WILLIAM E. BOEING DEPARTMENT OF
AERONAUTICS & ASTRONAUTICS
College of Engineering

AA421
Leveling System Test Procedure

SPACE Lab

Part Name: _____

Part Number: _____

Date: _____ / _____ / _____
yyyy mm dd

Test Team:

Name	Initials

Test Objective

Verify through testing that requirements Sys.7 and Sys.8, structures requirement Ls.1, and avionics requirements Ls.5 and Ls.6 will be met through the ability of the stepper motor to accurately move the structure of the leveling system. The stepper motor has a step size of 1.8 degrees, with a push rod thread pitch of 20 threads per inch and a length of 4.30 inches. This corresponds to a vertical displacement of 0.00025 inches per step of the motor. The ability of the leveling system to accurately bring the test stand back to the zero point will be verified by measuring the vertical displacement, which must be no more than 0.000639 inches +/-50%, of each step of the NEMA 23 stepper motor. The total angular range of the stepper motor, which should be at least 1.5 degrees in both directions, can be verified by measuring the vertical displacement of the leveling system as the stepper motor is worked through its full range of motion.

Equipment Required

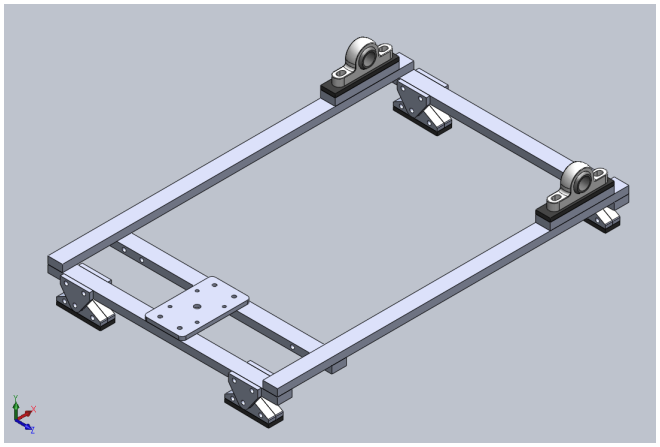
Qty	Description	Specs/Calibration	Check
1	NEMA 23 Stepper Motor		
1	Chamber Interface Assembly (p/n-CIA1)		
1	Leveling System Assembly (p/n-LSA1)		
4	2.5 kg masses		
1	0-1.25” Dial indicator	0-1.25”	
1	Scientific Bubble Level		

Test Procedure

1 Setup

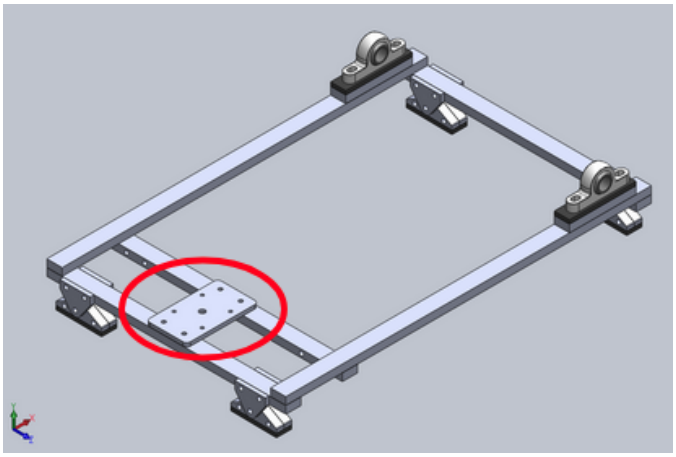
Assemble chamber interface assembly (p/n-CIA1) per assembly instructions

OK?_____



Mount NEMA 23 stepper motor with threaded pushrod onto the leveling system stepper motor mount, indicated in red, (p/n-SMM1) of the chamber interface

OK?_____

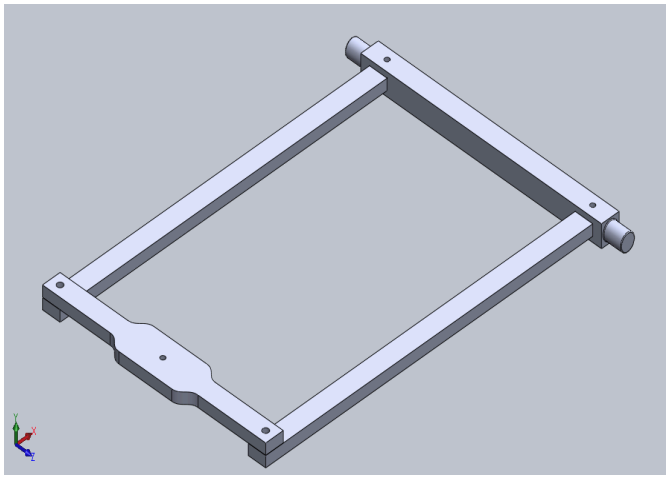


Set DM556T driver to 200 steps/rev per instructions on the side of the device.

OK?_____

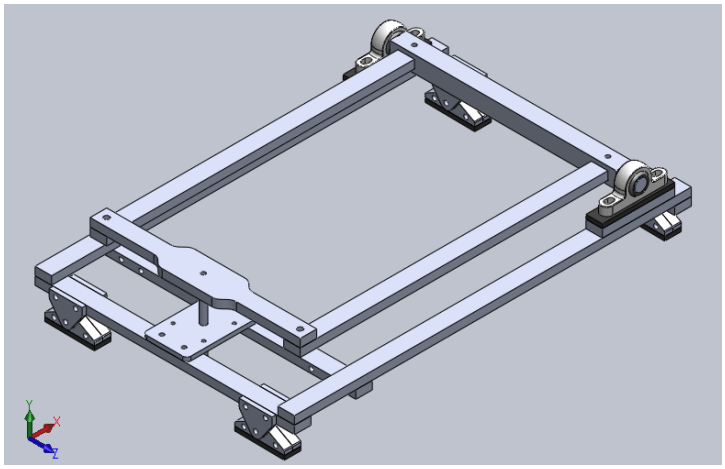
Assemble leveling system (p/n-LSA1) per assembly instructions

OK?_____



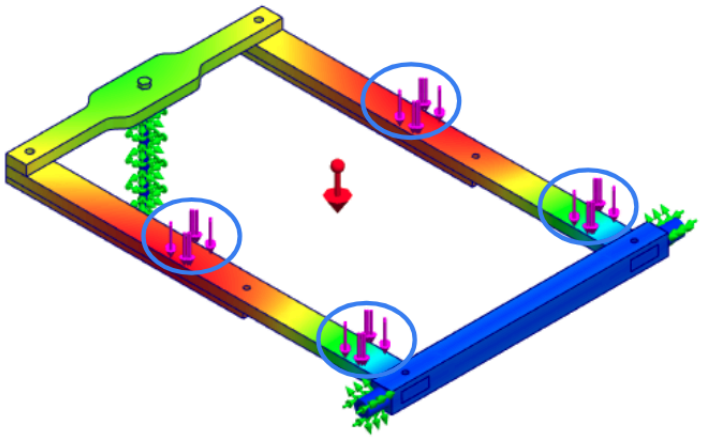
Install leveling system onto chamber interface per assembly instructions

OK?_____



Install 2.5 kg masses at the four pendulum mounting points on the leveling system longitudinal struts (p/n-LSLS1) indicated below to simulate maximum loading of the test stand pendulum assembly

OK?_____



Using scientific bubble level, level leveling system assembly

OK?_____

Zero dial indicator on the leveling system radial strut (p/n-LSRS1) directly above stepper motor pushrod

OK?_____

Plug motor molex connector into motor driver molex connector on black box

OK?_____

2 Power Up

Check that DC power supply supplies between 20 - 30 VDC

OK?_____

Plug DC power supply into power supply connector on black box

OK?_____

Confirm that the motor driver unit within black box has green LED lit up on the side with wire inputs.

OK?_____

3 Test

Using Python code to command stepper motor through Arduino, command stepper motor to travel 1 step positive and record displacement measured by dial indicator

_____in

Is this value less than 0.00035 inches +/-50%?

OK?_____

Re-zero dial indicator

OK?_____

Using Python code to command stepper motor through Arduino, command stepper motor to travel 1 step negative and record displacement measured by dial indicator

_____in

Is this value less than -0.00035 inches +/-50%?

OK?_____

Level leveling system using bubble level

OK?_____

Using Python code to command stepper motor through Arduino, command stepper motor to travel 1942 steps positive and record displacement measured by dial indicator

_____degrees

Is this value greater than 1.5 degrees +/-5%?

OK?_____

Level leveling system using bubble level

OK?_____

Using Python code to command stepper motor through Arduino, command stepper motor to travel 1942 steps negative and record displacement measured by bubble level

_____degrees

Is this value less than -1.5 degrees +/-5%?

OK?_____

4 Shut down

Stow dial indicator in box to return to AA machine shop OK?_____

Unplug power supply from wall

OK?_____

Remove leveling system from chamber interface

OK?_____

Remove NEMA 23 stepper motor from chamber interface

OK?_____

Store pendulum parts and frame in box and return to AERB 139

OK?_____

Change Log

Ver	Date	By	E-mail	Change
1.0	4/26/2024	Adam Delbow Winston Wilhere	adelbow@uw.edu wilhere@uw.edu	Initial release.