Modular Filler / Extractor

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Objective
Test the feasibility and efficiency of duckbill valves in an automated liquid actuation system.

Background
- Duckbills are a type of check valve
  - Open by applying force to each side
  - Allows for fluid flow in one direction
- Duckbills prevent contamination in medical devices and drainage systems

Specifications
- Minimum 8 duckbill valves
- Overall housing diameter < 10 cm
- Autonomous fluid dispensing
- No leakage
- 2 bar duckbill burst pressure
- Reusable actuating system
- Disposable device housing

Electrical System
- Shaft spins until switch activated in motor mount setting origin
- Arduino receives position from laptop user input (position 1-8)
- Stepper motor rotates to desired position
- Linear actuator extends to compress duckbill and dispense liquid

Improvements
- Different housing materials for ease of manufacturing, recycling, and lower cost (injection molding)
- Tighter tolerances; metric manufacturing
- Liquid rack designs
- Design and manufacture duckbills specific to our uses

Conclusion
- Would not recommend using duckbill valves for small scale, high precision work, specifically in life science industries
- Duckbill valves are viable for this application on larger scale because less precision is needed and more cost effective

Results

Preliminary Testing
- Duckbill Valve Burst Pressure Test:
  - Burst Pressure: 0.5 Bar
- Duckbill Compression Test:
  - 7 Newtons
- Duckbill Leakage Test:
  - Eliminated fluid leakage with the addition of a rubber grommet

Final Testing
- Actuator Alignment Test:
  - Aligned actuator with each valve
- Duckbill Valve Burst Pressure Test:
  - Burst Pressure: 0.5 Bar
- Zero Positioning Test:
  - Implemented switch to locate zero position

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Push sides of duckbill to open
Fluid flow through self closing direction

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