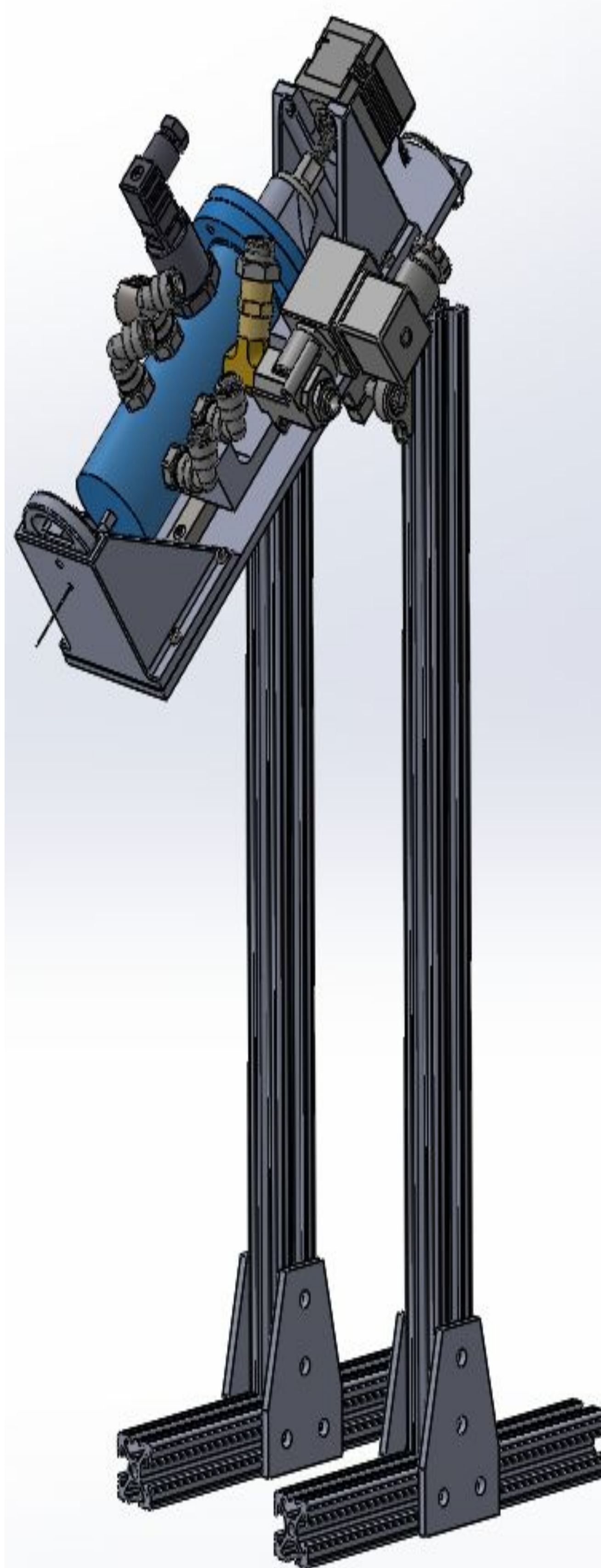


ABSTRACT

Glaukos, a medical device company specializing in glaucoma treatments, aims to reduce time and labor costs associated with cleaning hypodermic tubes ranging from 21-32 gauge. The team developed an automated washing device using a Tuohy Borst Hydraulic Block (TBHB). The TBHB seals the tube using a stepper motor and a consumable gasket, rotates 90° down and transport fluid from a reservoir for washing and rinsing. Key performance metrics include washing time, cleanliness and clog detection, with an estimated tube-washing duration of 26 seconds and cleanliness assessed via organic compound testing.

DESIGN OVERVIEW



To clean the inside of a hypodermic tube, we use air pressure to push liquids through them. We have a main container called a hydroblock that holds the cleaning solutions and the pressurized air. It is attached to a casing that moves it forward, compressing a silicon piece which in turn locks the needle in place. Then the hydroblock is turned from lying flat to pointing down. This helps gravity move the liquids to the bottom of the container so they can be easily expelled and do not splash.

When the hydroblock is vertical, we add each liquid one at a time and use air to push them through the hypodermic tube. Once we're finished, the hydroblock is turned back to its original flat position and the pressure is released through an air valve. The time it takes a needle to be cleaned is recorded by the pressure transducer. If it takes too long, that means there was debris in the needle and can not be used. The needle will then be replaced by a new one and the cycle repeats itself.

ROTATION

FUNCTIONS:

- Rotates the hydroblock
 - 90° down and 90° up
- Flush liquid through tube when rotated down
- Prepare clean tube for removal when rotated up

COMPONENTS:

- Metal gearmotor
- Motor coupling
- 5" steel shaft
- Pillow block bearing
- Shaft supports

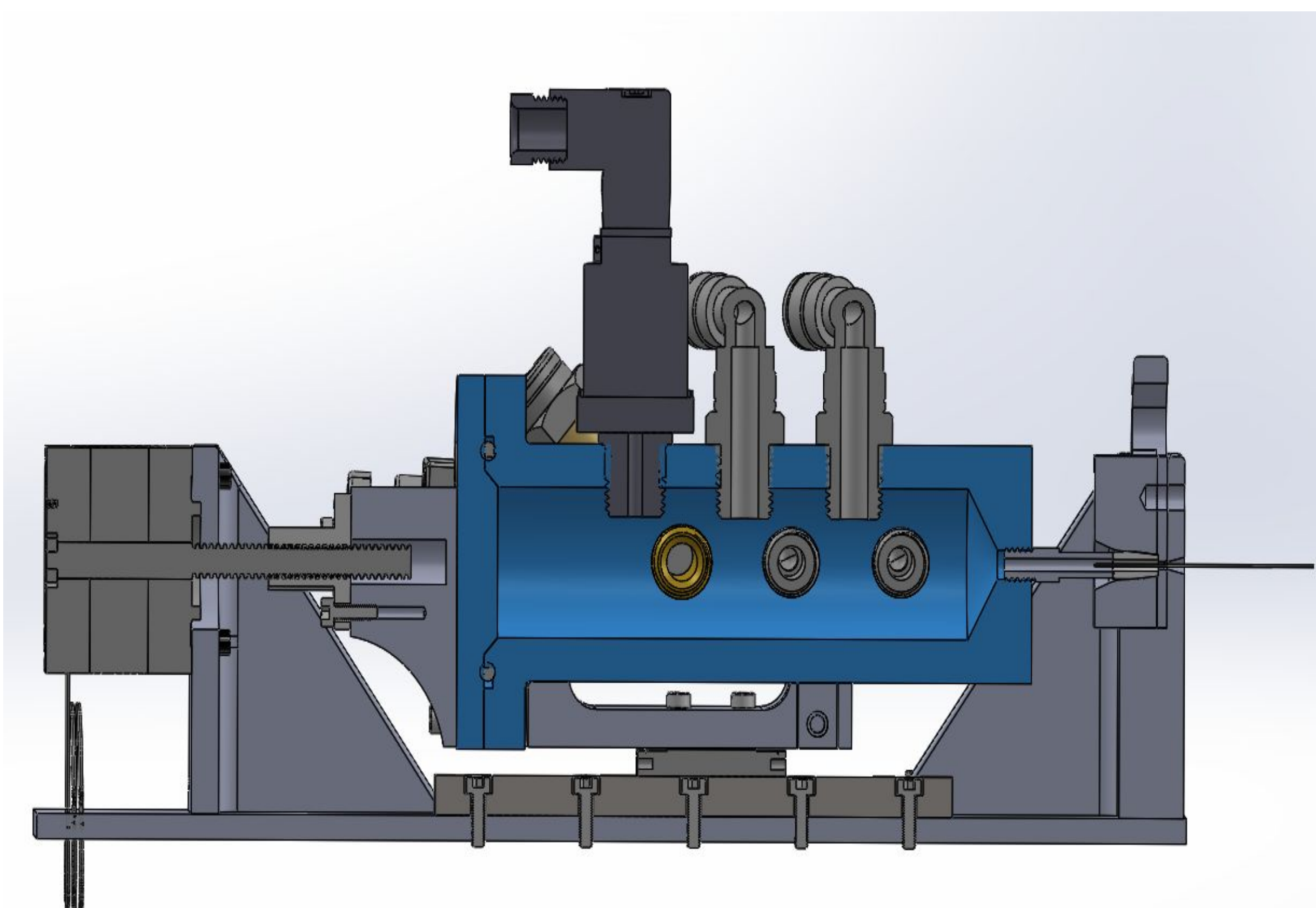
HYDROBLOCK

FUNCTIONS:

- Use pressurized air to flush cleaning liquid.
- Provide pressure data in order to analyze if a tube is clogged.

COMPONENTS:

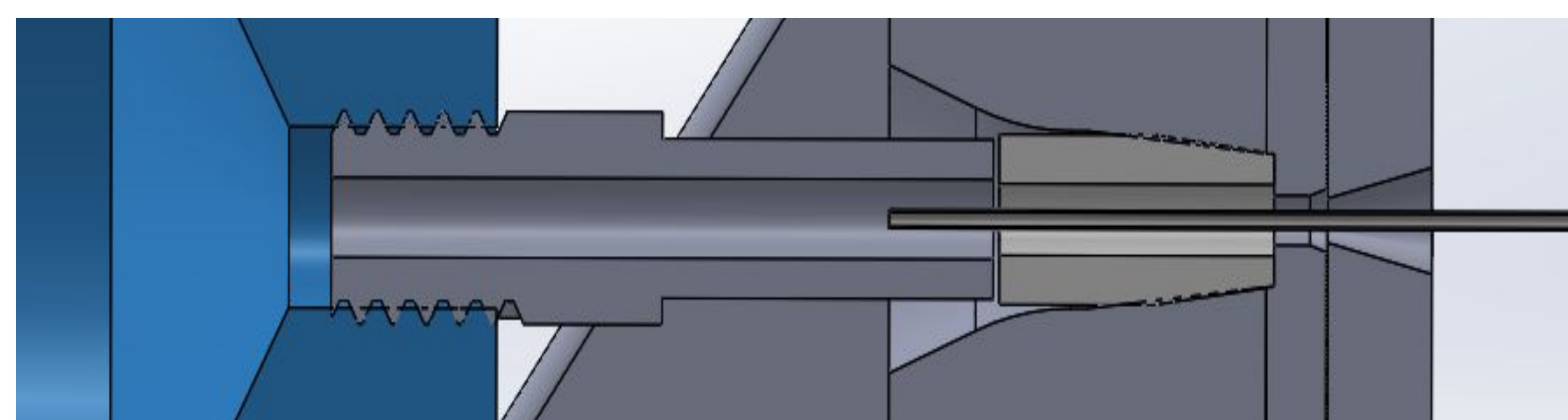
- Stepper motor
- Linear carriage
- 5 fluid inlets
- Pressure transducer
- Tuohy borst holder
- Air release valve



TUOHY BORST

SEALING FOR PRESSURE

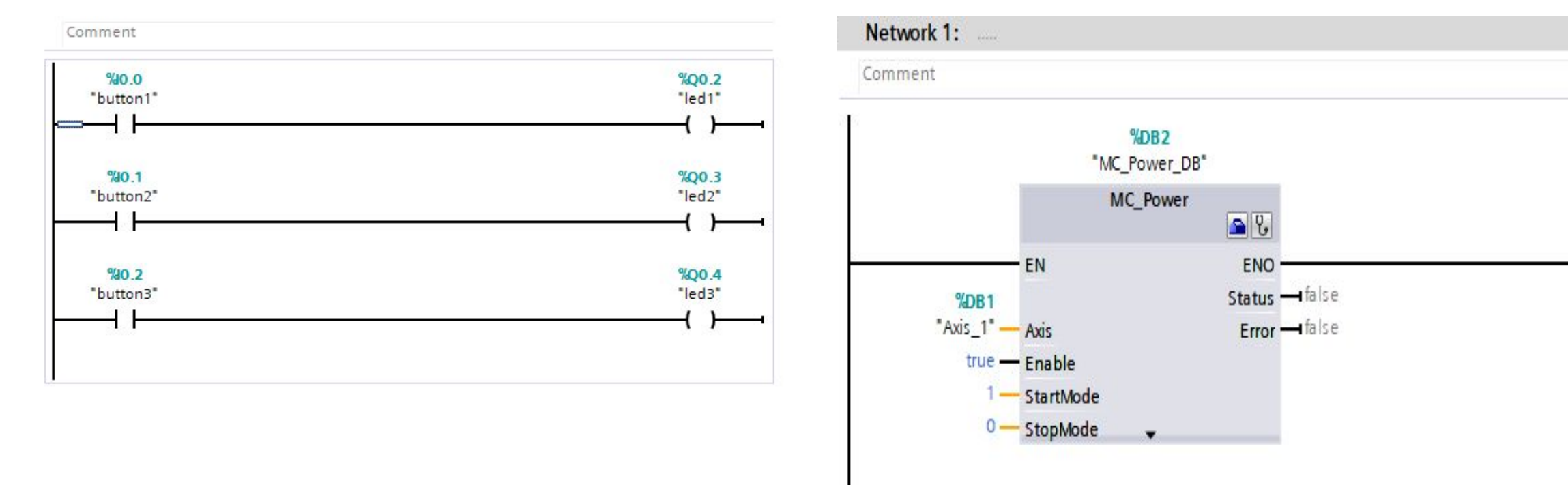
Using a Tuohy Borst silicon gasket and direct force to compress the seal around the tube, we achieved a successful seal with up to 100 PSI and a flow rate exceeding current methods.



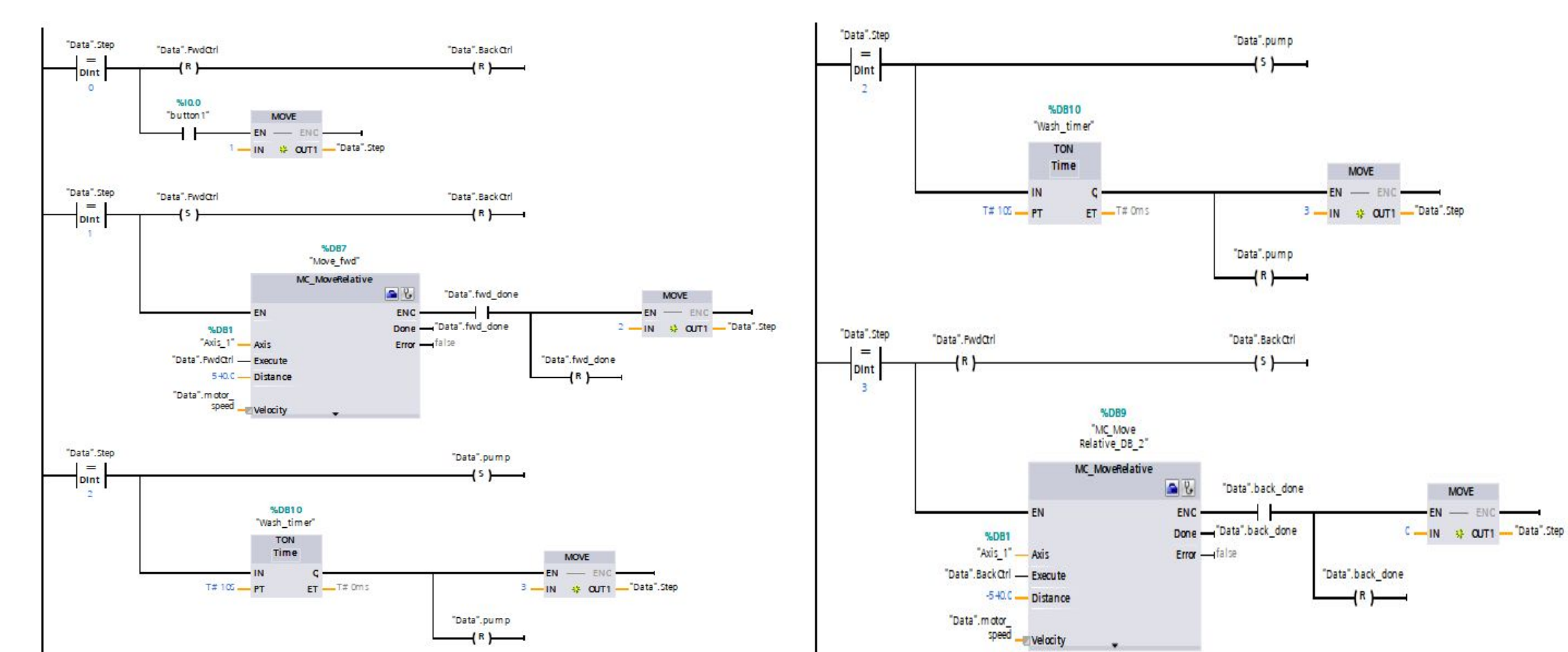
ONE TIME USE?

The tuohy borst silicon gasket is meant for single use; however, after a 2000 cycle compression test and multi day chemical baths. The tuohy borst silicon gasket was in tact and held the pressure.

PLC (PROGRAMMABLE LOGIC CONTROLLER)



CODED FUNCTION



Each part of the hydroblock from the linear actuator, pumps, rotation, etc., act on their own output/input. The code shown above sequences the actions taken to effectively and properly clean each tube.

VOLUMETRIC FLOW BASED CLOG DETECTION

