

Title: SPECIFICATION FOR BAKEOUT SYSTEM

SPECIFICATION FOR  
 BAKEOUT BLANKET SYSTEM  
 FOR  
 LIGO VACUUM EQUIPMENT

Hanford, Washington  
 and  
 Livingston, Louisiana

PREPARED BY:

*Fadi Bank*

QUALITY ASSURANCE:

*A.R. Bradbrook*

TECHNICAL DIRECTOR:

*D.A.M. Williams*

PROJECT MANAGER:

*Ronald Bayley*

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	FAB 5-2-96	TD.M.S. 5-2-96	RELEASE FOR FDR (PER DED # 0164)
1	4-5-96	4-5-96	RELEASE FOR INFO (PER DED # 0111)
0	2-27-96	2-28-96	RELEASE FOR PURCHASE (PER DED # 0073)
P2	1-15-96	1-15-96	RELEASE FOR QUOTE (BSC-PROTOTYPE ONLY)

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED	DATE	APPROVED	DATE	Number
	<i>F. Bank</i>	1-15-96	<i>D.M.W.</i>	1-15-96	V049-2-009
					Rev. <i>2</i>

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**1.0 SCOPE**

This specification covers the minimum requirements for the design, materials, fabrication, assembly, inspection, testing, preparation for shipping, and shipment of the bakeout blanket system for the LIGO vacuum system.

All attachments are part of this specification.

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 contract, includes two installations at widely separated sites: near Hanford, WA and Livingston, LA. Each installation contains laser interferometers in an L shape with 4 km arms, a vacuum system for the sensitive interferometer components and optical beams, and other support facilities.

Only one bakeout blanket system is required. It must be designed to work on either the Washington or the Louisiana installation. The PLC control system and power controls will be provided by the buyer. 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.

**2.0 SCHEDULE**

2.1 Blankets shall be provided as follows:

HAM Chamber

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	2	9/1/96
Washington Site	4	9/1/97

BSC Chamber

	<u>Quantity</u>	<u>Date</u>
Washington Site	3	9/1/96

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Prototype BSC Chamber

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	1	4/30/96

Prototype Flange Covers (Per Sketch)

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	4	4/30/96

Mode Cleaner Tubes

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	5	9/1/96

Beam Tube Manifold Sections

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	5	9/1/96
Washington Site	4	9/1/97

2.2 Additionally, the Vendor shall supply bakeouts for the following items. Detailed dimensions are not yet defined, but approximate information is given.

Bellows (152 cm x 100 cm)

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	2	9/1/96
Washington Site	4	9/1/97

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Gate Valve (152 cm)

	<u>Quantity</u>	<u>Date</u>
Washington Site	4	9/1/97

Gauge Sets (Per Sketch) (to 250 C)

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	6	9/1/96

Long 80 K Cryopump (Per Sketch)

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	1	9/1/96

Short 80 K Cryopump (Per Sketch)

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	1	9/1/96

Main Ion Pump

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	1	4/30/96
Washington Site	4	9/1/97

10" Gate Valves

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	1	4/30/96
Washington Site	3	9/1/97

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14" Gate Valves

	<u>Quantity</u>	<u>Date</u>
PSI (Westboro, MA)	1	4/30/96
Washington Site	4	9/1/97

2.3 Acceptances at the sites (the start of Vendor's warranty periods) are expected to occur on a staggered basis, with final acceptance expected to occur no later than May 31, 1998. Portions of the equipment may be accepted earlier.

**3.0 EQUIPMENT REQUIREMENTS**

The bakeout system is used for initial conditioning of the LIGO vacuum vessels and components, and for periodic reconditioning. The blankets will be used to heat the system to  $150^{\circ}\text{C} \pm 20^{\circ}\text{C}$  @ a rate of  $1.8^{\circ}\text{C/hr}$ . For design purposes, the blankets shall be capable of heating the vessels and components to  $200^{\circ}\text{C}$  in 48 hours. The blanket control system shall be capable of ramping the setpoint temperature to a desired target temperature at a desired rate, and maintain the target temperature  $\pm 20\text{C}$  for all vessel or component surfaces. Several smaller blankets are needed for bellows, gate valves and vacuum gauge pairs, as noted in Section 2.3, above. Also note that bakeout blankets are needed for the main ion pumps.

The buyer will provide the programmable controls, power distribution with overload protection, and interconnecting cables.

**4.0 DESIGN REQUIREMENTS**

4.1 Mechanical Requirements

- 4.1.1 Heating blankets shall be of durable construction, designed to be installed, removed and reinstalled on the vessels without degradation.
- 4.1.2 Materials shall be non-shedding and designed for installation, removal and storage in a Fed. Std. 209 Class 50,000 cleanroom.

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- 4.1.3 Insulation sizing shall result in a cost-effective system design (2 inch min.). The Vendor shall indicate the design heat loss with his proposal. K thermal conductivity, Cp specific heat and density data of the insulation shall be provided.
- 4.1.4 Components shall be identical to the maximum possible extent to minimize the number of required spare parts.
- 4.1.5 Each blanket shall be sized (area) so it is easily installed without requiring special equipment.
- 4.1.6 Each blanket shall be capable of being secured properly on the vessels/piping in any position (horizontal, vertical) without sliding off its desired location.
- 4.1.7 Each blanket shall be properly identified with a non-removable tag. Tagging shall be on the blanket outer section. Blanket identification shall match the bakeout blanket layout configuration as shown on Vendor's provided drawings. Tagging numbering method shall be coordinated with PSI.
- 4.1.8 Each blanket shall have approximately a 3" x 4" removable patch to allow the installation of the TC's onto the metal surface. This patch shall be in the middle of the blanket.
- 4.1.9 Outer and inner blanket cover material shall be submitted to the customer for approval prior to fabrication. Outer jacket shall be the low emissivity type.
- 4.2 Electrical Requirements
  - 4.2.1 Instrumentation Requirements
    - 4.2.1.1 Type "J", #20 AWG stranded not grounded, shielded, 300 volts, 260<sup>0</sup>C teflon insulated control thermocouples (2 per blanket) shall be routed in each blanket. Provide 12" of TC wiring, on the TC side, to allow for easy installation of the TC's in direct contact with the surface being heated. TC wiring (type J) shall extend 3 feet minimum outside the blanket boundary. Also it shall be terminated in a TC (Type J) male connector (one per TC). TC wiring shall be routed away from power wiring and shall be tension relieved. Wiring shall be tagged.
  - 4.2.2 Controls Requirements
    - 4.2.2.1 Controls for local operation will be provided by the buyer.

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**4.2.3 Power Requirements**

4.2.3.1 The system shall be powered from 277V power system.

4.2.3.2 Each blanket shall have its power wiring extend 3 feet minimum outside the blanket boundary. Also it shall be terminated in a male power plug. Make provisions for grounding. Wiring shall be tension relieved and routed away from TC wiring. Power wiring shall be stranded copper, 600V, 260°C minimum. Power requirements shall not exceed 8 amps per blanket, wiring shall be tagged.

4.2.3.3 The maximum BSC power available is 25 KW.  
The maximum system power available is 180 KW.

**4.3 Additional Requirements**

4.3.1 Provide oversized blanket velcro and fiberglass thermal flaps. The thermal flap assemblies will ensure that there are no exposed air gaps between the individual heating blankets.

4.3.2 Provide nylon straps and fiberglass strap loops. The nylon strap assemblies will ensure that the individual heating blankets are cinched down tight against the BSC.

4.3.3 Provide two (2) thermocouple sensors per blanket as previously stated in Section 4.2.1.1.

**5.0 REQUIRED DOCUMENTATION**

In addition to the documentation listed in Attachment A & B, the following documentation shall be provided prior to shipment (schedule later):

- Blanket drawings detailing each blanket.
- Blanket heat transfer calculations.
- Blanket layout drawings for each bakeout configuration along with blanket identification (TAG number).
- Blanket tag number versus power consumption table.

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**6.0 SHOP TESTING**

The Vendor shall perform his standard testing. The Buyer reserves the right to witness shop testing.

**7.0 INSPECTION**

The inspections called for in Attachment A & B shall be performed by the Vendor.

**8.0 WARRANTY**

Refer to V59049-2-034 (Commercial Requirements), General Provisions, for warranty requirements.

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ATTACHMENT "A"  
LIGO QUALITY ASSURANCE REQUIREMENTS SUMMARY

LIGO VACUUM EQUIPMENT	VENDOR:					JOB NO.: V59049
EQUIPMENT: BAKEOUT SYSTEM	VENDOR ENG. OFFICE:					DWG. NO.:
PSI P.O. NO:	VENDOR FACTORY:					SPECNO: V049-2-009
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	2 WK		X	2	X	
VENDOR Q.A. PLAN	2 WK		X	2	X	
CLEANING PROCEDURE	2 WK		X	2	X	
PREP FOR SHIPMENT PROCEDURE	6 WK		X	2	X	
DELETED			X	2	X	
ASSEMBLY DRAWINGS	4 WK		X	2	X	
DESIGN REVIEW		X			X	PRIOR TO RELEASE FOR FABRICATION
CERTIFIED MATERIAL TEST REPORTS						
IN-PROCESS INSPECTIONS	TBD	X		2	X	
OPERATION & MAINTENANCE MANUALS	8 WK			5	X	
SHOP TEST PLAN			X	2	X	PRIOR TO RELEASE FOR FABRICATION
SHOP TEST (WITH REPORT)		X		2	X	PRIOR TO RELEASE FOR SHIPMENT
SHOP DIMENSIONAL INSPECTION		X		2	X	PRIOR TO RELEASE FOR SHIPMENT

## ATTACHMENT C

### VESSEL DRAWING

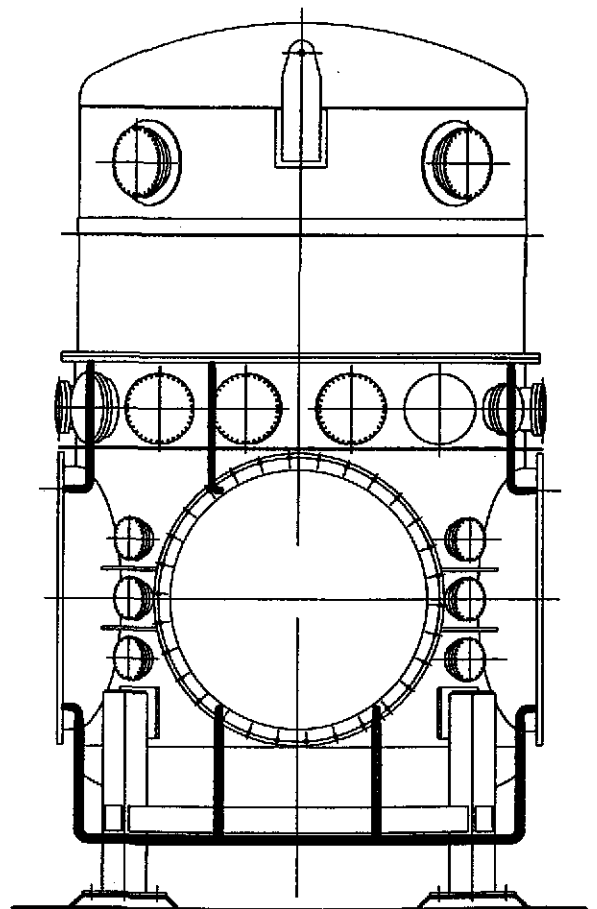
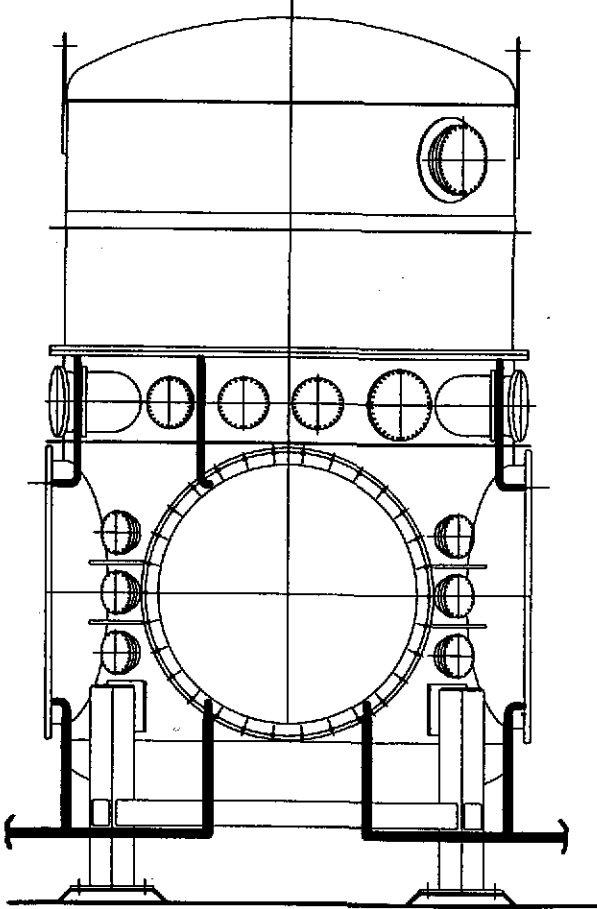
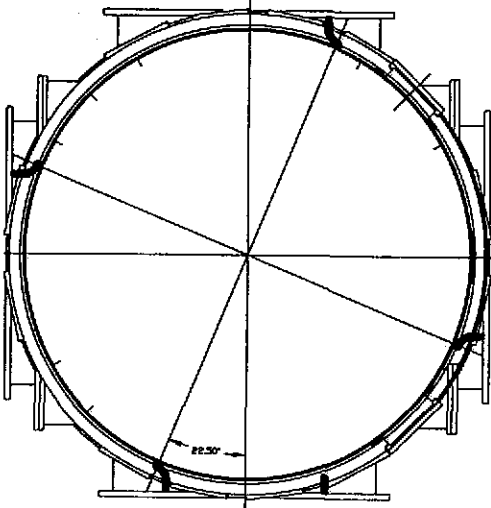
DRAWING NUMBER	REV	DESCRIPTION
V59049-4-001 Sheet 1	P6	BSC Details
V59049-4-001 Sheet 2	P6	BSC Details Lower
V59049-4-001 Sheet 3	P6	BSC Details Upper
V59049-4-001 Sheet 4	P6	BSC Details Roll-Up
V59049-4-001 Sheet 5	P6	BSC Details Stiffner
V59049-4-014	P3	BSC Tower Type II
V59049-4-019	P4	BSC 60 Flange Detail
V59049-4-022	P4	BSC 104 Flange Detail (Grooved)
V59049-4-023	P2	BSC Chamber Support Assembly
V59049-0-001 Sheet 1	0	Legend
V59049-0-001 Sheet 2	0	Station Diagram - Washington
V59049-0-001 Sheet 3	0	Station Diagram - Louisiana
V59049-4-025	P1	Annulus Piping
V59049-4-044	P1	Port Locations
V59049-4-041	P1	BSC-104 Flange Detail (Flat Face)
V59049-3-019 Sheet 1	0	Heater Blanket End Connector
V59049-3-019 Sheet 2	0	Blanket TC End Connector
V59049-3-019 Sheet 3	0	TC Installation Details

V049-2-009 REV. 1

FLANGE INTERCONNECTING PIPING

*This drawing shall be included as part of the bid drawings package. It shows the piping which connects the flange together (That is the area between the O'rings).*

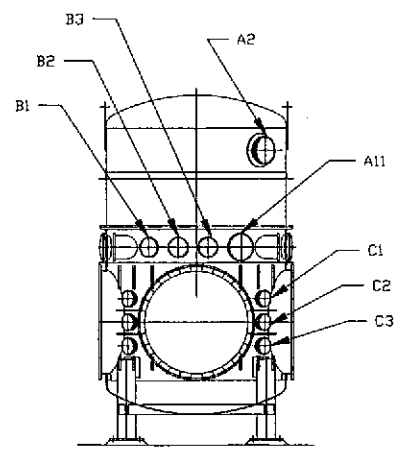
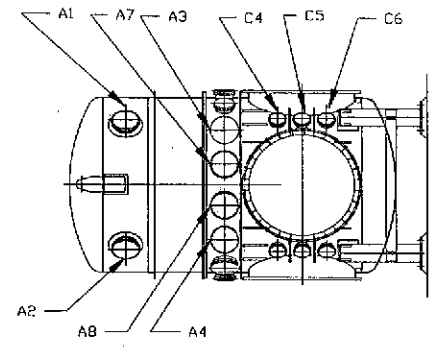
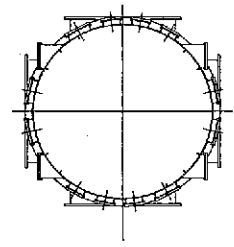
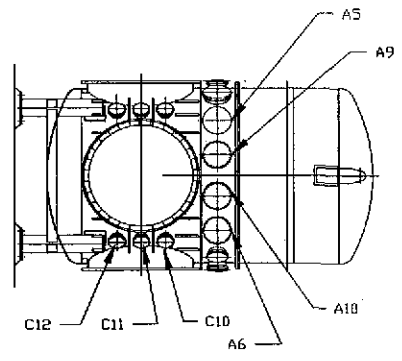
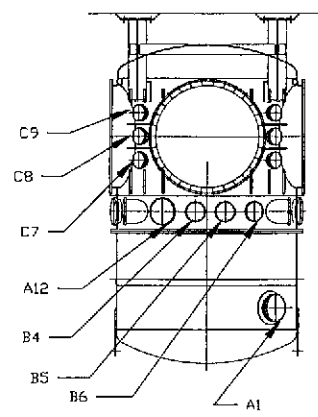
*Fadi*



(\*) Bakeout blanket vendor shall provide separate removable zones for each of the following ports: A11, A12, (14" ports) B1, B2, B3, B4, B5, B6. (10" ports)

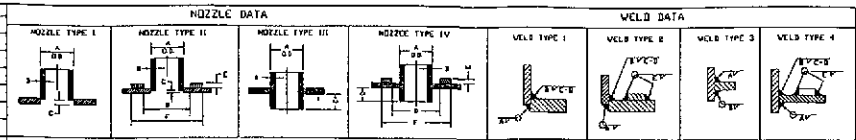
BSC PROTOTYPE PORT DESIGNATIONS

'A' PORTS 14" O.D. TUBE WITH 16 1/2" O.D. CONFLAT FLANGES  
 'B' PORTS 10" O.D. TUBE WITH 12" O.D. CONFLAT FLANGES  
 'C' PORTS 8" O.D. TUBE WITH 10" O.D. CONFLAT FLANGES



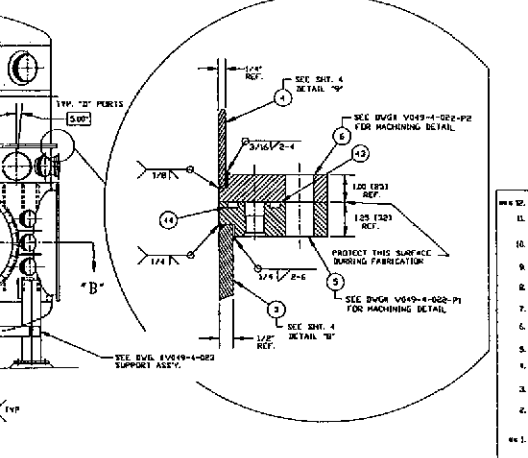
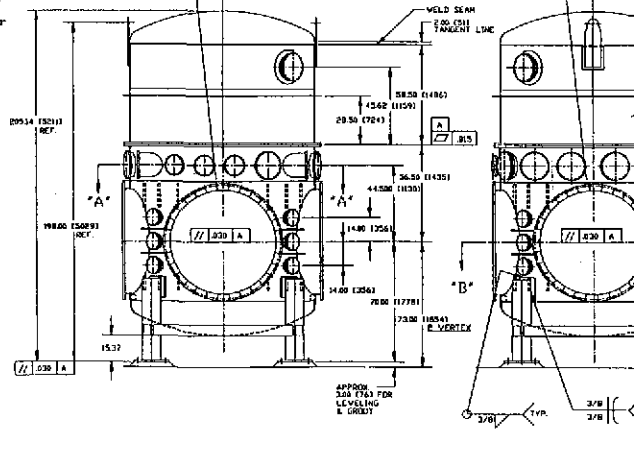
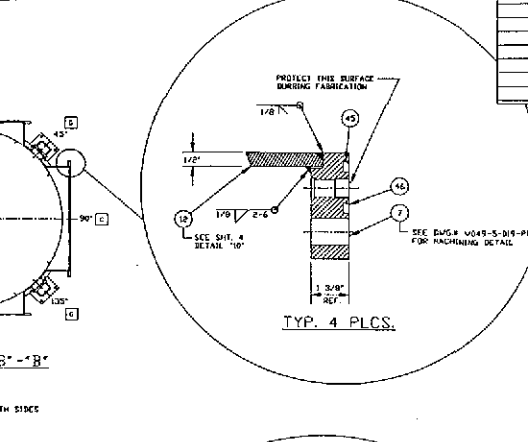
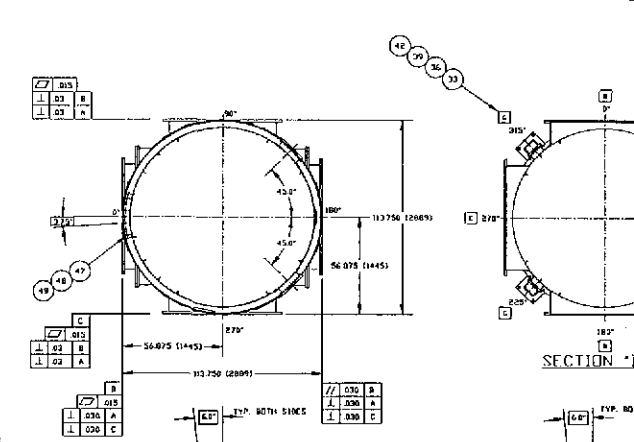
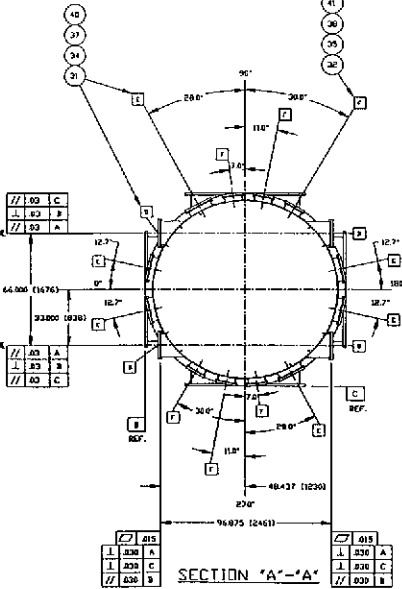
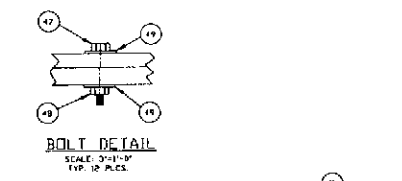
PORT	DESCRIPTION
A1	X
A2	X
A3	X
A4	X
A5	X
A6	X
A7	X
A8	X
A9	X
A10	X
A11	ION PUMP PORT
A12	ELECTRICAL FEEDTHRU
B1	TO BE DETERMINED
B2	CLEAN AIR VENT
B3	VACUUM INSTRUMENTATION (ION GAUGE, RGA, PIRANI)
B4	TO BE DETERMINED
B5	TURBO PUMP PORT
B6	LN2 TRAP
C1	X
C2	X
C3	X
C4	X
C5	X
C6	X
C7	X
C8	X
C9	X
C10	X
C11	X
C12	X

MARK	OFF	NOZZLE SCHEDULE			DESCRIPTION	NOZZLE TYPE							WELD TYPE								
		SIZE	RATING	TYPE		A	B	C	D	E	F	TYPE	A	B	C	D	E				
A	1	3/4 1/2" 1A		SEC NOTES 2 & 3	MAJOR AZELES																
B	2	3/4 1/2" 1A		SEC NOTES 2 & 3	LASER BEAM ACCESS OPTIMIZE NECK LENGTH																
C	2	3/4 1/2" 1A		SEC NOTES 2 & 3	ACCESS DRAINAGE NECK LENGTH																
D	4	1/2" 1/2" 1A		SEC NOTES 2 & 3	SUPPORT BEAMS																
E	4	1/2" 1/2" 1A		SEC NOTES 2 & 3	ACCESS DRIVE 3000-10 -AIR PUMPS BEARING & ION PUMPS UTILITY																
F	4	1/2" 1/2" 1A		SEC NOTES 2 & 3	ELECTRICAL FEEDTHROUGHS																
G	12	1/2" 1/2" 1A		SEC NOTES 2 & 3	DISCREETION BEAM PICK-UPS																



WELDING PROCEDURES					
WPS NO.	PROCESS	MATERIAL	WPS NO.	PROCESS	MATERIAL

DESIGN DATA		CODE: ASME SEC. VIII 1992 W/ 1993 ADDENDUM	
DESIGNER		DATE	
CHECKED		DATE	
SPECIFICATION			
CORROSION ALLOWANCE: 0			
POSTWELD HEAT TREATMENT: YES			
INSULATION: (SEE NOTES)			
FABRICATOR: MA			
MATERIALS			
HEADS: SA 308-304/304L			
SHELL: SA 308-304/304L			
FLANGES: SA 475-304/304L			
PIPE NECKS: SA 312-304/304L SA 240-304/252L			
REINFORCING			
BOLTS & NUTS: SA 193-B7			
CASSETS: (SEE NOTES)			
WEIGHTS			
FABRICATED:			
EXPTD: 14,800 LBS			
OPERATING:			
TEST:			



- NOTES**
1. THESE FLANGES ARE TO BE TANGENT TO THE SHELL OD.
  2. LEAK TEST & METHOD PER SPI SPEC V049-2-011
  3. REFER TO CODE CALCULATIONS PER SPEC
  4. CERTIFIED MANUFACTURER'S MATERIAL TEST REPORTS REQUIRED
  5. BOLT HOLES TO STRADDLE CENTERLINES IF VESSEL AS SHOWN
  6. CLEAN PER SPEC V049-2-015
  7. DO NOT USE CARBON STEEL BRUSHES OR BRUSHES CONTAMINATED WITH CARBON STEEL OR STAINLESS OR ALUMINUM MATERIAL.
  8. VISUAL INSPECTION PER SPEC
  9. WELD EFFICIENCY FACTOR: SHELL, LONG & CURVE SEAMS 100% & SHELL SEAM
  10. FOR FLANGE DETAILS SEE DWG V049-4-010 & V049-4-002.
  11. THESE FLANGES EACH INCLUDE AN INTERNAL CHANNEL BETWEEN 3-0888, WELDED TO A SINGLE PORT OF EACH CHAMBER, WITH CENTRAL SEAL.
  12. REGISTERED TRADEMARK, VARIAN VACUUM PRODUCTS; COMPATIBLE ALTERNATIVES ARE ACCEPTABLE.

REV	DESCRIPTION	DATE	BY	CHKD	DRWN	DATE	BY
01	ISSUE FOR PROTOTYPE FABRICATION	12/26/95					
02	RELEASE FOR FABRICATION	12/11/95					
03	PRELIMINARY DESIGN UPDATE	10/25/95					
04	DESIGN UPDATE	11/14/95					
05	PRELIMINARY DESIGN UPDATE	10/22/96					

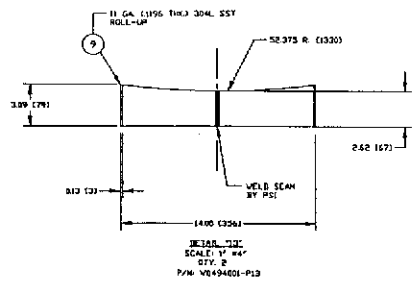
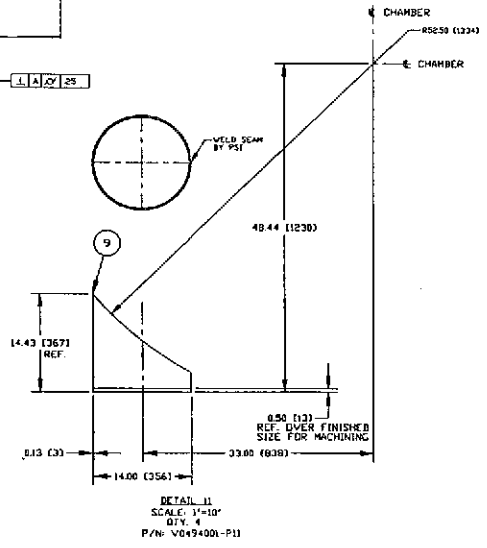
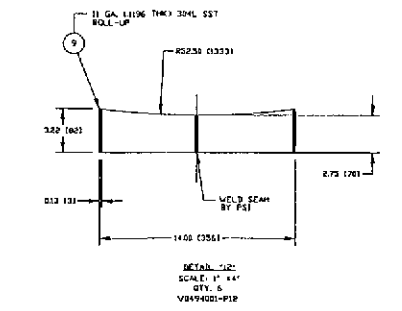
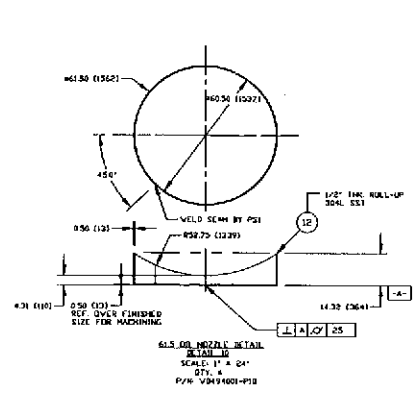
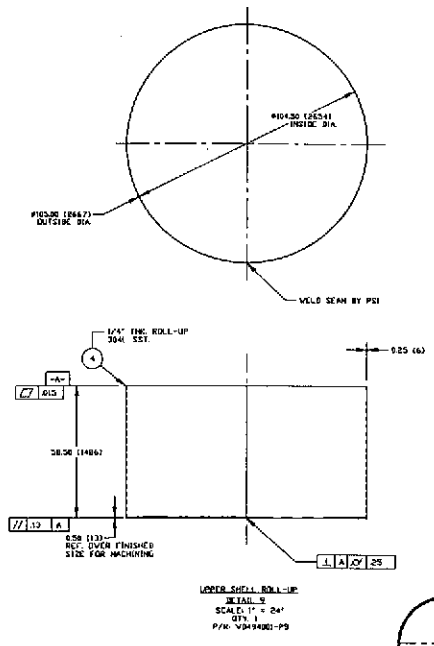
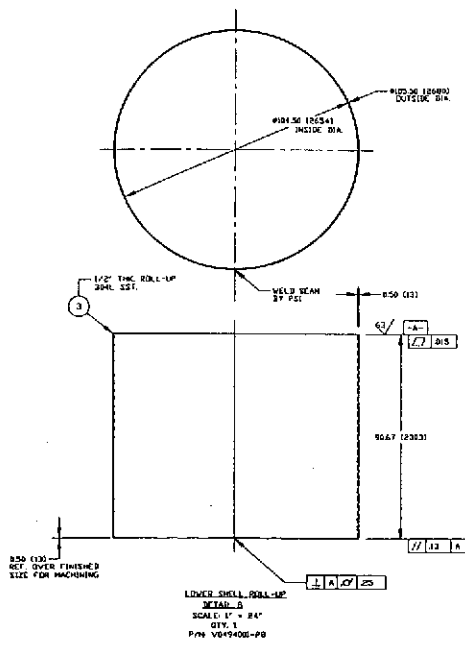
**PROCESS SYSTEMS INTERNATIONAL INC.**  
20 WINDY HILL, WESTBOROUGH, MASSACHUSETTS 01581 USA

**BEAM SPLITTER CHAMBER (BSC) LIGO VACUUM EQUIPMENT**

DWG NO: V049-4-001  
REV: 05  
DATE: 12/26/95

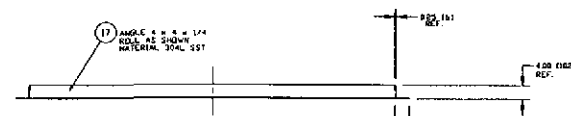
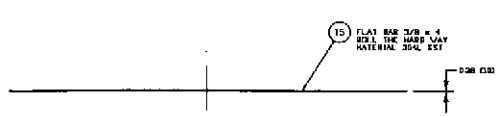
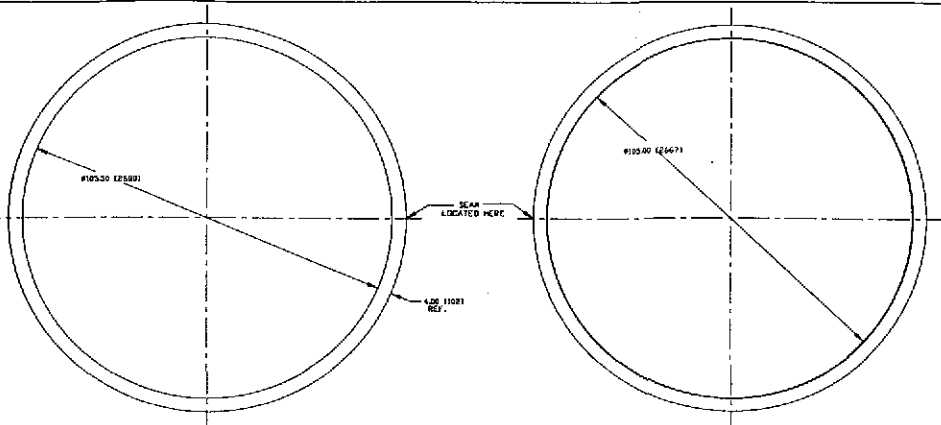
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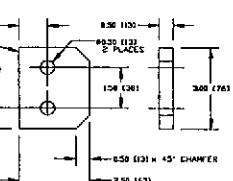
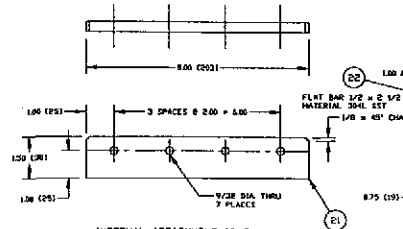
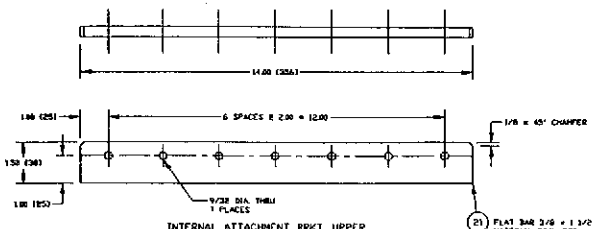
PROCESS SYSTEMS INTERNATIONAL, INC. 25 WALTON DR. WESTBOROUGH, MASSACHUSETTS 01581 USA			
BEAM SPLITTER CHAMBER (BSC) ROLL-UP DETAILS LIGO VACUUM EQUIPMENT			
CDR FILE 408154	REV D	PAGES 4 OF 5	P/N V049-4-001
AS NOTED			





**SHELL STIFFENERS LOWER CHAMBER**  
**DETAIL 17**  
 SCALE: 3/4"=1'-0"  
 QTY. 1  
 P/N: V0494001-P17

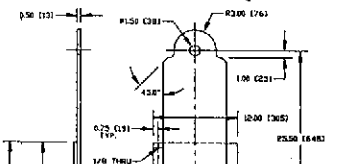
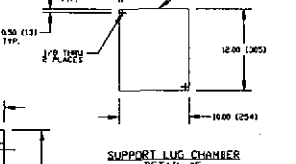
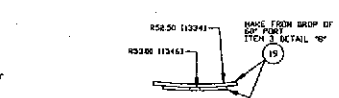
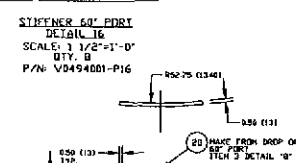
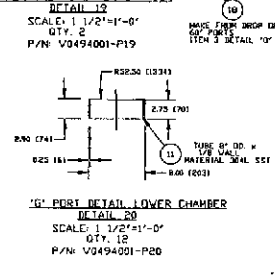
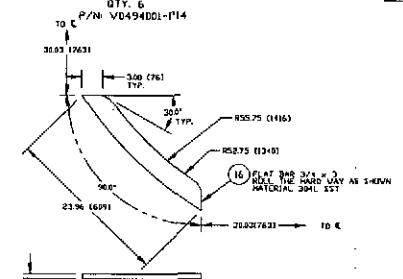
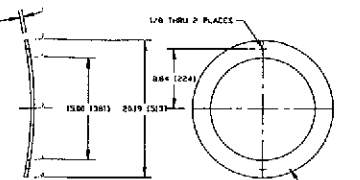
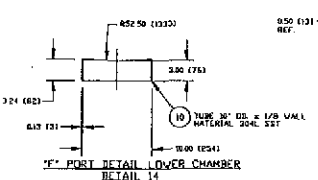
**SHELL STIFFENERS UPPER CHAMBER**  
**DETAIL 18**  
 SCALE: 3/4"=1'-0"  
 QTY. 1  
 P/N: V0494001-P18



**INTERNAL ATTACHMENT BRKT. UPPER**  
**DETAIL 22**  
 SCALE: HALF  
 QTY. 12  
 P/N: V0494001-P22

**INTERNAL ATTACHMENT BRKT. LOWER**  
**DETAIL 23**  
 SCALE: HALF  
 QTY. 12  
 P/N: V0494001-P23

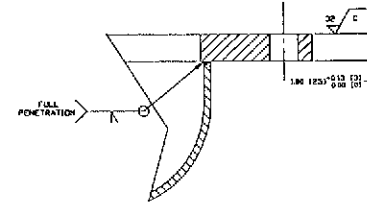
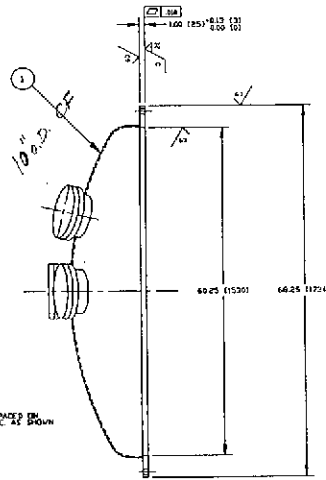
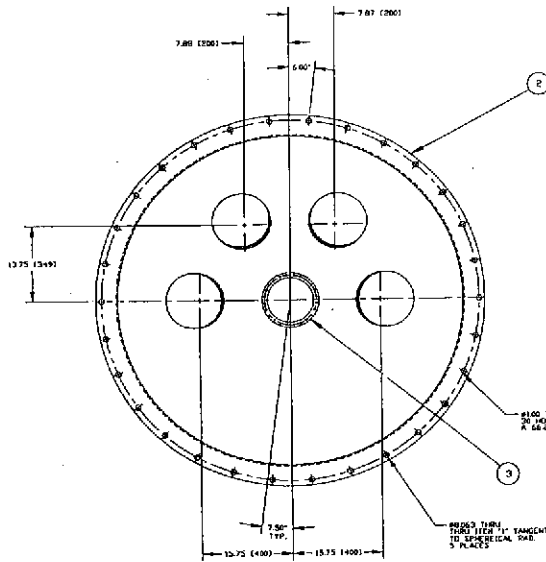
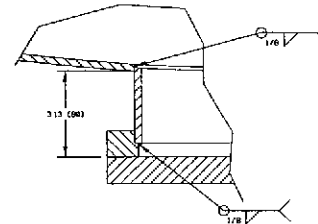
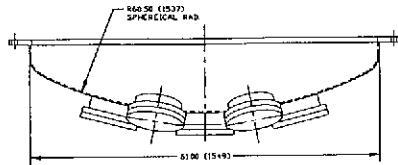
**FLAT BAR ATTACHMENT BRKT.**  
**DETAIL 21**  
 SCALE: HALF  
 QTY. 4  
 P/N: V0494001-P21



**SUPPORT LUG CHAMBER**  
**DETAIL 19**  
 SCALE: 1 1/2"=1'-0"  
 QTY. 4  
 P/N: V0494001-P19

**LIFTING LUG CHAMBER**  
**DETAIL 21**  
 SCALE: 1 1/2"=1'-0"  
 QTY. 2  
 P/N: V0494001-P21

<b>PROCESS SYSTEMS INTERNATIONAL INC.</b> 75 HUNTER DR. METRO PARK, OHIO 44130			
<b>BEAM SPLITTER CHAMBER (BSC)</b> <b>STIFFENER &amp; MISC. DETAILS</b> <b>LIGO VACUUM EQUIPMENT</b>			
DWG FILE 406125	SHEET 5	DWG NO. V049-4-001	REV. P-5
SCALE AS INDICED	SIZE 5 D BY 5		

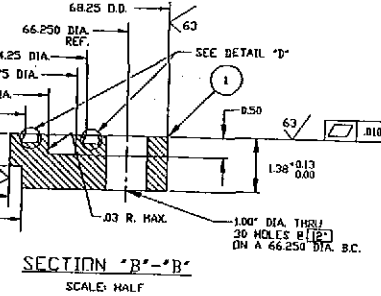
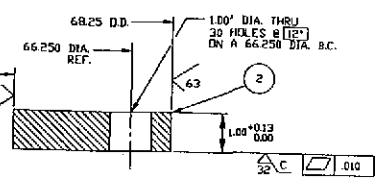
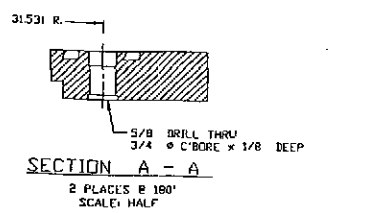
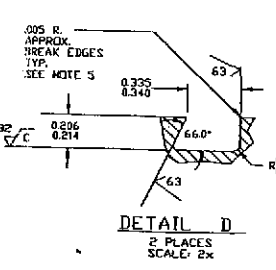
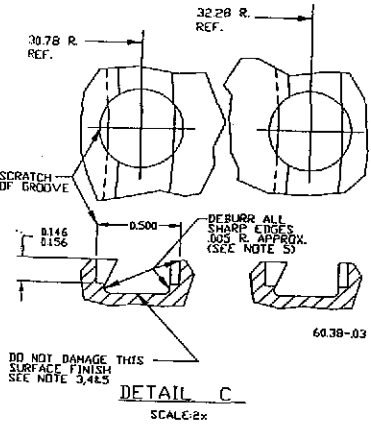
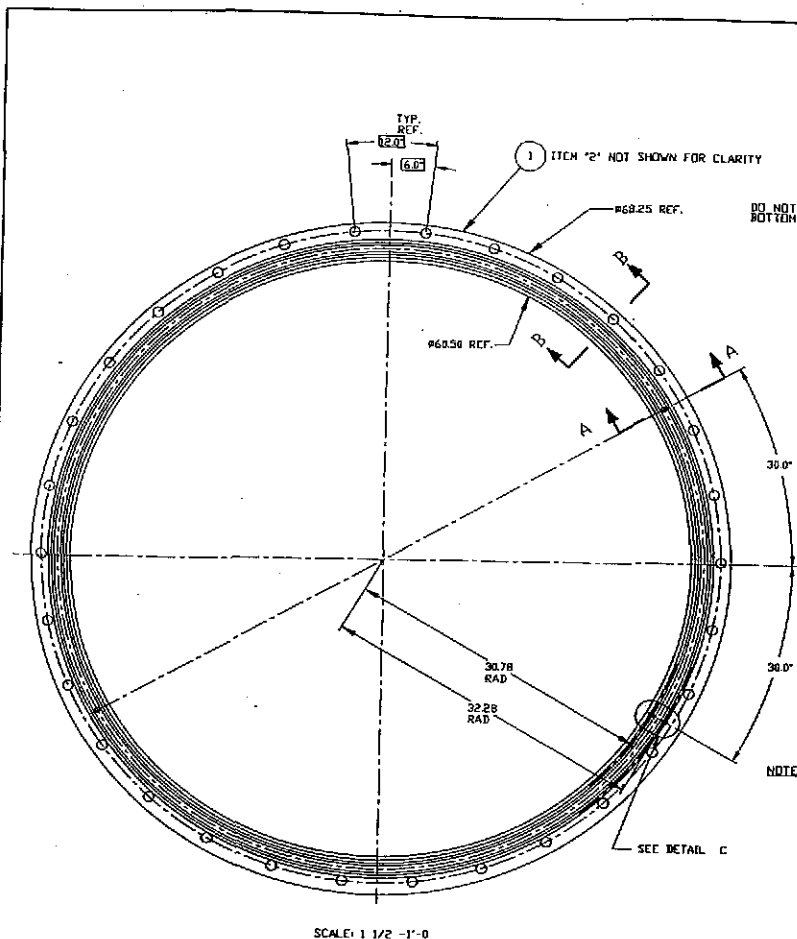


OFC 1 of 1995

NOTES

21. PRESSURE TEST & METHOD PER P11 SPEC.
22. REFERENCE CODE CALCULATIONS PER SPEC.
19. MATERIALS TO BE LEGIBLY STAMPED OR STENCILED PER SPEC.
18. CERTIFIED MANUFACTURER'S MECHANICAL TEST REPORTS REQUIRED.
17. FLANGE BOLT HOLES TO STRADDLE NATURAL CENTERLINES OF VESSEL. UNLESS NOTED.
16. CLEAN PER SPEC.
15. ALL NOZZLES TO BE CONSIDERED TO OUTSIDE DIAMETER OF SHELL OR TO CURVATURE OF HEAD, UNLESS OTHERWISE NOTED.
14. DEVIATION FROM STRAIGHT ALONG CENTER AXIS -1/4" PER 10'-0" OF SHELL LENGTH, +3/4" MAXIMUM OVERALL.
13. DO NOT USE CARBON STEEL. BRUSSELS OR BRUSSELS CONTAMINATED WITH CARBON STEEL OR STAINLESS OR ALUMINUM MATERIAL.
12. VISUAL INSPECTION PER SPEC.
- 11.
- 10.
9. WELD EFFICIENCY FACTOR: SHELL, LONG & CIRC. BEAMS; HEAD & SHELL BEAM.
8. LEAKS PENETRANT EXAMINATION REQUIRED AROUND ALL NOZZLES AND AT ATTACHMENTS WITH FLANGES 3/8" OR LARGER PER SPEC.
- 7.
6. HEADS ARE ASME F1B.
- 5.
4. TOLERANCES UNLESS OTHERWISE SPECIFIED: LENGTHS ± 0.05 CH. ANGLES AS ± 1.0 DEGREE.
- 3.
- 2.
1. REGISTERED TRADEMARK, VARIAN VACUUM PRODUCTS; COPYABLE ALTERNATIVES ARE ACCEPTABLE.

<p><b>PROCESSES AND SPECIFICATIONS</b></p> <p>THIS DRAWING CONTAINS PROPRIETARY INFORMATION AND IS LOANED TO YOU BY THE COMPANY FOR YOUR USE ONLY. IT IS NOT TO BE REPRODUCED, COPIED, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF PROCESS SYSTEMS INTERNATIONAL, INC. AND SHALL BE RETURNED TO US UPON REQUEST.</p>		<p><b>UNLESS OTHERWISE SPECIFIED</b></p> <p>FINISHES ARE AS SHOWN</p> <p>TOLERANCES:</p> <p>3/16" - 1/4" ± 0.005</p> <p>1/4" - 1/2" ± 0.010</p> <p>1/2" - 1" ± 0.015</p> <p>1" - 2" ± 0.020</p> <p>2" - 6" ± 0.030</p> <p>6" - 30" ± 0.040</p> <p>30" - 60" ± 0.050</p> <p>60" - 120" ± 0.060</p> <p>120" - 180" ± 0.070</p> <p>180" - 240" ± 0.080</p> <p>240" - 300" ± 0.090</p> <p>300" - 360" ± 0.100</p>		<p><b>PROCESS SYSTEMS INTERNATIONAL, INC.</b></p> <p>30 WASHINGTON STREET, WILMINGTON, MASSACHUSETTS 01978</p> <p>COVER, TYPE 1 BEAM SPLITTER CHAMBER LIGO VACUUM EQUIPMENT</p>	
<p>DO NOT SCALE THIS DRAWING</p> <p>USED ON:</p> <p>NEXT ASS'Y:</p>	<p>REV. 1</p> <p>PRELIMINARY</p>	<p>DATE: 02/88</p> <p>BY: [Signature]</p> <p>CHKD: [Signature]</p>	<p>SCALE: 1-10</p> <p>SHEET: 1 OF 1</p>	<p>FIG. NO: V049-4-014</p> <p>REV. P1</p>	



- NOTE:
- 1) FLANGES WILL BE USED IN ULTRA HIGH VACUUM SERVICE. SEE SPECIFICATION V049-2-040 FOR MATERIAL REQUIREMENTS.
  - 2) ALL MATERIAL TO BE 304L STAINLESS STEEL.
  - 3) FLANGES MUST BE PACKAGED, HANDLED, AND SHIPPED IN SUCH A MANNER AS TO MAINTAIN SPECIFIED SURFACE FINISHES AND FLATNESS TOLERANCES.
  - 4) MACHINE TOOL LAY TO BE CONCENTRIC ON ALL SURFACES THAT REQUIRE A 32 RMS FINISH.
  - 5) NO ABRASIVE STONES, CLOTHS OR GRINDING WHEELS MAY BE USED.
  - 6) NO OIL BASED OR HYDROCARBON BASED CUTTING FLUIDS TO BE USED.
  - 7) NO CARBON STEEL OR OTHER SOURCE OF IRON CONTAMINATION ARE TO COME IN CONTACT WITH FLANGES DURING MANUFACTURING OR HANDLING.
  - 8) FLANGE FINAL FACE CUTS AND O-RING GROOVES MUST BE MACHINED DURING THE SAME SETUP.

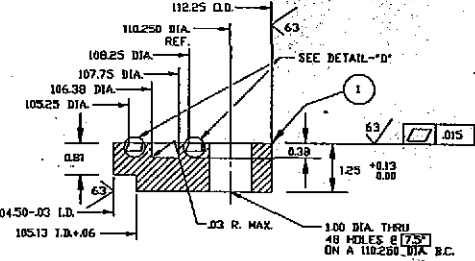
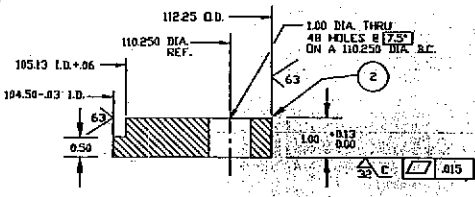
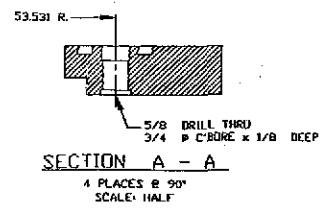
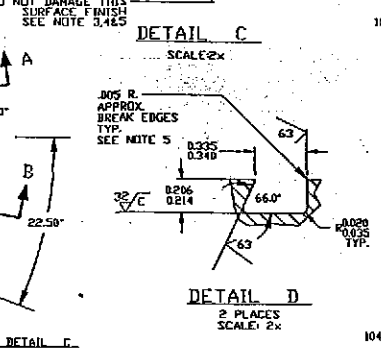
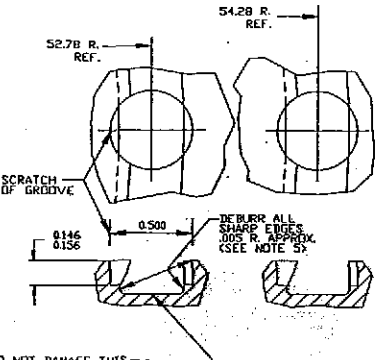
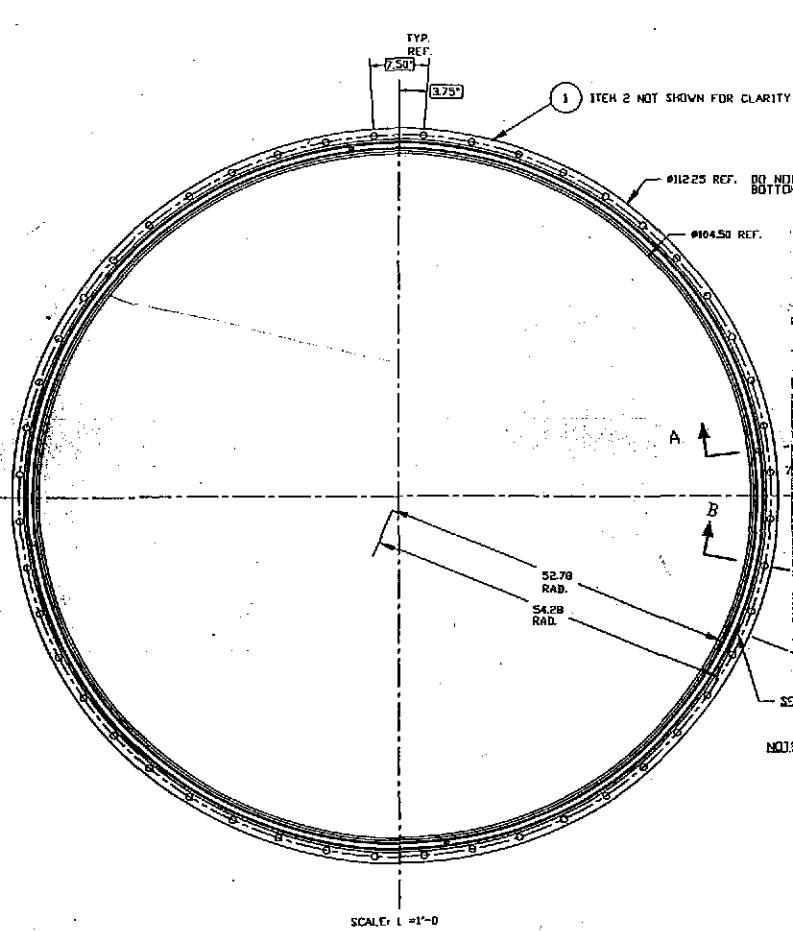
ITEM	PART NUMBER	DESCRIPTION
1	V049-4-019-P1	WITH O'RING GROOVE
2	V049-4-019-P2	WITHOUT O'RING GROOVE

INNER O-RING .275 DIA. STOCK x 191 1/4" LG. VULCANIZED - BAKED VITON E-60C  
 OUTER O-RING .275 DIA. STOCK x 200 5/8" LG. VULCANIZED - BAKED VITON E-60C

CORRECTIONS AND COMMENTS		UNLESS OTHERWISE SPECIFIED		PROCESS SYSTEMS INTERNATIONAL INC.	
THIS DRAWING CONTAINS PROPRIETARY INFORMATION BELONGING TO PROCESS SYSTEMS INTERNATIONAL, INC. AND IS TO BE USED ONLY FOR THE PURPOSES FOR WHICH IT WAS DRAWN. IT SHALL NOT BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN CONSENT OF PROCESS SYSTEMS INTERNATIONAL, INC. AND SHALL BE RETURNED UPON REQUEST.		DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.		PROCESS SYSTEMS INTERNATIONAL INC. 30 WALTON DRIVE, WESTBOROUGH, MASSACHUSETTS 01581	
REV. NO.		DESCRIPTION		DATE	
1		P3 RELEASE FOR QUOTE		KAR 12-14-95	
2		P2 UPDATE PRELIMINARY DESIGN		KAR 12-4-95	
3		P1 PRELIMINARY		KAR 10-24-95	
4		REV.		KAR 10-24-95	
5		ISSUE DESCRIPTION		KAR 10-24-95	
6		CHECK DRAWN		DCD	
7		DATE		DCD	
8		SCALE		AS NOTED	

CAN FILE	SIZE	REV.
V0494019	C	P3
60 1/2" I.D. FLANGE SET DETAIL (BSC) ACCESS COVERS LIGO		
V049-4-019		

DEC 15 1995



- NOTES**
1. FLANGES WILL BE USED IN ULTRA HIGH VACUUM SERVICE. SEE SPECIFICATION V049-2-040 FOR MATERIAL REQUIREMENTS.
  2. ALL MATERIAL TO BE 304L STAINLESS STEEL.
  3. FLANGES MUST BE PACKAGED, HANDLED, AND SHIPPED IN SUCH A MANNER AS TO MAINTAIN SPECIFIED SURFACE FINISHES AND FLATNESS TOLERANCES.
  4. MACHINE TOOL LAY TO BE CONCENTRIC ON ALL SURFACES THAT REQUIRE A 32 RMS FINISH.
  5. NO ABRASIVE STONES, CLOTHS OR GRINDING WHEELS MAY BE USED.
  6. NO OIL BASED OR HYDROCARBON BASED CUTTING FLUIDS TO BE USED.
  7. NO CARBON STEEL OR OTHER SOURCE OF IRON CONTAMINATION ARE TO COME IN CONTACT WITH FLANGES DURING MANUFACTURING OR HANDLING.
  8. FLANGE FINAL FACE CUTS AND DRING GROOVES MUST BE MACHINED DURING THE SAME SETUP.

ITEM	PART NUMBER	DESCRIPTION
1	V049-4-022-P1	WITH DRING GROOVE
2	V049-4-022-P2	WITHOUT DRING GROOVE

INNER O-RING .275 DIA. STOCK x 328 1/8" LG. VULCANIZED - BAKED VITON E-60C  
 OUTER O-RING .275 DIA. STOCK x 337 1/2" LG. VULCANIZED - BAKED VITON E-60C

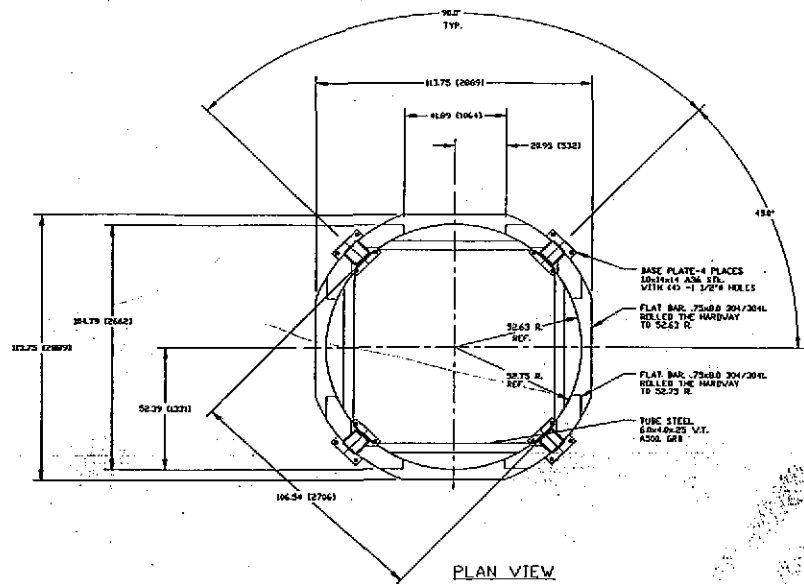
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		ISSUE 2: PRELIMINARY DESIGN		
		ISSUE 3: PRELIMINARY DESIGN		
		ISSUE 4: PRELIMINARY DESIGN		
		ISSUE 5: PRELIMINARY DESIGN		
		ISSUE 6: PRELIMINARY DESIGN		
		ISSUE 7: PRELIMINARY DESIGN		
		ISSUE 8: PRELIMINARY DESIGN		
		ISSUE 9: PRELIMINARY DESIGN		
		ISSUE 10: PRELIMINARY DESIGN		

PROCESS SYSTEMS INTERNATIONAL INC.  
 104 1/2" I.D. FLANGE SET DETAIL

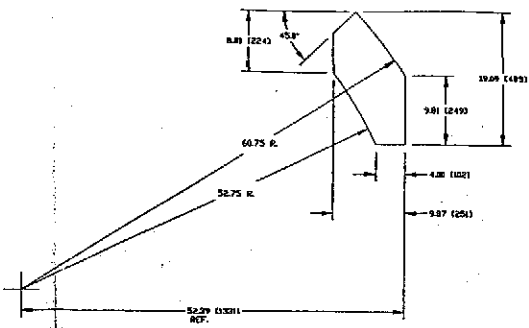
LIGO

CAP FILE V049022  
 DWG NO. V049-4-022  
 SHEET 1 OF 1

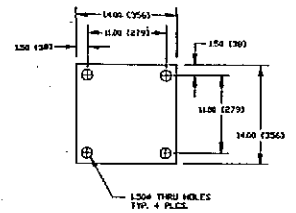
DEC 15 1995



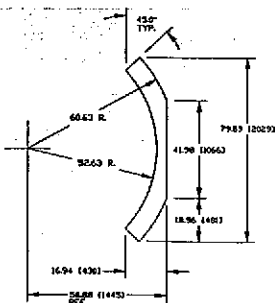
PLAN VIEW



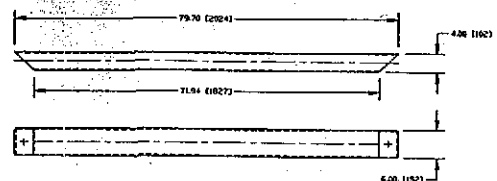
DETAIL "A"  
SCALE: 1/2"=1'-0"  
QTY. 10'



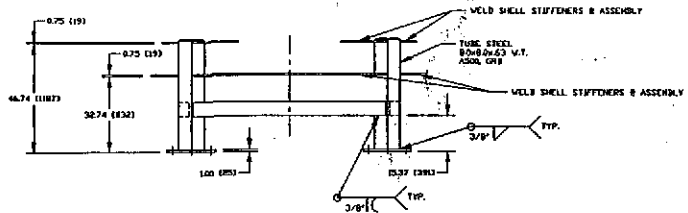
DETAIL "B"  
SCALE: 1/2"=1'-0"  
QTY. 10'



DETAIL "D"  
SCALE: 1/2"=1'-0"  
QTY. 10'



DETAIL "C"  
SCALE: 1/2"=1'-0"  
QTY. 10'



ELEVATION VIEW  
SCALE: 1/2"=1'-0"

DEC 15 1995

REV. NO.	DESCRIPTION	REV. NO.	DESCRIPTION

REV.	DESCRIPTION	ISSUE DESCRIPTION	CHG.	BRVN.	DATE	DESN.	SCALE
P1	PRELIMINARY FOR QUOTES						

PROCESS SYSTEMS INTERNATIONAL INC.  
 20 WASHINGTON ST. WILMINGTON, MASSACHUSETTS 01897 USA

CHAMBER SUPPORT ASSEMBLY  
 BSC  
 LIGO VACUUM EQUIPMENT

DWG FILE: V049-023  
 SHEET: 1 OF 1