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 LBSC3 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): | **LBSC3** |
| **Electronics Rack Designation**(s): | L1-SUS-R5. L1-SUS-C5. L1-SEI-C6. 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: | TCS-X Table, STS-2 Ground Seismometer, Cryopump Manifold Baffle (CMBx). |

# 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)*]* | [E1200918](https://dcc.ligo.org/LIGO-E1200918)-v2 was the initial procedure |
| **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
 | No as-built notes were recorded in document E1200918. However some as-built notes (“red lines”) were recorded in the file name BSC3INSTALL.pdf which is filed as an “other file” with [E1200344](https://dcc.ligo.org/LIGO-E1200344)-v4, the BSC Cartridge installation procedure.This installation event (including cartridge weight measurement) was occurred 6 Feb 2013 and was recorded in [LLO elog #6110](https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=6110) |
| **Baseline or initial Alignment Procedure**(s):*[enter linked DCC document #(s); found under* [*E1100734*](https://dcc.ligo.org/LIGO-E1100734)*]* | [E1200393-v](https://dcc.ligo.org/LIGO-E1200393-v4)4 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
 | [E1200393-v5](https://dcc.ligo.org/LIGO-E1200393-v5) is the as-built alignment procedure, with embedded notes.The LBSC3 cartridge alignment was recorded in LLO elog [#6110](https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=6110) The CMBy installation was completed but was not recorded in the LLO elog The in-chamber ITMy alignment was completed but was not recorded in the LLO elog. For embedded notes refer to [E1200393-v5](https://dcc.ligo.org/LIGO-E1200393-v5).The ITMy ACB installation and alignment was recorded in LLO elog [#11572](https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=11572) The CO2P relay optics alignment was recorded in LLO elog [#10789](https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=10789) OptLev alignment: [#11719](https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=11719)  |

# 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):  | [D0900492](https://dcc.ligo.org/LIGO-D0900492) aLIGO Systems, LBSC3-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): | [LIGO-D1000634](https://dcc.ligo.org/LIGO-D1000634) TCS CO2P Table Assembly, H1/L1 |
| ITM Optical Lever Drawing(s): | [LIGO-G1000700](https://dcc.ligo.org/LIGO-G1000700) Floor Occupancy, Optical Levers, LLO Corner Station. |
| Cryopump Manifold Baffle Dwg(s): | [LIGO-D0902617](https://dcc.ligo.org/LIGO-D0902617) aLIGO\_Manifold\_Cryo\_Baffle\_Assembly, ITM |

# 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 |
| D0900492 | aLIGO Systems, LBSC3-L1 Top Level Chamber Assembly | <https://ics-redux.ligo-la.caltech.edu/JIRA/browse/ASSY-D0900492-NA>  |
| D1000513 | HEPI | N/A (assembly and install done in 2004, before ICS) |

# 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 | [E1100857](https://dcc.ligo.org/LIGO-E1100857) |
| SEI | HEPI | N/A | [E1300928](https://dcc.ligo.org/LIGO-E1300928) |
| SUS | BSC3 Suspension (under Test Results) | [E1300916](https://dcc.ligo.org/LIGO-E1300916) |
| 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. |
| AOS/OptLev | ITMx OptLev Impulse Hammer Modal Testing | [T1100152](https://dcc.ligo.org/LIGO-T1100152) | Not completed |
| AOS/CMB | Impulse Hammer Modal Testing | [8703](https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=8703) |
| AOS/TCS/RHx | Collection, refer to link. | N/R | [T1300495](https://dcc.ligo.org/LIGO-T1300495) and [G1400018](https://dcc.ligo.org/LIGO-G1400018) |
| AOS/TCS/CO2Px | Collection, refer to link. | N/R | [T1300495](https://dcc.ligo.org/LIGO-T1300495) and [G1400018](https://dcc.ligo.org/LIGO-G1400018) |
| AOS/ACB | Photodiode continuity testing.In-situ operation. | Note completed for LBSC3. Refer to [E1300375](https://dcc.ligo.org/LIGO-E1300375) for LBSC4.Not envisioned at start. Diodes used for alignment of beam thus confirmed working. |
| 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). |
| ESD | ESD install/testing for the quads | ([E1300848](https://dcc.ligo.org/LIGO-E1300848)) | [#10797](https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=10797) for LBSC3 |

# 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 | There are some issues with ICS which are affecting this task. Some TCS and SLC records have been added but do not appear. Still need to add viewports, Oplev periscope and perhaps misc. other items to the ICS records.  |

# 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.*

|  |  |
| --- | --- |
| Tracker #*[hyperlinked]* | Title/description |
| [#572](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=572) open | LBSC3 (ITMX) Issue Tracker |
| [#63](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=63) closed | ECR: Dog Clamps for SLC suspended baffles |
| [# 761](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=761) | In Situ, Visual Inspections of All Viewport Windows |
| [#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 |
| [#186](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=186) closed | ECR: Topology Changes to SUS models as a result of ISC Informed Interaction |
| [#205](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=205) closed | ECR: Add Cartesian bias monitoring and offsets to the ISI models |
| #[207](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=207) closed | ECR: Model and screens update to allow sensor correction to the ISI using Ground seismometers (STS-2) |
| [#217](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=217) closed | Coil Driver was giving over-temp warnings. Replaced with a spare |
| [#283](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=283) | CPS Circuit Modification to eliminate a high frequency oscillation |
| [#355](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=355) closed | ECR: Modify HAM-ISI and BSC-ISI simulink control filters to monitor gain for ODC |
| [#375](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=375) closed | ECR: Migrate the ISI Checker Script functions to the frontend code |
| [#385](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=385) closed | ECR: create science frame channels for the SEI models |
| [#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 |
|  |  |
| [#482](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=482) | ECR: ODC changes in SUS, SEI, HPI and PSL |
| [#487](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=487) closed | ECR: Remove ISI IPC links which come from SUS offload |
| [#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 | ECR: update to the HEPI master model and related MEDM screens |
| [#551](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=551) closed | ECR: HEPI script update |
| [#650](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=650) | ECR: ISI model update - Jan 2014 |
|  |  |
| [#721](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=721) | ECR: Replace the custom cartesian-bias-ramping code with cdsFiltCtrl2 parts |
| [#722](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=722) | ECR: Adding Independent ASC IPC Paths for Dither Alignment to Most SUS |
|  |  |
| [#677](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=677) closed | the first UHV steering mirror for CO2P-X is mis-aligned inside BSC3 The CO2P-X beam path has been re-aligned. See elog entry: <https://alog.ligo-la.caltech.edu/aLOG/index.php?callRep=11435> |
| [#758](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=758) | 758: L1 ITMX L2 (PUM) LL OSEM magnet & flag alignment stability |