This document covers the technical content for acceptance review of a subset of the Advanced LIGO (aLIGO) installation. See document [M1300468](https://dcc.ligo.org/LIGO-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).

# 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 LHAM5 and all of the equipment within and attached plus associated electronics racks.

|  |  |
| --- | --- |
| **Interferometer** [*L1 or H1*]: | **L1** |
| **Building**(s)/**Room**(s): [*e.g. corner/LVEA*] | **LVEA** |
| **Vacuum Chamber**(s): | **LHAM1** |
| **Electronics Rack Designation**(s): | L1-ISC-C1, L1-ISC-C2, L1-ISC-C3, L1-ISC-C4, L1-SEI-C1, L1-ISC-R1, L1-ISC-R2, L1-ISC-R4.  Note that the Capacitive Position Sensor readout boxes, which sit on shelves near the HAM chambers do not have an official designation. |
| **Optics Table(s)/Enclosure(s) Designation**(s), and other equipment/assemblies related to this installation: | L1-ISCHT1L drawing at [D1201103](https://dcc.ligo.org/LIGO-D1201103) |

# 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):  *[enter linked DCC document #(s); found under* [*E1200023*](https://dcc.ligo.org/LIGO-E1200023)*]* | [E1200088](https://dcc.ligo.org/LIGO-E1200088) was the procedure to re-install the passive stack.  [E1200092](https://dcc.ligo.org/LIGO-E1200092) was the hazard analysis for the passive stack re-install. |
| **As-Built/Installed Procedure**(s), either:   1. Enter hyperlinked DCC number for revised or red-lined baseline install procedure, and/or 2. Enter hyperlinked DCC number for separate document with installation notes on deviations, changes in procedure, changes in tooling, etc., and/or 3. Enter a list of hyperlinked electronic log entries detailing the experience in applying the baseline installation procedure | The installation of the passive stack was recorded in aLOG [#6369](https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=6369).  [E1200088](https://dcc.ligo.org/LIGO-E1200088) has redlines accruing from this installation. [D1200428](https://dcc.ligo.org/LIGO-D1200428) and [D0901809](https://dcc.ligo.org/LIGO-D0901809) |
| **Baseline or initial Alignment Procedure**(s): *[enter linked DCC document #(s); found under* [*E1100734*](https://dcc.ligo.org/LIGO-E1100734)*]* | [E1100782](https://dcc.ligo.org/LIGO-E1100782) was the initial procedure. This is just an empty file card since there are no suspensions on this table to align. |
| **As-Built/Aligned Procedure**(s), either:   1. Enter hyperlinked DCC number for revised or red-lined baseline alignment procedure, and/or 2. Enter hyperlinked DCC number for separate document with alignment notes on deviations, changes in procedure, changes in tooling, etc., and/or 3. Enter a list of hyperlinked electronic log entries detailing the experience in applying the baseline alignment procedure | Components on the table were aligned using interferometer beams. |

# 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*](https://dcc.ligo.org/LIGO-E1200562) *and found linked under* [*D0901491*](https://dcc.ligo.org/LIGO-D0901491)*.*

|  |  |
| --- | --- |
| Applicable Building/Room Top-Level Drawing(s): | [D0901466](https://dcc.ligo.org/LIGO-D0901466) aLIGO Systems Layout LLO Corner Station |
| Top-Level Chamber Assembly Drawing(s): | [D0901809](https://dcc.ligo.org/LIGO-D0901809) aLIGO Systems, LHAM1-L1 Top Level Chamber Assembly |
| Electronics Rack Drawing(s): | All drawings for the racks can be found by navigating through [G1001032](https://dcc.ligo.org/LIGO-G1001032). |
| Optics Table/Enclosure Drawing(s): | L1-ISCHT1L drawing at [D1201103](https://dcc.ligo.org/LIGO-D1201103) |

# Serial Number Records

*Serial numbers are used to track a subset of the parts, particularly active elements (see* [*M1000051*](https://dcc.ligo.org/LIGO-M1000051)*) and electronics (with S-numbered documents; see* [*T0900520*](https://dcc.ligo.org/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. |
| D0900421 | aLIGO Systems, LHAM6-L1 Top Level Chamber Assembly | ICS entry click here [D0901809](https://ics-redux.ligo-la.caltech.edu/JIRA/browse/ASSY-D0901809-NA). This record exists but is misplaced in the hierarchial layout. You can find it by expanding the “BSC-ISI Unit1” assembly record at the bottom of the tree, and then looking for the boldfaced record (in this case 3rd from the bottom). I am unable to verify how much of the installed equipment is in the record since it keeps closing when I try to examine it. |
| D1000513 | HEPI | The aLIGO HEPI assembly is at [D1000514](https://dcc.ligo.org/LIGO-D1000514). Note that LHAM1 used to be LHAM2 on initial/enhanced LIGO. |

# Testing

*All post-installation, stand-alone, in situ, checkout/testing (phases 2 and 3 per* [*M1000211*](https://dcc.ligo.org/LIGO-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*](https://dcc.ligo.org/LIGO-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 | HEPI | N/A | [E1300922](https://dcc.ligo.org/LIGO-E1300922)  **Note: LHAM1 HEPI has yet to be commissioned so this record is empty.** |
| AOS/SLC/Viewports | Leak and pressure testing. | [E1200445](https://dcc.ligo.org/LIGO-E1200445). Leak and pressure testing was completed, refer to above link. All viewports were tagged at time of inspection and testing. | Visual inspection in-situ not completed, refer to bug list. |

# 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.** |
| ICS Assembly Record needs to be updated | **The ICS records for HAM1 may be incomplete; There is a top level assembly record but it has some problems.**  **The passive stack isolation table precedes aLIGO and has no ICS entry.** |

# 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*](https://dcc.ligo.org/LIGO-M1300323) *for a description of the Integration Issue and ECR Tracker.*

*The format of the url for the bug tracker is as follows e.g.*

***\****[***https://services.ligo-wa.caltech.edu/integrationissues/show\_bug.cgi?id=****826*](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=826)

|  |  |
| --- | --- |
| Tracker # *[hyperlinked]* | Title/description |
|  |  |
| [#73](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=73) closed | The RF photodetectors self destruct on loss of a single DC power rail |
| [#87](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=87) closed | Difficulty with covering viewports on HAM1 side of HAM1-HAM2 septum. |
| [#89](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=89) closed | Ag-SS 5/16-24 screws in double stack viewports require change to plain SS |
| [#95](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=95) closed | Quick look at contamination on PSL main double stack viewport |
| [#96](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=96) closed | ALS COMM/DIFF signals missing |
| [#100](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=100) closed | Add a half-wave plate to the REFL beam path in HAM1 |
| [#118](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=118) closed | ECR: HEPI medm screen update |
| [#182](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=182) closed | ECR: BSC-ISI and HEPI MEDM (Duplicate of #500) |
| [#196](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=196) closed | Cleanliness of input viewport and septum viewport that high power from PSL passes through |
| [#332](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=332) | RF phase shifts when cables moved |
| [#373](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=373) closed | Extraction of PSL beam in HAM1 through central viewport |
| [#441](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=441) closed | Cable plan for 5-way coax cables |
| [#443](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=443) closed | RF splitter for BBPDs need to be documented (Duplicate of #465) |
| [#445](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=445) closed | ECR: Update the SAFE level for the BSC and HEPI model watchdog |
| [#465](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=465) closed | Need for additional amplification on the 135MHz signal chain |
| [#482](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=482) | ECR: ODC changes in SUS, SEI, HPI and PSL |
| [#500](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=500) closed | ECR: HEPI MEDM Update |
| [#530](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=530) closed | update to the HEPI master model and related MEDM screens |
| [#534](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=534) closed | Dual 5 way coax feedthrus installed on HAM 1 and 2 are not of the latest version. |
| [#551](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=551) closed | HEPI script update |
| [#570](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=570) | LHAM1 Issue Tracker |
| [#577](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=577) | LHAM6 table weights are missing viton damping pads |
| [#668](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=668) | DC Switch Breaker Box Install in Pier Pod and TCS ISS Power cords. |
| [#741](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=741) | ISC tables: Lights and fan status readback |
| [#761](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=761) | In Situ, Visual Inspections of All Viewport Windows |
| [#771](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=771) | Missing 4 stage 0 to support tubes screws for LHAM1 |
| [#837](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=837) | HEPI L4C watchdog trips |