

Title: aLIGO Installation Acceptance Document for WBSC9 (X)

This document covers the technical content for acceptance review of a subset of the Advanced LIGO (aLIGO) installation. See document [M1300468](#) for an overview of the aLIGO acceptance process. Acceptance by Systems Engineering is to be indicated in the metadata for this document in the LIGO Document Control Center (DCC).

1 Installation Instance/Subset Definition

Insert a brief description of the subset of the aLIGO equipment which is covered under this installation acceptance document. Complete the entries in the following table. If elements of the table are not applicable, enter "not applicable".

This installation covers the BSC chamber WBSC9 and all of the equipment within and attached plus associated electronics racks.

Interferometer [<i>L1 or H1</i>]:	H1
Building(s)/Room(s) : [<i>e.g. corner/LVEA</i>]	LVEA
Vacuum Chamber(s) :	WBSC9 (X ARM)
Electronics Rack Designation(s) :	H1-SUS-C1 ETMX , H1-SUS-C2 ETMX H1-SUS-R1 EX , H1-SEI-XC1 BSC9 H1-ISC-XC3 , H1-ISC-XC4 , H1-ISC-XR1 TCS rack layouts in D1200259 Note that the Capacitive Position Sensor readout boxes which sit on the cable trays do not have an official designation.
Optics Table(s)/Enclosure(s) Designation(s) , and other equipment/assemblies related to this installation:	ETMX Cryo-Pump Baffle , Optical Lever and Photon Calibrator , ISCTEX Table , Temporary T240 Ground Seismometer in place of STS-2 (see D1400077). Position of Ground Seismometer at end X is recorded on page 1 of Systems layout drawing D0901468 .

2 Procedures

If there are any caveats or explanatory notes regarding the procedure documentation cited in the table below, then add these notes to the table entries.

Baseline or initial Installation Procedure(s) : <i>[enter linked DCC document #(s); found under E1200023]</i>	Install procedure document is E1300267 .
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<p>As-Built/Installed Procedure(s), either:</p> <p>a) Enter hyperlinked DCC number for revised or red-lined baseline install procedure, and/or</p> <p>b) Enter hyperlinked DCC number for separate document with installation notes on deviations, changes in procedure, changes in tooling, etc., and/or</p> <p>c) Enter a list of hyperlinked electronic log entries detailing the experience in applying the baseline installation procedure</p>	<p>Updates to doc were made in v3, see abstract.</p> <p>The cartridge installation occurred on 26 Sept 2013, see LHO elog 7881.</p>
<p>Baseline or initial Alignment Procedure(s): <i>[enter linked DCC document #(s); found under E1100734]</i></p>	<p>E1200952 was the initial procedure</p>
<p>As-Built/Aligned Procedure(s), either:</p> <p>a) Enter hyperlinked DCC number for revised or red-lined baseline alignment procedure, and/or</p> <p>b) Enter hyperlinked DCC number for separate document with alignment notes on deviations, changes in procedure, changes in tooling, etc., and/or</p> <p>c) Enter a list of hyperlinked electronic log entries detailing the experience in applying the baseline alignment procedure</p>	<p>E120092-v6 is the as-built alignment procedure.</p> <p>The WBSC9 ETMX alignment was reported in LHO elogs 8126 , 8150 and 8356.</p> <p>The CMBx installation was reported in LHO elogs 7241 and 7229.</p> <p>TMSx alignment is reported in LHO elog 8705.</p> <p>The ETMx ACB alignment is reported in LHO elog 8741.</p> <p>OptLev installation, calibration and alignment reported in LHO eLOGs 12683 , 10454 and 10220.</p>

3 Drawings

Enter hyperlinked DCC document number(s) for each drawing in the table below. If elements of the table are not applicable, enter "not applicable". All chamber-level, assembly drawings can be found listed at [E1200562](#) and found linked under [D0901491](#).

Applicable Building/Room Top-Level Drawing(s):	D0901468 aLIGO Systems Layout LHO X-End Station
Top-Level Chamber Assembly Drawing(s):	D0901150 aLIGO Systems, WBSC9-H1 Top Level Chamber Assembly
Electronics Rack Drawing(s):	H1-SUS-C1 ETMX , H1-SUS-C2 ETMX H1-SUS-R1 EX , H1-SEI-XC1 BSC9 H1-ISC-XC3 , H1-ISC-XC4 , H1-ISC-XR1 TCS rack layouts in D1200259



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	ISC End Station Field Rack D1001423 ISC End Station Remote Rack D1001459 BSC SEI System Wiring Diagrams D0901301
ETM Optical Lever Drawing(s):	G1000719 Floor Occupancy, OpLev & PCal, LHO X-End Station
Cryopump Manifold Baffle Dwg(s):	D1003181 Manifold_Cryo_Baffle_Assembly, ETMX
PCAL Video CAM Periscope	D1200174 : aLIGO, PCAL-VIDEO CAM, PERISCOPE
Photon Calibrator Transmission Pier Assembly	D1000676 : aLIGO AOS Photon Calibrator Transmission Pier Assembly
ISCTEX	ISC Table containing ALS optics etc. The drawing is D1201448 . Updates are noted in Notes and Changes.

4 Serial Number Records

Serial numbers are used to track a subset of the parts, particularly active elements (see [M1000051](#)) and electronics (with S-numbered documents; see [T0900520](#)). Enter the hyperlinked DCC document number(s), and name(s) for the highest level assembly(ies) covered by this installation acceptance document in the table below. Also enter the hyperlink to the ICS entry for the instance of this assembly in the Inventory Control System (ICS). If elements of the table are not applicable, enter "not applicable". If elements of the table are not available/missing, then enter "not available".

Assembly DCC D-Number	Assembly Name	ICS entry
D0901150	aLIGO Systems, WBSC9-H1 Top Level Chamber Assembly	ICS Record: D0901150
D1000513	HEPI	ICS Record: D0901150 (sub-assembly)

5 Testing

All post-installation, stand-alone, in situ, checkout/testing (phases 2 and 3 per [M1000211](#)) must be completed, be successful and be documented:

- phase 2: pre-installed, post-storage, test results for the assembly (testable item)
- phase 3: stand-alone, in situ test results for the assembly (testable item)

Note that integrated testing (phase 4 testing per [M1000211](#)) is covered under the system acceptance review, not this installation acceptance review. In the table below, enter hyperlinked DCC document number(s) for all of the relevant



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testing for the major subassemblies/subsystems covered within this installation instance/subset. If elements of the table are not applicable, enter "not applicable". If elements of the table are not available/missing, then enter "not available".

Subsystem	Testable Item	DCC document numbers	
		Phase 2	Phase 3
SEI	BSC-ISI	E1100849	
SEI	HEPI	N/A	E1300837
SUS	ETMX Suspension (under <i>Test Results</i>)	E1300908	
AOS/SLC/Viewports	Leak and pressure testing.	LHO viewport testing status T1200363 needs updating – no tests shown	???
AOS/OpLev	OpLev Impulse Hammer Modal Testing at CIT.	T1100152	Not Completed
AOS/ACB	Photodiode continuity testing. In-situ operation.	Baffle photodiodes used for OpLev calibration, reported in LHO eLOG 10331	
AOS/ACB	Impulse Hammer Modal Testing	One instance of testing completed, refer to LHO e-log entry 8656 .	
AOS/CMB	Impulse Hammer Modal Testing		Equivalent LLO measurement 9024 . No record found for LHO
AOS/TCS/RHx	Collection, refer to link.	N/R	T1300495 Initial testing 9272 Testing is now on TCS to-do list
TMSx	Transfer Functions B&K Hammer Test		Phase 3a in 13140 and 13151 after a reopening of chamber. See also 11915 for phase 3b done previously. No B&K measurements



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		taken for TMSX	
ESD	ESD install/testing for the quads	(E1300848)	Initial testing in 11573 and TFs in 11581

6 Installation Completeness

If/as applicable, provide a hyperlink reference to a list of remaining tasks to be completed before the installation is finished (i.e. a 'punch' list).

Installation tasks remaining to be completed:	All items are installed.

7 Installation/Integration Issues and ECRs

If/as applicable, provide a hyperlinked list of integration issues and Engineering Change Requests (ECRs) encountered during installation and which are relevant to the installation subset/instance covered by this acceptance document. See [M1300323](#) for a description of the Integration Issue and ECR Tracker.

WBSC9 issues will be kept in the WBSC9 Issue Tracker listed as bug [987](#) in the Bugzilla list.