



LIGO-E1200687-v1

ADVANCED LIGO

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aLIGO HEPI
Common Documentation Acceptance

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Distribution of this document:
LIGO Science Collaboration

This is an internal working note
of the LIGO Project.

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Purpose and general description

This document provides links to the acceptance documentation package (as defined in M1100282-v1. (acronyms are defined at the end of this document)

1 Requirements documentation

The design requirements document must be brought up to date, and pointers to background material, analyses, etc. added to the Requirements document. Pointers to prototyping endeavors should be included here.

- Design Requirements:
[LIGO-T020033-x0, Initial LIGO Seismic Isolation Upgrade Design Requirements Document](#)
- Performances requirements
[E990303-03-D, Seismic Isolation Subsystem Design Requirements Document.](#)
- Actuators requirements
[E1300154-v1 HEPI Hydraulic Actuator Statement of Work](#)

2 Design overview and detailed design documentation

The Final Design Document must be brought up to date, and the detailed design made available via a tree structure pointing to the DCC and design vaults. Lower-level software (control laws, basic machine state and reporting) should be documented in this way, pointing to a software version control system.

2.1 Conceptual Design Review

The HEPI Conceptual Design Review was held during iLIGO operation due to excess ground motion at LLO making it impossible to hold interferometer locking during the day.

The HEPI Conceptual Design page is on the Caltech server:

http://www.ligo.caltech.edu/~coyne/IL/EPI/review1/seismic_upgrade.htm

[G020169-x0, Conceptual Design Review: Initial LIGO Seismic Isolation System Upgrade](#)

[T020047-v1, Quiet Hydraulic Actuators for Initial LIGO](#)

2.2 Fabrication Readiness Review

The HEPI Fabrication Readiness Review page is in the Advanced LIGO wiki:

https://awiki.ligo-wa.caltech.edu/aLIGO/Advanced_LIGO_HEPI?highlight=%28HEPI%29

- **[E080359-v1 HEPI Fabrication Readiness Review](#)**
- **[M080046-v1 HEPI Fabrication/Procurement Plan](#)**

2.3 SolidWorks Model

The HEPI top assembly Solidworks Model is checked in the LIGO Caltech PDM vault, in the SEI folder:

The entire HEPI system and models for both the BSC style HEPI and the HAM style HEPI along with tooling necessary for assembly are checked in under this top assembly.

2.4 Drawings package

The top assembly, sub-assembly and parts drawings are all posted in the DCC in the pdf formats. The top level assembly drawings are

D1000513-v1 HEPI Assembly, BSC aLIGO

D040001-v2 HEPI-BSC Top Level Assy aLIGO BSC

D1000514-v1 HEPI Assembly, HAM aLIGO

D040002-v2 HEPI-HAM Housing Hydraulic Assy, aLIGO

D020284-x0 HEPI Hydraulic Actuator Assembly, aLIGO

T1300173-v1 SEI Electronics Drawing Hub aLIGO

3 Materials and Fabrication specifications:

Any special materials, or treatment of materials including preparation for in-vacuum use; this may be integrated into the Design documentation.

- **LIGO-E0900047: LIGO Contamination Control Plan**
- **LIGO-T1100066: Torque values**

4 Parts and spares

Parts and spares inventoried: All elements of aLIGO must be recorded in the ICS or in the DCC using the S-number scheme. A listing of HEPI spare parts is in the DCC.

E1200847-v2 aLIGO Seismic Isolation Spare Parts List

5 Assembly procedures:

All assembly procedures must be in the DCC and annotated or updated for lessons learned. Storage, if used, should be described here along with procedures to maintain the equipment in good condition (e.g., purge frequency). Transportation procedures and cautions must be noted. Assembly procedures for the larger sub-assemblies like the high power laser, 35W front-end laser, DBB are available from LZH, neoLASE or AEI.

Installation procedures: *All installation procedures must be in the DCC and annotated or updated for lessons learned.*

The assembly documentation is posted in the DCC under the document page:

E040011-v1 Installation Specification – HEPI Assembly and Installation Procedures

E1100075-v5 Removing iLIGO HAM-HEPI/ Installing aLIGO HAM-HEPI

E0900025-v1 aLIGO BSC HEPI Pre-Storage Assembly Procedure

6 Test documents

Test rationale, plans, and data for each unit must be documented as described in M1000211. That tree structure should be pointed to by the overall tree structure laid out in this Acceptance prescription. The top-level objective is to make clear how the measurements performed, which often will not directly measure a required performance parameter, give confidence that the subsystem will fulfill the requirements.

The SEI testing documentation is posted in the DCC under.

[LIGO-E1000304: aLIGO SEI Testing and Commissioning Documentation](#)

The document describes how the SEI testing and documentation are organized. The DCC page contains the links to the Seismic Group testing and commissioning documentation of the Advanced LIGO SEI installation. In particular, the testing page of sub-assemblies used on the HEPI:

[LIGO-E1100786: aLIGO SEI Instruments Testing Reports and Tracking Lists](#)

And the HEPI testing page:

[LIGO-E1000276: aLIGO HEPI Testing Phase 1](#)

This HEPI testing page contains the link to the testing documentation:

- **[LIGO-E1000307: aLIGO HAM-HEPI Testing and Commissioning Documentation](#)**
- **[LIGO-E1000308: aLIGO BSC-HEPI Testing and Commissioning Documentation](#)**
- **[LIGO-E1000209: HAM-HEPI Commissioning Procedure](#)**

And to the testing reports of all the units:

7 User's manual:

A manual appropriate for operators, covering alignment/adjustments and normal operations, must be available (and in the DCC). It must describe what not to do as well, and give clear guidance and cross-pointers to activities which require safety considerations. It must be accessible from standard user screens.

- **E1200762: User interfaces Overview and restart procedure of the Seismic systems**

8 Troubleshooting:

A guide must be developed that helps understand common error messages and events, and provides guidance for recovery and repair procedures as appropriate. Safety issues must be flagged.

- currently there is no Troubleshooting guideline as no *typical* errors occurred in the operation of the reference system, we have, however, started a troubleshooting section on the PSL wiki and will update this list
- we are testing a regular maintenance procedure to compensate for the aging of the PSL laser diodes, once this procedure is finalized a document will be put into the DCC
- **Safety** documentation
Safety documentation must be in the DCC for all phases of the subsystem development, including any needed for normal use or foreseen maintenance/repair scenarios.

Acronyms

BSC	Beam Splitter (and core optics) Chamber
DCC	Document Control Center
EPICS	Experimental Physics and Industrial Control System: a set of Open Source software tools, libraries and applications developed collaboratively and used worldwide to create distributed soft real-time control systems for scientific instruments
FE	Front End
HAM	Horizontal Access Module
HEPI	Hydraulic External Pre-Isolator
ISI	Internal Seismic Isolation System
LHO	LIGO Hanford Observatory
LLO	LIGO Livingston Observatory
LVEA	Laser Vacuum Equipment Area