Manufacturing Specification for the HAM ISI Transport and Storage Containers

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1 Scope

This specification is for the manufacture of a modular container to transport and provide long term storage for the HAM internal seismic isolation systems (ISI).

2 Specifications

a. The modular container is to be constructed of sheet aluminum a minimum of .125" thick or adequately stiffened.
b. The overall size shall be 78" wide x 90" long x 48" high in order to be able to house the HAM ISI units shown in fig.1.
c. The container must support a 6000 lbs load on internal rails.
d. The aluminum enclosure shall have no finish and rounded edges wherever possible so that the inside can be cleaned.
e. The container shall be top loading with the enclosure separating at the base.
f. Handles and lifting hooks are required to lift the enclosure off of the base.
g. The enclosure is to be sealed to maintain a dry nitrogen purge.
h. The container shall include an inlet and outlet port for nitrogen purging. A valve and auto/manual pressure relief valve will be required.
i. The base of the container shall include fork lift guides of adequate strength for lifting onto storage racks.
j. The pallet shall be designed to isolate the load from shock during transport and handling.
k. Four 5/8 wire helical isolators Aeroflex part number CB1500-20-C1are to be placed below the load to reduce shock loading.

3 Drawings

a. Overall Assembly - D071400-C
b. Optics Table - D071050-V2
c. Stage 0 Base - 1400D071001-V2

4 Transportation Plan

a. The most critical components of this design are the GS-13 seismometers, the locker/locators, position sensors, and the electromagnetic actuators. Dan Clark and Brian Lantz have recently proposed a design change to the GS-13 which is covered in LIGO document T0900089. This document shows that this new design can withstand accelerations to 18g's without damage to the unit. The locator/ locks will be engaged during shipping. It is the shipping brackets that are designed to hold stage 1 in place however high accelerations could cause a high localized stress inside the lock. Should this happen there could be damage to the pin or sleeve which will require replacement. These locks will however protect the rest of the system including the

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electromagnetic actuators from damage. Upon arrival the pin and sleeve will be inspected and replaced if necessary. The position sensors will either be removed or spaced far enough apart to prevent damage.

b. To reduce the risk of damage we will transport the HAM ISI units on an "Air Ride" equipped tractor-trailer. The benefits of the air-ride platform will be to "short out" the impact forces on the structure due to inertial loading and distribute them over a wider time period. The air-ride isolators on the trailer must be adjusted to match the mass of the load. If this is done and the operator maintains a reasonable speed the shock load under most conditions does not exceed 5g's

c. The requirement for the HAM ISI design is:
Earthquake/shipping: 1g (dead weight) plus any of the following
cases, considered separately:
+/-0.5g X
+/-0.5g Y
+/-1.0g Z
The shipping brackets will protect the equipment during shipping and dampening springs will be designed into the pallet/ skid to reduce dynamic accelerations to 5g during loading and unloading.

d. Loading and unloading of the HAM ISI units is a major threat to shock induced loading. Shock forces in excess of 10 g's can occur during the loading and unloading of the transport vehicle. For this reason:
    1. A dedicated truck will be required to go directly between sites.
    2. LIGO personal must witness both the loading and unloading
    3. Fork lift trucks rated at a minimum of 10,000 lbs are to be used for the loading and unloading.
    4. During transport on the fork lift truck the height above the ground should not exceed 6" and the speed of the fork lift should not exceed 5MPH.

e. Prior to loading, the humidity indicators should read dry. An automatic pressure relief valve must be set to compensate for elevation change.

f. Upon arrival check for the following:
    1. Shock watches that may be tripped.
    2. Crate damage
    3. Humidity indicator settings.