Document Classification	
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Test Pod User's Guide

Revision	Date	Author	Change Log
6	11/6/2006	Jonathan Brown	Moved to standard document format

1 Introduction

The Test Pod in Figure 1.1 is to be used by CubeSat developers as an environmental simulation of the P-POD deployer shown in Figure 1.2, this will allow validation of the structural integrity of CubeSats under launch loads. The Test Pod interior is designed to simulate the environment inside the P-POD deployer. The Test Pod allows CubeSat developers to test their satellites to the environment inside the P-POD deployer rather than designing to the launch vehicle loads.

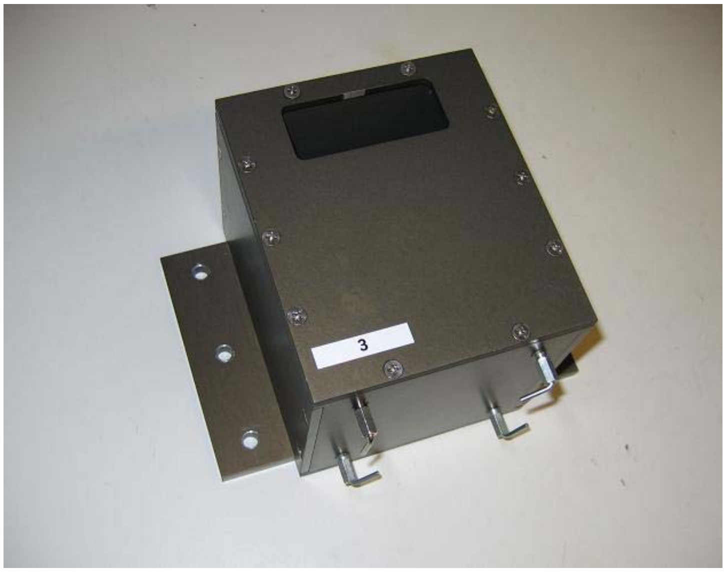

Figure 1.1: Test Pod

Figure 1.2: P-POD Mk. II

The Test Pod is not a fit check. CubeSats that do not meet the CubeSat Specification may still fit in the Test Pod. The developers are responsible for meeting the engineering specifications.

2 Description

The Test Pod interface control drawing is shown in Figure 2.1; this provides the necessary dimensions for adapting to your head plate. A Test Pod axis convention is also included in Figure 2.1, this will allow CubeSat developers to document and share results in a common format.

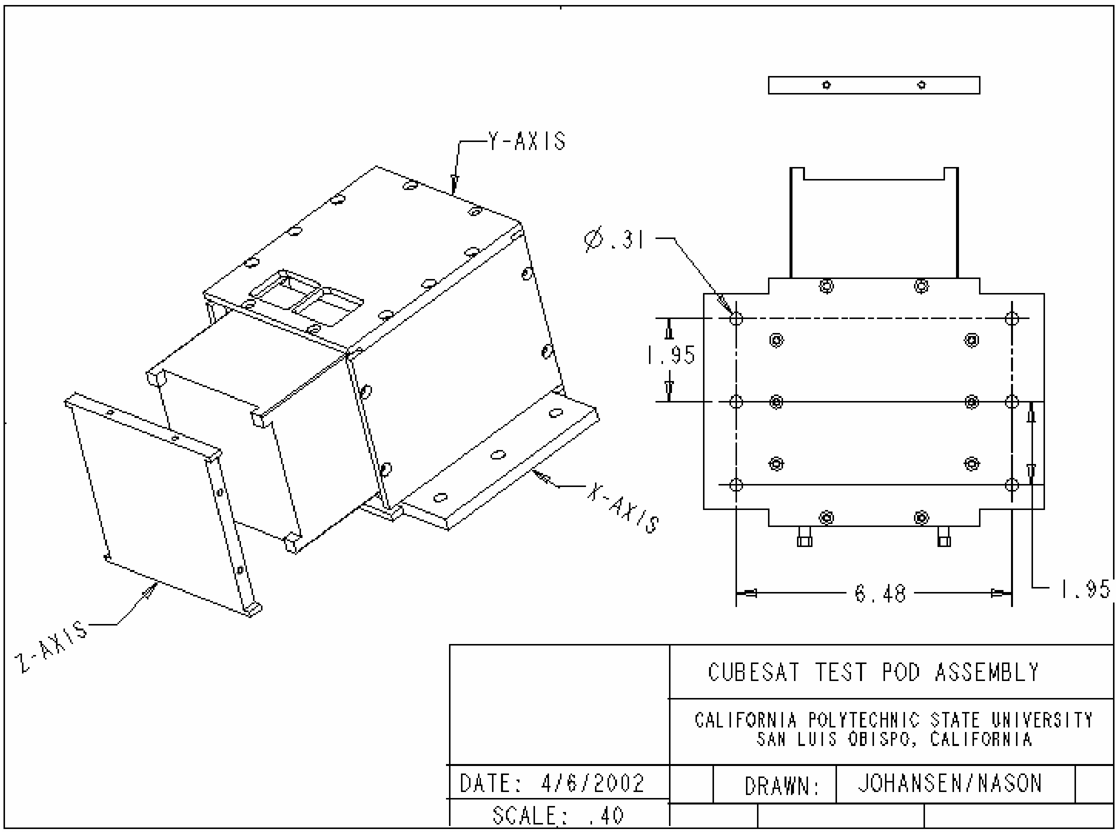

Figure 2.1 – Test Pod Interface Control Drawing

Table 2.1 gives the fundamental frequencies for the Test Pod's two primary axes. Sine sweep tests were repeatedly conduced with a 1 kilogram mass model inside to produce the resulting frequencies.

Table 2.1 – Test Pod Natural Frequencies

	Fundamental Frequencies (Hz)	
	X-AXIS	Z-AXIS
Test Pod	650	616

The intent is for CubeSat developers to share information learned during testing. Cal Poly will do its best to make all results available via the website (cubesat.org) or upon request.

3 Vibration Environments

A random vibration profile is provided specific to each launch vehicle. CubeSat developers can obtain random vibration spectral densities to input to their shake table controller by referencing launch vehicle user's guides. The NASA General Environmental Verification Specification (GEVS) is a "worst-case" vibration profile which encompasses all major launch vehicles.

Table 3.1 – NASA GEVS Random Vibration Profiles

Frequency (Hz)	ASD Level (G^2/Hz)	
	Qualification	Acceptance
20	0.026	0.013
20-50	+6 dB/oct	+6 dB/oct
50-800	0.16	0.08
800-2000	-6 dB/oct	-6 dB/oct
2000	0.026	0.013
Overall	14.1 G_{rms}	10.0 G_{rms}

4 Satellite Integration Procedure

4.1 Required Tools

- Phillip's head screwdriver
- Torque wrench (12 lb-in)
- ¼" Hex wrench
- Calipers

4.2 Procedure

4.2.1 Remove the 8 fasteners securing the top panel of the Test Pod, and remove the top panel from the assembly.

4.2.2 Remove the internal load plate from the Test Pod.

Refer to Figure 4.2.1 for the following dimension labels

4.2.3 Measure and record the thickness of the top panel (D) and the load plate (C).

4.2.4 Measure and record the overall height of the Test Pod from top to bottom (A), not including the spring plungers.

4.2.5 Measure and record the height for each of the satellite's four rails (B).

4.2.6 Calculate the height (H) that the spring plungers will protrude from the bottom of the Test Pod using the following equation:

Height (H) = Spring Plunger Length (L) + Satellite Height (B) + Load Plate (C) + Top Panel (D) – Entire Test Pod (A)

Nominal Values (Measure these yourself!):
Total Test Pod Height (A) = 147.83 mm (5.820 in.)
Satellite Rail Height (B) = 113.5 mm (4.469 in.)
Pusher Plate Thickness (C) = 6.60 mm (0.260 in.)
Top Plate Thickness (D) = 9.80 mm (0.386 in.)
Spring Plunger Length (L) = 31.75 mm (1.25 in.)
Height (H) = 13.82 mm (.544 in.)

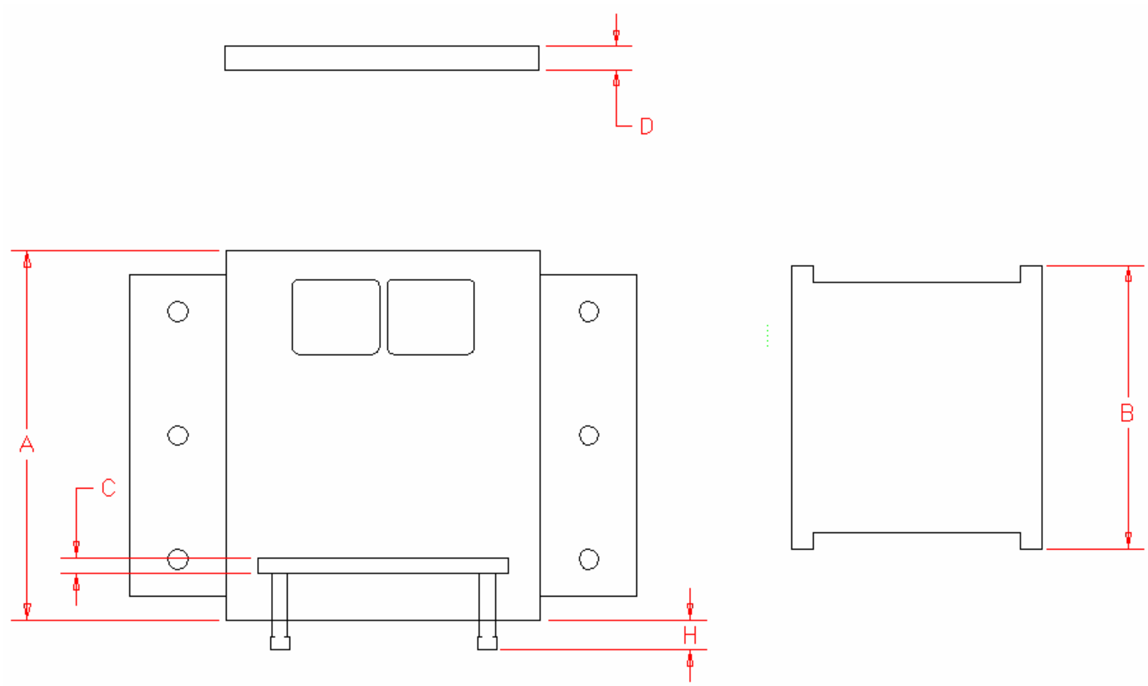

Figure 4.2.1 – Test Pod Dimension Labels

4.2.7 Once H has been calculated, measure how far the spring plungers are currently sticking out from the bottom panel. They should be sticking out at least a quarter inch farther than necessary at this point.

4.2.8 Insert the load plate into the Test Pod so that it rests flat on the spring plungers.

4.2.9 Carefully insert the satellite into the Test Pod.

4.2.10 Reattach the top plate to the Test Pod using the 8 fasteners. Lightly tighten the fasteners so that the panel is correctly aligned.

Note: It may be necessary to perform this step while the Test Pod is resting on the back panel (the side with the flanges) so that the lever portion of the spring plunger is free to move. The spring plungers are constructed such that the tip is rigidly connected to the L-handle in the back, so pushing down on the spring plungers while the test pod is resting on them will not do anything.

4.2.11 Torque the fasteners in an alternating pattern to 12 lb-in.

4.2.12 Use the ¼" wrench to tighten the spring plungers to the calculated H value from step 4.2.6. Tighten them in an X-shaped pattern to prevent the satellite from resting at an angle inside the Test Pod.

4.3 De-integration Procedure

4.3.1 Loosen the spring plungers 5-10 turns.

4.3.2 Remove the 8 fasteners securing the top panel. It may be necessary to have someone else press down on the top panel to keep it in place because of the spring forces acting on it.

4.3.3 Remove the top plate.

4.3.4 Carefully remove the satellite from the Test Pod.

4.3.5 Reattach the top plate using the 8 fasteners.