

LIGO-C960739-□□-B

**CBI Services, Inc.****FAX TRANSMISSION**

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FAX: 815 439 6010TO: Larry JonesFROM: Lance BuboltzCOMPANY: CaltechDATE: 4/11/96FAX NO.: 818-304-9834# OF PAGES: (including cover) 7Reference: LIGO Beam Tube Modules
Fabrication and Installation
Caltech Contract No. PC181520, Option
CBI Contract No. 953571

Subject: ICD-BTT Page 4 of 4 & ICD-BTSLAB

Larry,

Attached is page 4 of 4 of ICD-BTT which was inadvertently omitted from the Design Review Data Package.

Also attached is a new ICD for the beam tube and beam tube slab. This is a draft document sent for your information. Although not specifically required by the contract, CBI feels that an interface document for the beam tube and beam tube slab is required to document this interface. Please review this proposed interface document and provide your comments on the appropriateness and content of this document. Thanks.

Regards,

L. C. Buboltz
LIGO Project Managerbcc: L. Buboltz - MOF LIGO File 2.3
A. Libby / M. Tellalian - LIGO Engr File 2.3



		IDENTIFICATION			
		ICD-BTT			
TITLE	BEAM TUBE AND TERMINATION SUPPORT TO GATE VALVE AND TERMINATION FOUNDATION	REFERENCE NO. 963670		SHT. 4 OF 4	
		OFFICE LIGO		REVISION 0	
PRODUCT	LIGO BEAM TUBE MODULES CALIFORNIA INSTITUTE OF TECHNOLOGY	MADE BY MLT	CHKD BY ARL	MADE BY	CHKD BY
		DATE 3/8/96	DATE 3/8/96	DATE	DATE

4.1.2 Livingston

Modules LX1 & LY1: 47,027 mm (154'-3 7/16) & 2,015,405 mm (6,612'-2 5/8)

Modules LX2 & LY2: 2,019,095 mm (6,624'-3 15/16) & 3,987,473 mm (13,082'-3 1/8")

4.2 Termination Foundation Requirements

Each termination support is anchored to the foundation block with (20) of the following anchors:

Hilti HVA Anchor System with 1 1/4" Diameter HAS Super Rods (or equal)

The anchor bolt pattern is shown on CBI drawing 20, Sheet 1. The foundation block must have the following characteristics.

4.2.1 Foundation Block Dimensions

Minimum Thickness: 15" (To allow a 12" embedment depth of the anchor bolts.)

Minimum Width: 2,870 mm (9'-5) (Centered about the beam tube centerline.)

Minimum Length: 2,642 mm (8'-8) (Centered about the termination station centerline.)

4.2.2 Foundation Block Load Carrying Capacity

The termination support and anchor bolts have been designed to properly transmit the termination loads to a foundation block composed of 3,000 psi concrete meeting the dimensions stated above. The foundation system must be capable of resisting the following loads simultaneously applied at the beam tube centerline:

Axial: 58,485 pounds (Applied in either direction independently.)

Lateral: 3,086 pounds (Applied in either direction independently.)

Vertical: 7,937 pounds (Applied downward only.)

4.2.3 Foundation Block Elevation

The top of the foundation block shall be 1,070 mm +/- 13 mm (3'-6 1/8 +/- 1/2") below the beam tube centerline.



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TITLE	BEAM TUBE INTERFACE WITH THE BEAM TUBE SLAB, BEAM TUBE ENCLOSURE AND BAFFLES	REFERENCE NO.		SHT 1 OF 5	
		958570			
PRODUCT	LIGO BEAM TUBE MODULES CALIFORNIA INSTITUTE OF TECHNOLOGY	OFFICE		REVISION	
		LIGO		0	
		MADE BY	CHKD BY	MADE BY	CHKD BY
		ARL			
		DATE	DATE	DATE	DATE
		4/11/96			

1.0 SCOPE

This document provides the interface information for mechanical and dimensional interfaces between the following components:

- The beam tube supports and the beam tube slab.
- The beam tube pump ports and the beam tube enclosure.
- The beam tube circumferential weld seams and expansion joints and the beam tube baffles.

2.0 APPLICABLE DOCUMENTS

The following documents are applicable to the interfaces between the beam tube modules and the beam tube slab, beam tube enclosure and beam tube baffles:

- Caltech Dwg #D950021 - "LIGO Arm Layouts"
- Caltech Dwg #D950028 - "Beam Tube Terminations"
- Caltech Dwg #D950139 - "BTE Service Access And BT Pump Port Locations"
- CBI Dwg #1, Shts 1-4 - Beam tube module assemblies and pump port locations
- CBI Dwg #2, Shts 1-4 - Sub-assembly end locations for beam tube modules
- CBI Dwg #3, Shts 1-4 - Support locations for beam tube modules
- CBI Dwg #4, Shts 1-7 - Details for beam tube sub-assembly types A through S
- CBI Dwgs #6, #7, #8 - Beam tube fixed support details
- CBI Dwg #19 - Beam tube alternate guided support details

3.0 BEAM TUBE FIXED SUPPORT TO BEAM TUBE SLAB

The beam tube modules are supported at regular intervals by fixed-type supports which are composed of a welded steel frame with lateral and vertical adjustment capability. Each fixed support provides restraint for the beam tube in the vertical, lateral and axial directions. The support is anchored to the beam tube slab with expansion-type anchors in holes drilled into the slab during the installation of the support. The following sections provide the locations of the supports and the required dimensions and load carrying capacity of the slab.

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		953570			
		OFFICE		REVISION	
		LIGO		0	
PRODUCT	LIGO BEAM TUBE MODULES CALIFORNIA INSTITUTE OF TECHNOLOGY	MADE BY	CHKD BY	MADE BY	CHKD BY
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3.1 Fixed Support Station Locations

Each fixed support attaches to the beam tube at a support ring that is welded to the tube. The support ring is split approximately in half and the two halves overlap on each side of the beam tube at the vertical centerline of the tube. The station locations of the supports rings, measured from the vertex of the beam tube modules to the centerline of the lap joints in the rings, are given on CBI Drawing #3, Sheets 1-4, for both sites.

3.2 Beam Tube Slab Requirements

Each fixed support is anchored to the slab with (8) of the following anchors:

Hilti Kwik Bolt II 5/8" diameter expansion anchors with an embedment depth of 4" (or equal)

The anchor bolt pattern is shown on CBI Drawing #8. The slab must have the following characteristics.

3.2.1 Slab Dimensions

The fixed supports require an area of slab that is free and clear of obstructions with the minimum dimensions given below.

Minimum Thickness: 132 mm (5.2") (To allow a 4" embedment depth of the anchor bolts.)
 Minimum Width: 1,727 mm (5'-8") (Centered about the beam tube centerline.)
 Minimum Length: 1,168 mm (3'-10") (On the side of the support ring away from the Midstation.)
 203 mm (8") (On the side of the support ring toward the Midstation.)

3.2.2 Slab Load Carrying Capacity

The fixed support and anchor bolts have been designed to properly transmit the beam tube loads to a foundation composed of 3,000 psi concrete meeting the dimensions stated above. The foundation system must be capable of resisting the following loads, applied simultaneously. The axial load is applied at a height of 838 mm (2'-9") below the centerline of the beam tube. The lateral and vertical loads are applied at the centerline of the tube.

Loads at the fixed supports nearest to each end of each beam tube module:

Axial: 13,162 pounds (Applied in either direction independently.)

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		OFFICE LIGO		REVISION 0	
PRODUCT	LIGO BEAM TUBE MODULES CALIFORNIA INSTITUTE OF TECHNOLOGY	MADE BY	CHKD BY	MADE BY	CHKD BY
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Lateral: 2,607 pounds (Applied in either direction independently.)
Vertical: 8,948 pounds (Applied downward only.)

Loads at the fixed supports away from the ends of the beam tube modules:

Axial: 6,419 pounds (Applied in either direction independently.)
Lateral: 2,607 pounds (Applied in either direction independently.)
Vertical: 8,948 pounds (Applied downward only.)

3.2.3 Slab Elevation

The top of the foundation slab shall be 1,070 mm +/- 13 mm (3'-6 1/8 +/- 1/2") below the beam tube centerline.

4.0 BEAM TUBE GUIDED SUPPORT TO BEAM TUBE SLAB

The beam tube modules are supported at each expansion joint by guided-type supports which are composed of a welded steel frame with lateral and vertical adjustment capability. Each guided support provides restraint for the beam tube in the vertical and lateral directions. Axial movement of the beam tube is unrestrained at the guided supports. The support is anchored to the beam tube slab with anchor bolts epoxied into drilled holes during the installation of the support. The following sections provide the locations of the supports and the required dimensions and load carrying capacity of the slab.

4.1 Guided Support Station Locations

Each guided support attaches to the beam tube at two support rings that are welded to the tube near either end of an expansion joint. Each support ring is split approximately in half and the two halves overlap on each side of the beam tube at the vertical centerline of the tube. The station locations of the supports rings, measured from the vertex of the beam tube modules to the centerline of the lap joints in the rings, are given on CBI Drawing #3, Sheets 1-4, for both sites. The longitudinal centerline of the guided support is located half-way between the two support rings to which it is attached.

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4.2 Beam Tube Slab Requirements

Each guided support is anchored to the slab with (8) of the following anchors:

Hilti HY-150 1/2" diameter adhesive anchors with an embedment depth of 4.25" (or equal)

The anchor bolt pattern is shown on CBI Drawing #19. The slab must have the following characteristics.

4.2.1 Slab Dimensions

The guided supports require an area of slab that is free and clear of obstructions with the minimum dimensions given below.

Minimum Thickness: 152 mm (6") (To allow a 4.25" embedment depth of the anchor bolts.)

Minimum Width: 1,981 mm (6'-6) (Centered about the beam tube centerline.)

Minimum Length: 2,591 mm (8'-6) (Centered about the guided support longitudinal centerline.)

4.2.2 Slab Load Carrying Capacity

The guided support and anchor bolts have been designed to properly transmit the beam tube loads to a foundation composed of 3,000 psi concrete meeting the dimensions stated above. The foundation system must be capable of resisting the following loads, applied simultaneously at the centerline of the beam tube.

Axial: There is no significant axial foundation load at the guided supports.

Lateral: 1,625 pounds (Applied in either direction independently.)

Vertical: 7,824 pounds (Applied downward only.)

4.2.3 Slab Elevation

The top of the foundation slab shall be 1,070 mm +/- 13 mm (3'-6 1/8 +/- 1/2") below the beam tube centerline.

PRELIMINARY



		IDENTIFICATION			
		KCD-BTSLAB			
TITLE	BEAM TUBE INTERFACE WITH THE BEAM TUBE SLAB, BEAM TUBE ENCLOSURE AND BAFFLES	REFERENCE NO. 953570		SHT 5 OF 5	
		OFFICE LIGO		REVISION 0	
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		DATE 4/11/96	DATE	DATE	DATE

5.0 BEAM TUBE PUMP PORTS TO BEAM TUBE ENCLOSURE

Each beam tube module has seven pump ports that will be located inside the concrete beam tube enclosure and two pump ports that will be located inside the vacuum equipment areas at the ends of the module. The beam tube enclosure includes service access modules with doors that must be located near the seven enclosed beam tube pump ports to provide access to the ports from outside the enclosure. The station locations of all the pump ports, measured from the vertex of the beam tube modules to the centerline of the ports, are given on CBI Drawing #1, Sheets 1 and 3, for both sites.

6.0 BEAM TUBE TO BEAM TUBE BAFFLES

Each beam tube module has numerous baffles installed inside. The baffles fit close to the inside surface of the beam tube and therefore must be located away from the circumferential weld seams in the tube and away from the expansion joints so the gap between the baffle and the tube can be minimized. The station locations of the circumferential seams at the ends of each beam tube sub-assembly, measured from the vertex of the beam tube modules to the centerline of the seam, are given on CBI Drawing #2, Sheets 1-4, for both sites. See CBI Drawing #4, Sheets 1-7 to determine the position of any circumferential seams located within the interior of the individual sub-assemblies.

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