TO SHELL				X			
VISUALLY INSPECT ALL INTERNAL WELDS.	V	V049-2-128		X			

Serial No. V049118-01

SPECIFICATION V049-2-098 REV. 1

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND HELIUM LEAK TEST.		V049-2-047 V049-2-014		X X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

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Serial No. V0494118-02 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
20 Walkup Drive
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(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049-
ITEM BOK CRYO PUMP (LONG) DWG NO.
APPLICABLE CODE ASME VIII DIV.1 PG 6 OF 8
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RATIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW

QUALITY PLAN REVIEWED QA QAR AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE OF MATERIALS				X			
VERIFY DIA. & CIR. OF HEADS & SHELLS				X			SHELL HT# Heads HT#
VERIFY ROUNDNESS OF SHELL AFTER ROLLING.				X			
VERIFY ROUNDNESS OF HEADS				X			
INSPECT FIT-UP & WELDING OF FOLLOWING NOZZ			V049-2-070 V049-2-073	X			
- LONG SEAM SHELL				X			
- 1ST HEAD TO SHELL				X			

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SPECIFICATION V049-2-098 REV. 1

Serial No. V0494118-02

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP &			V049-2-070				
WELDING OF NOZZLES:			V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD		V049-4-146		X			
45° NOZ. TO HEAD		V049-4-146		X			
INSPECT FIT-UP &		D	V049-2-070				
WELDING OF:		V049-4-095	V049-2-073				
INTERNAL LN2				X			
RESERVOIR				X			
LEG SUPPORTS							
TO SHELL				X			
VISUALLY INSPECT		V	V049-2-128	X			
ALL INTERNAL							
WELDS.							

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494118-02

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND		V049-2-047		X			
HELIUM LEAK TEST.		V049-2-014		X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

BUDT TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO - 80K CRYOPUMP

QUALITY PLAN

FOR

LIGO

80K CRYOPUMP

SERIAL NO. V0494119-01&02

1	GS 10-10-96		Release Per DEO No. 0302
REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE

PROCESS SYSTEMS INTERNATIONAL, INC.			**SPECIFICATION**	
INITIAL APPROVALS	PREPARED DATE GS 10-10-96	APPROVED DATE	Number V049-2-098	Rev. 1

APPLICABLE DRAWINGS

V049-4-004	**80K Cryo Pump Long Assy.**
V049-4-118	**80K Cryo Pump Long Weldment**
V049-4-146	**80K Head/Nozzle Details**
V049-4-095	**Reseveir Support Assy.**

APPLICABLE PROCEDURES

V049-2-070	WELDING PLASMA-ARC	P8-P8
V049-2-073	WELDING GTAW	P8-P8
V049-2-015	CLEANING	
V049-2-019	BAKEOUT	
V049-2-047	FINAL VACUUM TEST	
V049-2-014	HELIUM LEAK TEST	
V049-2-096	80K PUMP FABRICATION SPEC	

Number

Rev.

SPECIFICATION

Number A V049-2-098 Rev. 1

Serial No. V0494119-01 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
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PROJECT LIGO
ITEM 80K CRYO PUMP (LONG)
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049-
DWG NO. V049-4-119
PG 3 OF 8

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RATIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW

QUALITY PLAN REVIEWED
QA QAS
AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE OF MATERIALS			X			
VERIFY DIA. & CIR. OF HEADS & SHELLS			X			SHELL HT# Heads HT#
VERIFY ROUNDNESS OF SHEL AFTER ROLLING.			X			
VERIFY ROUNDNESS OF HEADS			X			
INSPECT FIT-UP & WELDING OF FOLLOWING NOZZ		V049-2-070 V049-2-073	X			
- LONG SEAM SHELL			X			
- 1ST HEAD TO SHELL			X			

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494119-01

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP & WELDING OF NOZZLES:			V049-2-070 V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD		V049-4-147		X			
45" NOZ. TO HEAD		V049-4-147		X			
INSPECT FIT-UP & WELDING OF:		D V049-4-093 V049-4-095	V049-2-070 V049-2-073				
INTERNAL LN2 RESERVOIR				X X			
LEG SUPPORTS TO SHELL				X			
VISUALLY INSPECT ALL INTERNAL WELDS.		V V049-2-128		X			

SPECIFICATION V049-2-098 REV. 1

Serial No. U0494119-01

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND HELIUM LEAK TEST.		V049-2-047 V049-2-014		X X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

Serial No. V0494119-02 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049-
ITEM 80K CRYO PUMP (LONG) DWG NO. V049-4-119
APPLICABLE CODE ASME VIII DIV.1 PG 6 OF 8
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RATIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW

QUALITY PLAN REVIEWED QA ARB AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE OF MATERIALS			X			
VERIFY DIA. & CIR. OF HEADS & SHELLS			X			SHELL HT# Heads HT#
VERIFY ROUNDNESS OF SHELL AFTER ROLLING.			X			
VERIFY ROUNDNESS OF HEADS			X			
INSPECT FIT-UP & WELDING OF FOLLOWING NOZZ		V049-2-070 V049-2-073	X			
- LONG SEAM SHELL			X			
- 1ST HEAD TO SHELL			X			

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SPECIFICATION V049-2-098 REV. 1

Serial No. V0494119-02

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP & WELDING OF NOZZLES:			V049-2-070 V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD		V049-4-147		X			
45° NOZ. TO HEAD		V049-4-147		X			
INSPECT FIT-UP & WELDING OF:		V049-4-093 V049-4-095	V049-2-070 V049-2-073				
INTERNAL LN2 RESERVOIR				X X			
LEG SUPPORTS TO SHELL				X			
VISUALLY INSPECT ALL INTERNAL WELDS.	V	V049-2-128		X			

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494119-02

QUALITY PLAN REVIEWED QA QRS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND		V049-2-047		X			
HELIUM LEAK TEST.		V049-2-014		X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

Title: QUALITY PLAN FOR LIGO - 80K CRYOPUMP

QUALITY PLAN

FOR

LIGO

80K CRYOPUMP

SERIAL NO. V0494120-01 thru 04

1	GS 10-11-96		Release Per DEO No. 0302
REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE

PROCESS SYSTEMS INTERNATIONAL, INC.			**SPECIFICATION**	
INITIAL APPROVALS	PREPARED DATE GS 10-10-96	APPROVED DATE	Number V049-2-098	Rev. 1

APLICABLE DRAWINGS

V049-4-007	**80K Cryopump-Short Assy.**
V049-4-147	**Head/Nozzle Details**
V049-4-120	**80K Cryopump-Short Weldment**
V049-4-09180K	**80K Short-Reseveir Assy.**
V049-4-094	**80K Short-Reseveir Supports**

APPLICABLE PROCEDURES

V049-2-070	WELDING PLASMA-ARC	P8-P8
V049-2-073	WELDING GTAW	P8-P8
V049-2-015	CLEANING	
V049-2-019	BAKEOUT	
V049-2-047	FINAL VACUUM TEST	
V049-2-014	HELIUM LEAK TEST	
V049-2-096	80K PUMP FABRICATION SPEC	

Serial No. V0499120-01 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM BOK CRYO PUMP (Short)
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049-
DWG NO. V049-4-120
PG 3 OF 14

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RATIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW

QUALITY PLAN REVIEWED QA AKB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE OF MATERIALS				X			
VERIFY DIA. & CIR. OF HEADS & SHELLS				X			SHELL Ht# Heads Ht#
VERIFY ROUNDNESS OF SHELL AFTER ROLLING.				X			
VERIFY ROUNDNESS OF HEADS				X			
INSPECT FIT-UP & WELDING OF FOLLOWING NOZZ			V049-2-070 V049-2-073	X			
- LONG SEAM SHELL				X			
- 1ST HEAD TO SHELL				X			

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SPECIFICATION V049-2-098 REV. 1

Serial No. V0494120-01

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP &			V049-2-070				
WELDING OF NOZZLES:			V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD		V049-4-147		X			
45° NOZ. TO HEAD		V049-4-147		X			
INSPECT FIT-UP &	D	V049-4-094	V049-2-070				
WELDING OF:		V049-4-091	V049-2-073				
INTERNAL LN2				X			
RESERVOIR				X			
LEG SUPPORTS							
TO SHELL				X			
VISUALLY INSPECT	V	V049-2-128		X			
ALL INTERNAL							
WELDS.							

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494120-01

QUALITY PLAN REVIEWED QA QRB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND		V049-2-047		X			
HELIUM LEAK TEST.		V049-2-014		X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

Serial No. V0494120-02 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049-
ITEM 80K CRYO PUMP (Short) DWG NO. V049-4-120
APPLICABLE CODE ASME VIII DIV.1 PG 6 OF 14
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RATIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW

QUALITY PLAN REVIEWED QA AKB AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE OF MATERIALS			X			
VERIFY DIA. & CIR. OF HEADS & SHELLS			X			SHELL HT# Heads HT#
VERIFY ROUNDNESS OF SHEL AFTER ROLLING.			X			
VERIFY ROUNDNESS OF HEADS			X			
INSPECT FIT-UP & WELDING OF FOLLOWING NOZZ		V049-2-070 V049-2-073	X			
- LONG SEAM SHELL			X			
- 1ST HEAD TO SHELL			X			

Serial No. V049-4120-02

SPECIFICATION V049-2-098 REV. 1

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP &			V049-2-070				
WELDING OF NOZZLES:			V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD		V049-4-147		X			
45° NOZ. TO HEAD		V049-4-147		X			
INSPECT FIT-UP &		V049-4-094	V049-2-070				
WELDING OF:		V049-4-091	V049-2-073				
INTERNAL LN2				X			
RESERVOIR				X			
LEG SUPPORTS							
TO SHELL				X			
VISUALLY INSPECT		V V049-2-128		X			
ALL INTERNAL							
WELDS.							

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494120-02

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND HELIUM LEAK TEST.		V049-2-047 V049-2-014		X X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

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Serial No. V0494120-03 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM BOK CRYO PUMP (SLOT)
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049-
DWG NO. V049-4-120
PG 9 OF 14

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RATIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW

QUALITY PLAN REVIEWED
QA ARB
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE OF MATERIALS				X			
VERIFY DIA. & CIR. OF HEADS & SHELLS				X			SHELL HT# Heads HT#
VERIFY ROUNDNESS OF SHEL AFTER ROLLING.				X			
VERIFY ROUNDNESS OF HEADS				X			
INSPECT FIT-UP & WELDING OF FOLLOWING NOZZ			V049-2-070 V049-2-073	X			
- LONG SEAM SHELL				X			
- 1ST HEAD TO SHELL				X			

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Serial No. V0494120-03

SPECIFICATION V049-2-098 REV. 1

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP &			V049-2-070				
WELDING OF NOZZLES:			V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD		V049-4-147		X			
45" NOZ. TO HEAD		V049-4-147		X			
INSPECT FIT-UP &		D V049-4-094	V049-2-070				
WELDING OF:		V049-4-091	V049-2-073				
INTERNAL LN2				X			
RESERVOIR				X			
LEG SUPPORTS							
TO SHELL				X			
VISUALLY INSPECT		V V049-2-128		X			
ALL INTERNAL							
WELDS.							

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494120-03

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND HELIUM LEAK TEST.		V049-2-047 V049-2-014		X X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

Serial No. V0494120-04 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM 80K CRYO PUMP (Short)
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049-
DWG NO. V049-4-120
PG 12 OF 14

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISUAL, RT = RATIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW

QUALITY PLAN REVIEWED QA AAB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE OF MATERIALS				X			
VERIFY DIA. & CIR. OF HEADS & SHELLS				X			SHELL HT# Heads HT#
VERIFY ROUNDNESS OF SHELL AFTER ROLLING.				X			
VERIFY ROUNDNESS OF HEADS				X			
INSPECT FIT-UP & WELDING OF FOLLOWING NOZZ			V049-2-070 V049-2-073	X			
- LONG SEAM SHELL				X			
- 1ST HEAD TO SHELL				X			

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SPECIFICATION V049-2-098 REV. 1

Serial No. V0494120-04

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP &			V049-2-070				
WELDING OF NOZZLES:			V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD		V049-4-147		X			
45" NOZ. TO HEAD		V049-4-147		X			
INSPECT FIT-UP &		D V049-4-094	V049-2-070				
WELDING OF:		V049-4-091	V049-2-073				
INTERNAL LN2				X			
RESERVOIR				X			
LEG SUPPORTS							
TO SHELL				X			
VISUALLY INSPECT		V V049-2-128		X			
ALL INTERNAL							
WELDS.							

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494120-04

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND HELIUM LEAK TEST.		V049-2-047 V049-2-014		X X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

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Title: QUALITY PLAN FOR LIGO - 80K CRYOPUMP

QUALITY PLAN

FOR

LIGO

80K CRYOPUMP

SERIAL NO. V0494121-01 thru 04

1	GS 10-10-96		Release Per DEO No. 0302
REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE

PROCESS SYSTEMS INTERNATIONAL, INC.			**SPECIFICATION**	
INITIAL APPROVALS	PREPARED DATE GS 10-10-96	APPROVED DATE	Number V049-2-098	Rev. 1

APPLICABLE DRAWINGS

V049-4-005	**80K Cryopump Short Assy.**
V049-4-146	**Head/Nozzle Details**
V049-4-121	**80K Cryopump Short Weldment**
V049-4-049	**Reseveir Support Assy.**

APPLICABLE PROCEDURES

V049-2-070	WELDING PLASMA-ARC	P8-P8
V049-2-073	WELDING GTAW	P8-P8
V049-2-015	CLEANING	
V049-2-019	BAKEOUT	
V049-2-047	FINAL VACUUM TEST	
V049-2-014	HELIUM LEAK TEST	
V049-2-096	80K PUMP FABRICATION SPEC	

Serial No. V0494121-01 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM 80K CRYO PUMP (Short)
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049-
DWG NO. V049-4-121
PG 3 OF 14

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RATIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW

QUALITY PLAN REVIEWED
QA QRS
AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE OF MATERIALS			X			
VERIFY DIA. & CIR. OF HEADS & SHELLS			X			SHELL Ht# Heads Ht#
VERIFY ROUNDNESS OF SHEL AFTER ROLLING.			X			
VERIFY ROUNDNESS OF HEADS			X			
INSPECT FIT-UP & WELDING OF FOLLOWING NOZZ		V049-2-070 V049-2-073	X			
- LONG SEAM SHELL			X			
- 1ST HEAD TO SHELL			X			

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494121-01

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP &			V049-2-070				
WELDING OF NOZZLES:			V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD		V049-4-146		X			
45° NOZ. TO HEAD		V049-4-146		X			
INSPECT FIT-UP &		D V049-4-090	V049-2-070				
WELDING OF:		V049-4-094	V049-2-073				
INTERNAL LN2				X			
RESERVOIR				X			
LEG SUPPORTS							
TO SHELL				X			
VISUALLY INSPECT		V V049-2-128		X			
ALL INTERNAL							
WELDS.							

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494121-01

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND		V049-2-047		X			
HELIUM LEAK TEST.		V049-2-014		X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

Serial No. V0494121-02 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM 80K CRYO PUMP (Short)
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049-
DWG NO. V049-4-121
PG 6 OF 14

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RATIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW

QUALITY PLAN REVIEWED QA RRB AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE			X			
OF MATERIALS						
VERIFY DIA. & CIR.			X			SHELL HT#
OF HEADS & SHELLS						Heads HT#
VERIFY ROUNDNESS			X			
OF SHELL AFTER						
ROLLING.						
VERIFY ROUNDNESS			X			
OF HEADS						
INSPECT FIT-UP		V049-2-070	X			
& WELDING OF		V049-2-073				
FOLLOWING NOZZ						
- LONG SEAM SHELL			X			
- 1ST HEAD TO SHELL			X			

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SPECIFICATION V049-2-098 REV. 1

Serial No. V049A121-02

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP &			V049-2-070				
WELDING OF NOZZLES:			V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD				X			
45" NOZ. TO HEAD				X			
INSPECT FIT-UP &		D	V049-4-092	V049-2-070			
WELDING OF:				V049-2-073			
INTERNAL LN2				X			
RESERVOIR				X			
LEG SUPPORTS							
TO SHELL				X			
VISUALLY INSPECT		V	V049-2-128	X			
ALL INTERNAL							
WELDS.							

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494121-02

QUALITY PLAN REVIEWED QA QAB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND		V049-2-047		X			
HELIUM LEAK TEST.		V049-2-014		X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

Serial No. V0494121-03 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM 80K CRYO PUMP (Short)
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049-
DWG NO. V049-4-121
PG 9 OF 14

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RATIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW

QUALITY PLAN REVIEWED QA ARB AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
			X			
VERIFY ACCEPTANCE OF MATERIALS						
			X			SHELL HT#
VERIFY DIA. & CIR. OF HEADS & SHELLS						Heads HT#
			X			
VERIFY ROUNDNESS OF SHELL AFTER ROLLING.						
			X			
VERIFY ROUNDNESS OF HEADS						
		V049-2-070	X			
INSPECT FIT-UP & WELDING OF		V049-2-073				
FOLLOWING NOZZ						
- LONG SEAM SHELL			X			
-1ST HEAD TO SHELL			X			

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Serial No. V0494121-03

SPECIFICATION V049-2-098 **REV.** 1

QUALITY PLAN REVIEWED QA aRB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP &			V049-2-070				
WELDING OF NOZZLES:			V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD				X			
45" NOZ. TO HEAD				X			
INSPECT FIT-UP &		D V049-4-092	V049-2-070				
WELDING OF:			V049-2-073				
INTERNAL LN2				X			
RESERVOIR				X			
LEG SUPPORTS							
TO SHELL				X			
VISUALLY INSPECT		V V049-2-128		X			
ALL INTERNAL							
WELDS.							

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SPECIFICATION V049-2-098 REV. 1

Serial No. V0494121-03

QUALITY PLAN REVIEWED QA RRB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND		V049-2-047		X			
HELIUM LEAK TEST.		V049-2-014		X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

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Serial No. V0494121-04 SPECIFICATION V049-2-098 REV. 1

Process Systems International, Inc.
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(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM 80K CRYO PUMP (Short)
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049-
DWG NO. V049-4-121
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ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RATIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VERIFY ACCEPTANCE OF MATERIALS				X			
VERIFY DIA. & CIR. OF HEADS & SHELLS				X			SHELL HT# Heads HT#
VERIFY ROUNDNESS OF SHELL AFTER ROLLING.				X			
VERIFY ROUNDNESS OF HEADS				X			
INSPECT FIT-UP & WELDING OF FOLLOWING NOZZ			V049-2-070 V049-2-073	X			
- LONG SEAM SHELL				X			
- 1ST HEAD TO SHELL				X			

SPECIFICATION V049-2-098 REV. 1

Serial No. V0494121-04

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
INSPECT FIT-UP & WELDING OF NOZZLES:			V049-2-070 V049-2-073				
GN2 VENT				X			
LN2 LEVEL CONTROL				X			
WARM GN2 INLET				X			
ELECTRICAL				X			
RELIEF VALVE				X			
VACUUM GAUGE				X			
ROUGHING PORT				X			
LN2 INLET				X			
CLEAN AIR VENT				X			
45° NOZ. TO HEAD				X			
45" NOZ. TO HEAD				X			
INSPECT FIT-UP & WELDING OF:		Δ V049-4-092	V049-2-070 V049-2-073				
INTERNAL LN2 RESERVOIR				X X			
LEG SUPPORTS TO SHELL				X			
VISUALLY INSPECT ALL INTERNAL WELDS.		V V049-2-128		X			

Serial No. V0494121-04 SPECIFICATION V049-2-098 REV. 1

QUALITY PLAN REVIEWED QA ARB AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
VISUALLY INSPECT INTERNAL SHIELDING.				X			
INSPECT FIT-UP & WELDING OF 2ND HEAD TO SHELL.			V049-2-070 V049-2-073	X			
VISUALLY INSPECT LEG SUPPORT STRUCTURE.				X			
FINAL DIMENSIONAL INSPECTION.				X			
VERIFY FINAL CLEANING.		V049-2-015		X			
VERIFY FINAL BAKEOUT.		V049-2-019		X			
VERIFY FINAL VACUUM TEST AND HELIUM LEAK TEST.		V049-2-047 V049-2-014		X X			
SHIP TO LIGO				X			DOCUMENTATION PACKAGE

4.4 80K Pump Testing/Inspections

Each 80K pump will be inspected after mechanical assembly is complete prior to being released for conditioning/testing. (See "Dimensional Fabrication Procedure" V049-2-121 for additional details).

After release, the 80K pump will be leak checked, cleaned, baked out and prepared for shipment. (See "Component Shop Conditioning/Test Procedure" V049-2-047 and "Component Packaging, Handling and Preparation for Shipment" V049-2-123 for additional details).

5.1 Spool/Mode Cleaner/Beam Manifold Fabrication Plan V049-2-083

FABRICATION PLAN

FOR

SPOOLS AND BEAM TUBES

LIGO VACUUM EQUIPMENT

Hanford, Washington
and
Livingston, Louisiana

PREPARED BY: Phillip Fabrel

QUALITY ASSURANCE: Alan L Braddock

MANUFACTURING ENGINEER: Phillip Fabrel

TECHNICAL DIRECTOR: D. C. McWilliams

PROJECT MANAGER: Rudolf Bayer

REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
Ø	PF 5/2/96	RBS 5/2/96	ISSUED PER DED 0161 FOR FDR

PROCESS SYSTEMS INTERNATIONAL, INC.					SPECIFICATION	
INITIAL APPROVALS	PREPARED	DATE	APPROVED	DATE	Number A V049-2-083	Rev. Ø
	PEF	5/2/96	RBS	5/2/96		

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ATTACHMENTS:

1. Spool and Beam Tube Fabrication Documents
2. Fabrication Flow Chart
3. Fabrication Priority List

1.0 PURPOSE

The purpose of this procedure is to define design guidelines, specifications, and procedures to enable PSI to specify, purchase, inspect, fabricate, test and ship the spools and beam tubes per LIGO requirements.

2.0 GENERAL

All Spools and Beam Tubes shall be fabricated per this fabrication plan. Each fabrication process shall be controlled via a written procedure. A "first article" approach will be used to validate all fabrication processes prior to release of the full vessel lot.

All vessels will be fabricated in accordance with the Quality Plan. Key points in the fabrication process shall be verified to ensure consistent results.

All vacuum equipment shall be fabricated in accordance with LIGO Project Contract PC175730 dated September 12, 1995, and subsequent change orders.

3.0 RESPONSIBILITY

The Manufacturing Department is responsible for the execution of this procedure, with input and monitoring by the Project Engineer, the Quality Assurance Department, and the Project Manager.

4.0 FABRICATION PLAN

4.1 A first article approach will be used to start the manufacturing cycle to validate the manufacturing procedures and technique prior to the full production release.

4.2 All Spoosl and Beam Tubes will be fabricated at PSI. PSI will perform vessel cleaning, leak checking, bakeout and preparation for shipment.

4.3 All Spools and Beam Tubes will be fabricated and tested per documents listed in Attachment I "Fabrication Documents".

4.4 All Spools and Beam Tubes will be fabricated according to the Fabrication Priority List, Attachment 2.

4.5 Procurement

PSI will procure all S.S. plate and flange material.

PSI will purchase vessel heads.

4.6 Quality Assurance

Each Spool and Tube Fabrication Process shall be monitored and control via the Quality Plan.

PSI will inspect all incoming materials to purchase documents.

4.7 Shop Conditioning/Testing

The Spools and Beam Tubes will be shop conditioned (cleaning, bakeout, etc.) per PSI Procedure V049-2-047.

4.8 Preparation For Shipment

The Spools and Beam Tubes will be prepared and shipped per PSI Procedure V049-2-123.

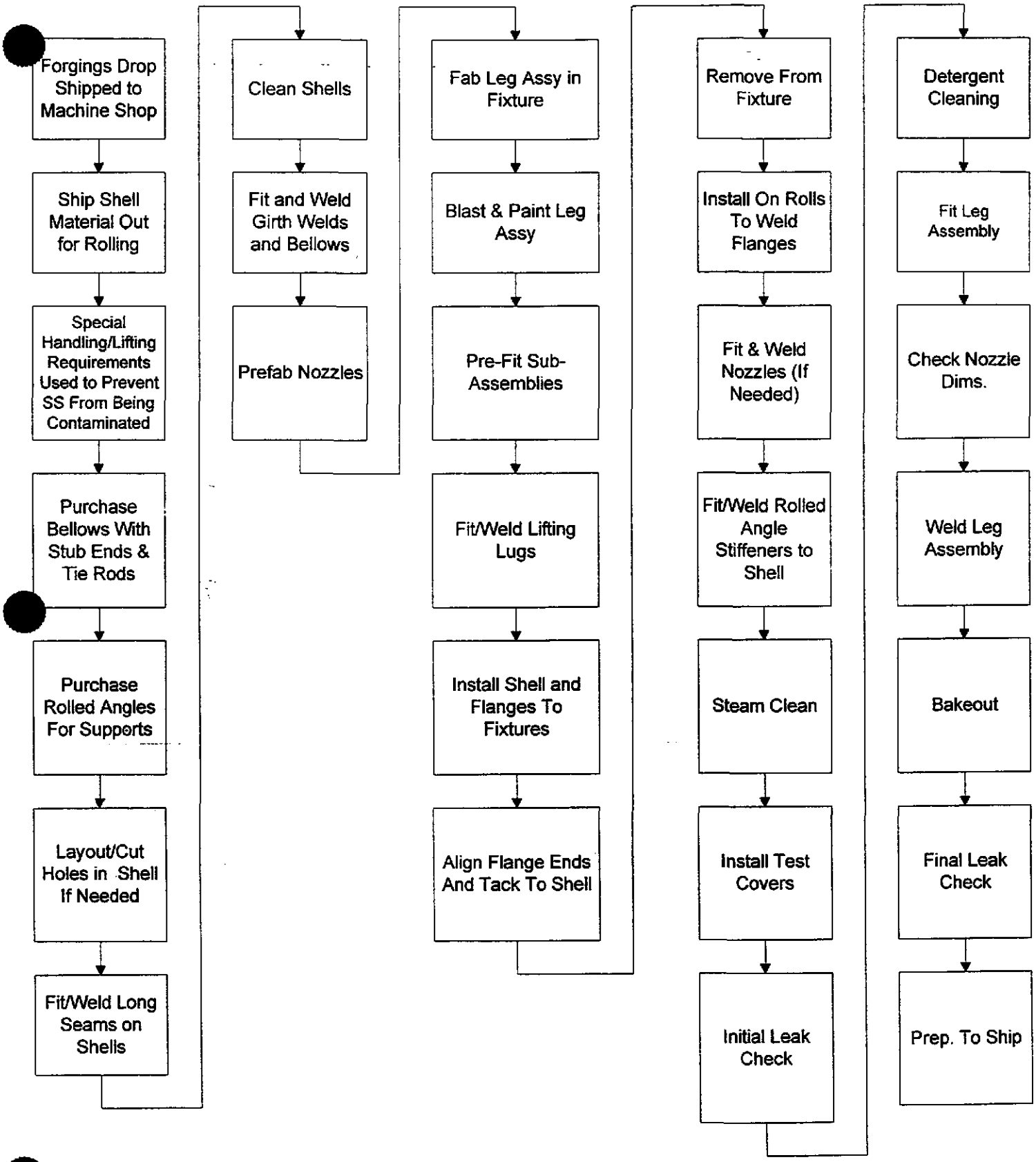
ATTACHMENT 1

SPOOLS AND BEAM TUBES DOCUMENTS

1.	Spec. For Spool and Beam Tube Fabrication	V049-2-097
2.	Spool and Beam Tube Quality Plan	V049-2-099
3.	Flanges	V049-2-040 & V049-2-042
4.	Raw Material Handling Procedure	V049-2-120
5.	Weld Data Sheet Spec.	V049-2-084
6.	Weld Procedures	V049-2-070, 071, 072, 073
7.	Weld Repair Procedure	V049-2-074
8.	Cleaning Procedures	V049-2-015
9.	Painting Procedures	V049-2-077
10.	Component Shop Conditioning/Test Plan	V049-2-014
11.	Bakeout Procedure	V049-2-019
12.	Leak Test Procedure	V049-2-047
13.	Dimensional Verification Procedure	V049-2-121
14.	Component, Handling, and Shipping Procedure	V049-2-123
15.	PSI Drawings	

Adapter A-1, 44.62" ID x 72.25 ID	V049-4-A1
Adapter A-2, 48.25" ID x 72.25 ID	V049-4-A2
Adapter A-3, 48.25" ID x 60.5 ID	V049-4-A3
60" HAM Cover, Grooved	V049-4-A4
Adapter A-6, 48.25" ID x 60.5 ID	V049-4-A6
Adapter A-7, 60.5" ID x 72.25 ID	V049-4-A7
Adapter A-12, 48.25" ID x 60.5 ID	V049-4-A12
BSC End Cover 60"	V049-4-All
Adapter A-13, 60.5" ID With 72.25 ID	V049-4-A13
Adapter A-14, 44.62" ID With 60.5 ID	V049-4-A14
Adapter A-15, 48.25" ID With 60.5 ID	V049-4-A15
Spool B-1, 72.25 ID	V049-4-B1
Spool B-2A, 30.5 ID x 60.5 ID	V049-4-B2A
Spool B-2B, 30.5 ID x 60.5 ID	V049-4-B2B
Spool B03A, 30.5 ID x 60.5 ID	V049-4-B3A
Spool B-4, 48.25" ID	V049-4-B4
Spool B-5A, 30.5 ID x 60.5 ID	V049-4-B5A
Spool B-6, 48.25" ID	V049-4-B6
Spool B-7, 48.25" ID	V049-4-B7
Spool B-8, 72.25" ID	V049-4-B8
Spool B-9, 72.25" ID	V049-4-B9
Spool BE-1, 72.25" ID	V049-4-BE1
Spool BE-2, 60.5" ID	V049-4-BE2
Off Set Spool BE-3, 60.5" ID x 60.5 ID	V049-4-BE3
Off Set Spool BE-3A, 60.5" ID x 60.5 ID	V049-4-BE3A
Spool, BE-4, 44.62" ID	V049-4-BE4
Spool, BE-5, 72.25" ID	V049-4-BE5
Spool, BE-6, 72.25" ID x 72.25 ID	V049-4-BE6

ATTACHMENT 2
SPOOLS AND BEAM TUBE FABRICATION PROCESS DIAGRAM



REV
Ø

ATTACHMENT 3

SPOOL AND BEAM TUBE FABRICATION PRIORITY LIST

First Priority For Washington	Second Priority For Washington
2-A1	
2-A3	4-A1
1-A6	2-A7
1-A12	
2-A13	2-A14
2-A15	2-BE4
2-A15	
2-B1	
2-B2A	
1-B3A	
1-B4	
1-B5A	
1-B6	
1-B7	
2-B8	
2-BE2	
2-BE3	
2-BE3A	
2-BE4	
1-BE5	
1-BE6	
2-BE9	

ATTACHMENT 3

SPOOLS AND BEAM TUBE FABRICATION PRIORITY LIST

For Louisiana Site

4-A1

2-A2

2-A3

2-A4

2-A7

2-B1

1-B3A

1-B5A

2-B9

2-BE1

2-BE2

4-BE3

4-BE4

1-BE5

1-BE6

5.2 Spool/Mode Cleaner/Beam Manifold Fabrication Specification V049-2-097

SPECIFICATION FOR

SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FABRICATION

PREPARED BY: R.E. Curtis 4/29/96

STRUCTURAL ENGINEER: R.P. Gatto

QUALITY ASSURANCE: A.R. Bradbrook

MANUFACTURING ENGR: Phillip Finlan

TECHNICAL DIRECTOR: D.A. McWilliams

PROJECT MANAGER: [signature]

REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
0	REC	REC 5/2/96	RELEASED PER DEO 3148 FOR FDR

TABLE OF CONTENTS

ATTACHMENTS:

1.0 SCOPE

1.1 This specification covers the minimum requirements of the manufacturing engineering, materials, fabrication, assembly, inspection, testing, preparation for shipping, shipment and delivery of vacuum vessels for the LIGO vacuum system.

1.2 All attachments are incorporated herein by reference and made a part of this specification.

1.3 The specified equipment is intended for use as part of the Vacuum Equipment supplied for the Laser Interferometer Gravitational-Wave Observatory (LIGO). LIGO, which is operated by Caltech and MIT under an NSF grant, includes two sites (Hanford Reservation near Richmond, WA and Livingston, LA). Each site contains laser interferometers in an L shape with 4 km arms, a vacuum system of the sensitive interferometer components and optical beams, and other support facilities.

1.4 Fabrication and material procurement will be by PSI.

2.0 SCHEDULE

2.1 Spool Assembly delivery shall be as follows: (To be determined by PSI Manufacturing)

3.0 GENERAL REQUIREMENTS

3.1 The design and materials of fabrication shall be as shown on the PSI vessel weldment drawings.

3.2 The vessels shall be fabricated and tested in accordance with drawings, standards, and specifications referred to or attached as part of this specification.

3.3 The vessels covered by this specification are to be used in ultra-high vacuum service and require strict cleanliness and contamination prevention throughout the material handling, fabrication and shipping process. All storage and fabrication for this vessel shall be done in the area isolated (plastic room or equal) to prevent contamination from smoke, dust and oily vapors from other manufacturing areas. The area shall be purged with clean air to prevent contamination and adjacent areas.

3.4 Stainless steel fixtures (spiders, roundup rings, etc.) shall be used as required to maintain vessel and nozzle roundness during fabrication.

3.5 The vessel shall be fabricated per the attached PSI Quality Plan, and Fabrication Flow Chart Attachment 2.

4.0 CODES AND STANDARDS

4.1 Priority Of Codes And Documents

1. This Specification
2. Fabrication drawings

4.2 The following codes and standards shall be applicable to the fabrication of the equipment:

4.2.1 American Society of Mechanical Engineers (ASME)

a. ASME Boiler and Pressure Vessel Code, 1992 Edition Through 1994 Addenda.

Section II	Material Specifications
	Part A, Ferrous
	Part B, Nonferrous
	Part C, Welding Rods, Electrodes and Filler Metals
Section VIII	Pressure Vessels, Division I (Stamp Not Required)
Section IX	Welding and Brazing Qualification

5.0 FABRICATION REQUIREMENTS

5.1 General

5.1.1 Mechanical design of the vessels shall be as shown on the PSI's fabrication drawings.

5.1.2 Vessels do not require ASME Code stamping or code inspection.

5.1.3 All vessels shall be furnished complete as shown on the PSI's drawings, as required, bolts, washers, and nuts. Tolerances shall be adhered to as specified on the detail drawings.

5.2 Rolling Of Shells

5.2.1 Carbon steel rollers shall be covered with heavy (paper or carpet) or S/S during the rolling process to prevent carbon steel contamination of the stainless steel.

5.2.2 The seam edges of plates to be rolled are to be preworked to assure roundness of the final cylinder.

5.3 Cleanliness

No grinding with abrasive wheels, cloth or stones is allowed on the internal vacuum surface unless specified in this specification. This material is intended for use in a high vacuum application. Potential hydrocarbon contamination shall be prevented. Also, the material shall be wrapped and covered at all times the material is not being processed to minimize possible exposure to contaminants. The shells shall be cleaned (per 9.1) prior to shipment.

No iron, carbon steel or other contaminants (such as grease, oil or hydrocarbons) are to come in contact with the vessel interior surfaces during material handling and assembly. Machining fluids shall be water soluble and free of oil, sulfur, and chorides.

5.4 Welding

5.4.1 All welding shall be performed in accordance with the applicable codes (Para. 4.2.1) and PSI procedures for design and fabrication.

5.4.2 The PSI fitup tack welding procedures and procedure qualifications shall be used.

5.4.3 All weld joint preparation shall be done by tungsten carbide tooling if possible.

5.4.4 Welding Process

1. Vacuum boundary and attachment welds shall be made with the Plasma Arc process per PSI weld procedure WPS151 PAW. Shielding gas shall be a 75% Argon/25% Helium mixture, backing gas shall be 100% Argon and Plasma gas shall be 100% Argon. Hydrogen gas is not permitted. GTAW welds are acceptable for minor welds per PSI procedure WPS153 GTAW.

2. All weld repairs shall be performed per PSI procedure V049-2-074.

3. External support structures may be welded using GMAW process. All attachments to the vessel shall be by plasma arc or GTAW.

4. All weld wire and weld joint preparation areas shall be cleaned with CO_2 scrubbing prior to welding per PSI procedure V049-2-070.

5.4.5 All penetrations in the chamber shall be continuously welded on the inside per drawing details. Internal weld surface to be smooth but NOT GROUND.

5.4.6 All welds at vacuum boundaries to be vacuum tight with a helium leak rate equivalent to a total of 1×10^{-9} torr liters/sec/chamber. PSI will leak test all vessel welds with a helium mass spectrometer.

5.5 Backing strips or rings shall not be used.

5.6 Longitudinal seams shall be positioned as shown on detail drawings.

5.7 Sharp edges are to be removed from all carbon steel areas where external painting is to be applied.

5.8 Post Weld Heat Treatment - Not Required

6.0 MATERIALS

6.1 All vacuum boundary shell material shall meet the requirement of SA240 for both grades 304 and 304L. Vessel head and flange material shall be type 304L. All materials listed on the PSI bill of material will be provided by PSI.

7.0 IDENTIFICATION

7.1 Identification of the material shall be maintained through all manufacturing processes. All cutoff parts shall be marked with the heat number of the parent part as indicated below on the exterior surface only (not on the vacuum boundary).

7.2 If material identity is lost, the plate shall be requalified by making all tests that were required by the material specification or as indicated in this specification at the sellers expense. CMTRS have been provided to PSI for the above material, traceability of all materials must be maintained.

7.3 Marking the materials with marking fluids, die stamps, crayons, paints and/or electro-etching is not permitted. A vibratory tool with a minimum tip radius of .005" is acceptable for marking the outside only of the finished shell. All other marking methods must be approved by the purchaser prior to use. All parts shall be marked on outside surface only. Marking on interior boundary vacuum boundary surfaces is not allowed. The minimum marking is to be the heat/lot number.

8.0 SHOP TESTING

8.1 Testing shall be per the Q.A. plan (V049-2-099).

9.0 CLEANING AND PAINTING

9.1 Cleaning before shipment to be per PSI Specification V049-2-015.

9.2 Only carbon steel members are to be painted per specification V049-2-077.

10.0 STORING AND SHIPPING

10.1 Shipping covers shall be used on all flanged connections. Covers shall be provided by the buyer for protecting the connections from mechanical damage and preventing the entry of dirt into the equipment. The use of tape or plastic sheet alone as a shipping cover is not acceptable.

10.2 The vessels shall be wrapped in waterproof polyethylene and covered with a tarp immediately after cleaning operations have been completed to minimize contamination.

10.3 Finished flange surfaces must be covered and protected during all fabrication steps and during shipment to PSI.

10.4 The components of this specification shall be prepared and shipped per PSI Procedure V049-2-123.

11.0 INSPECTION AND QUALITY REQUIREMENTS

11.1 PSI shall have in effect at all times, an inspection, testing and documentation program that will ensure that the equipment furnished under the specification will meet in all respects the requirements of the specification. The responsibility for inspection rests with Q.A. Department.

11.2 PSI is to inspect the materials and store them indoors in a clean dry storage space after delivery.

12.0 NON-ESCORT PRIVILEGES AND INSPECTION RIGHT

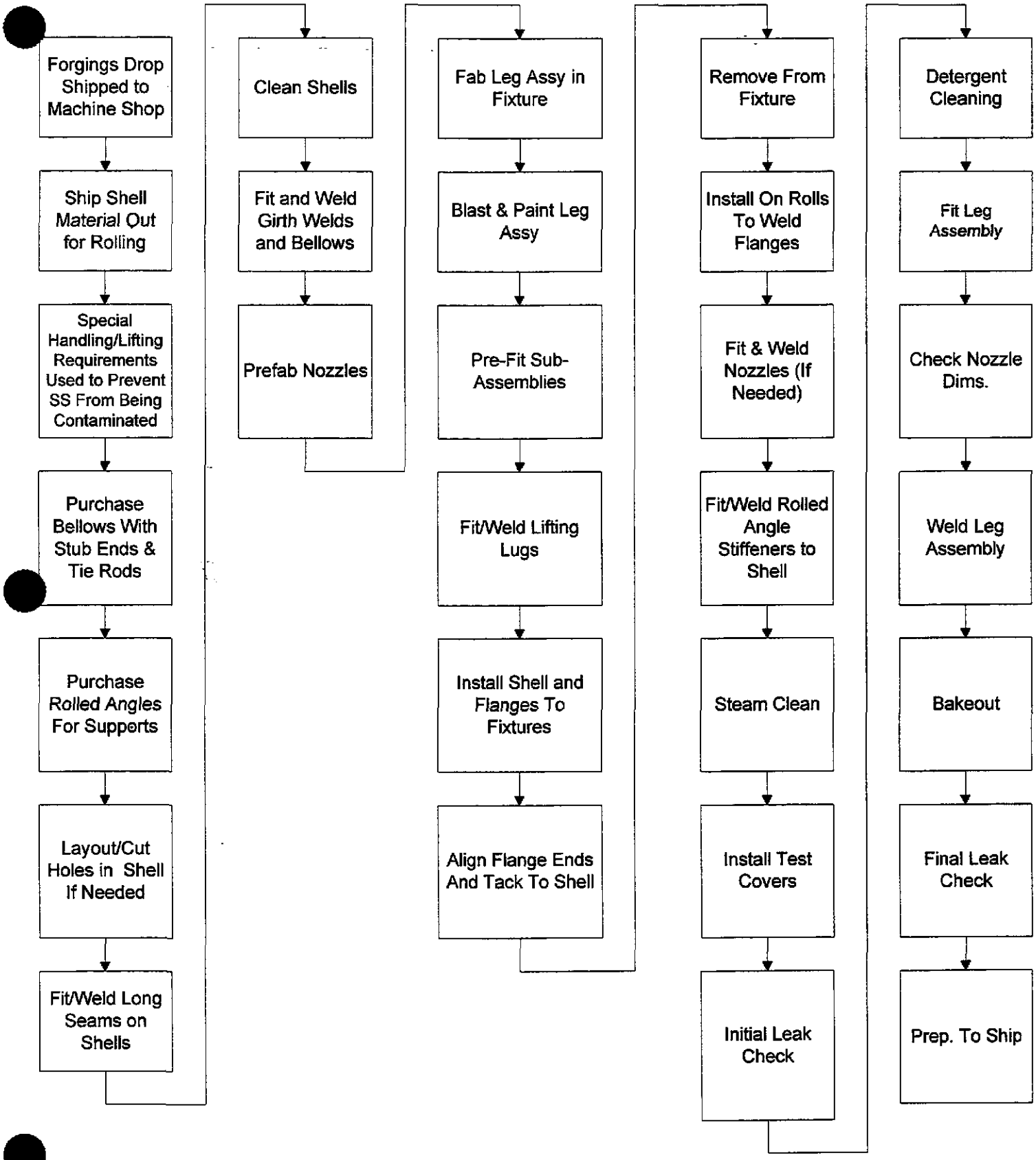
Non-escort privileges for LIGO or Government and LIGO representatives to all areas of the facilities where the work is being performed shall be arranged. This will include access to all areas where material is being processed and stored.

ATTACHMENT 1

SPOOLS AND BEAM TUBES DOCUMENTS

1.	Spec. For Spool and Beam Tube Fabrication	V049-2-097
2.	Spool and Beam Tube Quality Plan	V049-2-099
3.	Flanges	V049-2-040 & V049-2-042
4.	Raw Material Handling Procedure	V049-2-120
5.	Weld Data Sheet Spec.	V049-2-084
6.	Weld Procedures	V049-2-070, 071, 072, 073
7.	Weld Repair Procedure	V049-2-074
8.	Cleaning Procedures	V049-2-015
9.	Painting Procedures	V049-2-077
10.	Component Shop Conditioning/Test Plan	V049-2-047
11.	Bakeout Procedure	V049-2-019
12.	Leak Test Procedure	V049-2-014
13.	Dimensional Verification Procedure	V049-2-121
14.	Component, Handling, and Shipping Procedure	V049-2-123
15.	PSI Drawings	
	Adapter A-1, 44.62" ID x 72.25 ID	V049-4-A1
	Adapter A-2, 48.25" ID x 72.25 ID	V049-4-A2
	Adapter A-3, 48.25" ID x 60.5 ID	V049-4-A3
	60" HAM Cover, Grooved	V049-4-A4
	Adapter A-6, 48.25" ID x 60.5 ID	V049-4-A6
	Adapter A-7, 60.5" ID x 72.25 ID	V049-4-A7
	Adapter A-12, 48.25" ID x 60.5 ID	V049-4-A12
	BSC End Cover 60"	V049-4-All
	Adapter A-13, 60.5" ID With 72.25 ID	V049-4-A13
	Adapter A-14, 44.62" ID With 60.5 ID	V049-4-A14
	Adapter A-15, 48.25" ID With 60.5 ID	V049-4-A15
	Spool B-1, 72.25 ID	V049-4-B1
	Spool B-2A, 30.5 ID x 60.5 ID	V049-4-B2A
	Spool B-2B, 30.5 ID x 60.5 ID	V049-4-B2B
	Spool B03A, 30.5 ID x 60.5 ID	V049-4-B3A
	Spool B-4, 48.25" ID	V049-4-B4
	Spool B-5A, 30.5 ID x 60.5 ID	V049-4-B5A
	Spool B-6, 48.25" ID	V049-4-B6
	Spool B-7, 48.25" ID	V049-4-B7
	Spool B-8, 72.25" ID	V049-4-B8
	Spool B-9, 72.25" ID	V049-4-B9
	Spool BE-1, 72.25" ID	V049-4-BE1
	Spool BE-2, 60.5" ID	V049-4-BE2
	Off Set Spool BE-3, 60.5" ID x 60.5 ID	V049-4-BE3
	Off Set Spool BE-3A, 60.5" ID x 60.5 ID	V049-4-BE3A
	Spool, BE-4, 44.62" ID	V049-4-BE4
	Spool, BE-5, 72.25" ID	V049-4-BE5
	Spool, BE-6, 72.25" ID x 72.25 ID	V049-4-BE6

ATTACHMENT 2
SPOOLS AND BEAM TUBE FABRICATION PROCESS DIAGRAM



REV
Ø

ATTACHMENT 3

SPOOL AND BEAM TUBE FABRICATION PRIORITY LIST

First Priority For Washington	Second Priority For Washington
2-A1	
2-A3	4-A1
1-A6	2-A7
1-A12	
2-A13	2-A14
2-A15	2-BE4
2-A15	
2-B1	
2-B2A	
1-B3A	
1-B4	
1-B5A	
1-B6	
1-B7	
2-B8	
2-BE2	
2-BE3	
2-BE3A	
2-BE4	
1-BE5	
1-BE6	
2-BE9	

ATTACHMENT 3

SPOOLS AND BEAM TUBE FABRICATION PRIORITY LIST

For Louisiana Site

4-A1

2-A2

2-A3

2-A4

2-A7

2-B1

1-B3A

1-B5A

2-B9

2-BE1

2-BE2

4-BE3

4-BE4

1-BE5

1-BE6

5.3 Spools/Mode Cleaner/Beam Manifold Quality Plan V049-2-172 and V049-2-173

Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A1-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBurbank 11/22/96	APPROVED DATE REO 11/25/96	Number A V049-2-172	Rev. ϕ

Title

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING GTAW P8-P8 100%Ar
V049-2-146	WELDING PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE
V049-2-014	LEAK CHECK PLAN
V049-2-015	CLEANING PROCEDURE
V049-2-019	BAKEOUT PROCEDURE
V049-2-040	STAINLESS STEEL FLANGE FORGINGS
V049-2-047	COMPONENT SHOP CONDITIONING PLAN
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB
V049-2-120	RAW MATERIAL HANDLING PROCEDURE
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING
V049-2-084	WELD DATA SHEET SPECIFICATIONS

Number

Rev.

SPECIFICATION

Number A V049-2-172 Rev. 0

11/88

ADAPTER V049-4-A1-01

SPECIFICATION V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-2 44.62" ID / 72.25" ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)

JOB NO. V59049
DWG NO. V049-4-A1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

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ADAPTER V049-4-A1-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	**PSI** Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And Welding of Flanges to Shell	V-D						
Inspect following Fit-up And Welding: Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross Leak Check	R			X			
Perform final Dimensional Insp.	V-D			X			

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ADAPTER V049-4-A1-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	Y			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A1 - 02

φ	ARB 11/22/96	——	RELEASED ON DED # 0363
REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE

PROCESS SYSTEMS INTERNATIONAL, INC.					SPECIFICATION	
INITIAL APPROVALS	PREPARED ARBuckbook	DATE 11/22/96	APPROVED RER	DATE 11/25/96	Number A V049-2-172	Rev. φ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING GTAW P8-P8 100%Ar
V049-2-146	WELDING PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE
V049-2-014	LEAK CHECK PLAN
V049-2-015	CLEANING PROCEDURE
V049-2-019	BAKEOUT PROCEDURE
V049-2-040	STAINLESS STEEL FLANGE FORGINGS
V049-2-047	COMPONENT SHOP CONDITIONING PLAN
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB
V049-2-120	RAW MATERIAL HANDLING PROCEDURE
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING
V049-2-084	WELD DATA SHEET SPECIFICATIONS

ADAPTER V049-4-A1-02

SPECIFICATION V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-1 44.62"ID/72.25"ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

ADAPTER V049-4-A1-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

ADAPTER V049-4-A1-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	Y			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A1-03

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBurdick 11/22/96	RLS 11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A1-03 **SPECIFICATION** V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-2 74.62" ID / 72.25" ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			Verify Roundness of Rolled Shells
V-D			X			Verify Location of Nozzle Cutouts in Shell.
V-D			X			Verify Fit-UP & Welding of Long Seam(s)
						Verify Fit-UP and Welding of Girth Seams

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ADAPTER V049-4-A1-03 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	**PSI** Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect Following							
Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-UP And	V-D						
Welding of Flanges							
to Shell							
Inspect Following				X			
Fit-UP And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform Final	V-D			X			
Dimensional Insp.							

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ADAPTER V049-4-A1-03 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	V			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A1 - 04

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
φ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.					SPECIFICATION	
INITIAL APPROVALS	PREPARED: ALBuchholz	DATE: 11/22/96	APPROVED: RZB	DATE: 11/25/96	Number: A V049-2-172	Rev. φ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A1-04 **SPECIFICATION** V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-1 44.62" ID / 72.25" ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. Y59049
DWG NO. V049-4-A1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			
V-D			X			
V-D			X			

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ADAPTER V049-4-A1-04 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect Following							
Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-UP And	V-D						
Welding OF Flanges							
to Shell							
Inspect Following				X			
Fit-UP And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform Final	V-D			X			
Dimensional Insp.							

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ADAPTER V049-4-A1-04 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A1 - 05

ϕ	ARB 11/22/96	——	RELEASED ON DED # 0363
REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE

PROCESS SYSTEMS INTERNATIONAL, INC.					SPECIFICATION	
INITIAL APPROVALS	PREPARED ARBuddock	DATE 11/22/96	APPROVED RJB	DATE 11/25/96	Number A V049-2-172	Rev. ϕ

Title

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

Number

Rev.

SPECIFICATION

Number A V049-2-172 Rev. 0

PS-997

ADAPTER V049-4-A1-05 **SPECIFICATION** V049-2-172 **REV.** e

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-1 44.62"ID/72.25"ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

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ADAPTER V049-4-A1-05 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

ADAPTER V049-4-A1-05 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	V			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A1 - 06

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED: ARBuckholt	DATE: 11/22/96	APPROVED: REG	DATE: 11/25/96	Number: A V049-2-172	Rev. ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A1-06 **SPECIFICATION** V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-1 44.62" ID / 72.25" ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

ADAPTER V049-4-A1-06 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect Following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect Following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

ADAPTER V049-4-A1-06 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A1-07

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
Φ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBurdick 11/22/96	REO 11/25/96	A V049-2-172	Φ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A1-07

SPECIFICATION V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-1 44.62"ID/72.25"ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)

JOB NO. V59049
DWG NO. V049-4-A1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

ADAPTER V049-4-A1-07 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	**PSI** Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect Following Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And Welding of Flanges to Shell	V-D						
Inspect Following Fit-up And Welding:				X			
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross Leak Check	R			X			
Perform Final Dimensional Insp	V-D			X			

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ADAPTER V049-4-A1-07 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	Y			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A1-08

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
Ø	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBurdick 11/22/96	RES 11/25/96	A V049-2-172	Ø

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A1-08 **SPECIFICATION** V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A-2 74.62" ID/72.25" ID Flanges DWG NO. V049-4-A1
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE) PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			Verify Roundness of Rolled Shells
V-D			X			Verify Location of Nozzle Cutouts in Shell.
V-D			X			Verify Fit-UP & Welding of Long Seam(s)
						Verify Fit-UP and Welding of Girth Seams

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ADAPTER V049-4-A1-08 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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ADAPTER V049-4-A1-08 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	**PSI** Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A1-09

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC. — **SPECIFICATION**

INITIAL APPROVALS	PREPARED	DATE	APPROVED	DATE	Number	Rev.
	ALBuckbark	11/22/96	BES	11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A1-09 **SPECIFICATION** V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A-1 44.62"ID/72.25"ID Flanges DWG NO. V049-4-A1
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE) PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

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ADAPTER V049-4-A1-09 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY							
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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ADAPTER V049-4-A1-09 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A1-10

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ALBudlong 11/22/96	RES 11/25/96	A V049-2-172	

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A1-10 **SPECIFICATION** V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-1 44.62" ID / 72.25" ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			
V-D			X			
V-D			X			

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ADAPTER V049-4-A1-10" **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT **√** = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect Following							
Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect Following				X			
Fit-up And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform Final	V-D			X			
Dimensional Insp.							

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ADAPTER V049-4-A1-10 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	Y			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A2-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED	DATE	Number	Rev.
	ARBuddhoo 11/22/96	RES	11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A2-01 **SPECIFICATION** V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A-2 78.25"ID with 72.25"ID Flanges DWG NO. V049-4-A2
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			Verify Roundness of Rolled Shells
V-D			X			Verify Location of Nozzle Cutouts in Shell.
V-D			X			Verify Fit-UP & Welding of Long Seam(s)
						Verify Fit-UP and Welding of Girth Seams

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ADAPTER V049-4-A2-01

SPECIFICATION V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect Following							
Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-Up And	V-D						
Welding of Flanges							
to Shell							
Inspect Following				X			
Fit-Up And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform Final	V-D			X			
Dimensional Insp.							

ADAPTER V049-4-A2-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	Y			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A 2 - 02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
Φ	ARB 11/22/96	—	RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED: ARBuddock	DATE: 11/22/96	APPROVED: RGB DATE: 11/25/96	Number: A V049-2-172	Rev. Φ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A2-02 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A-2 78.25"ID with 72.25"ID Flanges DWG NO. V049-4-A2
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE) PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

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ADAPTER V049-4-A2-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp							

ADAPTER V049-4-A2-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY							
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	Y			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A3-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBurdick 11/22/96	RES 11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A3-01 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-3 48.25"ID with 60.5"ID flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A3
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

ADAPTER V049-4-A3-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND: D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect Following							
Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-Up And	V-D						
Welding of Flanges							
to Shell							
Inspect Following				X			
Fit-Up And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

ADAPTER V049-4-A3-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A3-02

REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE		APPROVED DATE	Number	Rev.
	ARBurdick	11/22/96	11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A3-02 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-3 48.25"ID with 60.5"ID flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A3
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			Verify Roundness of Rolled Shells
V-D			X			Verify Location of Nozzle Cutouts in Shell.
V-D			X			Verify Fit-UP & Welding of Long Seam(s)
						Verify Fit-UP and Welding of Girth Seams

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ADAPTER V049-4-A3-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

ADAPTER V049-4-A3-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW **VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	Y			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A3-03

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	←	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBuddhoo 11/22/96	RES 11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING GTAW P8-P8 100%Ar
V049-2-146	WELDING PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE
V049-2-014	LEAK CHECK PLAN
V049-2-015	CLEANING PROCEDURE
V049-2-019	BAKEOUT PROCEDURE
V049-2-040	STAINLESS STEEL FLANGE FORGINGS
V049-2-047	COMPONENT SHOP CONDITIONING PLAN
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB
V049-2-120	RAW MATERIAL HANDLING PROCEDURE
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING
V049-2-084	WELD DATA SHEET SPECIFICATIONS

ADAPTER V049-4-A3-03 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-3 48.25"ID with 60.5"ID flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A3
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			
V-D			X			
V-D			X			

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ADAPTER V049-4-A3-03 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect Following							
Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-Up And	V-D						
Welding of Flanges							
to Shell							
Inspect Following				X			
Fit-Up And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform Final	V-D			X			
Dimensional Insp.							

ADAPTER V049-4-A3-03 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY; PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT; LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS; X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A3-04

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
Φ	ARB 11/22/96	—	RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED	DATE	APPROVED	DATE	Number: A V049-2-172	Rev. Φ
	ARBurdick	11/22/96	RGS	11/25/96		

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING GTAW P8-P8 100%Ar
V049-2-146	WELDING PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE
V049-2-014	LEAK CHECK PLAN
V049-2-015	CLEANING PROCEDURE
V049-2-019	BAKEOUT PROCEDURE
V049-2-040	STAINLESS STEEL FLANGE FORGINGS
V049-2-047	COMPONENT SHOP CONDITIONING PLAN
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB
V049-2-120	RAW MATERIAL HANDLING PROCEDURE
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING
V049-2-084	WELD DATA SHEET SPECIFICATIONS

ADAPTER V049-4-A3-04 **SPECIFICATION** V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A-3 48.25"ID with 60.5"ID flanges DWG NO. V049-4-A3
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

ADAPTER V049-4-A3-04 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Grass	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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ADAPTER V649-4-A3-04 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW **VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A6-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
φ	ARB 11/22/96	——	RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.		SPECIFICATION	
INITIAL APPROVALS	PREPARED: ARBuckbork DATE: 11/22/96	APPROVED: [signature] DATE: 11/25/96	Number: A V049-2-172	Rev. φ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A6-01 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-6 48.25" ID with 60.5" ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A6
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

ADAPTER V049-4-AG-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	**TYPE INSP.**	**PROCEDURE OR DRAWING**	**WELDING PROCEDURE**	**PSI** Inspection SIGN/DATE	**AUTHORIZED INSPECTOR** SIGN/DATE	**CUSTOMER QA** SIGN/DATE	**REMARKS**
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Grass	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

ADAPTER V049-4-A6-01 **SPECIFICATION** V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A6-02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED	DATE	Number	Rev.
	ARBurdick 11/22/96	KGS	11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A6-02 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-6 48.25" ID with 60.5" ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A6
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

ADAPTER V649-4-AG-02 **SPECIFICATION** V649-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffnes	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

ADAPTER V049-4-A6-02 **SPECIFICATION** V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL, **V** = VISIUAL, **RT** = RADIOGRAPHY, **PT** = LIQUID PENETRANT, **MT** = MAGNETIC PARTICLE, **ET** = EDDY CURRENT, **LT** = LEAK TEST, **UT** = ULTRASONIC, **W** = WITNESS, **X** = HOLD POINT, **√** = APPROVED, **R** = REVIEW, **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	Y			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A7A-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	———	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBuddhook 11/22/96	APPROVED DATE REG 11/25/96	Number A V049-2-172	Rev. ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A7A-01 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A7A 60.5"ID with 72.25"ID Thick Flanges DWG NO. V049-4-A7A
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

ADAPTER V049-4-A7A-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

ADAPTER V049-4-A7A-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT **√** = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A7A-02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBuddhoo 11/22/96	APPROVED DATE RES 11/25/96	Number A V049-2-172	Rev. ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A7A-02 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A7A 60.5"ID with 72.25"ID Main Flanges DWG NO. V049-4-A7A
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

ADAPTER V049-4-A7A-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp							

ADAPTER V049-4-A7A-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A7A-03

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED	DATE	Number	Rev.
	ARBuddhoo 11/22/96	[illegible]	11/25/96	A V049-2-172	0

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING GTAW P8-P8 100%Ar
V049-2-146	WELDING PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE
V049-2-014	LEAK CHECK PLAN
V049-2-015	CLEANING PROCEDURE
V049-2-019	BAKEOUT PROCEDURE
V049-2-040	STAINLESS STEEL FLANGE FORGINGS
V049-2-047	COMPONENT SHOP CONDITIONING PLAN
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB
V049-2-120	RAW MATERIAL HANDLING PROCEDURE
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING
V049-2-084	WELD DATA SHEET SPECIFICATIONS

ADAPTER V049-4-A7A-03 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A7A 60.5"ID with 72.25"ID Union+Flanges DWG NO. V049-4-A7A
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI *Inspection* SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D.			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

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ADAPTER V649-4-A7A-03 **SPECIFICATION** V649-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Grass	R			X			
Leak Check							
Perform Final	V-D			X			
Dimensional Insp.							

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ADAPTER V049-4-A7A-03 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A7B-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBuddhoo 11/22/96	AES 11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A7B-01 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A-7B 60.5"ID with 72.25"ID Union Flange DWG NO. V049-4-A7B
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-Up & Welding of Long Seam(s)	V-D			X			
Verify Fit-Up and Welding of Girth Seams							

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ADAPTER V049-4-A7B-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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ADAPTER V049-4-A7B-01 **SPECIFICATION** V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	V			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A7B-02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBurdick 11/22/96	11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A7B-02 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-7B 60.5"ID with 72.25"ID Union Flange
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A7B
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

ADAPTER V049-4-A7B-02

SPECIFICATION V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Grass	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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ADAPTER V049-4-A713-02 **SPECIFICATION** V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY							
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	**PSI** Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	Y			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A7B-03

ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363
REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE

PROCESS SYSTEMS INTERNATIONAL, INC.					SPECIFICATION	
INITIAL APPROVALS	PREPARED: ALBudlock	DATE: 11/22/96	APPROVED: REA	DATE: 11/25/96	Number: A V049-2-172	Rev. ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A7B-03 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A-7B 60.5"ID with 72.25"OD Union Flange DWG NO. V049-4-A7B
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE) PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

ADAPTER V049-4-A7B-03 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffnes	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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ADAPTER V049-4-A7B-03 **SPECIFICATION** V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A12-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBradbrook 11/22/96	[illegible] 11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A12-01 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A12 48.25"ID with 56.00 & 66.25"OD
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A12
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

ADAPTER V049-4-A12-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform Final	V-D			X			
Dimensional Insp							

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ADAPTER V049-4-A12-01 **SPECIFICATION** V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	V			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A12-02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	——	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED ARBudlock DATE 11/22/96	APPROVED [signature] DATE 11/25/96	Number A V049-2-172	Rev. ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A12-02 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A12 48.25"ID with 56"OD & 68.25"OD
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A12
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

ADAPTER V049-4-A12-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect Following Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-Up And Welding Of Flanges To Shell	V-D						
Inspect Following Fit-Up And Welding: Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross Leak Check	R			X			
Perform Final Dimensional Insp.	V-D			X			

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ADAPTER V049-4-A12-02 **SPECIFICATION** V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	Y			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A 13-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBurdick 11/22/96	RSG 11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A13-01 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A13 60.5" ID with 72.25" ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A13
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

ADAPTER U049-4-A13-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp							

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ADAPTER V049-4-A13-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A13-02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	——	RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED ARBuddeck	DATE 11/22/96	APPROVED [signature]	DATE 11/25/96	Number A V049-2-172	Rev. ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A13-02 **SPECIFICATION** V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-13 60.5" ID with 72.25" ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A13
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

ADAPTER V049-4-A13-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	**PSI** Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And Welding of Flanges to Shell	V-D						
Inspect following Fit-up And Welding: Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross Leak Check	R			X			
Perform final Dimensional Insp	V-D			X			

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ADAPTER V049-4-A13-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	V			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A14 - 01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	———	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBuddhook 11/22/96	RES 11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A-14-01 **SPECIFICATION** V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-14 44.62" ID with 60.5" ID Flange
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A14
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			Verify Roundness of Rolled Shells
V-D			X			Verify Location of Nozzle Cutouts in Shell.
V-D			X			Verify Fit-up & Welding of Long Seam(s)
						Verify Fit-up and Welding of Girth Seams

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ADAPTER V049-4-A14-01 **SPECIFICATION** V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	**PSI** Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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ADAPTER V049-4-A14-01 **SPECIFICATION** V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT **√** = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049-4-A14-02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
φ	ARB 11/22/96		RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.					SPECIFICATION	
INITIAL APPROVALS	PREPARED: ARBuddenhagen	DATE: 11/22/96	APPROVED: [illegible]	DATE: 11/25/96	Number: A V049-2-172	Rev. φ

Title

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

Number

Rev.

SPECIFICATION

Number A V049-2-172 Rev. P

PS-997

ADAPTER V049-4-A-14-02 **SPECIFICATION** V049-2-172 **REV.** 0

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM Adapter A-14 44.62" ID with 60.5" ID Flange DWG NO. V049-4-A14
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE) PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

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ADAPTER V049-4-A14-02 **SPECIFICATION** V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY							
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	**PSI** Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

ADAPTER V049-4-A14-02

SPECIFICATION V049-2-172 **REV.** 0

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI *Inspection* SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	Y			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A15-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	——	RELEASED ON DED # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBurdick 11/22/96	APPROVED DATE RES 11/25/96	Number A V049-2-172	Rev. ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A15-01

SPECIFICATION V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-15 48.25"ID with 60.25"ID Flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-A15
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			
V-D			X			
V-D			X			

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ADAPTER V049-4-A15-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect Following							
Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect Following				X			
Fit-up And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform Final	V-D			X			
Dimensional Insp							

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ADAPTER V049-4-A1S-01 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT √ = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	V			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- ADAPTERS

QUALITY PLAN

FOR

LIGO

ADAPTERS

SERIAL No. V049 - 4 - A15-02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DEO # 0363

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE	APPROVED DATE	Number	Rev.
	ARBuckbee 11/22/96	A EO 11/25/96	A V049-2-172	ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

ADAPTER V049-4-A15-02

SPECIFICATION V049-2-172 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM Adapter A-15 48.25"ID with 60.25"ID flanges
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)

JOB NO. V59049
DWG NO. V049-4-A15
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

ADAPTER V049-4-A15-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY **PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT **LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS **X** = HOLD POINT **√** = APPROVED **R** = REVIEW **VR** = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	**PSI** Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following Pre Fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-UP And Welding OF Flanges to Shell	V-D						
Inspect following Fit-UP And Welding: Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross Leak Check	R			X			
Perform Final Dimensional Insp	V-D			X			

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ADAPTER V049-4-A15-02 **SPECIFICATION** V049-2-172 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** **D** = DIMENSIONAL **V** = VISIUAL **RT** = RADIOGRAPHY	**PT** = LIQUID PENETRANT **MT** = MAGNETIC PARTICLE **ET** = EDDY CURRENT	**LT** = LEAK TEST **UT** = ULTRASONIC **W** = WITNESS	**X** = HOLD POINT **√** = APPROVED **R** = REVIEW	**VR** = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - B1-05

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBradbrook 11/22/96	APPROVED DATE RGS 11/25/96	Number A V049-2-173	Rev. ϕ

Title

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

Number

Rev.

SPECIFICATION

Number A V049-2-173 Rev. Ø

SPOOL V049-4-B1-05 **SPECIFICATION** V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM SPOOL B1 72.25" ID with 80" O.D Flange DWG NO. V049-4-B1
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

SPOOL V049-4-B1-05 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And Welding of Flanges to Shell	V-D						
Inspect following Fit-up And Welding: Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross Leak Check	R			X			
Perform final Dimensional Insp.	V-D			X			

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SPOOL V049-4-B1-05 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	V			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - B1 - 04

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBrudbrook 11/22/96	APPROVED DATE [illegible] 11/25/96	Number A V049-2-173	Rev. ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

SPOOL V049-4-B1-04 **SPECIFICATION** V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM SPOOL B1 72.25" ID with 80" O.D Flange
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-B1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D.			X			
Verify Fit-up & Welding of Long Seam(s)	V-D			X			
Verify Fit-up and Welding of Girth Seams							

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SPOOL V049-4-B1-04 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And Welding of Flanges to Shell	V-D						
Inspect following Fit-up and Welding: Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross Leak Check	R			X			
Perform final Dimensional Insp.	V-D			X			

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SPOOL V049-4-B1-04 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	Y			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - B1-03

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
Φ	ARB 11/22/96	—	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBundbak 11/22/96	APPROVED DATE RGS 11/25/96	Number A V049-2-173	Rev. Φ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

SPOOL V049-4-B1-03

SPECIFICATION V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM SPOOL B1 72.25" ID with 80" O.D Flange
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)

JOB NO. V59049
DWG NO. V049-4-B1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			Verify Roundness of Rolled Shells
V-D			X			Verify Location of Nozzle Cutouts in Shell.
V-D			X			Verify Fit-UP & Welding of Long Seam(s)
						Verify Fit-UP and Welding of Girth Seams

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SPOOL V049-4-B1-03 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY							
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-UP And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-UP and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp							

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SPOOL V049-4-B1-03 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	V			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - B1-02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBrudbrook 11/22/96	APPROVED DATE 11/25/96	Number A V049-2-173	Rev. ϕ

Title

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

Number

Rev.

SPECIFICATION

Number A V049-2-173 Rev. Ø

PS-007

SPOOL V049-4-B1-02 **SPECIFICATION** V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM SPOOL B1 72.25" ID with 80" O.D Flange DWG NO. V049-4-B1
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell.	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

SPOOL V049-4-B1-02 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Grass	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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SPOOL V049-4-B1-02 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	Y			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049-4-B1-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
Φ	ARB 11/22/96	———	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED	DATE	APPROVED	DATE	Number A V049-2-173	Rev. Φ
	ARBrudbrook	11/22/96	RES	11/25/96		

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING GTAW P8-P8 100%Ar
V049-2-146	WELDING PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE
V049-2-014	LEAK CHECK PLAN
V049-2-015	CLEANING PROCEDURE
V049-2-019	BAKEOUT PROCEDURE
V049-2-040	STAINLESS STEEL FLANGE FORGINGS
V049-2-047	COMPONENT SHOP CONDITIONING PLAN
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB
V049-2-120	RAW MATERIAL HANDLING PROCEDURE
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING
V049-2-084	WELD DATA SHEET SPECIFICATIONS

SPOOL V049-4-B1-01 **SPECIFICATION** V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM SPOOL B1 72.25" ID with 80" O.D Flange
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-B1
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

SPOOL V049-4-B1-01 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And Welding of Flanges to Shell	V-D						
Inspect following Fit-up and Welding: Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross Leak Check	R			X			
Perform final Dimensional Insp	V-D			X			

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SPOOL V049-4-B1-01 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - B1-06

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
Φ	ARB 11/22/96	———	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBundbrook 11/22/96	APPROVED DATE 11/25/96	Number A V049-2-173	Rev. Φ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING GTAW P8-P8 100%Ar
V049-2-146	WELDING PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE
V049-2-014	LEAK CHECK PLAN
V049-2-015	CLEANING PROCEDURE
V049-2-019	BAKEOUT PROCEDURE
V049-2-040	STAINLESS STEEL FLANGE FORGINGS
V049-2-047	COMPONENT SHOP CONDITIONING PLAN
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB
V049-2-120	RAW MATERIAL HANDLING PROCEDURE
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING
V049-2-084	WELD DATA SHEET SPECIFICATIONS

SPOOL V049-4-B1-06 **SPECIFICATION** V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
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(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM SPOOL B1 72.25" ID with 80" O.D Flange DWG NO. V049-4-B1
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			Verify Roundness of Rolled Shells
V-D			X			Verify Location of Nozzle Cutouts in Shell.
V-D			X			Verify Fit-UP & Welding of Long Seam(S)
						Verify Fit-UP and Welding of Girth Seams

SPOOL V049-4-B1-06 **SPECIFICATION** V049-2473 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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SPOOL V049-4-B1-06 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	V			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - B2A-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBrudbrook 11/22/96	APPROVED DATE RBS 11/25/96	Number A V049-2-173	Rev. ϕ

Title

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

Number

Rev.

SPECIFICATION

Number A V049-2-173 Rev. 0

SPOOL V049-4-B2A-01 **SPECIFICATION** V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM SPOOL B-2A 30.5" ID with 60.5" ID Flange DWG NO. 1/549-4-B2A
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			
V-D			X			
V-D			X			
V-D			X			

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SPOOL V049-4-B2A-01 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And Welding of Flanges to Shell	V-D						
Inspect following Fit-up And Welding: Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross Leak Check	R			X			
Perform final Dimensional Insp.	V-D			X			

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SPOOL V049-4-B2A-01 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	Y			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - BZB-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
φ	ARB 11/22/96	—	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.					SPECIFICATION	
INITIAL APPROVALS	PREPARED ARBrudbrook	DATE 11/22/96	APPROVED RGB	DATE 11/25/96	Number A V049-2-173	Rev. φ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

SPOOL V049-4-B2B-01 **SPECIFICATION** V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V59049
ITEM SPOOL B-2B 30.5" ID with 60.5" ID Flange DWG NO. V049-4-B2B
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			
V-D			X			
V-D			X			

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SPOOL V049-4-B2B-01 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And Welding of Flanges to Shell	V-D						
Inspect following Fit-up and Welding: Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross Leak Check	R			X			
Perform final Dimensional Insp	V-D			X			

SPOOL V049-4-B2B-01 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - B3A-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
φ	ARB 11/22/96	—	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.					SPECIFICATION	
INITIAL APPROVALS	PREPARED ARBrandbrook	DATE 11/22/96	APPROVED [illegible]	DATE 11/25/96	Number A V049-2-173	Rev. φ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

SPOOL V049-4-B3A-01 **SPECIFICATION** V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO JOB NO. V69049
ITEM SPOOL B-3A 30.5"ID with 60.5"ID Flange DWG NO. V049-4-B3A
APPLICABLE CODE ASME VIII DIV.1 PG 3 OF 5
(WHERE APPLICABLE)

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			Verify Roundness of Rolled Shells
V-D			X			Verify Location of Nozzle Cutouts in Shell.
V-D			X			Verify Fit-UP & Welding of Long Seam(s)
						Verify Fit-UP and Welding of Girth Seams

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SPOOL J049-4-B3A-01 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

SPOOL V049-4-B3A-01 **SPECIFICATION** V049-2-173 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	Y			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

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Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - B3A-02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBrudbrook 11/22/96	APPROVED	DATE 11/25/96	Number A V049-2-173	Rev. ϕ

Title

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

Number

Rev.

SPECIFICATION

Number A V049-2-173 Rev. Ø

PS-997

SPOOL V049-4-B3A-02

SPECIFICATION V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366- 9111 Fax (508) 870-5930

PROJECT LIGO
ITEM SPOOL B-3A 30.5"ID with 60.5"ID Flange
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)
JOB NO. V59049
DWG NO. V049-4-B3A
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL; V = VISIUAL; RT = RADIOGRAPHY; PT = LIQUID PENETRANT; MT = MAGNETIC PARTICLE; ET = EDDY CURRENT; LT = LEAK TEST; UT = ULTRASONIC; W = WITNESS; X = HOLD POINT; √ = APPROVED; R = REVIEW; VR = VERIFY

QUALITY PLAN REVIEWED QA GS AI N/A

	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Verify Roundness of Rolled Shells	V-D			X			
Verify Location of Nozzle Cutouts in Shell	V-D			X			
Verify Fit-UP & Welding of Long Seam(s)	V-D			X			
Verify Fit-UP and Welding of Girth Seams							

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SPOOL J049-4-B3A-02 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY					
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up And Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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SPOOL V049-4-B3A-02 **SPECIFICATION** V049-2-173 **REV.** 0

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final	V			X			
Detergent Clean							
Bakeout	R	V049-2-019		X			
Perform Final	R	V049-2-047					
Leak Check				X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - B4-01

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
Φ	ARB 11/22/96	—	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBrudbrook 11/22/96	APPROVED DATE BJS 11/25/96	Number A V049-2-173	Rev. Φ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	

SPOOL 11649-4-B4-01

SPECIFICATION V049-2-173 **REV.** Ø

Process Systems International, Inc.
20 Walkup Drive
Westborough, MA 01581-5003
(508) 366-9111 Fax (508) 870-5930

PROJECT LIGO
ITEM SPOOL B-4 48.25" ID with 56" OD Flange
APPLICABLE CODE ASME VIII DIV.1 (WHERE APPLICABLE)

JOB NO. V59049
DWG NO. V049-4-B4
PG 3 OF 5

ASME CODE QUALITY PLAN

LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY

QUALITY PLAN REVIEWED
QA GS
AI N/A

TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
V-D			X			
V-D			X			
V-D			X			

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SPOOL V049-4-B4-01 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	LEGEND: D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Inspect following							
Pre fab Nozzles:	V-D			X			
Leg Assembly:	V-D			X			
Verify Fit-up And	V-D						
Welding of Flanges							
to Shell							
Inspect following				X			
Fit-up and Welding:							
Nozzles	V-D			X			
Angle Stiffners	V-D			X			
Perform Gross	R			X			
Leak Check							
Perform final	V-D			X			
Dimensional Insp.							

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SPOOL V049-4-B4-01 **SPECIFICATION** V049-2-173 **REV.** Ø

ASME CODE QUALITY PLAN	**LEGEND:** D = DIMENSIONAL, V = VISIUAL, RT = RADIOGRAPHY, PT = LIQUID PENETRANT, MT = MAGNETIC PARTICLE, ET = EDDY CURRENT, LT = LEAK TEST, UT = ULTRASONIC, W = WITNESS, X = HOLD POINT, √ = APPROVED, R = REVIEW, VR = VERIFY						
QUALITY PLAN REVIEWED QA GS AI N/A	TYPE INSP.	PROCEDURE OR DRAWING	WELDING PROCEDURE	PSI Inspection SIGN/DATE	AUTHORIZED INSPECTOR SIGN/DATE	CUSTOMER QA SIGN/DATE	REMARKS
Perform Final Detergent Clean	V			X			
Bakeout	R	V049-2-019		X			
Perform Final Leak Check	R	V049-2-047		X			
Ship to LIGO							

FILED:F:\TEMPLATE\ENGFORMS\ASMEQPL

Title: QUALITY PLAN FOR LIGO- SPOOLS

QUALITY PLAN

FOR

LIGO

SPOOLS

SERIAL No. V049 - 4 - B4-02

REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
ϕ	ARB 11/22/96	—	RELEASED ON DED # 0364

PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION	
INITIAL APPROVALS	PREPARED / DATE ARBradford 11/22/96	APPROVED DATE RBS 11/25/96	Number A V049-2-173	Rev. ϕ

APPLICABLE DRAWINGS

REFER TO FABRICATION PLAN

APPLICABLE PROCEDURES

V049-2-070	WELDING	PAW P8-P8 75%Ar, 25%He
V049-2-071	WELDING	PAW P8-P8 75%Ar, 25%He PWHT
V049-2-072	WELDING	GTAW P8-P8 100%Ar PWHT
V049-2-073	WELDING	GTAW P8-P8 100%Ar
V049-2-146	WELDING	PAW P8-P8 75%He, 25%Ar
V049-2-074	GENERAL REPAIR PROCEDURE	
V049-2-014	LEAK CHECK PLAN	
V049-2-015	CLEANING PROCEDURE	
V049-2-019	BAKEOUT PROCEDURE	
V049-2-040	STAINLESS STEEL FLANGE FORGINGS	
V049-2-047	COMPONENT SHOP CONDITIONING PLAN	
V049-2-097	SPOOLS/MODE CLEANERS/BEAM TUBE MANIFOLDS FAB	
V049-2-120	RAW MATERIAL HANDLING PROCEDURE	
V049-2-121	PROCEDURE FOR VERIFYING COMPONENT DIMENSIONAL ACCURACY	
V049-2-123	COMPONENT PACKAGING, HANDLING AND SHIPPING	
V049-2-084	WELD DATA SHEET SPECIFICATIONS	