



		IDENTIFICATION			
		CRSPEC			
		LIGO-8950096-01-B			
TITLE CLEAN ROOM SPECIFICATION	REFERENCE NO.	SHT 1 OF 32			
	930212				
PRODUCT LIGO BEAM TUBE MODULES CALIFORNIA INSTITUTE OF TECHNOLOGY	OFFICE	REVISION			
	RSE	1			
	MADE BY	CHKD BY	MADE BY	CHKD BY	
	SDH	MLT	SDH	MLT	
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1.0 SCOPE:

1.1 Clean Room Concept: A movable building constructed from a commercial shipping container with cleanable interior surfaces separated by built-in walls with windows allowing view from the entry room known as the change room through the ante room and into the clean area. Safety features such as emergency lighting, first aid equipment and a personnel escape door is included in the design. The HVAC system will consist of heating and cooling unit with air ducts and adjustable registers, high performance filtration unit consisting of HEPA filters and bag type pre-filters. The system will be balanced by the Clean Room Fabricator and will be adjustable during operation with the use of pressure gauges/manometers mounted in each room, building exterior and near the beam tube entrance. The beam tube entrance will be covered by an exhaust hood and a stainless steel floor pan with adjustable registers mounted in the ducts. This system is used for the exhausting of small amounts of air born cleaning solvents moving out of the Beam Tube end.

1.2 The term Contractor identifies the party purchasing the Clean Room. The term Clean Room Fabricator identifies the vendor responsible for constructing, testing and delivering the Clean Room(s).

1.3 This specification provides the requirements for the fabrication and delivery of the LIGO Clean Room(s). The Clean Room(s) consist of a 8ft x 8ft x 40' commercial shipping container.

1.3.1 The Clean Room Fabricator will fit out the container with insulated walls, windows, doors, HVAC system, exhaust hood, floor tray and miscellaneous equipment.

1.3.2 The Clean Room Fabricator shall provide specified equipment including cabinets, tables, benches, lockers, and trash receptacles.

1.3.3 The Clean Room Fabricator shall provide all electrical equipment and installation to the National Electrical Code(NEC) as detailed in the attached sketches.

APPROVED

J. Don 11/10/95
LIGO

M. Jellalian 11/10/95
C&I



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1.3.5 The Clean Room Fabricator shall paint the container(s) as detailed in the attached specification.

1.3.6 The Clean Room Fabricator will prepare the clean room(s) for shipment per the requirements of this specification.

1.4 The LIGO Project requires two(2) clean room assemblies to be delivered to the LIGO Hanford, Washington site at the scheduled time agreed upon by the Contractor and the Clean Room Fabricator.

1.5 Definition of clean: Surfaces which are visibility clean to the unaided eye and will not display any visual signs of dust when wiped with a clean, unbleached cloth. This condition will be described as "Conference Room Clean."

1.6 The terms "submit" an "approval" relates to the sharing of information from the Clean Room Fabricator and subsequent approval by the Contractor. This may be performed by mail, Fax or telephone conversation as long as the discussions are documented and distributed to both parties.

2.0 REFERENCES:

The Clean Room is deisgned to meet the requirements of LIGO based on the following references. All changes or revisions to this specifcaiton must be consistant with and meet the requirements of these procedures.

2.1 The construction and operation of the clean room is based on the following references:

- 2.1.1 Summary of concepts and Reference Design for a Laser Gravitational-Wave Observatory, CAL TECH; Feb-92.
- 2.1.2 Chicago Bridge & Iron Safety Manual for L.I.G.O. Project.
- 2.1.3 CBI Cleaning Procedure CL3N.



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2.1.4 CBI Contamination Control Procedure CCP-1.

2.1.5 CBI Procedure for Clean Room Transportation, Storage, and Maintenance; CRTSM-1.

3.0 OUTLINE DRAWINGS

The following is a listing of Clean Room Outline drawings.

- Sketch P1 General Views and Dimensions
- Sketch P2 Equipment Plan View and Listing
- Sketch P3 Lower Framing Framing Plan
- Sketch P4 Upper and Ceiling Framing Plan
- Sketch P5 Bulkhead Elevations
- Sketch P6 Electrical Power Plan
- Sketch P7 Emergency Equipment Plan
- Sketch P8 Electrical Lighting Plan
- Sketch P9 Electrical Receptacle Plan
- Sketch P10 Inflatable Seal System, CRS-5-ISS; 1 of 2
- Sketch P11 Inflatable Seal System, CRS-5-ISS; 2 of 2
- Sketch P12 Rolling Frame Plan View; 1 OF 3
- Sketch P13 Rolling Frame Track Assembly; 2 OF 3
- Sketch P14 Rolling Frame Track Assembly; 3 OF 3
- Sketch P15 Exhaust Hood
- Sketch P16 Floor Pan
- Sketch P17 Penetration Details
- Sketch P18 HVAC Balancing Details

4.0 EQUIPMENT:

Fabrication of the Clean Room(s) shall include the following as a minimum for materials and equipment purchased, provided and/or installed by the Clean Room Fabricator.



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4.1 Clean Room Container shall consist of a used shipping container in good condition or new shipping container which meets the following requirements:

4.1.1 Container must have an attached nameplate stating that the container is **CSC Safety Approved, Approved for Transport Under Customs Seal with the Registered Seal Number, and Licensable** for interstate transport.

4.1.2 Maximum Tare Weight of 8,500 lbs.

4.1.3 Minimum Payload Capacity of 58,000 lbs.

4.1.4 Minimum Volume Capacity of 2,300 cu-ft.

4.1.5 All container door hardware must be lockable and free of movement and in good repair. All hinges and hinge connections shall be free of rust and treated for corrosion resistance.

4.1.6 Container flooring shall meet or exceed ISO Floor Strength Requirements of Test ISO 1496 Part1, 1990.8.15(5470kg(ie 2730 kg on each two wheels).

4.2 Clean Room Safety Equipment shall be provided as noted on the table **Table 4.0** and these specifications. Substitutions of equipment shall be identical to that listed or an approved equal. All substitutions shall be pre-approved in writing before purchase.

4.3 Clean Room Electrical Equipment shall be provided as noted on the table **Table 4.0** and these specifications. Substitutions of equipment shall be identical to that listed or an approved equal. All substitutions shall be pre-approved in writing before purchase.

4.4 Clean Room Construction Materials shall meet the following standards listed.

4.4.1 Wood Studs used for framing shall be structural quality fir meeting requirements of the Southern Builders Association.

4.4.2 Insulation Materials shall be sheet foam with aluminized backing and a minimum of 1 1/2" total thickness(laminating multiple pieces is acceptable) and/or blanket type insulation with aluminized backing. All



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insulation material shall meet or exceeding UL®, Factory Mutual, and NFPA requirements

4.4.3 Walls and ceilings shall be covered with MARLITE® board. This is a ceramic coated Masonite® type material with the color white.

Substitutions are allowable per requirements noted below.

4.4.3.1 Fasteners shall be white and as suggested by the panel manufacturer.

4.4.3.2 Panel Joint and corner assembly strips shall be as suggested by panel manufacturer.

4.4.4 Fasteners used for Clean Room fabrication and construction shall conform to the following:

4.4.4.1 Interior fasteners used for framing and structural work shall be drive screw type fasteners properly sized and coated for corrosion resistance.

4.4.4.2 Exterior fasteners used for attaching framing to container walls shall be 18-8 stainless steel button head screws. All exterior fasteners shall be sealed to prevent leakage and painted to match the surface where screw head is visible.

4.4.4.1 Fasteners used for molding shall be galvanized nails or equal.

4.4.5 Doors and framing shall be pre-hung type assemblies and as described below.

4.4.5.1 Two interior doors and frames, to and from Ante room, shall be hollow core and painted with high gloss white enamel. See painting specifications for interior wood surfaces. Doors shall have 12" x12" windows conforming to 4.4.6 of this specification. Doors shall have latch and lock hardware with like keys.

4.4.5.2 Exterior door and frame from outside into Change Room shall be metal and painted with high gloss, white enamel. See painting specifications 5.4. Doors shall have standard sized window conforming to 4.4.6 of this specification. Doors shall have latch and lock hardware with like keys.

4.4.5.3 Exterior Emergency Door from Clean Room shall be an insulated, metal door painted with high gloss orange enamel on the inside and painted with blue enamel used on the container for the door exterior coating. Door



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release and latching hardware shall be mounted on inside door surface for interior opening only. Outside door surface shall be flush.

4.4.6 Windows shall be fabricated from clear cast acrylic or wire reinforced glass. Window details shall conform to the following.

4.4.6.1 Interior windows shall be sized to fit per the details noted on sketch Bulkhead Elevations. Acrylic or glass shall be minimum of 1/4" thickness. Window shall be framed in 3/4" quarter round or molding as application warrants. All molding shall be fir and painted with high gloss, white enamel.

4.4.6.2 Exterior windows shall be sized to fit per the details noted on sketch Outside Wall Elevations. Acrylic or glass shall be minimum of 3/8" thickness. Window shall be framed inside penetration angle and attached to the inner rim (see Penetration and Window Details) and shall be sealed with caulking on the exterior. A 3/4" round molding shall be used in the inside surfaces and attached to angle frame with screws or pop rivets. All molding shall be fir and painted with high gloss, white enamel as noted in paint specifications 5.4.

4.4.7 Flooring shall be blue in color with smooth finish. Material shall be applied to container floor with adhesive as suggested by flooring manufacturer. floor surface shall be "wax free" finish and resistant to alcohol and detergent. Flooring material shall be pre-approved by the Contractor prior to purchasing. The Clean Room Fabricator shall provide a sample of a minimum size of 6"x6" to the Contractor for approval.

Substitutions of equipment may be permitted. All suggested, alternate materials shall be identical to that listed or an approved equal. All substitutions shall be pre-approved in writing before acceptance.

4.5 Clean Room Safety Equipment shall be provided as noted on the table **Listing 4.0**. Substitutions of equipment shall be identical to that listed or an approved equal. All substitutions shall be pre-approved in writing before purchase.



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5.0 EXECUTION:

Construction of the Clean Room(s) shall include the following as a minimum for workmanship and quality of installation. The Contractor reserves the right to inspect the fabrication and constructions during the Clean Room construction.

5.1 Framing shall be performed using materials specified and installed in a craftsmanship like manner.

5.1.1 All framing shall be attached to the container flooring in a manner which will not be detrimental to the floor strength. All fasteners penetrating the container walls or flooring shall be sealed with caulking before the joint is covered.

5.1.2 No roof penetrations are allowed. Fastening which requires roof attachment(if needed) shall be made by epoxy adhesive conforming to the specifications.

5.1.3 Additional blocking shall be provided at shelving installation.

5.1.4 Electrical wiring required within the walls of the container shall be installed before the insulation and paneling is installed.

5.1.5 Equipment installation(HVAC Unit and duct, Exhaust Hood & Floor Pan, lighting and electrical equipment must be installed prior to wall and ceiling paneling. The Contractor reserves the right to inspect the framing and equipment installation prior to installation of the paneling.

5.1.6 Wall Paneling shall be installed per the paneling manufacturers recommendations. Materials shall conform to the specifications. Damage, including cracks, chips, and mismatched panels shall be repaired by means of replacement or patching based on the discretion of the Contractor.

5.1.7 Flooring is installed after wall & ceiling panels and equipment is installed. Flooring shall be applied by adhesive and floor molding shall be installed around all walls. Caulk with clear caulk between molding at the wall and the floor.

5.2 Container wall penetrations shall be performed as noted on the applicable sketches.

5.2.1 All container penetrations shall be cleanly cut without removing any additional wall material as required.



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5.2.2 Penetrations including windows, electrical wireways, exhaust fan curb, emergency door and beam tube penetration shall be reinforced with galvanized angle or channel. reinforcement shall be fastened to the shell and the inner framing for rigid support.

5.2.3 Reinforcement angle shall be installed in a manner to prevent standing water and shall be caulked air tight.

5.2.4 The Beam Tube Penetration at the end of the container shall be reinforced using a rolled angle with drilled and tapped holes as noted on sketch detail.

5.3 Electrical installation shall conform to NEC and the local building code for the Clean Room Fabricator. All work shall be performed in a quality workmanship manner.

5.3.1 All wireways shall be rigid conduit and carry a #14 ground wire to the Clean Room Ground at the breaker panel.

5.3.2 All interior boxes shall be metal with conduit compression connectors used for junctions of conduit.

5.3.3 All Flexible conduit shall be liquid-tight with box connections being liquid-tight.

5.3.4 Interior wall plates shall be sized and typed for application. Wall plate color shall be white.

5.3.5 Conductors shall be THHN stranded building wire color and sized per NEC requirements.

5.3.6 Receptacles shall be sized per sketch detail and color shall be white. They shall be ground fault unless respective breaker in the electrical breaker panel is designated ground fault.

5.3.7 Light switches shall be sized and color of white.

5.3.8 HVAC Equipment wiring shall be the requirements of the manufacturer.

5.3.9 Power wiring to the remote source shall conform the the details on the attached sketches. Equipment for this installation shall be provided by the Clean Room Fabricator and installed per details. FOR THIS DETAIL, NO SUBSTITUTIONS ARE ALLOWED.

5.3.10 Exterior receptacles and equipment shall be installed per the detailed sketch.



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5.4 Painting of surfaces shall be performed in a professional manner with attention to sealing and caulking areas exposing the container interior to the outside environment. This spec does not apply to factory painted equipment unless noted.

5.4.1 If a used container is determined acceptable by the Clean Room Fabricator and the Contractor, the outside surfaces including the container door exterior, interior and hardware shall be sandblasted to a SSP-SP3 finish. Immediately coat the container and door surfaces with an epoxy primer, color gray. Final paint surfaces using a two part blue epoxy paint. Provide a sample of the paint color for approval prior to final coat. Paint thickness shall meet the paint manufacturers recommendations.

5.4.2 New container(s) shall be supplied with a Contractor pre-approved paint system. Paint shall conform to ISO standard for Approved Customs Transport. Alternate coatings may be submitted for Contractor approval.

5.4.3 Interior metal surfaces requiring painting shall be coated with high gloss, white, oil base enamel paint pre-approved by the Contractor. A minimum of two coats is required.

5.4.4 Interior wood surfaces requiring painting shall be coated with high gloss, white, oil base enamel paint pre-approved by the Contractor. A minimum of a sealing primer and two coats of enamel is required. The sealing coat may consist of a oil based sanding sealer or oil based gray primer.

5.4.5 Caulking is required for all areas where sealing is needed and/or surfaces join causing a corner which can accumulate dust and debris. All caulking shall be of a white or clear, Latex-Based siliconized acrylic caulk and applied in a quality workmanship manner. The caulk bead shall be concave and a radius which is tangent with the intersecting surfaces. Caulking used to cover or seal openings shall be applied in a manner to smooth and seal the opening. Caulking shall be applied before painting to allow proper cure time. White caulking shall be painted with the surface paint.

5.5 HVAC Installation, start-up and balancing shall be performed in a professional, craftsman manner. The following details specific minimum requirements.



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5.5.1 The Clean Room Fabricator shall install the HVAC system including the Unit, Exhaust fan, Hood and Floor pan as detailed in the applicable specifications. The following is determined to be required:

5.5.1.1 HVAC Unit including fan, condenser, evaporator, electric heating coil and pre- filter. The unit shall be sized as noted below:

- 460 Volt AC/60hz 3Ø
- 30 amp Maximum Unit Total Current
- Adjustable and/or Variable Fan Speed
- 2000cfm Minimum of Filtered, Conditioned Air
- 36,000 BTU/hr Cooling Capacity(minimum)
- 35,900 BTU/hr Heating Capacity(minimum)
- Pre-Filter: Bag type Fiber Glass Unit
- Final HEPA Filter 0.3 Micron Unit
- 24VAC Thermostat and Control Voltage
- Compressor Short Cycle Protection
- Voltage and Over-current protection
- Sheet Metal Cabinet with Factory Finish

The unit shall be secured to the container floor as detailed on the applicable sketch. Power and control wiring shall be installed based on specifications and the manufacturers recommendations.

5.5.1.2 HVAC duct shall be insulated and installed in conjunction with the clean room container construction and be equipped with required registers and dampers. Hangers and supports shall be supported from the wall and ceiling framing.

5.5.1.3 The stainless Steel exhaust hood shall be installed per the applicable details and the floor pan and ducting installed at the same time. All exhaust registers and dampers shall be factory installed.

5.5.1.4 The exhaust fan shall be installed to the curb penetration and meet the following requirements:

- 120 volts/60hz TEFC 1/2 hp Motor
- 2,400cfm @ 1/4" Static Pressure minimum flow
- Curb sized by Clean Room Fabricator
- Control Switch mounted to exhaust hood as detailed in sketch.



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5.5.1.4 The filter system including the bag filters and the HEPA filter elements shall be attached or integrated into the HVAC Unit. Access to inspect, remove and replace shall be demonstrated by the Clean Room Fabricator.

5.5.2 The Clean Room Fabricator will operate and balance the system using gauges noted in Table 4.0 and with the assistance of the Contractor. These gauges will consist of three manometers for the purpose to adjust air flow while exhausting through the clean room hood. This demonstration is to assure adequate conditioned air is available for clean room operation. See applicable sketch for test set-up.

6.0 ACCEPTANCE:

Prior to shipping, the Clean Room(s) shall be inspected by the Contractor. This inspection may be performed during the HVAC demonstration.

6.1 The inspection will include a demonstration of the operation of the systems including the lighting, emergency lighting, HVAC, inventory of equipment/condition and cleanliness.

6.2 At the time of acceptance by the Contractor, the Clean Room Fabricator shall provide two(2) sets of keys for each clean room(s) to the Contractor's representative.

6.3 The Contractor's Representative will provide padlock(s) to the Clean Room Fabricator for use in locking the shipping container doors prior to shipment. CBI will provide two(2) working keys for the shipping locks to Clean Room Fabricator for use and distribution to shipper.

7.0 SHIPPING:

The Clean Room Fabricator shall prepare the clean room(s) for shipment by performing the following as a minimum:



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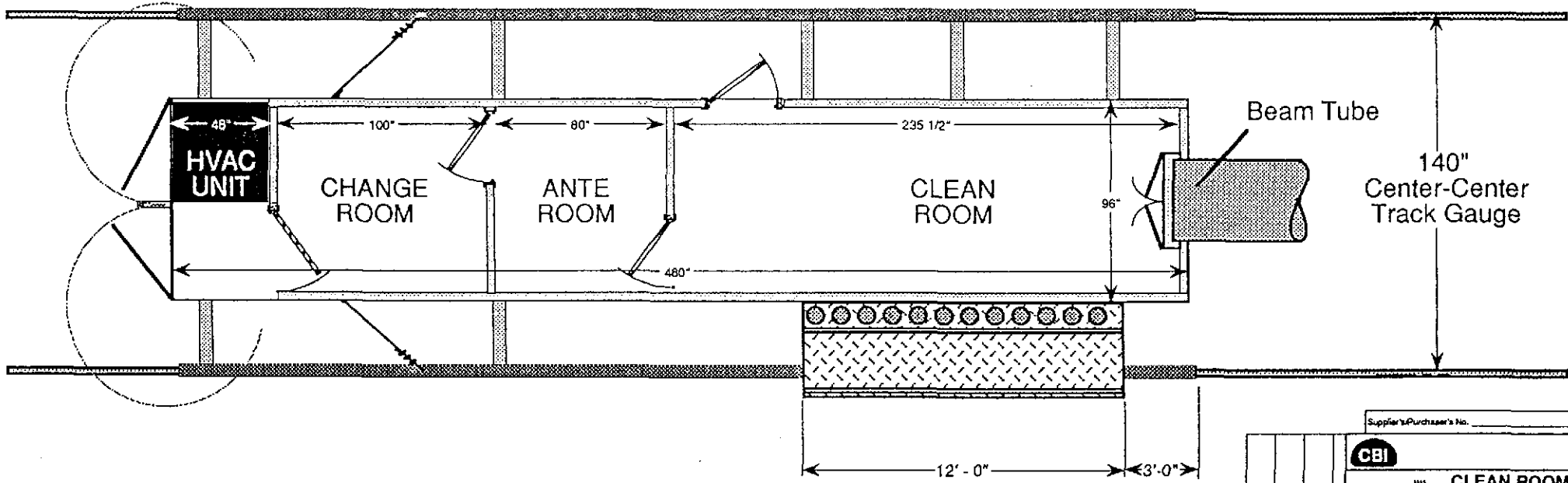
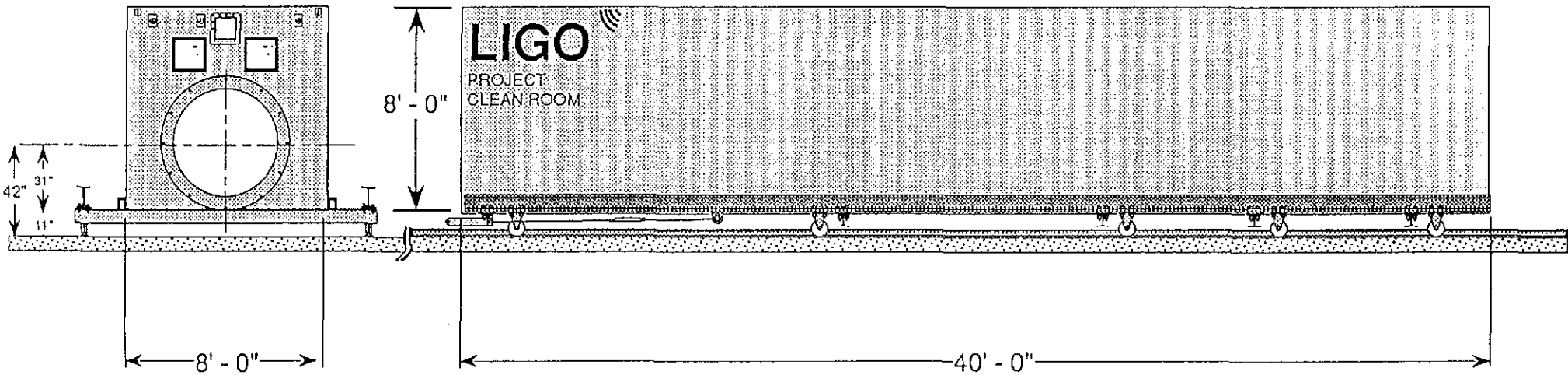
- 7.1 Wipe clean all surfaces of the clean room using a 30:1 mixture of MirrorChem 500 detergent and water. The mixture will be applied by spray bottle and wiped down with clean wiping cloths. Assure all safety precautions are followed.
- 7.2 Remove outside lighting from hangers, package and store light inside clean room for shipping.
- 7.3 Seal all penetrations with blind covers. These covers are detailed on sketches.
- 7.4 Cover windows using blind covers as detailed on sketches.
- 7.5 Secure all clean room equipment to avoid movement during shipment.
- 7.6 Disconnect power cord and coil the cord inside the container port side door, in front of the change room exterior door. Store receptacle and cover for generator in the same location.
- 7.7 Install locking bar on emergency door. Lock all interior and exterior doors and seal edges with tape.
- 7.8 Latch container doors and padlock with CBI provided lock.

TABLE 4.0

ITEM No.	ITEM I.D.	Quantity	Description	Distributer	Catalog No.
1	N/A	1	Container 40' x 8' x 8' with doors on one end To include door lockable hardware		
2	1	1	Hanging Lockers -4 compartment, lockable	McMaster-Carr	4692T1
3	2	2	Changing Bench 36" x 9 1/2"	McMaster-Carr	4854T13
4	3	2	Lift Top Wall Attachment Desk	McMaster-Carr	4894T36
5	4	2	Clean Room Stool 30" x 13"Ø	McMaster-Carr	5096T53
6	5	1	Overhead Hood 48" x 72"	HVAC-03	
7	6	1	Mobile Drain Off Workbench	McMaster-Carr	4785T24
8	7	1	Baffle Storage Cart	McMaster-Carr	2559T32
9	8	1	Stainless Gas Hose Bin 18"w x 12"d x 18"h	CRS-1-GBH	
10	9	1	Stainless Steel Floor Tray 36" x 72" x 3"	HVAC-04	
11	10	2	Personnel/Equipment Creepers	CRS-2-PEC	
12	11	4	Purge Manifold System	CRS-3-PMS	
13	12	1	Gas Bottle Rack Assembly	CRS-4-GBR	
14	13	1	HVAC/FILTER Unit	HVAC-02	
15	14	2	Flire Resistant Trash Container 20"Ø x 31"h	McMaster-Carr	4388T4
16	15	1	Inflatable Seal Assembly	CRS-5-ISS	
17	16	1	Secondary Seal System	CRS-6-SSS	
18	17	1	Open		
19	18	1	Screen Door Assembly	CRS-7-SDA	
20	19	1	First Aid Kit 18"w x 24"h	Masuen	53500M
21	20	6	Wire Mesh Shelving 12"w x 36"length	McMaster-Carr	4717T22
22		3	Wire Shelving Brackets for 12"w (per pair)	McMaster-Carr	4717T15
23	21	4	Wire Mesh Shelving 18"w x 48"length	McMaster-Carr	4717T25
24		1	Wire Shelving Brackets for 18"w (per pair)	McMaster-Carr	4717T44
25	22	1	Inflatable Purge Dam Storage Cart	McMaster-Carr	2559T22
26	23	2	Wire Mesh Shelving 12"w x 48"length	McMaster-Carr	4717T23
27			Wire Shelving Brackets for 12"w (per pair)	McMaster-Carr	4717T15
28	24	1	Flamable Material Storage Cabinet 18"x43"	McMaster-Carr	4477T16
29	25	1	Tool Storage Cabinet 18" x18" x 66"	McMaster-Carr	4451T52
30	26	1	S.S. Purge Tube Storage Rack 6" x 12" x 144"	CRS-8-TSC	
31	27	2	Oily Waste Storage Containers 21 gal. Cap.	McMaster-Carr	4070T8
32	28	2	S.S. Dispensing Plunger Can(OSHA/FM)	McMaster-Carr	40075T51
33	29	2	Type 2 Flammable Liquid Container 2 gal.	McMaster-Carr	4289T7
34	E1	2	Emergency Lighting with Exit Light	WW Grainger	4V324
35	E2	1	Emergency Exit Alarm Lock	WW Grainger	1U121
36	A	1	100 Amp Breaker Panel with 18 min Slots	WW Grainger	4A562
37	B	1	100 Amp Receptacle for Marine Connection	Hubbell	4100B12R
38	C	1	100 Amp Plug for Marine Connection	Hubbell	4100R12
39	D	2	15° Box for Marine Plug/Recpt	Hubbell	BB1001W
40		2	Box Spacer for Maring Application	Hubbell	FW60/100
41	E	1	100 A Marine Cord with Plug/Receptacle- 75'	Hubbell	4100CS75
42	F	12	15 Amp Breaker(one Spare Included)	WW Grainger	4A585
43	G	3	15 Amp GFI Breaker	WW Grainger	4A583
44	H	2	30 Amp, 2 Pole Breaker	WW Grainger	4A588
45	I		Open		
46	J	10	Fluorescent Light Fixture 24"x48", 4 tube	WW Grainger	3V515
47	K	1	Fluorescent Light Fixture 24"x24", 2 tube	WW Grainger	4V375
48		2	Fluorescent Tubes FU40, Philips "U" Bent	WW Grainger	3V528
49	L	2	Fluorescent Vapor Proof Light Fixture	WW Grainger	3V424
50		4	Fluorescent Tubes F40, Philips "U" Bent	WW Grainger	4V300
51	M	1	Incandescent Vapor Resistant Fixture	WW Grainger	2V565

TABLE 4.0

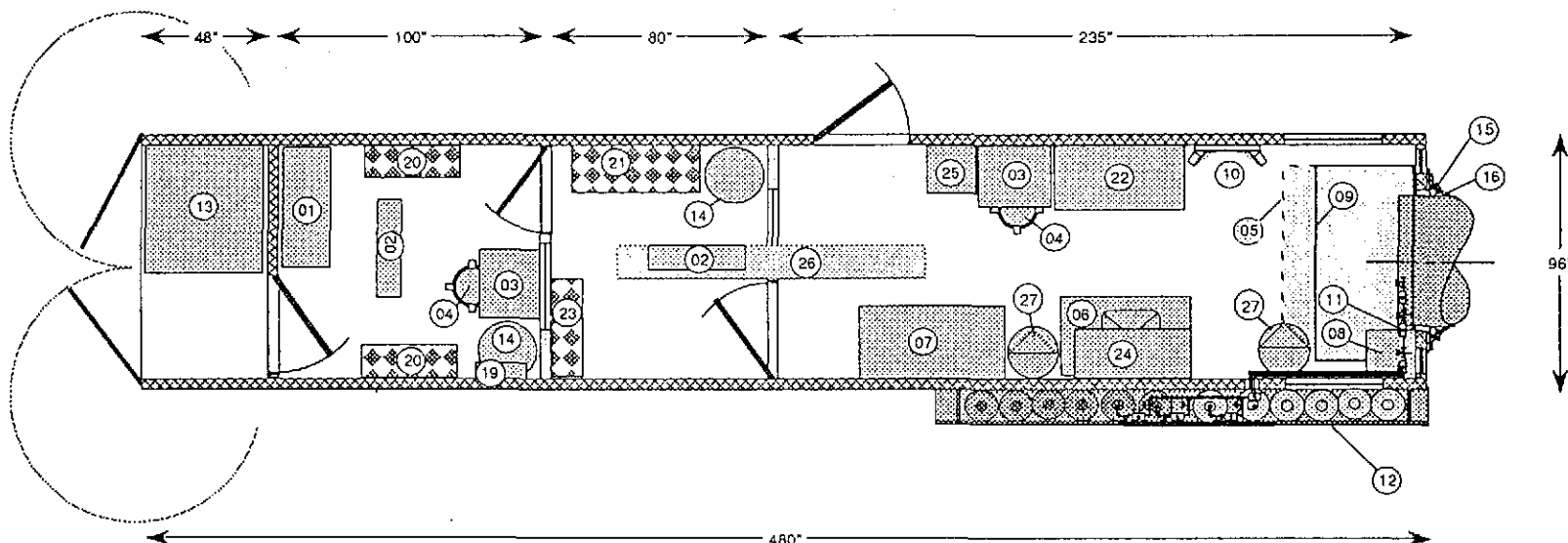
ITEM No.	ITEM I.D.	Quantity	Description	Distributer	Catalog No.
52		1	Incandescent 60w "Bug Away" Bulb	WW Grainger	2V290
53	N	6	Light Fixture Mounting Hook Assembly	CRS-9-LFH	
54	O	2	100W HPS Portable Area Light with Plug/Cord	WW Grainger	4V256
55	P	6	Duplex Receptacle 5-15R, 15 amp	WW Grainger	3A378
56		6	Duplex Covers Rated NEMA 4X	WW Grainger	2V705
57	Q	3	Single Pole Switch - Rocker Type, 15 Amp	WW Grainger	6A678
58		1	Wall Plate for 3 Switch Box	WW Grainger	
59	R	1	Single Pole Switch - Rocker Type, 15 Amp	WW Grainger	6A678
60		1	Wall Plate for Single Switch Box	WW Grainger	6A677
61	S	2	Single Pole Switch - Rocker Type, 15 Amp	WW Grainger	6A678
62			Wall Plate for Double Switch Box	WW Grainger	6A677
63	T	1	Hood Mounted Switch for Fan and Lights	HVAC-03	
64	U		Open		
65	V		Open		
66	W	5	Flush Duplex Receptacle 5-15R, 15 amp	WW Grainger	6A680
67		5	Flush Duplex Wall Plate	WW Grainger	6A677
68	X	2	Duplex Twist Lock Receptacle L5-15, 15 amp	WW Grainger	3A388
69		2	Duplex Wall Plate, Orange Color	WW Grainger	1A558
70	Y	1	Single Twist Lock Receptacle L5-15, 15 Amp	WW Grainger	6X057
71			Single L5-15 Wall Plate, Stainless Steel	WW Grainger	6X062
72	Z		Open		
73		1 Lot	Insulation for Walls	Per Specifications	
74		1 Lot	Conduit	Per Specifications	
75		1 Lot	Electrical Wire	Per Specifications	
76		1 Lot	Electrical Boxes, Fittings, Etc	Per Specifications	
76		1 Lot	Fasteners	Per Specifications	
77		1 Lot	Wall Board	Per Specifications	
78		1 Lot	Floor Treatment	Per Specifications	
79		1 Lot	Paint	Per Specifications	
80		2	Interior Doors	Per Specifications	
81		1	Front Exterior Door	Per Specifications	
82		1	Metal Emergency Exit Door	Per Specifications	
83		3	Window Units 18" x 36"	Per Specifications	
84		5	Door/Wall Window Units 12" x 12"	Per Specifications	
85		1 Lot	Caulking and Sealing Materials	Per Specifications	
86		-	Insect Treatment Before Construction	Per Specifications	
87		8	Floor Mats	McMaster-Carr	62675T82
88		4	Locking bars	McMaster-Carr	1241A2
89		6	Dial Manometers	McMaster-Carr	4021K15
All items listed in this table may be substituted based on documented pre-approval.					



Clean Room
Specifications
Sketch P1

INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No.	
CBI	
LIGO CLEAN ROOM GENERAL Views and Dimensions	
Customer No. 20X <i>11/10/85</i>	Contract No.
Engineering Approval	Drawn
Checked	Rev.
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EQUIPMENT LISTING

MARK	QTY	DESCRIPTION	SIZE	COMMENTS	REFERENCE NO.	MARK	QTY	DESCRIPTION	SIZE	COMMENTS	REFERENCE NO.
01	1	Hanging Lockers with Bar	4 comp		MMC4692T1	15	1	Inflatable Seal for Tube Penet.	48" Ø	See Seal Det	CRS-5-ISTP
02	2	Changing Bench	36"	Incls Pedestals	MMC4854T13	16	1	Secondary Gasket Seal	48" Ø	See Seal Det	CRS-6-SGF
03	2	Wall Attachment Desk	24x23"	Lift Top	MMC4894T36	17		Open			
04	2	Clean Room Stool	30" h		MMC5096T53	18	1	Screen Door Assembly	50" Ø	100 Mesh	CRS-7-SDA
05	1	Overhead Hood	48"x72"	See HVAC	HVAC EX04	19	1	First Aid Equipment Cabinet	18x24"	with Supplies	Masuen 53500M
06	1	Mobile Drain-off Workbench	48x28"	with Casters	MMC4785T24	20	6	Chrome Wire Mesh Shelving	36x12"	2units/3 shlvs	MMC4717T22 & 17
07	1	Baffle Storage Cart	27x54	with Casters	MMC2559T31	21	4	Chrome Wire Mesh Shelving	48x18"	1unit/4 shlvs	MMC4717T25 & 44
08	1	Gas Hose Bin 18" Deep	18x18"	18ga.S.S	CRS-1-GHB	22	1	Inflatable Purge Dam Storage	48x24"	48" Height	MMC2559T21
09	1	Floor Tray Drain Mat	36"x72"	18ga.S.S	HVAC EX07	23	2	Chrome Wire Mesh Shelving	48x12"	1unit/2 shlvs	MMC4717T23 & 15
10	2	Personnel/Equip Creepers	18"x36"	Tellon Wheels	CRS-2-PEC	24	1	Flammable Mat'l Storage Cabinet	43x18"	Per OSHA	MMC4477T16
11	4	Purge Manifold Systems	N/A	S.S.Const	CRS-3-PMS	25	1	Tool Storage Cabinet	18x18"	66" Height	MMC4451T52
12	1	Gas Bottle Rack	Later	Per OSHA	CRS-4-GBR	26	1	S.S. Tube Storage Container	12x12	114" Length	CRS-8-TSC
13	1	HVAC/Filter Unit	N/A	See HVAC	HVAC AHU-1	27	2	Oily Waste Cans	21" Ø	Per OSHA	MMC4070T8
14	2	Trash Container	N/A	Per NFPA	MMC4398T4	28	2	S.S. Dispensing Plunger Cans	1 qt	Not Shown	MMC40075T51
						29	2	Type II Safety Can with Spout	2 qt	Not Shown	MMC4289T7

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Clean Room
Specifications
Sketch P2

Supplier's/Purchaser's No. _____

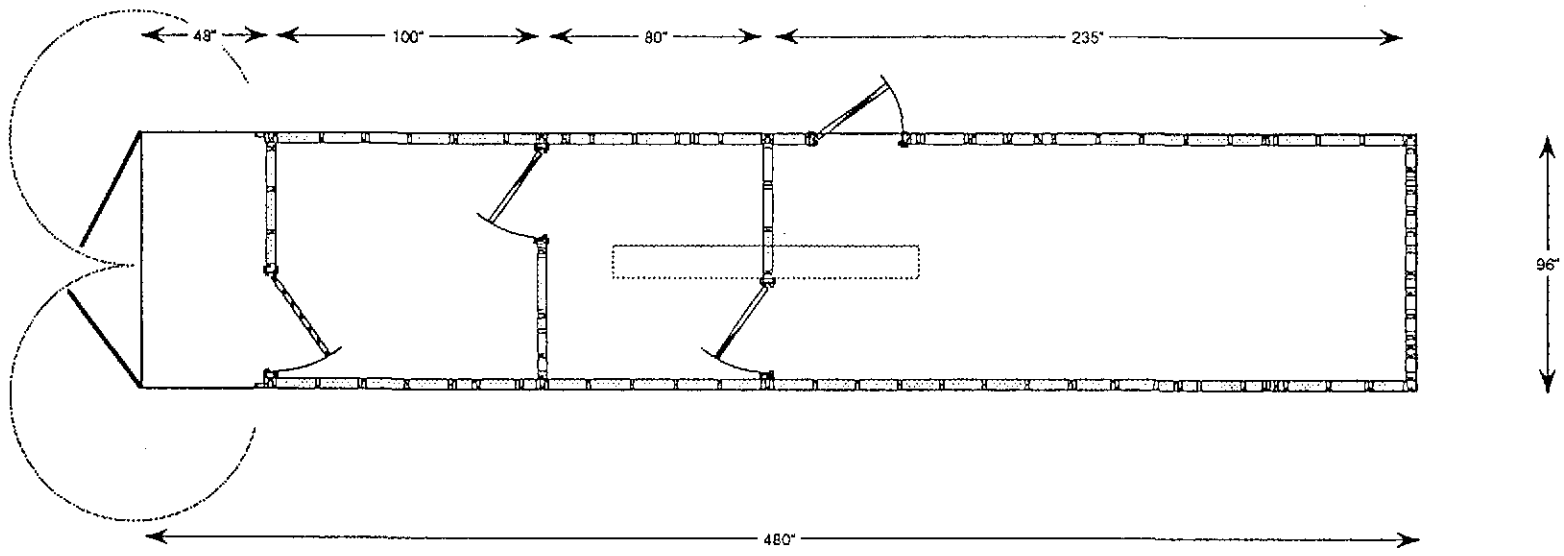
CBI

LIGO CLEAN ROOM EQUIPMENT PLAN VIEW

W/LD/95

Engineering Engineer

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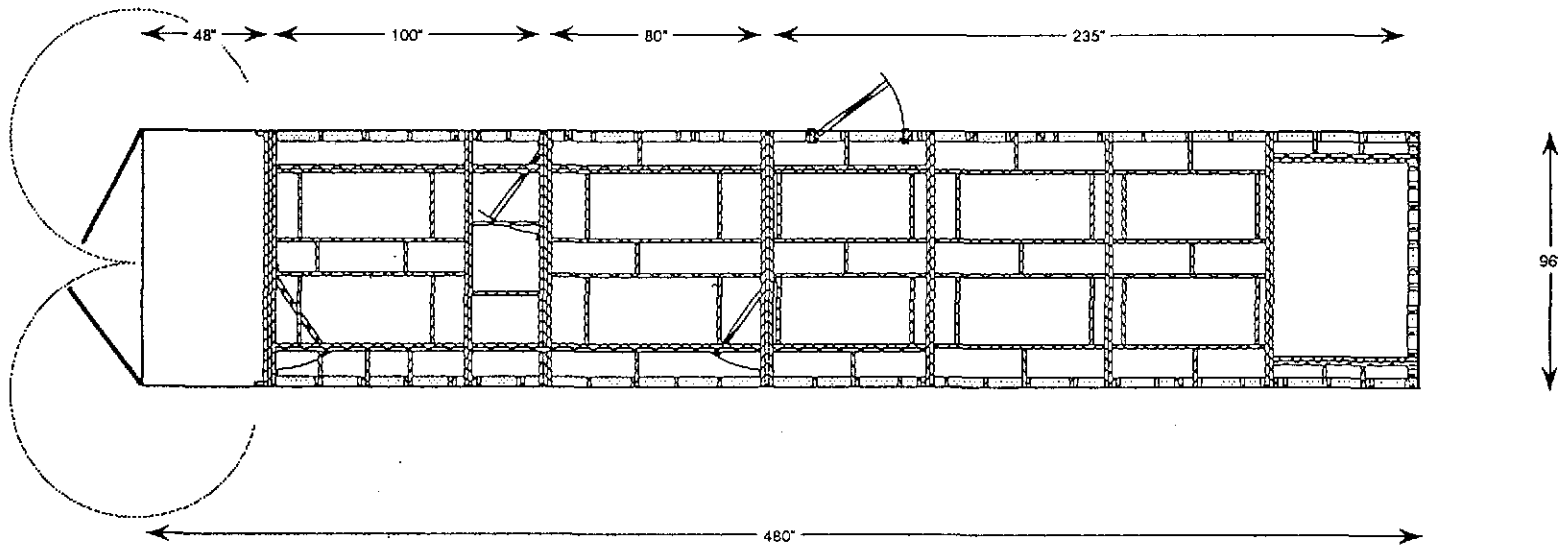
Notes:

- 1) Framing is shown as 2"x4" construction. Metal Framing is also acceptable at 1 1/2" x 3 1/2" size.
- 2) Insulate outer walls using a foil or vinyl faced material conforming to applicable codes and requirements of NFPA, Factory Mutual, etc.
- 3) Fasteners for side wall shall be stainless steel and sealed with silicone and/or gasketed for a No Leak Condition.
- 4) No drilling thru roof material is allowed. If attachment is required, epoxy is acceptable.

Clean Room
Specifications
Sketch P3

INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
CBI	
LIGO CLEAN ROOM Lower Framing PLAN VIEW	
Date: <u>8/11/95</u>	
Engineering Reviewer	Per
Sheet	Rev
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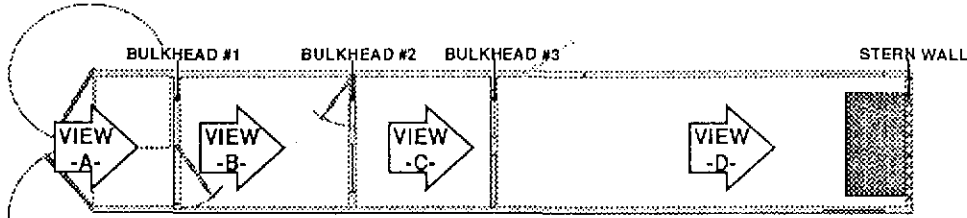
Notes:

- 1) Framing is shown as 2"x4" construction. Metal Framing is also acceptable at 1 1/2" x 3 1/2" size.
- 2) Insulate outer walls using a foil or vinyl faced material conforming to applicable codes and requirements of NFPA, Factory Mutual, etc.
- 3) Fasteners for side wall shall be stainless steel and sealed with silicone and/or gasketed for a No Leak Condition.
- 4) No drilling thru roof material is allowed. If attachment is required, epoxy is acceptable.

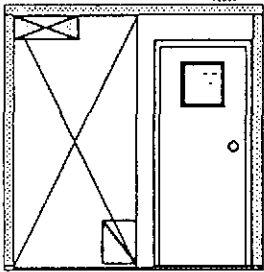
Clean Room Specifications Sketch P4

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

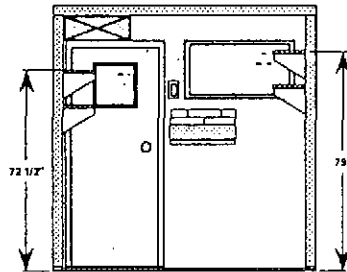
Supplier/Purchaser's No. _____	
CBI	
LIGO CLEAN ROOM Upper & Ceiling Framing Plan	
Date: <u>11/04/95</u> Drawing by: _____ Checked by: _____ Date: _____	Drawing No. _____ Date: _____
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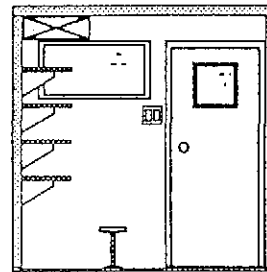
PLAN VIEW OF CLEAN ROOM CONTAINER



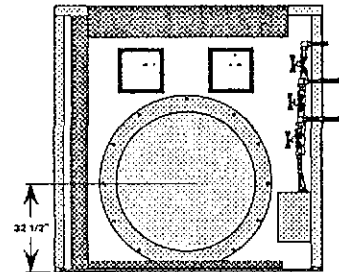
VIEW A
(BULKHEAD #1)



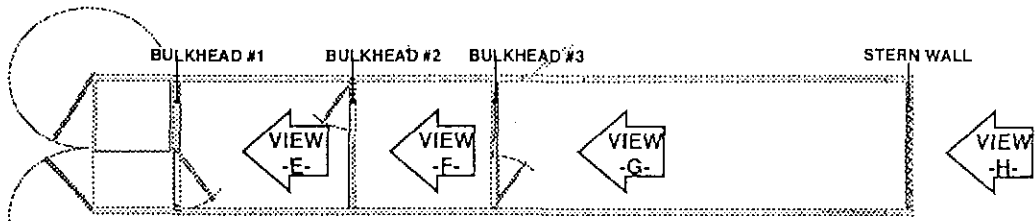
VIEW B
(BULKHEAD #2)



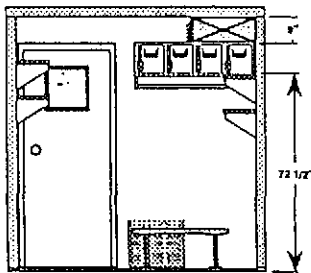
VIEW C
(BULKHEAD #3)



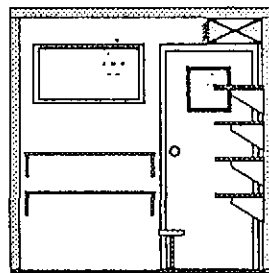
VIEW D
(STERN WALL)



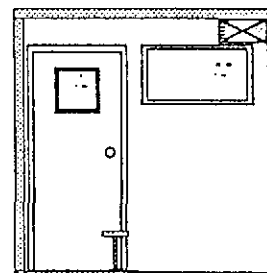
PLAN VIEW OF CLEAN ROOM CONTAINER



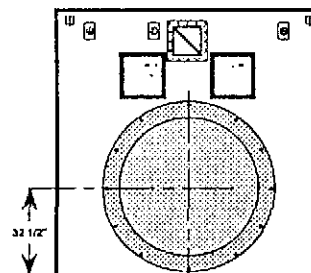
VIEW E
(BULKHEAD #1)



VIEW F
(BULKHEAD #2)



VIEW G
(BULKHEAD #3)



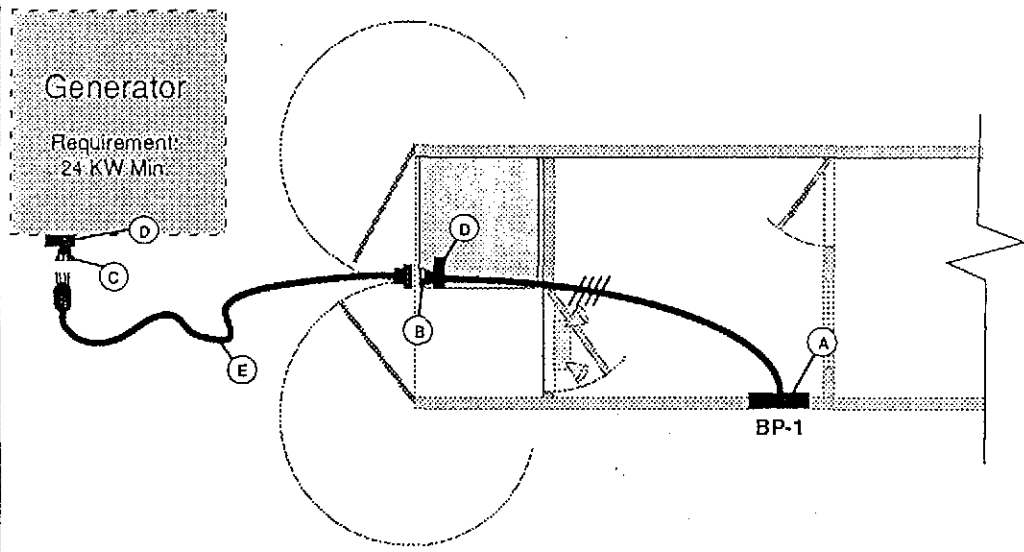
VIEW H
(STERN WALL)

Clean Room
Specifications
Sketch P5

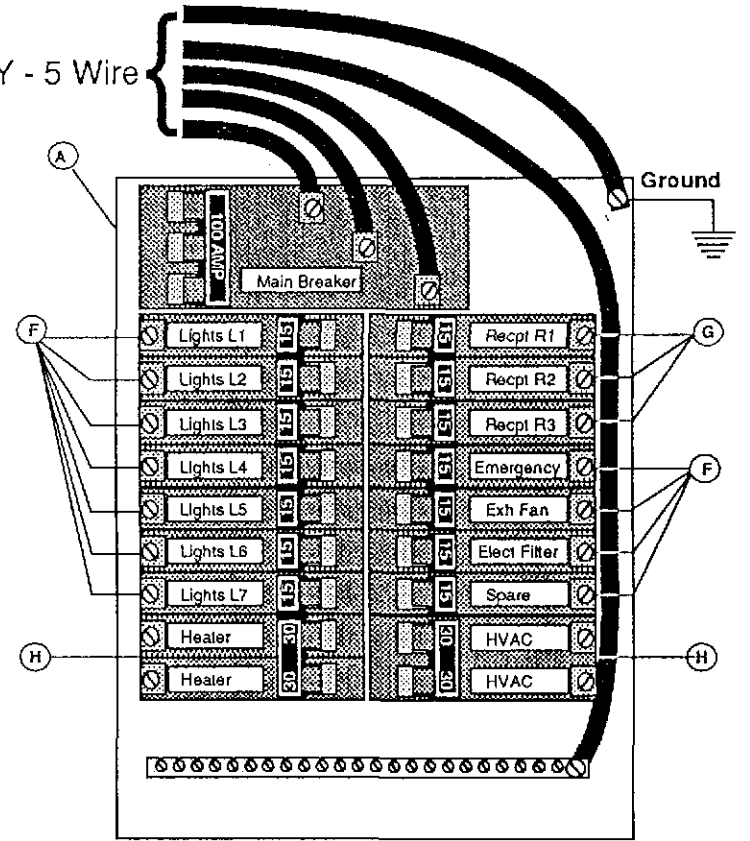
▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
CBI	
LIGO CLEAN ROOM BULKHEAD ELEVATIONS	
Date: <u>11/14/65</u> Drawing No. _____ Project No. _____ Drawing Title: _____ Drawing Scale: _____ Drawing Date: _____ Drawing By: _____ Drawing Check: _____ Drawing Appr: _____ Drawing Date: _____	

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208Volt, 3Ø Y - 5 Wire



BP-1

MARK	QTY	DESCRIPTION	SIZE	COMMENTS	REFERENCE NO.
(A)	1	100 Amp Breaker Panel	18 spcs	240/1Ø	Flush WWG# 4A562
(B)	1	100Amp Marine Receptacle	5 wire	with Cover	Hubbell 5100B9R Watertight Receptacle
(C)	1	100Amp Plug for Generator	5 wire	with Cover	Hubbell 5100R9 Watertight Plug
(D)	1	15° Angle Back Box & Spacer	4x4"	NEMA 4X	Hubbell #BB1002W and FW60/100
(E)	1	100Amp Marine Cord Set	100'	Watertight	Hubbell 5100CS100
(F)	11	15 Amp Breaker	1"		WWG#4A585
(G)	3	15 Amp Breaker with GFI	1"		WWG#4A583
(H)	2	30 Amp Breaker	1"		WWG#4A588
(I)		Spare			

Clean Room
Specifications
Sketch P6

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____

CBI

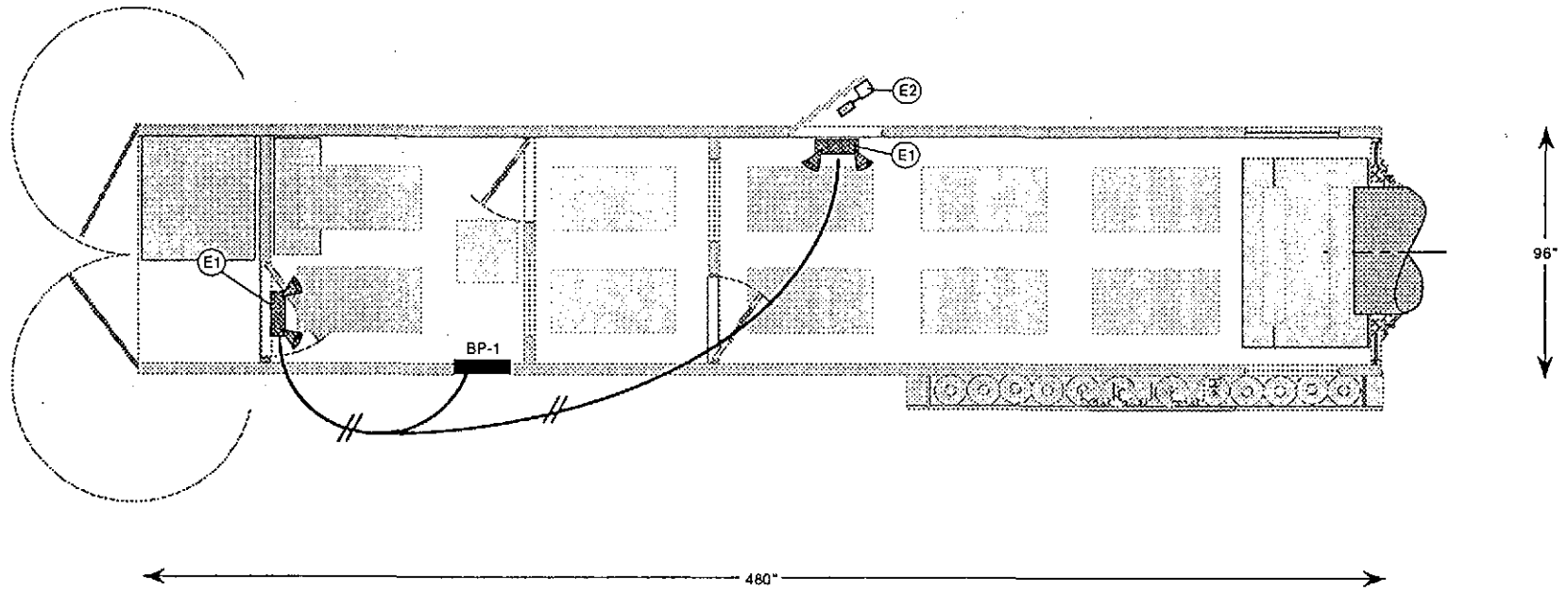
LIGO CLEAN ROOM ELECTRICAL POWER PLAN

Drawn by: *[Signature]* Date: _____

Lighting Supplier: _____

Sheet: _____ of _____

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MARK	QTY	DESCRIPTION	SIZE	COMMENTS	REFERENCE NO.
(E1)	2	Combination Emergency & Exit Lighting	16x12"	120 volt	WWG#4V324
(E2)	1	Emergency Escape Bolt Ass'y	32"	Battery Pwr'd	WWG#1U037(left Hand Door)

Clean Room
Specifications
Sketch P7

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____

CBI

LIGO CLEAN ROOM EMERGENCY EQUIPMENT PLAN

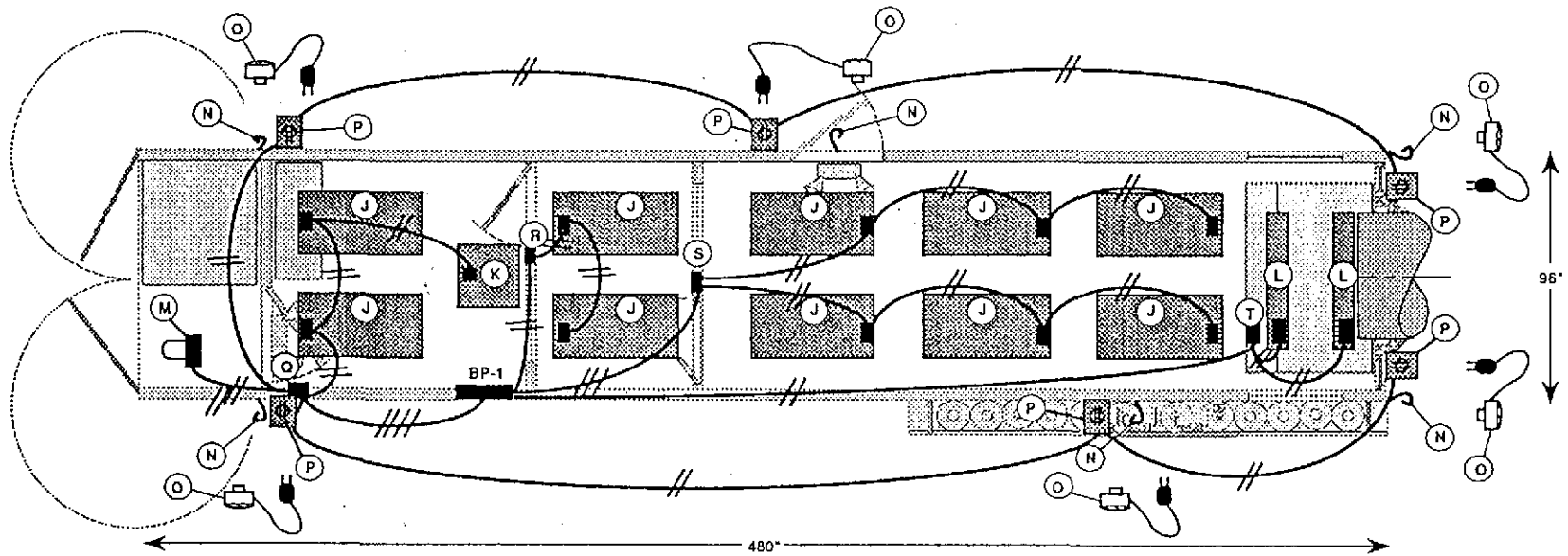
Quantity No. 11/10/95

Engineering Supervisor _____

Drawn _____

Checked _____

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MARK	QTY	DESCRIPTION	SIZE	COMMENTS	REFERENCE NO.
J	10	Fluorescent Recessed Fixtures	24x48"	4-F40 Tubes	WWG#3V420
K	1	Fluorescent Recessed Fixture	24x24"	2-FU20 Tubes	WWG#4V375
L	2	Fluorescent Vapor Resistant Fix	12x48"	2-F40 Tubes	WWG#3V424
M	1	Incandescent Vapor Res. Flx	6x10"	Ceiling Mount	WWG#2V565
N	6	Ext. Light Pad Mount Hook	3/8"Ø	To fit "F"	Fabricate to support Item "F"
O	6	100W HPS Portable Area Light	100w	Wet Location	WWG#4V256
P	6	5-15 Single Receptacle & Cove	15 amp	NEMA 4X	Single 5-15 Receptacle with Weather Cover
Q	-	Single Pole Rocker Switches	15 amp	3 switches	WWG#6A678 with 3 switch wall plate
R	-	Single Pole Rocker Switch	15 amp	1 switch	WWG#6A678 with single switch wall plate
S	-	Single Pole Rocker Switches	15 amp	2 switches	WWG#6A678 with 2 switch wall plate
T	-	Hood Mounted Switch	15 amp	UL List	Per Hood Manufacturer Specification
U		Open			

Supplier's/Purchaser's No. _____

CBI

**CLEAN ROOM
LIGO ELECT. LIGHTING
PLAN VIEW**

Drawn by: *W. H. G. S.*

Checked by: _____

Approved by: _____

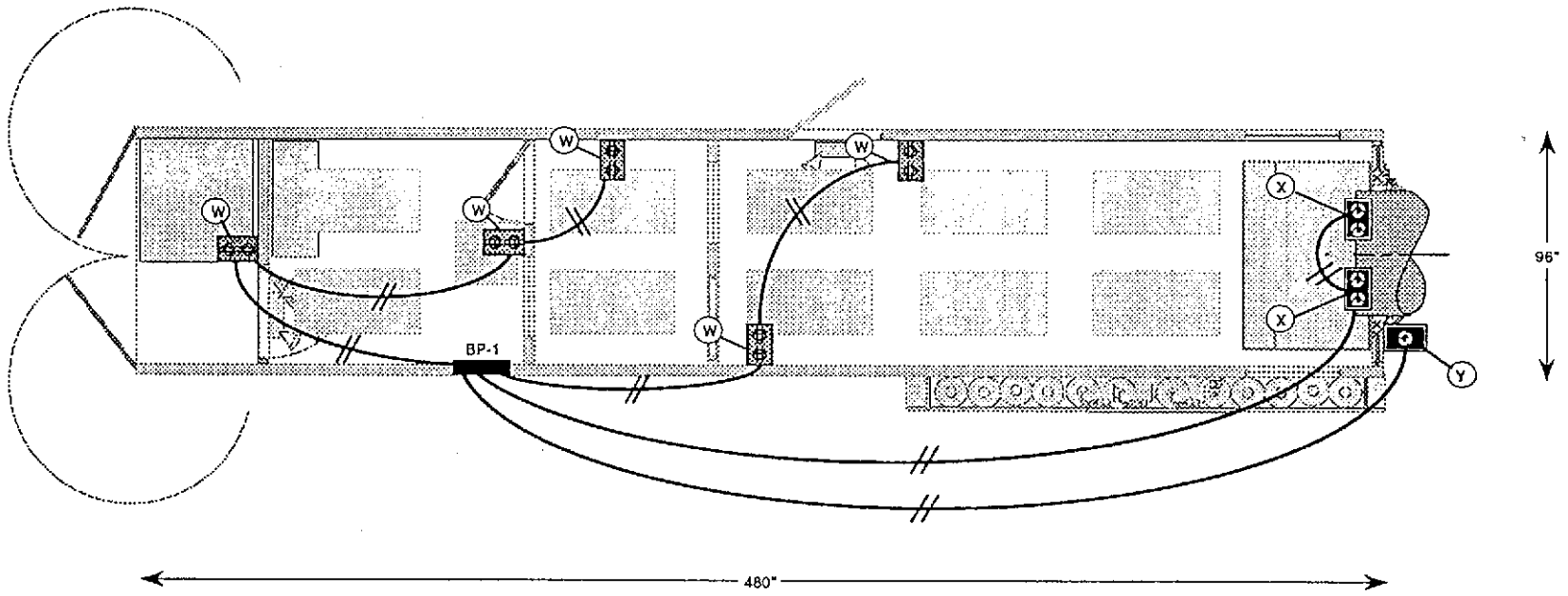
Engineering Department

Sheet _____ of _____

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▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Clean Room
Specifications
Sketch P8



MARK	QTY	DESCRIPTION	SIZE	COMMENTS	REFERENCE NO.
(W)	5	5-15 Duplex Receptacles	15 amp	Straight Blade	Flush WWG#6A680, Wall Plate = 6A677
(X)	2	L5-15 Duplex Receptacles	15 amp	Twist Locking	WWG#6A664, Orange Wall Plate = 1A558
(Y)	2	L5-15 Duplex Receptacles	15 amp	Twist Locking	WWG#6X057, NEMA 4X Wall Plate = 2V704
(Z)		Open			

Supplier's/Purchaser's No. _____

CBI

LIGO CLEAN ROOM RECEPTACLE PLAN VIEW

Drawn by: #/10/95

Checked by: _____

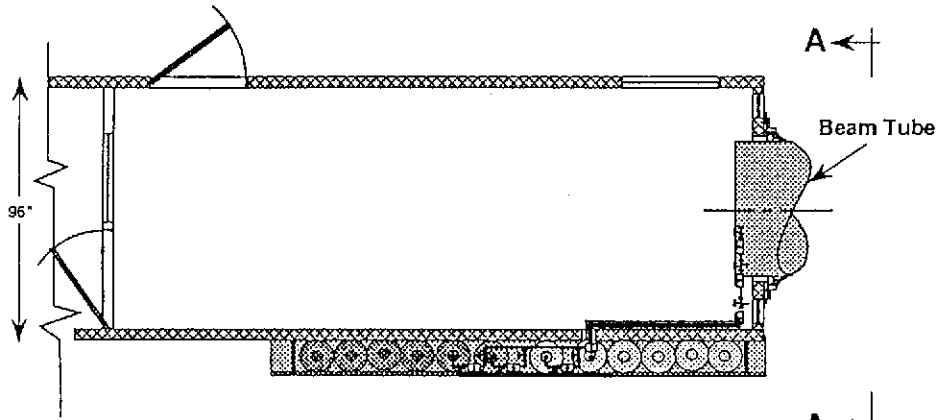
Engineering Department _____

Dept. _____

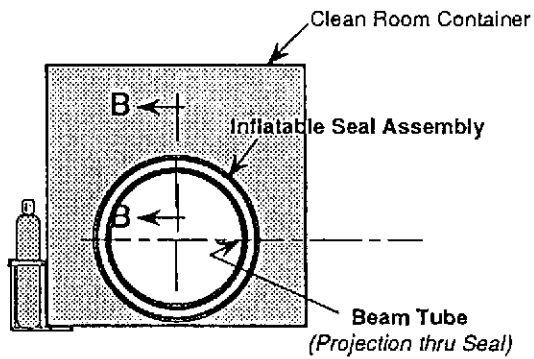
Sheet _____

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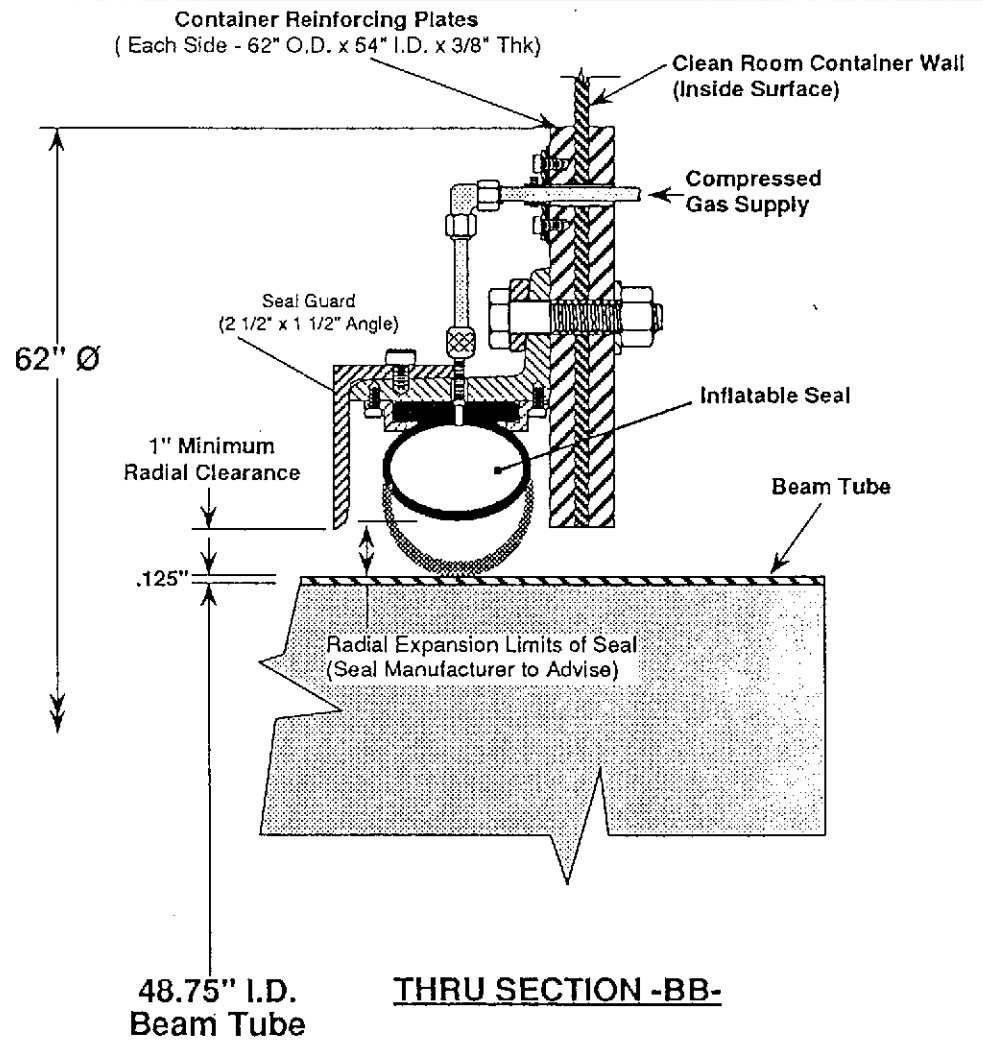
▶ INDICATES CHANGE FROM PREVIOUS ISSUE



Plan View
Section of Clean Room



END VIEW -AA-



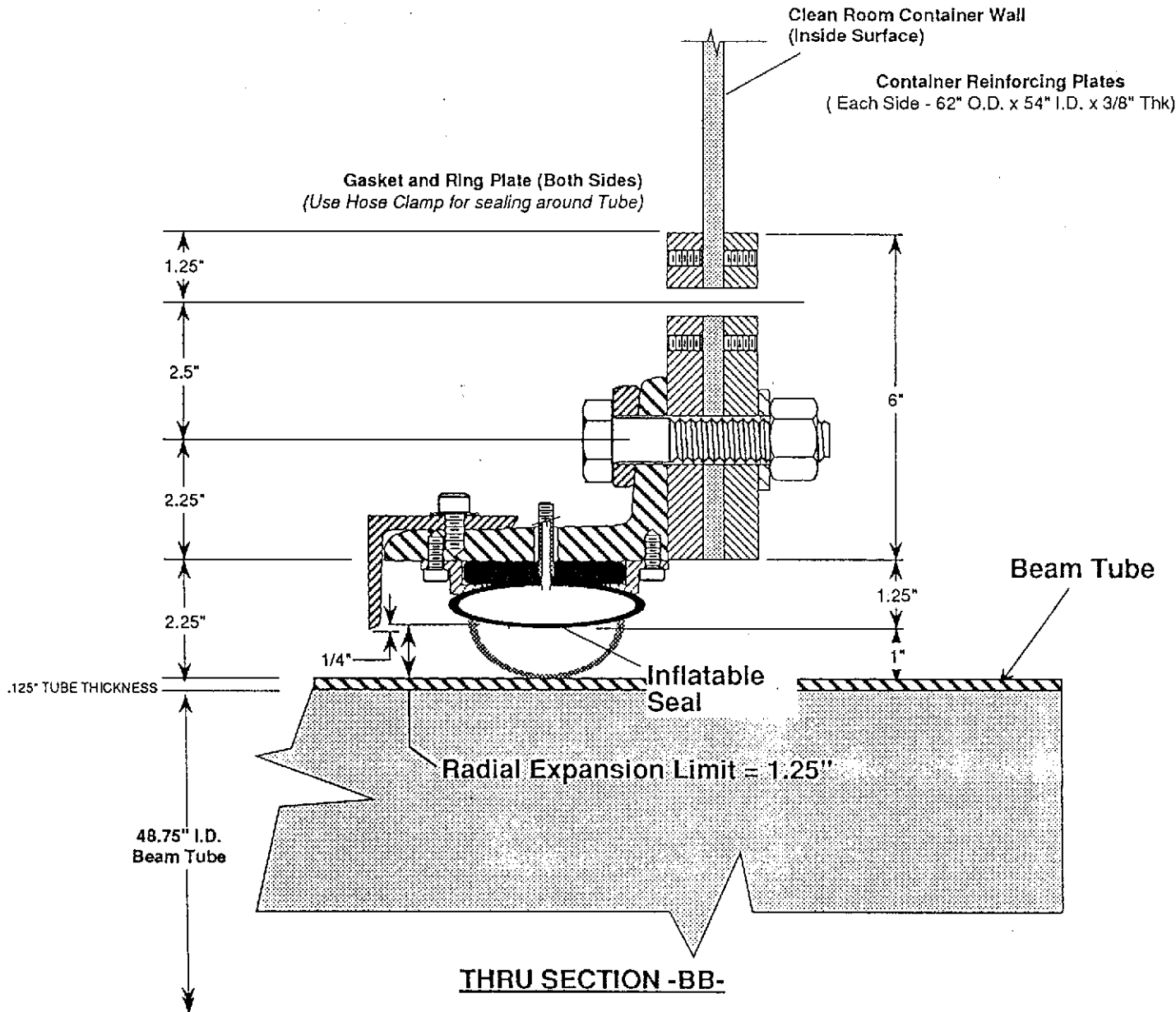
THRU SECTION -BB-

48.75" I.D.
Beam Tube

Clean Room
Specifications
Sketch P10

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
CBI	
LIGO CLEAN ROOM Inflatable Seal Detail	
Specimen No. W/10/85	Revised No. _____
Engineering Sketches	Drawn CRS-5-1SS
	Checked SHI 10/2
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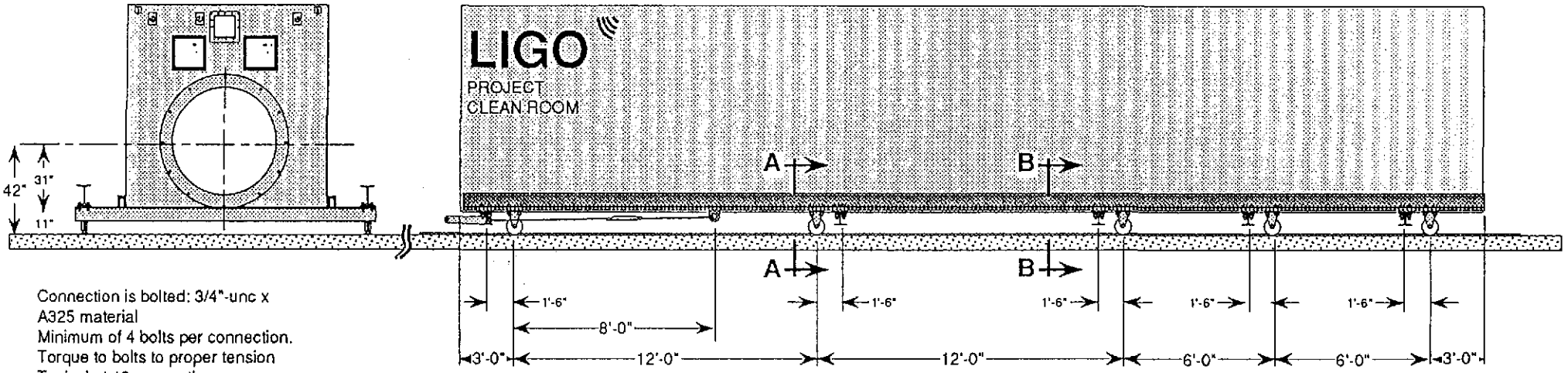


Clean Room Specifications Sketch P11

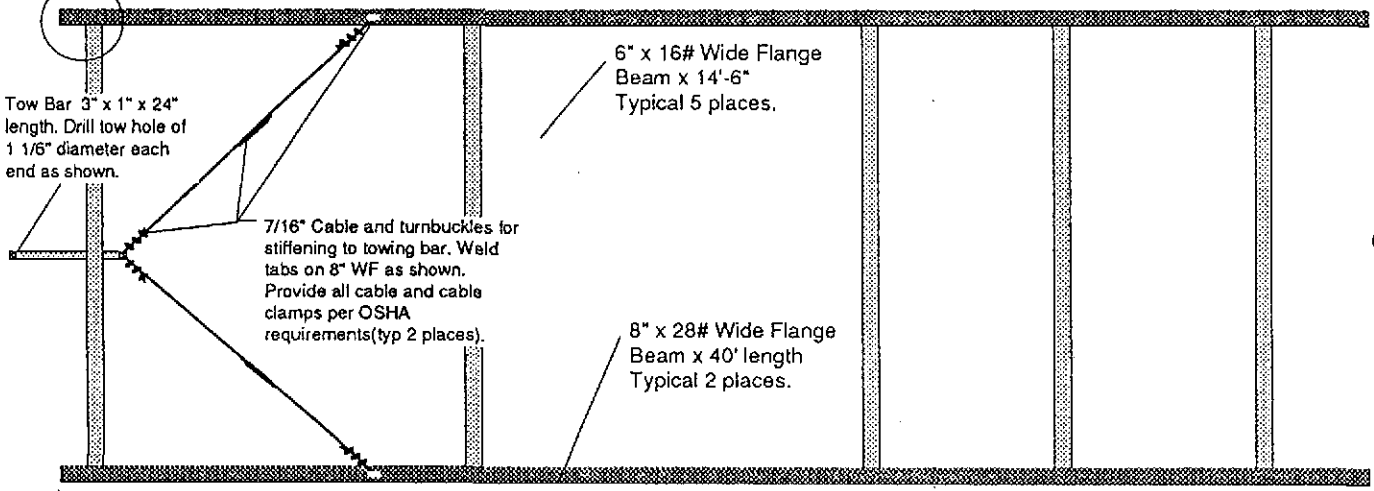
INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
CBI	
LIGO CLEAN ROOM Inflatable Seal Detail	
Drawn by: <i>W. H. Jones</i>	Checked by: _____
Engineering Department: _____	Part No: CBS-8-1SS
Sheet: SH 2 of 2	Rev: _____
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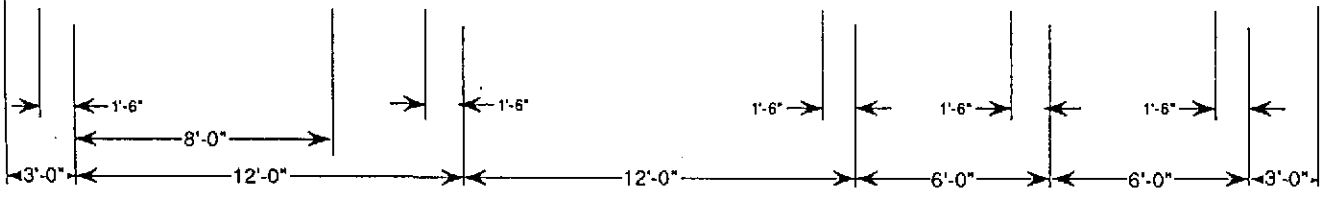
LIGO
PROJECT
CLEAN ROOM



Connection is bolted: 3/4"-unc x A325 material
Minimum of 4 bolts per connection.
Torque to bolts to proper tension
Typical at 10 connections



140"
Center-Center
Track Gauge



Clean Room
Specifications
Sketch P12

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

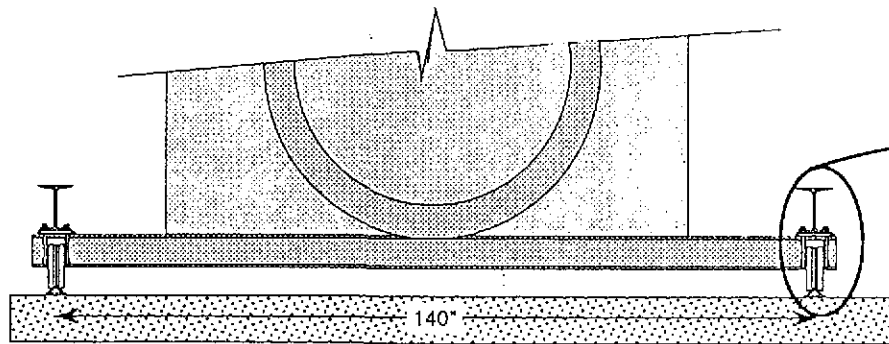
Supplier's/Purchaser's No. _____

CBI

LIGO CLEAN ROOM Rolling Frame & Track Assembly

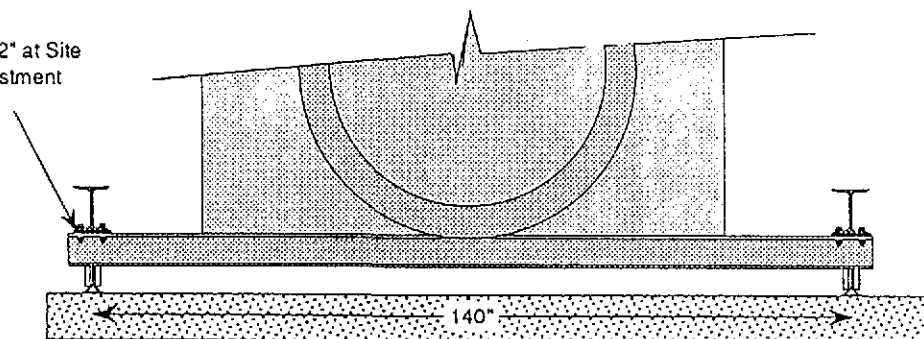
Drawn by: *W. L. Hughes* Date: _____
 Checked by: _____
 Engineering: _____
 Sheet: _____

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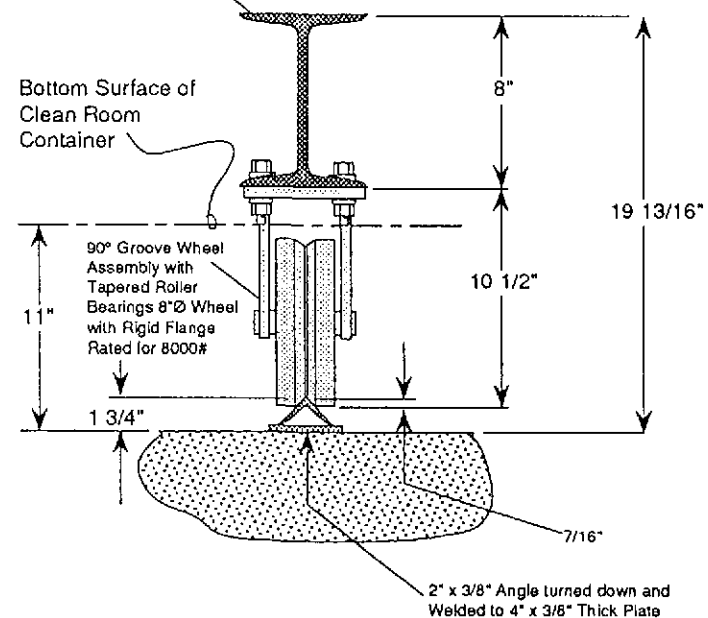
Sectional View -AA-

Shim 1/2" at Site for Adjustment



Sectional View -BB-

Wide Flange Beam 8" x 28#

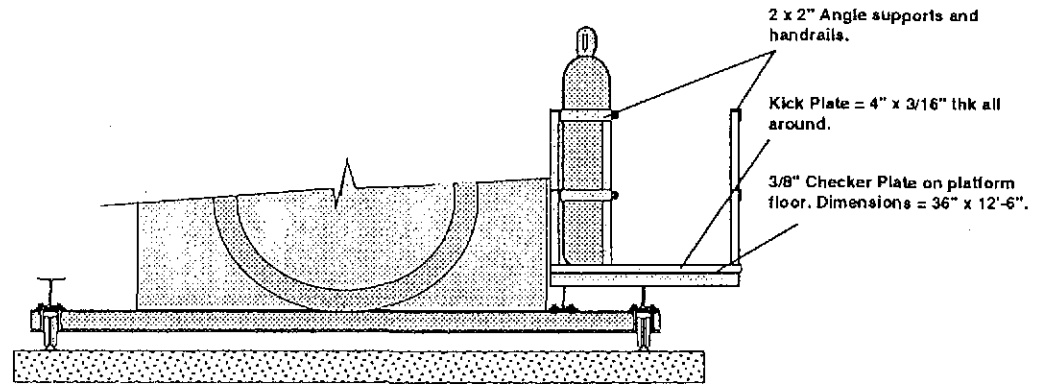


Bottom Surface of Clean Room Container

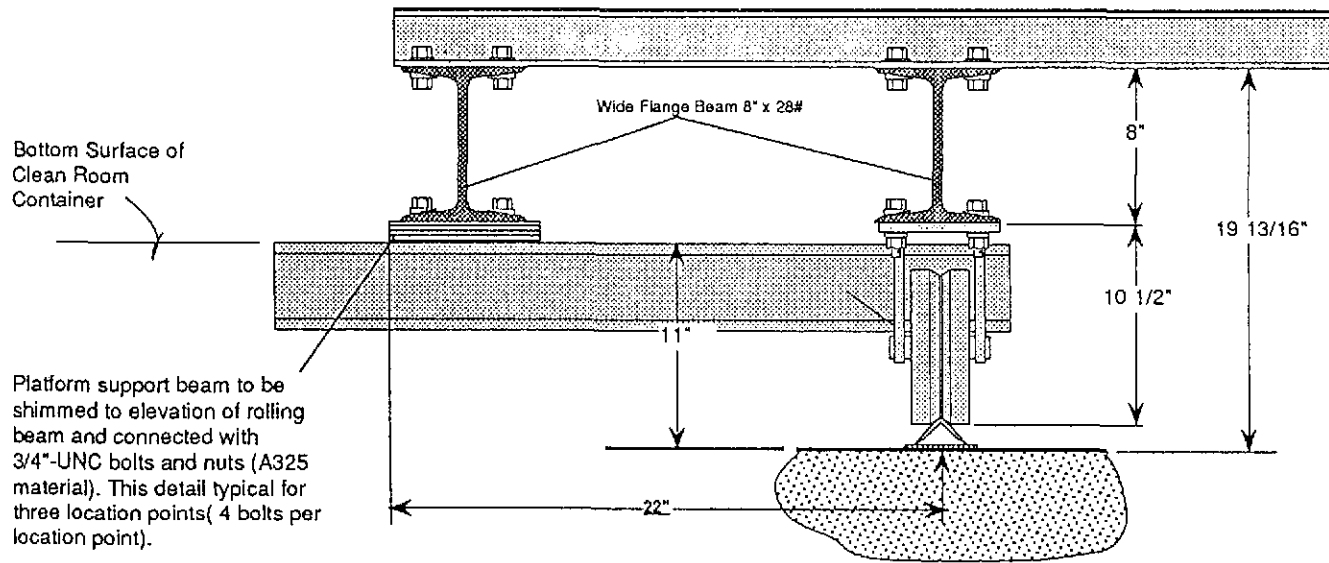
90° Groove Wheel Assembly with Tapered Roller Bearings 8"Ø Wheel with Rigid Flange Rated for 8000#

2" x 3/8" Angle turned down and Welded to 4" x 3/8" Thick Plate

Supplier's/Purchaser's No. _____			
CBI		CLEAN ROOM	
LIGO		Rolling Frame & Track Assembly	
Customer No. <i>45123</i>	Drawn By <i>WJ/KRS</i>	Checked By	Date
Engineering Supervisor	Sheet	Rev.	
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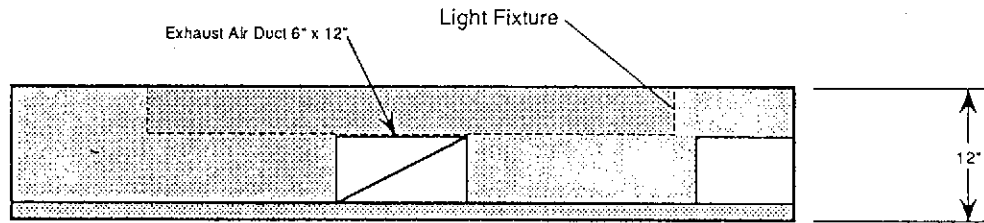
Sectional View -AA-



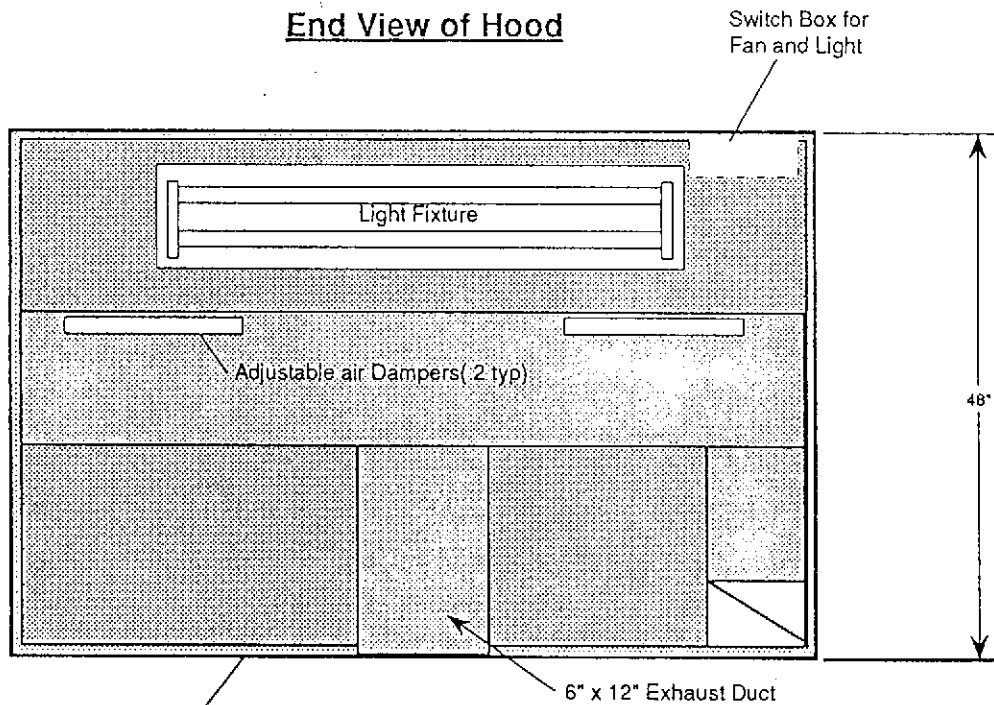
Clean Room
Specifications
Sketch P14

INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____			
CBI			
CLEAN ROOM			
LIGO Rolling Frame & Track Assembly			
Date: 11/10/95		Drawn by: _____	
Engineering Supervisor: _____		Checked by: _____	
Sheet: _____		Date: _____	
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End View of Hood



Bottom View of Hood

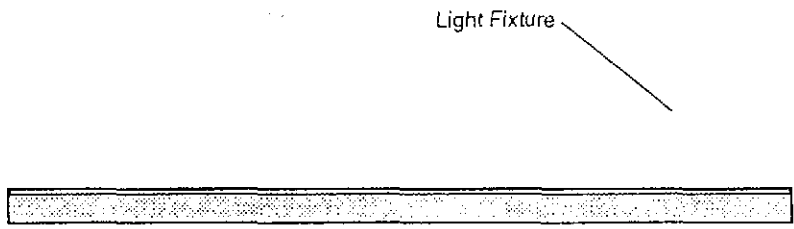
NOTES:

- 1) Hood is constructed from Grade 400 stainless steel or equal, 18 gauge minimum thickness.
- 2) Light Fixture shall be as detailed in Table 4.0, list Item No. 49.
- 3) Duct details as noted on drawing and per fabricator's methods for connection to hood.
- 4) Adjustable dampers on intake of exhaust duct (2 at each hood).
- 5) Light and Control switch shall be 120 vac/60hz.
- 6) Floor pan duct connection shown and shall be provided for duct connections with screws.

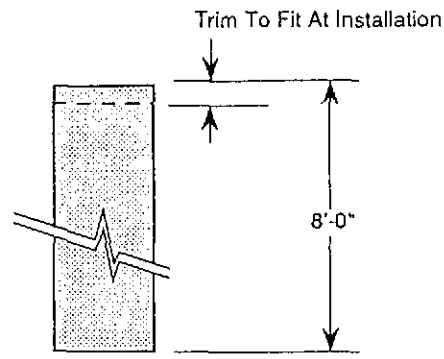
Clean Room Specifications Sketch P 15

INDICATES CHANGE FROM PREVIOUS ISSUE

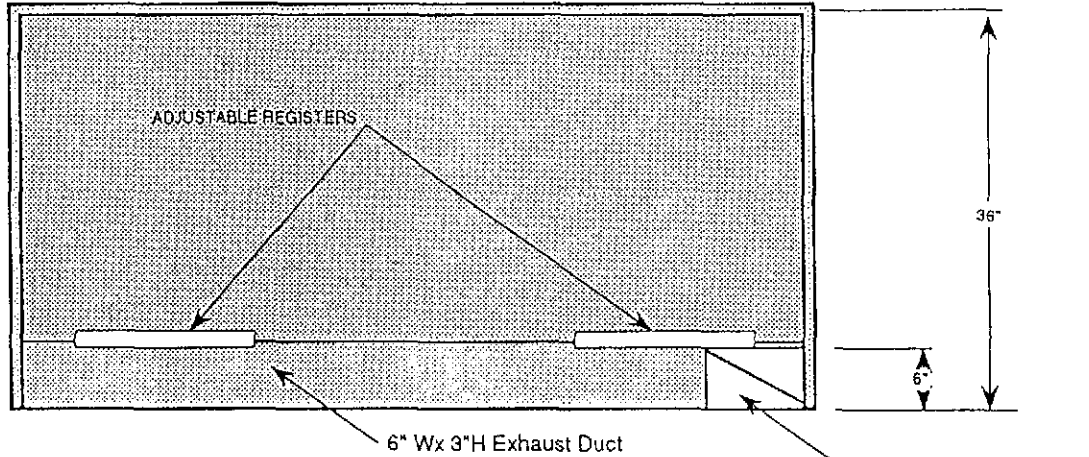
Supplier's/Purchaser's No. _____	
CBI	
CLEAN ROOM LIGO EXHAUST HOOD	
Drawing No. u110195 By <i>[Signature]</i> Date _____ Engineering's approval _____ Sheet _____	Division No. _____ No. HVAC-03
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End View of Hood



Elevation View
6" x 3" Floor Tray Duct



Plan View of Hood

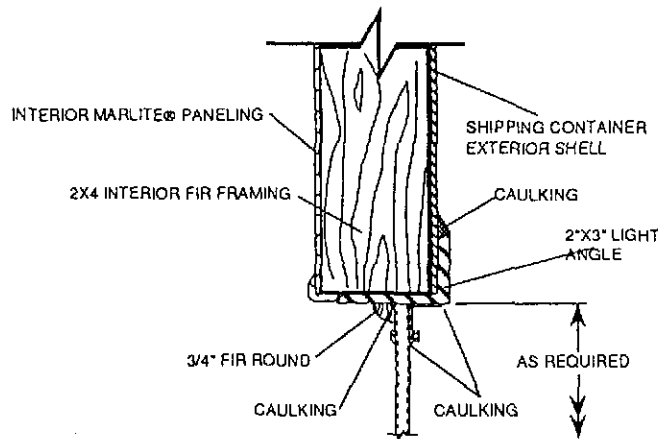
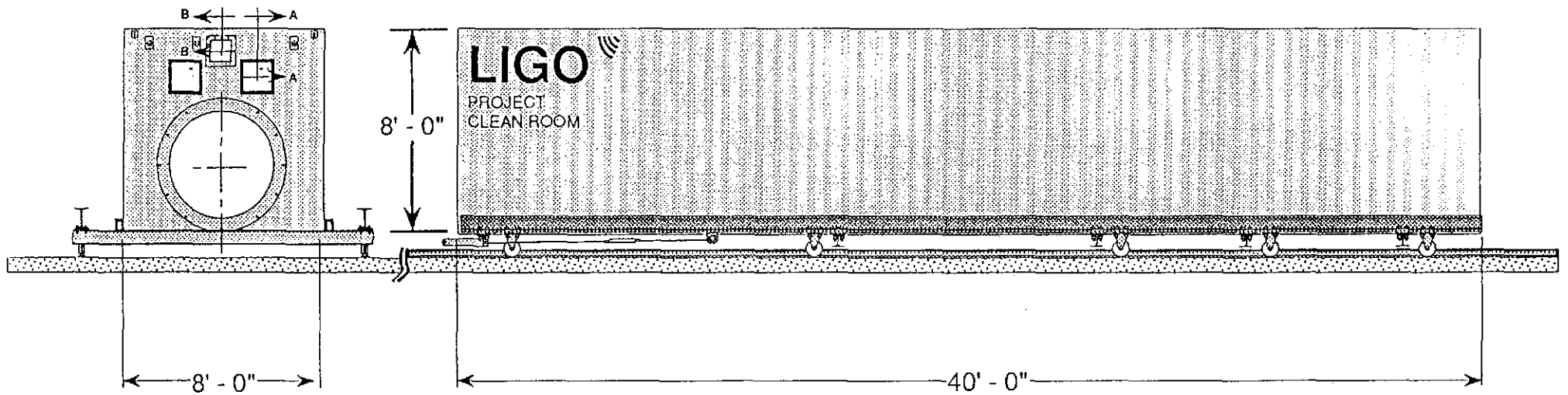
NOTES:

- 1) Floor Tray is constructed from Grade 400 stainless steel or equal, 18 gauge minimum thickness.
- 2) Duct details as noted on drawing and per fabricator's methods for connection to hood.
- 4) Adjustable dampers on intake of exhaust duct(2 at each tray).
- 5) Floor pan duct connection shown and shall be provided for duct connections with screws.

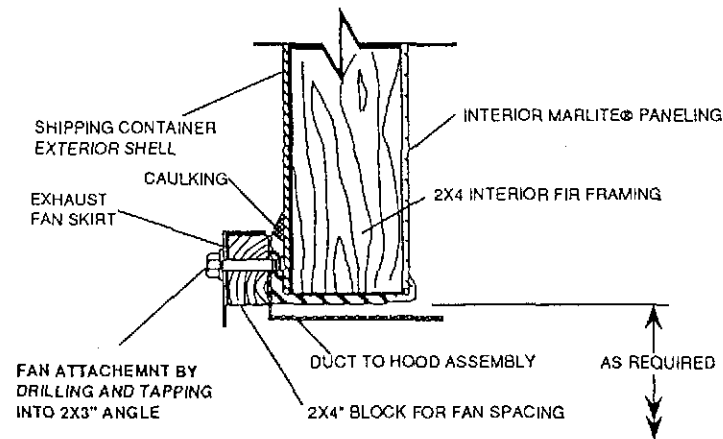
Clean Room
Specifications
Sketch P16

Supplier's/Purchaser's No. _____	
CBI	
CLEAN ROOM FLOOR TRAY	
Customer's No. # 504	Drawn By 11/18/65
Engineering Specialist	Drawn HVAC-04
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▶ INDICATES CHANGE FROM PREVIOUS ISSUE



SECTION AA
WINDOW PENETRATION



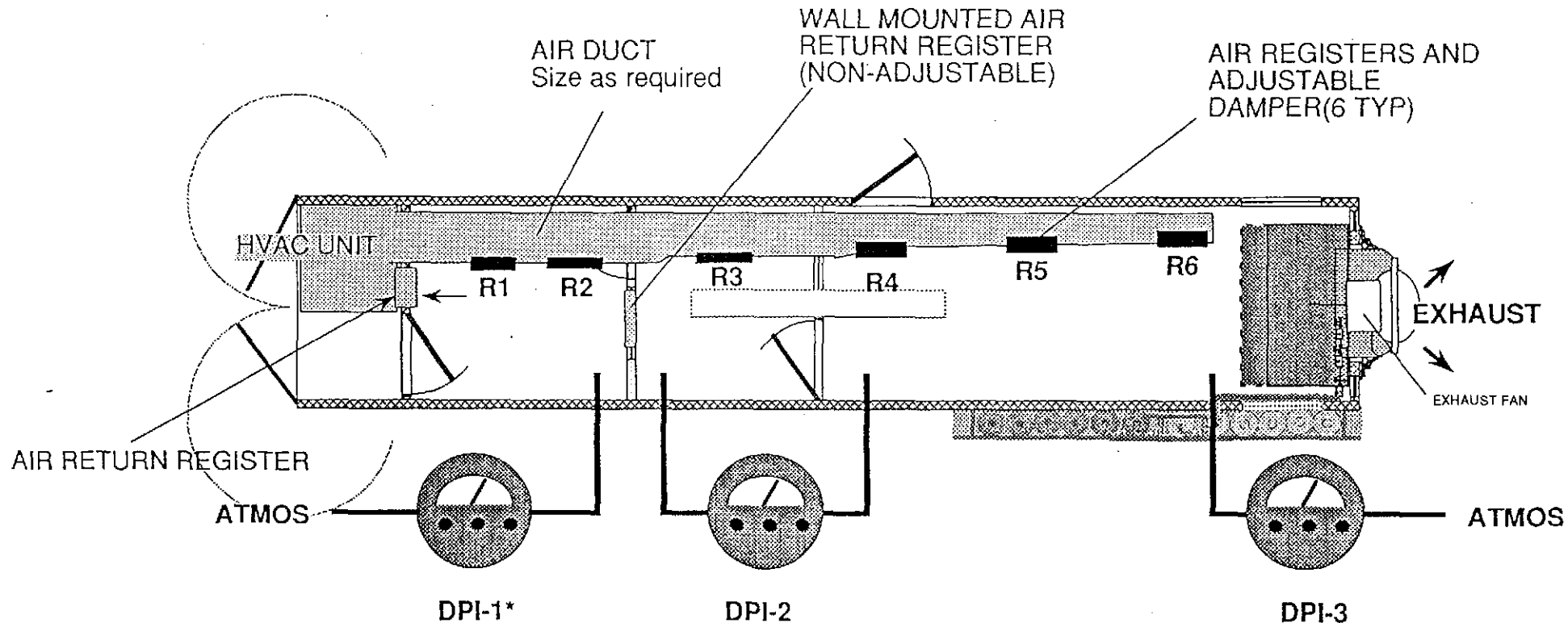
SECTION BB
EXHAUST FAN PENETRATION

Supplier's/Purchaser's No. _____

CBI	
LIGO PENETRATION DETAILS	
Designed by <i>11/12/85</i>	Control No.
Engineering Supervisor	Day
	Even

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▶ INDICATES CHANGE FROM PREVIOUS ISSUE



BALANCING TEST AIR FLOW

LOCATION	AIR FLOW	STATIC PRESSURE**
REGISTER 1	100 CFM	0.3 IN.
REGISTER 2	100 CFM	0.3 IN.
REGISTER 3	200 CFM	0.3 IN.
REGISTER 4	425 CFM	0.5 IN.
REGISTER 5	425 CFM	0.5 IN.
REGISTER 6	425 CFM	0.5 IN.
AIR RETURN	350 CFM	0.3 IN.
EXHAUST FAN	1350 CFM *	0.5 IN.

* ACTUAL EXHAUST DURING TUBE INSTALLATION = 2,400 CFM

*DPI - DIFFERENTIAL
PRESSURE INDICATOR
** ABOVE OUTSIDE AMBIENT

Supplier's/Purchase's No. _____

CBI	
HVAC LIGO BALANCING TEST CONFIGURATION	
Customer's Name <i>W. C. ...</i>	Date <i>4/10/88</i>
Engineering Specialist <i>[Signature]</i>	Drawn by <i>[Signature]</i>
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Clean Room