Update 3/23/2026

The “Stiction” rabbit hole

From Merriam-Webster: “The word is a blend word formed from the *st-* of static ("of or relating to bodies at rest") and the *-iction* of friction ("the force that resists relative motion between two bodies in contact"). So, basically, it means "static friction" (or to put it another way, "stationary friction").”

This Project was almost killed due to Stiction. After sitting for 12 hours or more, the Piston would literally get stuck. Too much grease was the culprit. This led to testing various lubricants.

Grease is out, oil is in.

Lubricant Test:

- Super Lube Silicone Grease
- Slickoleum Grease
- Super Lube O-ring Lubricant
- Labelle Oil #108

Right now the winner is the Super Lube O-ring Lubricant. Long term use will determine maintenance requirements. The Piston acceleration rate was increased from 100 PPS to 400 PPS for quicker Fill and Empty times.

The Tank: scratch built vs commercial syringe.

I tried a 50mm acrylic tube and 3D printed Piston. Static sealing was excellent with 50 durometer O-rings, however, the dimensional tolerances of the tube were too loose and caused tight spots for the Piston. Credit goes to Danny Engelhardt of Maximus-Modellbau and his associates for choosing the syringe for a Piston Tank Ballast. For cost and reliability, the syringe is definitely the way to go.

Ongoing Work:

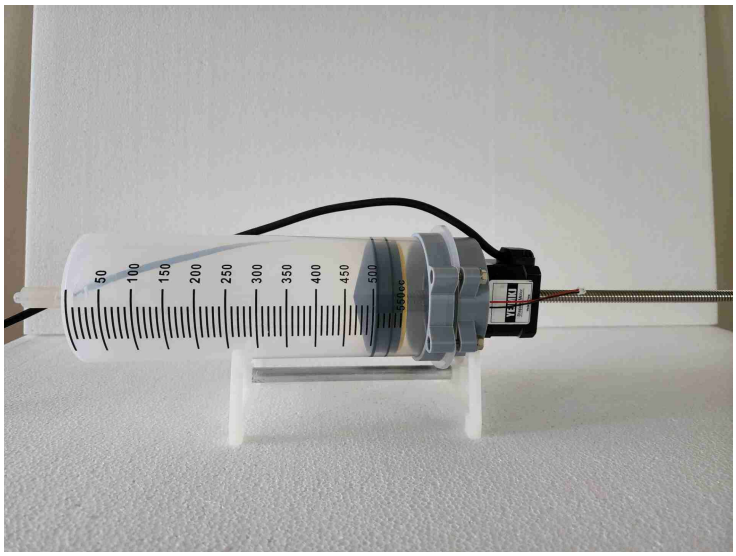
550mL syringe Piston Tank Development with NEMA17 Stepper Motor & 8x8 leadscrew.

300mL syringe Piston tank with originally tested NEMA11 linear actuator for dual Ballast System.

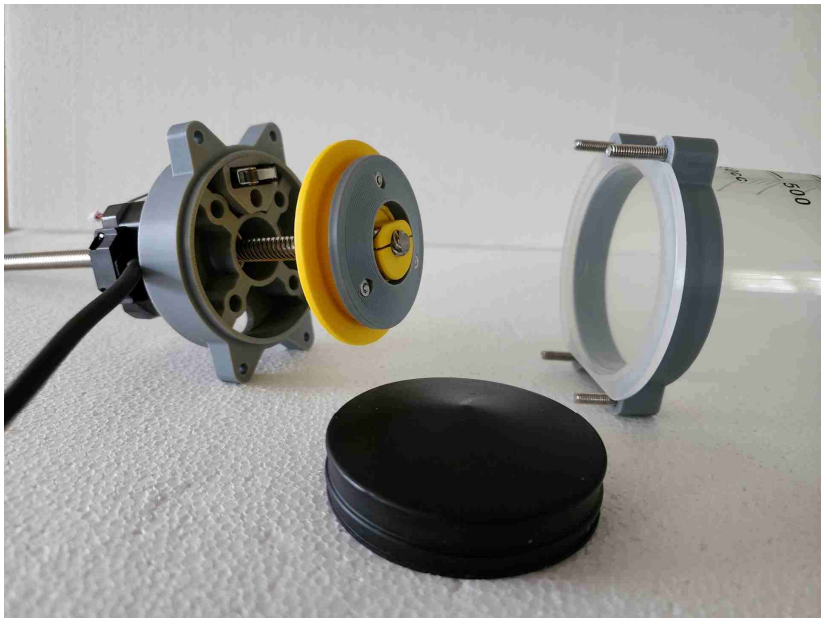
Cheaper Hardware:

5 DRV8825 Stepper Drivers on order at Amazon for 10 USD. Unlike the POLOLU Tic T500 Driver for 35 USD, these will require a microprocessor like the Arduino for control.

Scratch Built with Force Meter to measure static friction



550mL Syringe with NEMA17 Linear Actuator



550mL Component Breakdown