



		IDENTIFICATION			
		ICD-BTSLAB			
		LIGO-8970033-01-B			
TITLE	BEAM TUBE INTERFACE WITH THE BEAM TUBE SLAB, BEAM TUBE ENCLOSURE AND BAFFLES	REFERENCE NO.		SHT 1 OF 5	
		953570			
		OFFICE		REVISION	
		LIGO		1D	
PRODUCT	LIGO BEAM TUBE MODULES CALIFORNIA INSTITUTE OF TECHNOLOGY	MADE BY	CHKD BY	MADE BY	CHKD BY
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		4/11/96	4/11/96	1/27/97	1/29/97

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

APPROVED	
<i>M. Jellison</i> 2-7-97	
CBI	DATE
CALTECH	DATE

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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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 locations are 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 and expansion joints with the minimum dimensions given below.

Minimum Thickness: 132 mm (5.2") (To allow a 4" embedment depth of the anchor bolts.)

Minimum Width: 2,057 mm (6'-9) (Centered about the beam tube centerline.)

Minimum Length: 1,346 mm (8'-10) (Centered about the support ring stiffener.)

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. The loads given below include beam tube bake out loads and seismic loads. The highest loads at any fixed support are:



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Axial: 8,128 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 +/- 25 mm (3'-6 1/8 +/- 1") 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.

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)



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The anchor bolt pattern is shown on CBI Drawing #19. Holes or anchors which are not used must be at least 1 7/8" away from any active anchor bolt, centerline to centerline. If possible, grout all holes which are drilled but not used. 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 and expansion joints 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. The loads given below include beam tube bake out loads and seismic loads.

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 +/- 25 mm (3'-6 1/8 +/- 1") below the beam tube centerline.



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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.