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

|  |  |
| --- | --- |
| **Interferometer** [*L1 or H1*]: | **H1** |
| **Building**(s)/**Room**(s): [*e.g. corner/LVEA*] | **LVEA** |
| **Vacuum Chamber**(s): | **WBSC9 (X ARM)** |
| **Electronics Rack Designation**(s): | [H1-SUS-C1 ETMX](https://dcc.ligo.org/S1301903), [H1-SUS-C2 ETMX](https://dcc.ligo.org/S1301904)  [H1-SUS-R1 EX](https://dcc.ligo.org/S1301900), [H1-SEI-XC1 BSC9](https://dcc.ligo.org/S1301907)  [H1-ISC-XC3](https://dcc.ligo.org/S1301905), [H1-ISC-XC4](https://dcc.ligo.org/S1301906), [H1-ISC-XR1](https://dcc.ligo.org/S1301901)  TCS rack layouts in [D1200259](https://dcc.ligo.org/LIGO-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](https://dcc.ligo.org/LIGO-D1003181) , [Optical Lever and Photon Calibrator](https://dcc.ligo.org/LIGO-D1000323) , [ISCTEX Table](https://dcc.ligo.org/LIGO-D1201448) , Temporary T240 Ground Seismometer in place of STS-2 (see [D1400077](https://dcc.ligo.org/LIGO-D1400077)).  Position of Ground Seismometer at end X is recorded on page 1 of Systems layout drawing [D0901468](https://dcc.ligo.org/D0901468). |

# 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)*]* | Install procedure document is [E1300267](https://dcc.ligo.org/LIGO-E1300267). |
| **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 | Updates to doc were made in v3, see abstract.  The cartridge installation occurred on 26 Sept 2013, see LHO elog [7881.](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=7881) |
| **Baseline or initial Alignment Procedure**(s): *[enter linked DCC document #(s); found under* [*E1100734*](https://dcc.ligo.org/LIGO-E1100734)*]* | [E1200952](https://dcc.ligo.org/LIGO-E1200952) was the initial procedure |
| **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 | [E120092-v6](https://dcc.ligo.org/LIGO-E1200952) is the as-built alignment procedure.  The WBSC9 ETMX alignment was reported in LHO elogs [8126](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=8126) , [8150](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=8150) and [8356](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=8356).  The CMBx installation was reported in LHO elogs [7241](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=7241) and [7229](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=7229).  TMSx alignment is reported in LHO elog [8705](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=8705).  The ETMx ACB alignment is reported in LHO elog [8741](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=8744).  OptLev installation, calibration and alignment reported in LHO eLOGs [12683](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=12683) , [10454](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=10454) and [10220](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=10220). |

# 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): | [D0901468](https://dcc.ligo.org/LIGO-D0901468) aLIGO Systems Layout LHO X-End Station |
| Top-Level Chamber Assembly Drawing(s): | [D0901150](https://dcc.ligo.org/LIGO-D0901150) aLIGO Systems, WBSC9-H1 Top Level Chamber Assembly |
| Electronics Rack Drawing(s): | [H1-SUS-C1 ETMX](https://dcc.ligo.org/S1301903), [H1-SUS-C2 ETMX](https://dcc.ligo.org/S1301904)  [H1-SUS-R1 EX](https://dcc.ligo.org/S1301900), [H1-SEI-XC1 BSC9](https://dcc.ligo.org/S1301907)  [H1-ISC-XC3](https://dcc.ligo.org/S1301905), [H1-ISC-XC4](https://dcc.ligo.org/S1301906), [H1-ISC-XR1](https://dcc.ligo.org/S1301901)  TCS rack layouts in [D1200259](https://dcc.ligo.org/LIGO-D1200259)  ISC End Station Field Rack [D1001423](https://dcc.ligo.org/LIGO-D1001423)  ISC End Station Remote Rack [D1001459](https://dcc.ligo.org/LIGO-D1001459)  BSC SEI System Wiring Diagrams [D0901301](https://dcc.ligo.org/LIGO-D0901301) |
| ETM Optical Lever Drawing(s): | [G1000719](https://dcc.ligo.org/LIGO-G1000719) Floor Occupancy, OpLev & PCal, LHO X-End Station |
| Cryopump Manifold Baffle Dwg(s): | [D1003181](https://dcc.ligo.org/LIGO-D1003181) Manifold\_Cryo\_Baffle\_Assembly, ETMX |
| PCAL Video CAM Periscope | [D1200174](https://dcc.ligo.org/LIGO-D1200174): aLIGO, PCAL-VIDEO CAM, PERISCOPE |
| Photon Calibrator Transmission Pier Assembly | [D1000676](https://dcc.ligo.org/LIGO-D1000676): aLIGO AOS Photon Calibrator Transmission Pier Assembly |
| ISCTEX | ISC Table containing ALS optics etc. The drawing is [D1201448](https://dcc.ligo.org/LIGO-D1201448). Updates are noted in Notes and Changes. |

# 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 |
| [D0901150](https://dcc.ligo.org/LIGO-D0901150) | aLIGO Systems, WBSC9-H1 Top Level Chamber Assembly | [ICS Record: D0901150](https://ics-redux.ligo-la.caltech.edu/JIRA/browse/ASSY-D0901150-NA) |
| [D1000513](https://dcc.ligo.org/LIGO-D1000513) | HEPI | [ICS Record: D0901150](https://ics-redux.ligo-la.caltech.edu/JIRA/browse/ASSY-D0901150-NA) (sub-assembly) |

# 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 | BSC-ISI | [E1100849](https://dcc.ligo.org/LIGO-E1100849) | |
| SEI | HEPI | N/A | [E1300837](https://dcc.ligo.org/LIGO-E1300837) |
| SUS | ETMX Suspension (under Test Results) | [E1300908](https://dcc.ligo.org/LIGO-E1300908) | |
| AOS/SLC/Viewports | Leak and pressure testing. | LHO viewport testing status [T1200363](https://dcc.ligo.org/LIGO-T1200363) needs updating – no tests shown | ??? |
| AOS/OpLev | OpLev Impulse Hammer Modal Testing at CIT. | [T1100152](https://dcc.ligo.org/LIGO-T1100152) | Not Completed |
| AOS/ACB | Photodiode continuity testing.  In-situ operation. | Baffle photodiodes used for OpLev calibration, reported in LHO eLOG [10331](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=10331) | |
| AOS/ACB | Impulse Hammer Modal Testing | One instance of testing completed, refer to LHO e-log entry [8656](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=8656). | |
| AOS/CMB | Impulse Hammer Modal Testing |  | Equivalent LLO measurement [9024](https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=9024). No record found for LHO |
| AOS/TCS/RHx | Collection, refer to link. | N/R | [T1300495](https://dcc.ligo.org/LIGO-T1300495)  Initial testing [9272](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=9272)  Testing is now on TCS to-do list |
| TMSx | Transfer Functions  B&K Hammer Test | No B&K measurements taken for TMSX | Phase 3a in [13140](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=13140) and [13151](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=13151) after a reopening of chamber. See also [11915](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=11915) for phase 3b done previously. |
| ESD | ESD install/testing for the quads | ([E1300848](https://dcc.ligo.org/LIGO-E1300848)) | Initial testing in [11573](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=11573) and TFs in [11581](https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=11581) |

# 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.** |
|  |  |

# 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.*

WBSC9 issues will be kept in the WBSC9 Issue Tracker listed as bug [987](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=987) in the Bugzilla list.