USGS High Pressure Testing Chamber

Mechanical Engineering Department

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Objective

The objective of this project is to enhance a high pressure testing chamber in order to:

1. Significantly increase the pressure rating from 800 psi to 1472 psi.
2. Remove bolts in the top end cap to reduce assembly and disassembly time.

Purpose

Engineers and researchers at the USGS conduct research for underwater projects by deploying underwater instrumentation at depths exceeding 1000 meters below the surface of the ocean.

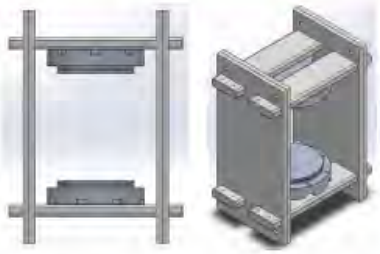
They are not able to test underwater instrumentation for design integrity and pre-deployment water tightness with the pressure chamber in its original configuration.

This project enhances the high pressure testing chamber at the USGS to enable the engineers to test instrumentation at 1472 psi, which is equivalent to the pressure at 1000 meters below the surface of the ocean.

Components

- L brackets
- Hand truck
- 5/8-11 bolts
- 1/4-20 bolts
- Strap and wedge
- Chamber end caps
- High pressure testing chamber
- T-handle clevis pins, 5/8" diameter
- 6061 T-6 Al side bars (12" x 24" x 5/8")
- A514 steel cross bars (4.5" x 18" x 1.25")

SolidWorks Design



The following components are shown:

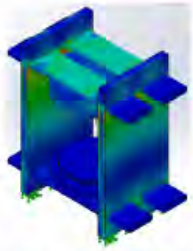
- Chamber end caps (2)
- A514 steel cross bars (4)
- 6061 T-6 Al side bars (2)

Note that each side bar consists of two pieces of 5/8" thick 6061 T-6 Al sheet stacked together. This was the most cost effective way to create side bars with integrity.

Fabrication

Fabrication of L brackets involved the use of a horizontal band saw, a drill press, and a mill.

SolidWorks Simulations



SolidWorks simulation results:

1. The maximum displacement of the top end cap is 1.0 mm. This is below the maximum allowed displacement of 3.0 mm.
2. The maximum stress in the framework is 63,700 psi and occurs in the cross bars. The cross bar material, A514 steel, has a yield strength 100,000 psi.
3. The framework design has a total life of 1,600 cycles.

Testing

1. Place underwater instrumentation into the chamber and fill the chamber with water.

2. Place the top end cap on the chamber. Place the chamber in the framework (not shown).

3. Use a hand pump to create a pressure of 1472 psi in the chamber.

4. After 20 minutes, release the pressure and remove the underwater instrumentation to inspect for damage.

Sponsor

United States Geological Survey
Pacific Coastal and Marine Science Center
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