

## BEAM TUBE MODULES DETAILED DESIGN Master Document List

CBI Document I.D.	LIGO Document I.D.	Description	Current Rev.	Remarks
<b>Plans &amp; Manuals</b>				
LIGPSM	C950497-00-B	Project Safety Manual	0	
QAM	C950498-04-B	Quality Assurance Manual	4	*CBI-WIDE
MI	C950499-01-B	Material Traceability	1	
<b>Material Specifications</b>				
C-240-186	E950022-03-B	Beam Tube Material Specification	3	
C-CMBS1	E950023-03-B	Coil Material Bake Specification	3	
WMS-ER308L	E950024-04-B	Cleaned ER308L Filler Material Specification	4	
<b>Purchasing Specifications</b>				
C-BT-CO	E950025-02-B	LIGO Beam Tube Sections, Construction Option	2	Spiral Weld Mods. TBD
C-EJ-CO	E950026-03-B	LIGO Beam Tube Expansion Joints, Construction Option	3	
C-VAC-1	E950027-03-B	Vacuum Stiffener Fabrication Specification	3	
C-SUPT-1	E950028-02-B	Beam Tube Support Specification	2	
C-SUPSTF-1	E950029-04-B	Support Ring Fabrication Specification	4	
C-PORT-OP	E950030-04-B	Pump Port Fabrication Specification, Construction Option	4	
C-PORTPAD-1	E950031-04-B	Pump Port Reinforcing Pad Fabrication Specification	4	
CRSPEC	E950096-01-B	Clean Room Specification	1	
WSSPEC	E950097-01-B	Weld Shelter Specification	1	
<b>Welding Procedures</b>				
GWPS-SMAW	E950032-15-B	General Welding Procedure SMAW	15	*CBI-WIDE

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GWPS-GTAW	E950033-14-B	General Welding Procedure GTAW	14	*CBI-WIDE
GWPS-GMAW & FCAW	E950034-15-B	General Welding Procedure GMAW & FCAW	15	*CBI-WIDE
WPS-ER308L/Circ (w/PQR 10029)	E950035-05-B	Welding Procedure for Expansion Joint to Beam Tube Can Assemblies	5	
WPS-ER308L/Stiffener (w/PQR 4858)	E950036-05-B	Welding Procedure for Stiffener to Beam Tube Cans	5	
WPS-ER308L/Port (w/PQR 10029)	E950037-05-B	Welding Procedure for 10" dia. Vacuum Port Nozzle to Beam Can Assemblies	5	
WPS-ER308L/GMA (w/PQR 4858)	E950038-03-B	Weld Procedure, GMA Welding for 304L Materials	3	
WPS-ER308L/REPAIR (w/PQR's 10029, 4858, & 6250)	E950039-02-B	Weld Procedure, GMA for Repair Welding for 304L Materials	2	
WPS-E7018L/STRUCT (w/PQR 8903)	E950040-00-B	Welding Procedure for Structural (Carbon to Carbon)	0	
WPS-E308L/STRUCT (w/PQR 9168)	E950041-01-B	Welding Procedure for Structural (Stainless to Stainless)	1	
WPS-E309/STRUCT (w/PQR 6190)	E950042-00-B	Welding Procedure for Structural (Carbon to Stainless)	0	
WPS-ER70S-3/STRUCT (w/PQR 10348)	E950043-00-B	Welding Procedure for Structural (Carbon to Carbon)	0	
WPS-E6010/STRUCT (w/PQR 7543)	E950044-00-B	Welding Procedure for Structural (Carbon to Carbon)	0	
STD 823X	E950045-02-B	Storage and Care of Welding Consumables	2	
GR-8X	E950046-02-B	General Repair Procedure for Materials and Welds	2	
CUP-8X	E950047-02-B	Plate Clean-Up Procedure for Tube Modules	2	
<b>Fabrication/Installation Procedures</b>				
EQT	E950102-01-B	Equipment Qualification Test	1	
FABSEQ	E950048-03-B	Beam Tube Can Section Fabrication Sequence	3	
INSTALLSEQ	E950049-03-B	Beam Tube Can Section Installation Sequence	3	
FPCircumferential	E950050-05-B	Fitting/Purge Procedure for Circumferential Butt Welds	5	

CBI Document I.D.	LIGO Document I.D.	Description	Current Rev.	Remarks
FPStiffener	E950051-05-B	Fitting/Purge Procedure for Stiffener Attachment Welds	5	
FPPumpPort	E950052-05-B	Fitting/Purge Procedure for Pump Port Attachment Welds	5	
CRTSM	E950053-02-B	Clean Room Transporting, Storage and Maintenance Procedure	2	
BDF1	E950054-03-B	Positive Blower/Dryer/Filtration System (BDF) Installation and Maintenance	3	
IR	E950055-01-B	Receiving Inspection	1	
DC	E950056-02-B	Dimensional Control Procedure	2	
MODSEQ	E950057-02-B	Final Alignment and Module Testing Sequence	2	
<b>NDE Procedures</b>				
VI 5	E950058-00-B	Visual Inspection Procedure	0	
VI 8X	E950059-01-B	Visual Inspection Requirements for Beam Tube and Components	1	
<b>Cleaning Procedures</b>				
CLCOUP	E950061-04-B	Cleaning of Outgas Coupons	4	
CL4	E950062-02-B	Cleaning of Beam Tube Can Sections	2	Equipment, FTIR Mods. TBD
CCP-1	E950063-02-B	Contamination Control for Construction Activities During Beam Tube Installation	2	Enclosure Mods. TBD
CL3N	E950064-02-B	Final Cleaning & Inspection of Beam Tube Module Inner Surfaces	2	
CRWA-1	E950065-01-B	Clean Room Wearing Apparel for Beam Tube Access during Construction Inspection Activity	1	
<b>Leak Testing Procedures</b>				
HMST1N	E950066-02-B	Helium Mass Spectrometer Hood Test of Beam Tube Can Sections	2	Hood Mods. TBD
HMST2N	E950067-02-B	Helium Mass Spectrometer Hood Test of Closing Weld Joints Between Beam Tube Cans	2	Hood Mods. TBD
HMST3N	E950068-02-B	Helium Mass Spectrometer Hood Test of Pump Ports with Valve, LN2 Pump and Blind Flange with RGA Assembly	2	Hood Mods. TBD

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RGAPT	E950069-01-B	RGA Performance Test of Beam Tube Module	1	Mods. TBD
HMST5N	E950070-02-B	Helium Mass Spectrometer Hood Test of Beam Tube Module	2	
	E950071-01-B	Leak Test Decision Tree	1	
<b>Outgas Testing Procedure</b>				
COUP-01	E950072-03-B	Coupon Outgassing Test Procedure Option Phase	3	
<b>Alignment Procedures</b>				
ALI-1	E950073-05-B	Initial & Final Alignment During Installation of LIGO Beam Tube Modules Using GPS System	5	For Reference Only
ALM-B	E950074-03-B	Procedure for Alignment Maintenance Using the Global Positioning System (GPS) Technique	3	For Reference Only
<b>Quality Assurance Procedures</b>				
QAP 1.1	C950501-04-B	Management Responsibility	4	*CBI-WIDE
QAP 1.2	C960583-00-B	Authorized Inspectors (AI)	0	*CBI-WIDE
QAP 2.1	C950502-02-B	Quality System	2	*CBI-WIDE
QAP 2.2	C950503-02-B	Quality Plan	2	*CBI-WIDE
QAP 2.3	C950504-02-B	Contract QAP's	2	*CBI-WIDE
QAP 3.1	C950505-03-B	Pre-Contract Review	3	*CBI-WIDE
QAP 3.2	C950506-03-B	Post-Award Review	3	*CBI-WIDE
QAP 4.1	C950507-04-B	Preparation of Detail Drawings, Written Requisitions and Procurement Specifications	4	*CBI-WIDE
QAP 4.2	C960584-01-B	Additional Design Requirements for ASME Work	01	*CBI-WIDE
QAP 5.1	C950508-03-B	Document Control	3	*CBI-WIDE
QAP 5.2	C950509-03-B	Distribution of Detail Drawings, Written Requisitions and Procurement Specifications	3	*CBI-WIDE
QAP 5.3	C950510-01-B	CBI Standards	1	*CBI-WIDE
QAP 5.4	C950511-04-B	Contract QA Documents	4	*CBI-WIDE
QAP 5.5	C950512-02-B	Customer Drawings	2	*CBI-WIDE
QAP 5.6	C960585-00-B	Control of Documents Made Available Electronically On-Line	0	*CBI-WIDE

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QAP 6.1	C950513-05-B	Purchase Orders	5	*CBI-WIDE
QAP 6.2	C950514-02-B	Vendor Survey	2	*CBI-WIDE
QAP 6.3	C950515-03-B	Vendor Assignment & Surveillance	3	*CBI-WIDE
QAP 6.4	C960586-00-B	Vendor Control	0	*CBI-WIDE
QAP 7.1	C950516-03-B	Receipt of Customer Supplied Material	3	*CBI-WIDE
QAP 7.2	C960587-00-B	Receipt of Customer Supplied Material for ASME Work	0	*CBI-WIDE
QAP 8.1	C950517-03-B	Material Control	3	*CBI-WIDE
QAP 9.1	C950518-03-B	Process Control	3	*CBI-WIDE
QAP 9.2	C950519-05-B	Welding Control	5	*CBI-WIDE
QAP 9.3	C950520-03-B	Heat Treating	3	*CBI-WIDE
QAP 9.4	C950521-02-B	Miscellaneous Process Control	2	*CBI-WIDE
QAP 10.1	C950522-05-B	Receiving Inspection	5	*CBI-WIDE
QAP 10.2	C950523-04-B	NDE, Inspection and Testing	4	*CBI-WIDE
QAP 10.3	C950524-03-B	Final Inspection	3	*CBI-WIDE
QAP 10.4	C960588-02-B	Data Reports and Stamping for ASME Work	2	*CBI-WIDE
QAP 11.1	C950525-00-B	Calibration	0	*CBI-WIDE
QAP 12.1	C950526-02-B	Inspection and Test Status	2	*CBI-WIDE
QAP 13.1	C950527-04-B	Nonconformities	4	*CBI-WIDE
QAP 14.1	C950528-02-B	Corrective Action	2	*CBI-WIDE
QAP 15.1	C950529-02-B	Handling, Storage, Packaging and Shipping	2	*CBI-WIDE
QAP 16.1	C950530-03-B	Quality Records	3	*CBI-WIDE
QAP 16.2	C960589-00-B	Quality Records for ASME Work	0	*CBI-WIDE
QAP 17.1	C950531-04-B	Internal Auditing	4	*CBI-WIDE
QAP 18.1	C950532-03-B	Training	3	*CBI-WIDE
QAP 18.2	C960590-00-B	Qualification and Training Requirements of Corporate Welding Personnel	0	*CBI-WIDE
QAP 18.3	C960591-00-B	Qualification and Training Requirements for Engineering Personnel	0	*CBI-WIDE

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QAP 18.4	C960592-00-B	Qualification and Training Requirements of Manufacturing and QC Personnel	0	*CBI-WIDE
QAP 18.5	C960593-00-B	Qualification and Training Requirements of Manufacturing Production Personnel	0	*CBI-WIDE
QAP 18.6	C960594-00-B	Qualification and Training Requirements of Kankakee's Purchasing Department Personnel	0	*CBI-WIDE
QAP 19.1	C960595-01-B	National Board Repairs and Alterations	1	*CBI-WIDE
<b>Configuration Drawings (Plainfield)</b>				
1	D950031-04-B	General Module Configuration	4	Terminations, Length Mods.
2	D950032-02-B	Sub-Modules A & D	2	
3	D950033-03-B	Sub-Modules E, F, G & H	3	Terminations, Length Mods.
4	D950034-02-B	Sub-Assemblies A, B & C	2	
6	D950035-03-B	Fixed Support Elevation	3	
7	D950036-04-B	Fixed Support Plan View and Details	4	
8	D950037-05-B	Support Lug Assembly & Section Details	5	
9	D950038-02-B	Sub-Assemblies H, J, K & L	2	
13	D950039-02-B	Pump Ports	2	
15	D950040-02-B	Vacuum Stiffener	2	
16	D950041-03-B	Support Ring/Baffle Stiffener	3	
17	D950042-03-B	Guided Support Elevation	3	
18	D950043-04-B	Guided Support Section Details	4	
19	D950044-03-B	Guided Support Section Details	3	
ER1	D950045-02-B	Support Leveling, Fixed & Guided Supports	2	
<b>**Erection Drawings ("ER") (Houston)</b>				
ER-6	D950046-01-B	Fab Shop Top View at Stiffener Fit and Weld Section	1	
ER-14	D950047-01-B	Cross Section of Truck Loading	1	

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ER-15	D950048-01-B	Elevation of Truck Loading	1	
ER-16	D950049-01-B	Transport and Handling Frame	1	
ER-45	D950050-03-B	Fit Up Clamp	3	
ER-46	D950051-03-B	Fit Up Clamp Details	3	
ER-50	D950052-01-B	Leak Test Station: Isometric View	1	Hood Mods. TBD
ER-51	D950053-04-B	Helium Hood: Leak Test Station	4	Hood Mods. TBD
ER-54	D950054-02-B	St. Hood Test Enclosure: Top Section	2	Hood Mods. TBD
ER-55	D950055-02-B	St. Hood Test Enclosure: Bottom Section	2	Hood Mods. TBD
ER-56	D950056-02-B	Hood Test Enclosure: Helium Hood Details	2	Hood Mods. TBD
ER-57	D950057-04-B	Saddle and Hinge: Helium Hood	4	Hood Mods. TBD
ER-58	D950058-04-B	Saddle and Hinge Details	4	Hood Mods. TBD
ER-59	D950059-02-B	Helium Hood Enclosure Equipment	2	Hood Mods. TBD
ER-60	D950060-02-B	Vacuum Pump End Seal	2	Hood Mods. TBD
ER-61	D950061-02-B	Vacuum Pump End Seal Assembly	2	Hood Mods. TBD
ER-62	D950062-02-B	Vacuum Pump End Seal; Carriage Assembly	2	Hood Mods. TBD
ER-63	D950063-02-B	Vacuum Pump End Seal; Rolling Base Assembly	2	Hood Mods. TBD
ER-64	D950064-02-B	Vacuum Pump End Seal; End Cap Assembly	2	Hood Mods. TBD
ER-65	D950065-02-B	Vacuum Pump End Seal; Lifting Frame Subassembly	2	Hood Mods. TBD
ER-66	D950066-02-B	Mechanical Vacuum Pump Line Subassembly	2	Hood Mods. TBD
ER-67	D950067-02-B	Diffusion Pump Line Subassembly	2	Hood Mods. TBD
ER-68	D950068-02-B	Cross-over Line Subassembly	2	Hood Mods. TBD
ER-69	D950069-02-B	Interspace Vacuum Pump Line Subassembly	2	Hood Mods. TBD
ER-70	D950070-02-B	Cold Trap End Seal	2	Hood Mods. TBD
ER-71	D950071-02-B	Cold Trap End Seal Assembly	2	Hood Mods. TBD

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ER-72	D950072-02-B	Cold Trap End Seal; Carriage Assembly	2	Hood Mods. TBD
ER-73	D950073-02-B	Cold Trap End Seal; Rolling Carriage Assembly	2	Hood Mods. TBD
ER-74	D950074-02-B	Cold Trap End Seal; End Cap Assembly	2	Hood Mods. TBD
ER-75	D950075-02-B	Cold Trap End Seal; Lifting Frame Subassembly	2	Hood Mods. TBD
ER-76	D950076-02-B	Cold Trap End Seal; Cold Trap Line Subassembly	2	Hood Mods. TBD
ER-77	D950077-02-B	Cold Trap End Seal; Cold Trap Evac. Line Subassembly	2	Hood Mods. TBD
ER-96	D950078-01-B	Protective End Cap	1	
ER-121	D950079-04-B	Circumferential Leak Test Box	4	Box Mods. TBD
ER-122	D950080-04-B	Circumferential Leak Test Box Details	4	Box Mods. TBD
ER-123	D950081-02-B	Helium Mass Spectrometer Test Arrangement	2	Box Mods. TBD
ER-125	D950082-02-B	Vacuum Port Leak Test Box	2	Box Mods. TBD
ER-126	D950083-01-B	Pieces Vacuum Port Leak Test Box	1	Box Mods. TBD
ER-127	D950084-00-B	Pump Port Welding Jig and Repair Jack	0	
ER-133	D950085-02-B	Fit-Up Welding and Leak Testing Configurations at Fixed Support	2	
ER-134	D950086-02-B	Fit-Up Welding and Leak Testing Configurations at Guide Support	2	
ER-140	D950087-01-B	Elevation View of Tube Installation	1	

\* Items listed "CBI-Wide" are company-wide CBI documents that do not require Caltech approval when revised. As with all documents in this list, Caltech will receive copies of all revisions in a timely manner. In the event that Caltech believes that a change is not in the best interests of the LIGO Project, it will inform CBI, who will then write a LIGO project-specific document that will include the provisions of the document prior to the change. This project-specific document will then replace the changed document in this listing.

\*\* Erection drawings are equipment/fixture drawings that do not require Caltech approval when revised. As with all documents in this list, Caltech will receive copies of all revisions in a timely manner. In the event that Caltech believes that a change is not in the best interests of the LIGO Project, it will inform CBI, who will then return the drawing to its original form or make a change that is mutually acceptable.