

## 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
<b>Material Specifications</b>				
MI	C950499-01-B	Material Traceability	1	
C-240-186	E950022-03-B	Beam Tube Material Specification	3	
C-240-EJ	E970010-04-B	Expansion Joint Material Specification	4	
C-CMBS1	E950023-04-B	Coil Material Bake Specification	4	
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	
C-EJ-CO	E950026-06-B	LIGO Beam Tube Expansion Joints, Construction Option	6	
C-VAC-1	E950027-04-B	Vacuum Stiffener Fabrication Specification	4	
C-SUPT-1	E950028-03-B	Beam Tube Support Specification	3	
C-SUPSTF-1	E950029-05-B	Support Ring Fabrication Specification	5	
C-TERMSTF	E970011-00-B	Termination Ring Fabrication Specification	0	
C-PORT-OP	E950030-05-B	Pump Port Fabrication Specification, Construction Option	5	
H-PORT	E970012-00-B	Pump Port Hardware Specification	0	
C-PORTPAD-1	E950031-04-B	Pump Port Reinforcing Pad Fabrication Specification	4	

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CRSPEC	E950096-01-B	Clean Room Specification	1	
WSSPEC	E950097-01-B	Weld Shelter Specification	1	
SPEC 801	E970013-01-B	Residual Gas Analyzer Specification	1	
SPEC 802	E970014-01-B	Specification for Pump Port Hardware Assembly	1	
SPEC 803	E970015-02-B	Specification for Ultra High Vacuum Valve	2	
SPEC 804	E970016-02-B	Specification for Variable Leak Valve	2	
SPEC 805	E970017-01-B	Specification for Vacuum Gaging	1	
SPEC 806	E970018-01-B	Specification for Calibrated Leaks	1	
SPEC 807	E970019-01-B	Specification for Pure Gas Supplies	1	
SPEC 808	E970020-01-B	Specification for Oil Free Roughing Pump	1	
SPEC 809	E970021-01-B	Liquid Nitrogen Trap Specification	1	
SPEC 810	E970022-02-B	Specification for Small Vacuum Valves	2	
<b>Welding Procedures</b>				
GWPS-SMAW	E950032-15-B	General Welding Procedure SMAW	15	*CBI-WIDE
WPS ER308L/MANUAL	E960118-01-B	Welding Procedure Specification	1	
WPS COIL/SPLICE	E960119-01-B	Welding Procedure Specification	1	
WPS SPIRAL	E960120-02-B	Welding Procedure Specification	2	
WPS SPECIAL	E970024-00-B	Special Repair Procedure	0	
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)	E950035-06-B	Welding Procedure for Expansion Joint to Beam Tube Can Assemblies	6	
WPS-ER308L/ STIFFENER (w/PQR 4858)	E950036-07-B	Welding Procedure for Stiffener to Beam Tube Cans	7	

CBI Document I.D.	LIGO Document I.D.	Description	Current Rev.	Remarks
WPS-ER308L/PORT (w/PQR 10029)	E950037-06-B	Welding Procedure for 10" dia. Vacuum Port Nozzle to Beam Can Assemblies	6	
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)	E950039-03-B	Weld Procedure, GMA for Repair Welding for 304L Materials	3	
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	E950048-07-B	Beam Tube Can Section Fabrication Sequence	(stet)	
INSTALLSEQ	E950049-07-B	Beam Tube Can Section Installation Sequence	7	
FPCircumferential	E950050-06-B	Fitting/Purge Procedure for Circumferential Butt Welds	6	
FPStiffener	E950051-06-B	Fitting/Purge Procedure for Stiffener Attachment Welds	6	
FPPumpPort	E950052-06-B	Fitting/Purge Procedure for Pump Port Attachment Welds	6	
CRTSM	E950053-04-B	Clean Room Transporting, Storage and Maintenance Procedure	4	
BDF1	E950054-03-B	Positive Blower/Dryer/Filtration System (BDF) Installation and Maintenance	3	

CBI Document I.D.	LIGO Document I.D.	Description	Current Rev.	Remarks
ICD-BTT	E970025-02-B	Beam Tube & Termination Support to Gate Valve & Termination Foundation	2	
ICD-BTSLAB	E970033-01-B	Beam Tube Interface with the Beam Tube Slab, Beam Tube Enclosure and Baffles	1	
ICD-PPH	E980072-03-B	Pump Port Hardware to Vacuum Equipment	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	
MACRO EXAM	E970026-02-B	Macro Exam of Spiral Welds for Full Fusion	2	
<b>Cleaning Procedures</b>				
CLCOUP	E950061-04-B	Cleaning of Outgas Coupons	4	
CL4	E950062-03-B	Cleaning of Beam Tube Can Sections	3	
CL-55	E980071-00-B	Special Cleaning of Beam Tube Can Sections	0	
CCP-1	E950063-04-B	Contamination Control for Construction Activities During Beam Tube Installation	4	
CL3N	E950064-04-B	Final Cleaning & Inspection of Beam Tube Module Inner Surfaces	4	
CRWA-1	E950065-03-B	Clean Room Wearing Apparel for Beam Tube Access during Construction Inspection Activity	3	
CLSAMP1	E970027-06-B	Procedure for Obtaining a Cleanliness Assessment Sample	6	
<b>Leak Testing Procedures</b>				
HMST1N	E950066-07-B	Helium Mass Spectrometer Hood Test of Beam Tube Can Sections	7	

CBI Document I.D.	LIGO Document I.D.	Description	Current Rev.	Remarks
HMST1N (ALT)	E970028-04-B	Helium Mass Spectrometer Hood Test of Beam Tube Can Sections (with Hood Bags)	4	
HMST2N	E950067-06-B	Helium Mass Spectrometer Hood Test of Closing Weld Joints Between Beam Tube Cans	6	
HMST3N	E950068-06-B	Helium Mass Spectrometer Hood Test of Pump Ports with Valve, LN2 Pump and Blind Flange with RGA Assembly	6	
RGAPT	E950069-01-B	RGA Performance Test of Beam Tube Module	1	
HMST5N	E950070-02-B	Helium Mass Spectrometer Hood Test of Beam Tube Module	2	
	E950071-01-B	Leak Test Decision Tree	1	
ACCEPT	E970030-05-B	Module Air Signature Acceptance Test Procedure	5	
LEAK-LOC	E970031-01-B	Module Leak Localization Procedure	1	
<b>Outgas Testing Procedure</b>				
COUP-01	E950072-03-B	Coupon Outgassing Test Procedure Option Phase	3	
<b>Alignment Procedures</b>				
ALI-1	E950073-09-B	Initial & Final Alignment During Installation of LIGO Beam Tube Modules Using GPS System	9	
ALM-B	E950074-03-B	Procedure for Alignment Maintenance Using the Global Positioning System (GPS) Technique	3	For Reference Only
SUP-ADJUST	E980336-03-B	Procedure for Adjusting Fixed and Guided Supports	3	
<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

CBI Document I.D.	LIGO Document I.D.	Description	Current Rev.	Remarks
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
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

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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
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>				
0	D960510-08-B	General Notes	8	
1	D950031-06-B	Hanford & Livingston Beam Tube Modules	6	
2	D950032-05-B	Sub-Assembly End Locations	5	
3	D950033-05-B	Support Locations	5	
4	D950034-07-B	Sub-Assemblies A-S	7	
6	D950035-08-B	Fixed Support Elevation	8	
7	D950036-09-B	Fixed Support Plan View and Details	9	

CBI Document I.D.	LIGO Document I.D.	Description	Current Rev.	Remarks
8	D950037-10-B	Fixed Support: Support Lug Assembly & Section Details	10	
13	D950039-03-B	Pump Port Details	3	
15	D950040-05-B	Vacuum Stiffener Details	5	
16	D950041-06-B	Support Rings: Fixed, Guided and Termination Supports	6	
19	D950044-09-B	Guided Support	9	
20	D960512-04-B	BT Termination Support	4	
21	D960513-02-B	Termination Support Ring Details	2	
22	D960511-03-B	Gate Valve Soft Support	3	
101	D961302-04-B	Pump Port Hardware Type "B"	4	
102	D961303-01-B	Pump Port Hardware Type "H"	1	
103	D961301-02-B	Portable Calibration Module	2	
104	D970062-01-B	Pump Port Isolation Valve	1	
<b>**Erection Drawings ("ER") (Houston)</b>				
ER-15	D950048-01-B	Elevation of Truck Loading	1	
ER-45	D950050-03-B	Fit Up Clamp	3	
ER-46	D950051-03-B	Fit Up Clamp Details	3	
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	
ER-200	D970011-01-B	Tube Section Leak Test, General View	1	
ER-201	D970012-01-B	Tube Section Leak Test, Casket Enclosure	1	
ER-202	D970013-01-B	Tube Section Leak Test, Casket Enclosure	1	
ER-203	D970014-01-B	Tube Section Leak Test, Casket Enclosure	1	



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ER-204	D970015-01-B	Tube Section Leak Test, Casket Cross-Section	1	
ER-205	D970016-01-B	Tube Section Leak Test, Casket Supports	1	
ER-206	D970017-01-B	Tube Section Leak Test, Casket Supports	1	
ER-207	D970018-01-B	Tube Section Leak Test, Tube Supports	1	
ER-208	D970019-01-B	Tube Section Leak Test, Tube Supports	1	
ER-209	D970020-01-B	Tube Section Leak Test, Casket and Head Seals	1	
ER-210	D970021-01-B	Tube Section Leak Check, Head Details	1	
ER-211	D970022-01-B	Tube Section Leak Test, Pump End Frame & Equipment	1	
ER-212	D970023-01-B	Tube Section Leak Test, Pump End Frame	1	
ER-213	D970024-01-B	Tube Section Leak Test, Pump End Equipment Supports	1	
ER-214	D970025-01-B	Tube Section Leak Test, Blind End Head Supports	1	
ER-215	D970026-01-B	Tube Section Leak Test, Frame Wheels & Elbow	1	
ER-216	D970027-00-B	Tube Section Leak Test, Frame and Track Details	0	
ER-217	D970028-00-B	Tube Section Leak Test, Frame Balance Beams & Miscellaneous	0	
ER-218	D970029-00-B	Tube Section Leak Test, Frame Drive and Balance Lug	0	
ER-219	D970030-00-B	Tube Section Leak Test, Head Nozzles	0	
ER-220	D970031-00-B	Tube Section Leak Test, Casket Alignment Pins and Lugs	0	
ER-221	D970032-00-B	Tube Section Leak Test, Spreader Bar and Casket Seal	0	
ER-231	D970033-01-B	P&I Diagram, Vacuum Systems, Tube Section Leak Test Pump System	1	

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ER-232	D970034-01-B	P&I Diagram, Vacuum Systems, Tube Section Leak Test Hood Systems	1	
ER-233	D970035-01-B	P&I Diagram, Vacuum Systems, Helium Supply System	1	
ER-234	D970036-01-B	P&I Diagram, Vacuum Systems, Fabrication Facility Nitrogen Supply System	1	
ER-240	D970037-00-B	Tube Section Leak Test Pump System, Pump End	0	
ER-250	D970038-03-B	Vacuum Test System, Electrical Block Diagram	3	
ER-251	D970039-02-B	Section Test System Power, Single Line Diagram	2	
ER-252	D970040-01-B	Section Test Skid, Junction Box Layout	1	
ER-253	D970041-02-B	Section Test D I/O Junction/Card and Distribution Panel Layout	2	
ER-254	D970042-03-B	Section Test Skid D I/O Wiring Diagram for Skid "A"	3	
ER-255	D970043-01-B	Casket Hood Skid Junction Box Wiring	1	
ER-256	D970044-03-B	Section Test Control Room D I/O Distribution Panel Wiring	3	
ER-257	D970045-01-B	Section Test Control Room 120 VAC Supply Diagram	1	
ER-258	D970046-03-B	Section Test Skid D I/O Wiring Diagram for Skid "B"	3	
ER-259	D970047-02-B	Section Test Skid D I/O Wiring Diagram for Skid "C"	2	
ER-260	D970048-00-B	Section Test System Analog I/O Wiring Diagram	0	
ER-261	D970049-01-B	Wiring Schematic, Distribution Panel #1, Circuit "D"	1	
ER-262	D970050-02-B	Wiring Schematic, Distribution Panel #1, Circuit "A"	2	
ER-263	D970051-02-B	Wiring Schematic, Distribution Panel #1, Circuit "B"	2	
ER-264	D970052-02-B	Wiring Schematic, Distribution Panel #1, Circuit "C"	2	

CBI Document I.D.	LIGO Document I.D.	Description	Current Rev.	Remarks
ER-300	D960514-01-B	Beam Tube Assembly, Cleaning Room Equipment Layout and Sections	1	
ER-301	D960515-01-B	Beam Tube Section Cleaning, Spraying Apparatus	1	
ER-302	D960516-01-B	Beam Tube Section Cleaning, Extension Assembly	1	
ER-303	D960517-00-B	Cleaning Room Equipment, General Tube Section Layout	0	
ER-304	D960518-00-B	Cleaning Room Equipment, Tube Section Support	0	
ER-305	D960519-00-B	Cleaning Room Equipment, Tube Section Support	0	
ER-306	D960806-00-B	Cleaning Room Equipment, Fluid Catch Basin	0	
ER-307	D960807-00-B	Cleaning Room Equipment, Fluid Tilting Extension	0	
ER-308	D961204-00-B	Cleaning Room Equipment, Tube Support Points	0	
ER-309	D961205-00-B	Cleaning Room Equipment, Tube Support Points	0	
ER-310	D961299-00-B	Cleaning Room Equipment, Tube Support Points	0	
ER-311	D961300-00-B	Tube Section End Covers	0	
ER-600	D970053-01-B	Circumferential Leak Test Box, General View	1	
ER-601	D970054-01-B	Circumferential Leak Test Box, Clamping Details	1	
ER-602	D970055-01-B	Circumferential Leak Test Box, Hinge Details	1	
ER-603	D970056-01-B	Circumferential Leak Test Box, Hinge Details	1	
ER-604	D970057-01-B	Circumferential Leak Test Box, Nozzle Details	1	
ER-605	D970058-00-B	Tube Section Leak Test, Pump Port Leak Test Fixture	0	
ER-606	D970059-00-B	Tube Section Leak Test, Pump Port Leak Test Fixture	0	
ER-607	D970060-00-B	Tube Section Leak Test, Pump Port Nozzle and Valves	0	

\* 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 originally submitted or 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.