



ALIGO INSTALLATION INSTANCE ACCEPTANCE DOCUMENT

Title: aLIGO Installation Acceptance Document for **LHAM2**

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 HAM chamber LHAM2 and all of the equipment within and attached plus associated electronics racks.

Interferometer [<i>L1 or H1</i>]:	L1
Building(s)/Room(s): [<i>e.g. corner/LVEA</i>]	LVEA
Vacuum Chamber(s):	LHAM2 Top Level Chamber Assembly drawing D0900365 includes the following major assemblies: <ul style="list-style-type: none"> • HEPI • HAM ISI • One HLTS: PR3 • Three HSTS: MC1, MC3, PRM • Four HAUX: SM1, SM2, PMMT1, PMMT2 • Faraday Isolator Assy • Three IO Periscope Assy (2 types) • PSL Photodiode Assy • Plus fixed mirror assemblies, baffles and balance masses.
Electronics Rack Designation(s):	D1100909 , Input Optics Electronics Layout D1100170 , Vertex ISC Electronics Layout L1-ISC-R1 (LVEA) L1-SUS-R1 (LVEA) L1-ISC-C1 (CER) L1-SEI-C2 (CER) L1-SUS-C3 (CER) L1-SUS-C4 (CER) 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	Two IO Tables: IOT2L and IOT2R Ground Seismometer SEI-GND-STS-A Mode Cleaner Tube Baffle Assys for the IMC



ALIGO INSTALLATION INSTANCE ACCEPTANCE DOCUMENT

Title: aLIGO Installation Acceptance Document for **LHAM2**

installation:

Optical Levers for PR3 & HAM2 table

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.

<p>Baseline or initial Installation Procedure(s): <i>[enter linked DCC document #(s); found under E1200023]</i></p>	<p>E1200565-v1 was the initial procedure for the LHAM2 chamber. This procedure lists the major sub-assemblies.</p> <p>E1100718 was the procedure used to install the MC Tube Baffles</p> <p>E1200063, was the procedure used to install the Optical Levers</p>
<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>No as-built notes were recorded in any of the installation documents, including E1200565.</p> <p>The LHAM2 ISI was removed from the transport container and placed on test stand on 14-Feb-2012 in elog #2489.</p> <p>The LHAM2 ISI installation was reported as completed on 28-Feb-2012 in elog #2586.</p> <p>elog #2604: MCA1 Baffle installation elog #2683: LHAM2 ISI elog #2686: MCA2 Baffle installation elog #3522: PR3 suspension installation elog #3611: MC1 suspension installation elog #3693: MC3 suspension installation elog #3976: optics table balanced elog #4083: viewports installed elog #6149: HEPI controller working elog #6556: IO baffles installed elog #1298: closeout LHAM2 elog #7344: PDL outer loop PD Array installed elog #10811: PR3 and LHAM2 OptLevs are installed and working</p>

Title: aLIGO Installation Acceptance Document for LHAM2

<p>Baseline or initial Alignment Procedure(s): <i>[enter linked DCC document #(s); found under E1100734]</i></p>	<p>E1200640-v5 was the principal initial alignment procedure (for chambers, optics tables and core optics)</p> <p>E1200037 is the alignment procedure for optical levers</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>E1200640-v6 is the as-built alignment procedure, with embedded notes.</p> <p>eelog #7383: DRMI alignment checked out as well within IAS tolerances</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):	D0901466 , aLIGO Systems Layout LLO Corner Station
Top-Level Chamber Assembly Drawing(s):	D0900365 , aLIGO Systems, LHAM2-L1 Top Level Chamber Assembly
Electronics Rack Drawing(s):	All drawings for the racks can be found by navigating through G1001032 .
Optics Table/Enclosure Drawing(s):	D1300356 , As Built Layouts for ALIGO L1 IOT2L and IOT2R
Optical Lever Drawing(s):	G1000700 Floor Occupancy, Optical Levers, LLO Corner Station D1001334 , PR3 OptLev Transmitter (Tx) Assy D1001166 , PR3 OptLev Receiver (Rx) Assy D1001851 , HAM2 OptLev (Tx/Rx) Assy
Mode Cleaner Tube Baffle Dwg(s):	D1000774 , Mode Cleaner Tube Baffle Assy (specifically MCA1 and MCA2)

Title: aLIGO Installation Acceptance Document for LHAM2

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
D0900365	aLIGO Systems, LHAM2-L1 Top Level Chamber Assembly	https://ics-redux.ligo-la.caltech.edu/JIRA/browse/ASSY-D0900365-NA
D1000514	HEPI	N/A (assembly and install done in 2004, before ICS)
S1201192	L1-ISC-R1 (LVEA)	NA
S1200749	L1-SUS-R1 (LVEA)	NA
S1201186	L1-ISC-C1 (CER)	NA
S1200744	L1-SEI-C2 (CER)	NA
S1104357	L1-SUS-C3 (CER)	NA
S1104358	L1-SUS-C4 (CER)	NA

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 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	HAM-ISI	E1200105	
SEI	HEPI	N/A	E1300923
SUS	PR3 Suspension	E1300836	

(under Test Results)	PRM Suspension	E1400114	
	MC1 Suspension	E1400118	
	MC3 Suspension	E1400120	
IO	HAM AUXiliary Suspensions (4 reports linked to DCC entry)	T1300396	
AOS/SLC/Vi ewports	Leak and pressure testing.	E1200445 . Leak & pressure testing completed. All viewports tagged at time of inspection and testing.	Visual inspection in-situ not completed, refer to bug list.
AOS/OptLev	PR3 OptLev	E1200992 : Completed test reports for OptLev QPD Amplifiers E1200214 : In-situ optical-lever testing and acceptance procedure (no completed reports filed)	
IO	Faraday Isolator	E1300484	
PSL	ISS outer loop PD Array	T1300594	

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.
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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. The format of the url for the issue tracker is as follows.

https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=*

*id	status	resolution	Title/description
3	Closed	Won't fix	Unintentional ground connection at GS-13 pods
9	Accepted	Pending	SUS Coil Driver Noise Monitor Circuits Untrustworthy

**ALIGO INSTALLATION INSTANCE
ACCEPTANCE DOCUMENT****Title: aLIGO Installation Acceptance Document for **LHAM2****

19	Closed	fixed	Increasing "Control" HSTS M2 (Middle) Stage Coil Drivers
24	Closed	Fixed	Increase series resistors on HAM-A and TT coil drivers
45	Closed	Fixed	propose new location for the corner station STS-2 ground seismometers
53	Closed	Fixed	HSTS lower blade stop replacement
71	Closed	Fixed	ISS PD array issues
78	Closed	Fixed	SUS Electronics Missing/Incomplete/Out-of-date Drawings
91	Closed	Fixed	ECR - Adding Coil Driver Monitor Signals to Frames
108	Closed	Won't fix	Light transmitted through the HAM OptLev mirrors may scatter into OSEMs, PDs
118	Closed	Fixed	ECR: HEPI medm screen update
140	Closed	Fixed	ECR HAM-ISI model and MEDM screen update
186	Closed	Fixed	ECR: Topology Changes to SUS models as a result of ISC Informed Interaction
205	Closed	Fixed	ECR: Add Cartesian bias monitoring and offsets to the ISI models
207	Closed	Fixed	ECR: Model and screens update to allow sensor correction to the ISI using Ground seismometers (STS-2)
257	Closed	Won't fix	Include new 'command' screen using Python/ guardian tools
283	Accepted	Pending	CPS Circuit Modification to eliminate a high frequency oscillation
355	Closed	Fixed	ECR: Modify HAM-ISI and BSC-ISI simulink control filters to monitor gain for ODC
360	Closed	Fixed	Ground loop fix in interface to all GS-13
375	Closed	Fixed	ECR: Migrate the ISI Checker Script functions to the frontend code
385	Closed	Fixed	ECR: create science frame channels for the SEI models
445	Closed	Fixed	Update the SAFE level for the BSC and HEPI model watchdog
460	Closed	Fixed	Update watchdog trip plotting software
461	Closed	Works	Move HAM-ISI Optical Levers to HSTSs
464	Closed	Fixed	Baffle on PR3 SUS to prevent pitch alignment drift



ALIGO INSTALLATION INSTANCE ACCEPTANCE DOCUMENT

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482	Accepted	Pending	ECR: ODC changes in SUS, SEI, HPI and PSL
487	Closed	Fixed	ECR: Remove ISI IPC links which come from SUS offload
500	Closed	Fixed	ECR: HEPI MEDM Update
530	Closed	Fixed	ECR: update to the HEPI master model and related MEDM screens
534	Closed	Won't fix	Dual 5 way coax feedthrus installed on HAM 1 and 2 are not of the latest version
551	Closed	Fixed	ECR: HEPI script update
571	Accepted	Pending	LHAM2 Issue Tracker: a place to collect any pending issues specific to LHAM2
629	Accepted	Pending L1 Fixed	CPS Racks Grounding Schemes
630	Accepted	Pending	CPS cross talk
644	Accepted	Pending	checking electronics modules without visible over-current protection
650	Accepted	Pending	ECR: ISI model update - Jan 2014
659	Accepted	Pending	options to ameliorate spot size issues with ISS PD arrays in HAM2 chambers
668	Accepted	Pending	DC Switch Breaker Box Install in Pier Pod and TCS ISS Power cords.
721	Assigned		ECR: Replace the custom cartesian-bias-ramping code with cdsFiltCtrl2 parts
722	Accepted	Pending	ECR: Adding Independent ASC IPC Paths for Dither Alignment to Most SUS
741	Accepted	Pending	ISC/IO tables: Lights and fan status readback
746	Accepted	Pending	ECR: store suspension mis/alignment values separately in EPICS database
759	Closed	Fixed	Add BLRMS for OpLevs on suspensions
761	Accepted	Pending	In Situ, Visual Inspections of All Viewport Windows
779	Assigned		HAM 2&3 and ITMX, BS & ITMY (ISI and HEPI) local models slightly differ from documentation (ADC/DAC numbering)

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788	Assigned		mechanical problems with the Optical Levers (OptLev) at both sites
803	Accepted	Pending	IM3 (HAUX) excess noise on UL channel
804	Accepted	Pending	IM1 (HAUX) excess noise on LR channel
805	Accepted	Pending	IM3 (HAUX) first structural mode resonance non-compliance
836	Accepted	Pending	Glitches in ISI drives from the Blend switching algorithm
837	Accepted	Pending	HEPI L4C watchdog trips
842	Accepted	Pending	ECR: Adding optical lever damping infrastructure to QUAD, BSFM, and HLTS
848	Accepted	Pending	ISS Picomotor Nonfunctional