



SPECIFICATION

SPECIFICATION FOR COMPONENT ALIGNMENT

| APPROVALS | DATE | REV | DCN NO. | BY | CHECK | DCC | DATE |
|-------------|------|-----|---------|----|-------|-----|------|
| AUTHOR: | | | | | | | |
| CHECKED: | | | | | | | |
| APPROVED: | | | | | | | |
| DCC RELEASE | | | | | | | |

TABLE OF CONTENTS

- 1.0 Purpose
- 2.0 General
- 3.0 Responsibilities
- 4.0 Procedure

ATTACHMENTS:

- A. Component Beamline Elevations
- B. Component Installation Data Sheet

1.0 Purpose

The purpose of this procedure is to define the requirements for aligning and positioning vacuum equipment components for the LIGO project.

2.0 General

The major vacuum component anchor bolts are located, drilled and installed after the component has been pre-aligned with the Laser beam line in each building. This requires that each major vacuum boundary component (BSC, HAM, Spools, etc.) be located in its final location and precision aligned (with optical surveying equipment) so that the centerline of the beam line nozzles are within ± 2 mm of the actual beam line.

The actual beam line location is established by the target Buyers benchmarks and the existing equipment already installed. The beam line reference is established by using surveying equipment to site on two adjacent targets to establish the beam line. The component is then adjusted until it is aligned with the established beam line.

The Buyer will verify each component location as part of the installation process.

The Class 5 air must be installed and operational prior to component alignment to provide clean air (Class 5 air will be provided by the Buyer).

The component alignment data sheet shall be filled out as each component is installed. (S/off = data signoff point).

3.0 Responsibilities

The Buyer's Surveyor is responsible for establishing the target bench marks and providing alignment services. The Seller is responsible for the labor and equipment to install and align each component.

The Buyer will verify each component location and alignment.

All components shall be installed per LIGO_E1000707

All anchor bolts shall be installed per specification LIGO_E1000712.

4.0 Procedure

The Beamline elevation at each component is shown in Attachment A of this specification.

- 1) Establish the target bench marks in the building being worked using the Buyer supplied floor bench marks.
- 2) Set up the surveying equipment to site on two adjacent target bench marks to establish the beam line.

**SPECIFICATION FOR COMPONENT ALIGNMENT**

- 3) Move the component into the installed position using the referenced dimensions on the installation documents.
 - 4) Connect class 100 air to the component being aligned (using hoses from the mechanical room).
 - 5) Verify that all shipping door cross hairs are located at the centerline of the nozzles (s/off).
 - 6) Align the component nozzle (shipping door cross hair) with the established beam line. The alignment shall be +/- 2 mm of the beam line.
 - 7) Mark the floor to establish the anchor bolt locations by scribing two holes in each component leg pad on to the floor (s/off).
 - 8) Move the component back from its installed position to allow anchor bolt hole drilling.
 - 9) Using a component anchor bolt template, mark and drill each anchor bolt hole (using a core drilling system capable of cutting rebar).
 - 10) Install anchor bolts and let cure per Spec. LIGO_E1000712.
 - 11) Once the anchor bolts have cured, lift the component to clear the installed anchor bolts and reposition the component to once again align the cross hairs on the shipping covers with the beam line.
 - 12) Adjust anchor bolt nuts and washers to hold the component in the aligned position and lock into place.
 - 13) Remove the lifting tension on the alignment jacks or crane and allow the anchor bolts to support the component.
 - 14) Verify with the surveying equipment that the nozzle centerlines are within +/- 2 mm of the beam line (s/off).
 - 15) Notify the Buyer to witness and signoff the final alignment (s/off).
 - 16) Verify that the vessel ports are closed with covers or Cleanroom fabric and disconnect the class 100 air.
 - 17) Repeat steps 1 thru 16 for each major component until all of the major components are aligned. Spools that fit between major components are aligned automatically by bolting up the spool using the centering pins .
- Components shall be grouted into place per Spec. LIGO_E1000712 after approval by the Buyer.



SPECIFICATION FOR COMPONENT ALIGNMENT

ATTACHMENT A
COMPONENT BEAMLIN ELEVATIONS

WA XMid Station - 73.125 inches

WA XEnd Station - 73.250 inches

WA YMid Station - 73.250 inches

WA YEnd Station - 74.000 inches

WA Corner Station - 70.063 inches

LA Corner Station - 69.063 inches



SPECIFICATION FOR COMPONENT ALIGNMENT

ATTACHMENT B

COMPONENT INSTALLATION DATA SHEET

Component Tag Number

Component Name

Component S/N

Component Installation Weight (lb.)

Four horizontal lines for data entry corresponding to the labels above.

Component Installation Position
(Ref. D Build Grid)

Large empty rectangular box for describing the component installation position.

| | Signoffs (Seller Unless Otherwise Noted) | By | Date |
|----|---|-----------|-------------|
| 1. | Nozzle Cross Hairs Verified | | |
| 2. | Component Located For Anchor Bolt Marking | | |
| | | Buyer | |
| 3. | Final Component Location Complete | | |
| | | Buyer | |
| | | | |

Large empty rectangular box at the bottom of the page.