

BEAM TUBE MODULES DETAILED DESIGN Master Document List

| CBI Document I.D. | LIGO Document I.D. | Description | Current Rev. | Remarks |
|----------------------------------|--------------------------|--|-----------------|--------------------------|
| Plans & Manuals | | | | |
| LIGPSM | C950497-00-B | Project Safety Manual | 0 | |
| QAM | C950498-00-B | Quality Assurance Manual | 0 | |
| MI | C950499-01-B | Material Traceability | 1 | |
| | C950500-00-B | Environmental Plan | | |
| Material Specifications | | | | |
| C-240-186 | E950022-02-B | Beam Tube Material Specifica- tion | 2 | |
| C-CMBS1 | E950023-03-B | Coil Material Bake Specification | 3 | |
| WMS-ER308L | E950024-04-B | Cleaned ER308L Filler Material Specification | 4 | |
| Purchasing Specifications | | | | |
| C-BT-CO | E950025-01-B | LIGO Beam Tube Sections, Construction Option | 1 | Spiral Weld Mods. TBD |
| C-EJ-CO | E950026-02-B | LIGO Beam Tube Expansion Joints, Construction Option | 2 | |
| C-VAC-1 | E950027-03-B | Vacuum Stiffener Fabrication Specification | 3 | |
| C-SUPT-1 | E950028-02-B | Beam Tube Support Specifica- tion | 2 | |
| C-SUPSTF-1 | E950029-03-B | Support Ring Fabrication Specification | 3 | |
| 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 | |
| Welding Procedures | | | | |
| GWPS-SMAW | E950032-15-B | General Welding Procedure SMAW | 15 | |
| GWPS-GTAW | E950033-14-B | General Welding Procedure GTAW | 14 | |

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| GWPS-GTAW | E950033-14-B | General Welding Procedure GTAW | 14 | |
| GWPS-GMAW & | E950034-15-B | General Welding Procedure GMAW & FCAW | 15 | |
| 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) | E950036-04-B | Welding Procedure for Stiffener to Beam Tube Cans | 4 | |
| WPS-ER308L/Port (w/PQR 10029) | E950037-04-B | Welding Procedure for 10" dia. Vacuum Port Nozzle to Beam Can Assemblies | 4 | |
| WPS-ER308L/GMA (w/PQR 4858) | E950038-02-B | Weld Procedure, GMA Welding for 304L Materials | 2 | |
| WPS-ER308L/REPAIR (w/PQR's 10029, 4858, & 6250) | E950039-01-B | Weld Procedure, GMA for Repair Welding for 304L Materials | 1 | |
| 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 | E950045-01-B | Storage and Care of Welding Consumables | 1 | |
| 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 | |
| Fabrication/Installation Procedures | | | | |
| FABSEQ | E950048-02-B | Beam Tube Can Section Fabrication Sequence | 2 | |
| INSTALLSEQ | E950049-02-B | Beam Tube Can Section Installation Sequence | 2 | |
| FPCircumferential | E950050-04-B | Fitting/Purge Procedure for Circumferential Butt Welds | 4 | |

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| FPStiffener | E950051-04-B | Fitting/Purge Procedure for Stiffener Attachment Welds | 4 | |
| FPPumpPort | E950052-04-B | Fitting/Purge Procedure for Pump Port Attachment Welds | 4 | |
| CRTSM | E950053-01-B | Clean Room Transporting, Storage and Maintenance Procedure | 1 | |
| BDF1 | E950054-02-B | Positive Blower/Dryer/Filtration System (BDF) Installation and Maintenance | 2 | |
| IR | E950055-00-B | Receipt Inspection | 0 | |
| DC | E950056-01-B | Dimensional Control Procedure | 1 | |
| MODSEQ | E950057-01-B | Final Alignment and Module Testing Sequence | 1 | |
| NDE Procedures | | | | |
| VI 5 | E950058-00-B | Visual Inspection Procedure | 0 | |
| VI 8X | E950059-01-B | Visual Inspection Requirements for Beam Tube and Components | 1 | |
| Cleaning Procedures | | | | |
| B11N | E950060-02-B | Blacklight Inspection Technique | 2 | |
| CLCOUP | E950061-03-B | Cleaning of Outgas Coupons | 3 | |
| CL4 | E950062-01-B | Cleaning of Beam Tube Can Sections | 1 | Equipment, FTIR Mods. TBD |
| CCP-1 | E950063-01-B | Contamination Control for Construction Activities During Beam Tube Installation | 1 | Enclosure Mods. TBD |
| CL3N | E950064-01-B | Final Cleaning & Inspection of Beam Tube Module Inner Surfaces | 1 | |
| CRWA-1 | E950065-00-B | Clean Room Wearing Apparel for Beam Tube Access during Construction Inspection Activity | 0 | |
| Leak Testing Procedures | | | | |
| HMST1N | E950066-01-B | Helium Mass Spectrometer Hood Test of Beam Tube Can Sections | 1 | Hood Mods. TBD |
| HMST2N | E950067-01-B | Helium Mass Spectrometer Hood Test of Closing Weld Joints Between Beam Tube Cans | 1 | Hood Mods. TBD |

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| HMST3N | E950068-01-B | Helium Mass Spectrometer Hood Test of Pump Ports with Valve, LN2 Pump and Blind Flange with RGA Assembly | 1 | Hood Mods. TBD |
| RGAPT | E950069-00-B | RGA Performance Test of Beam Tube Module | 0 | Mods. TBD |
| HMST5N | E950070-01-B | Helium Mass Spectrometer Hood Test of Beam Tube Module | 1 | |
| | E950071-00-B | Leak Test Decision Tree | | |
| Outgas Testing Procedure | | | | |
| COUP-01 | E950072-02-B | Coupon Outgassing Test Procedure Option Phase | 2 | |
| Alignment Procedures | | | | |
| ALI-1 | E950073-04-B | Initial & Final Alignment During Installation of LIGO Beam Tube Modules Using GPS System | 4 | For Reference Only |
| ALM-B | E950074-02-B | Procedure for Alignment Maintenance Using the Global Positioning System (GPS) Technique | 2 | For Reference Only |
| Quality Assurance Procedures | | | | |
| QAP 1.1 | C950501-00-B | Management Responsibility | 0 | |
| QAP 2.1 | C950502-00-B | Quality System | 0 | |
| QAP 2.2 | C950503-00-B | Quality Plan | 0 | |
| QAP 2.3 | C950504-00-B | Contract QAP's | 0 | |
| QAP 3.1 | C950505-00-B | Pre-Contract Review | 0 | |
| QAP 3.2 | C950506-00-B | Post-Award Review | 0 | |
| QAP 4.1 | C950507-00-B | Preparation of Detail Drawings, Written Requisitions and Procurement Specifications | 0 | |
| QAP 5.1 | C950508-00-B | Document Control | 0 | |
| QAP 5.2 | C950509-00-B | Distribution of Detail Drawings, Written Requisitions and Procurement Specifications | 0 | |
| QAP 5.3 | C950510-00-B | CBI Standards | 0 | |
| QAP 5.4 | C950511-00-B | Contract QA Documents | 0 | |
| QAP 5.5 | C950512-00-B | Customer Drawings | 0 | |
| QAP 6.1 | C950513-00-B | Purchase Orders | 0 | |

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| QAP 6.2 | C950514-00-B | Vendor Survey | 0 | |
| QAP 6.3 | C950515-00-B | Vendor Assignment & Surveillance | 0 | |
| QAP 7.1 | C950516-00-B | Receipt of Customer Supplied Material | 0 | |
| QAP 8.1 | C950517-00-B | Material Control | 0 | |
| QAP 9.1 | C950518-00-B | Process Control | 0 | |
| QAP 9.2 | C950519-00-B | Welding Control | 0 | |
| QAP 9.3 | C950520-00-B | Heat Treating | 0 | |
| QAP 9.4 | C950521-00-B | Miscellaneous Process Control | 0 | |
| QAP 10.1 | C950522-00-B | Receiving Inspection | 0 | |
| QAP 10.2 | C950523-00-B | NDE, Inspection and Testing | 0 | |
| QAP 10.3 | C950524-00-B | Final Inspection | 0 | |
| QAP 11.1 | C950525-00-B | Calibration | 0 | |
| QAP 12.1 | C950526-00-B | Inspection and Test Status | 0 | |
| QAP 13.1 | C950527-00-B | Nonconformities | 0 | |
| QAP 14.1 | C950528-00-B | Corrective Action | 0 | |
| QAP 15.1 | C950529-00-B | Handling, Storage, Packaging and Shipping | 0 | |
| QAP 16.1 | C950530-00-B | Quality Records | 0 | |
| QAP 17.1 | C950531-00-B | Internal Auditing | 0 | |
| QAP 18.1 | C950532-00-B | Training | 0 | |
| Configuration Drawings (Plainfield) | | | | |
| 1 | D950031-03-B | General Module Configuration | 3 | 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 | |

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| 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 | D950041-02-B | Support Ring/Baffle Stiffener | 2 | |
| 17 | D950042-03-B | Guided Support Elevation | 3 | |
| 18 | D950043-03-B | Guided Support Section Details | 3 | |
| 19 | D950044-03-B | Guided Support Section Details | 3 | |
| ER1 | D950045-02-B | Support Leveling, Fixed & Guided Supports | 2 | |
| Erection Drawings ("ER") (Houston) | | | | |
| 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 | |
| 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 | |
| ER-51 | D950053-04-B | Helium Hood: Leak Test Station | 4 | |
| ER-54 | D950054-02-B | St. Hood Test Enclosure: Top Section | 2 | |
| ER-55 | D950055-02-B | St. Hood Test Enclosure: Bottom Section | 2 | |
| ER-56 | D950056-02-B | Hood Test Enclosure: Helium Hood Details | 2 | |
| ER-57 | D950057-04-B | Saddle and Hinge: Helium Hood | 4 | |
| ER-58 | D950058-04-B | Saddle and Hinge Details | 4 | |
| ER-59 | D950059-02-B | Helium Hood Enclosure Equipment | 2 | |
| ER-60 | D950060-02-B | Vacuum Pump End Seal | 2 | |
| ER-61 | D950061-02-B | Vacuum Pump End Seal Assembly | 2 | |
| ER-62 | D950062-02-B | Vacuum Pump End Seal; Carriage Assembly | 2 | |

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| ER-63 | D950063-02-B | Vacuum Pump End Seal; Rolling Base Assembly | 2 | |
| ER-64 | D950064-02-B | Vacuum Pump End Seal; End Cap Assembly | 2 | |
| ER-65 | D950065-02-B | Vacuum Pump End Seal; Lifting Frame Subassembly | 2 | |
| ER-66 | D950066-02-B | Mechanical Vacuum Pump Line Subassembly | 2 | |
| ER-67 | D950067-02-B | Diffusion Pump Line Subassembly | 2 | |
| ER-68 | D950068-02-B | Cross-over Line Subassembly | 2 | |
| ER-69 | D950069-02-B | Interspace Vacuum Pump Line Subassembly | 2 | |
| ER-70 | D950070-02-B | Cold Trap End Seal | 2 | |
| ER-71 | D950071-02-B | Cold Trap End Seal Assembly | 2 | |
| ER-72 | D950072-02-B | Cold Trap End Seal; Carriage Assembly | 2 | |
| ER-73 | D950073-02-B | Cold Trap End Seal; Rolling Carriage Assembly | 2 | |
| ER-74 | D950074-02-B | Cold Trap End Seal; End Cap Assembly | 2 | |
| ER-75 | D950075-02-B | Cold Trap End Seal; Lifting Frame Subassembly | 2 | |
| ER-76 | D950076-02-B | Cold Trap End Seal; Cold Trap Line Subassembly | 2 | |
| ER-77 | D950077-02-B | Cold Trap End Seal; Cold Trap Evac. Line Subassembly | 2 | |
| ER-96 | D950078-01-B | Protective End Cap | 1 | |
| ER-121 | D950079-04-B | Circumferential Leak Test Box | 4 | |
| ER-122 | D950080-04-B | Circumferential Leak Test Box Details | 4 | |
| ER-123 | D950081-01-B | Helium Mass Spectrometer Test Arrangement | 1 | |
| ER-125 | D950082-01-B | Vacuum Port Leak Test Box | 1 | |
| ER-126 | D950083-00-B | Pieces Vacuum Port Leak Test Box | 0 | |
| ER-127 | D950084-00-B | Pump Port Welding Jig and Repair Jack | 0 | |

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| | 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 Installa- tion | 1 | |