

### Pneumatic Actuated Folding Plates:

The folding plates are multi-part assemblies that are used to wrap the label after it has been positioned via the operator. The top plates are perforated with a cavity inside the assembly to pull vacuum pressure through to maintain control of the label during folding. The plates feature alignment edges to aid the operator in consistency when placing the label.

### Automated Hole Punching:

After the plates have fully folded, the additional stroke of the folding cylinder actuates a bell-crank punching head that cuts out the desired warranty date and catches the label scrap in a 3-D printed waste bin

### Problem Statement:

Raybend, a pump manufacturer in Kalamazoo, desired to address the problem of warranty labels being placed and dates being punched out inconsistently and inaccurately. The goal of the project was to reduce these errors of label misalignment and inaccurate date punching with an operator-assisted and repeatable process.

### Notable Changes:

Throughout the development of the Raybend cord wrapper, several major changes were made to enhance functionality and reduce costs to better accommodate the budget. The initial designs featured a fully automated system utilizing a PLC and numerous moving components and sensors, which proved to be cost-prohibitive. After a thorough redesign, the new model was divided into separate stages and relied solely on pneumatics, significantly streamlining the system and bringing it within budget constraints.

### Design Approach:

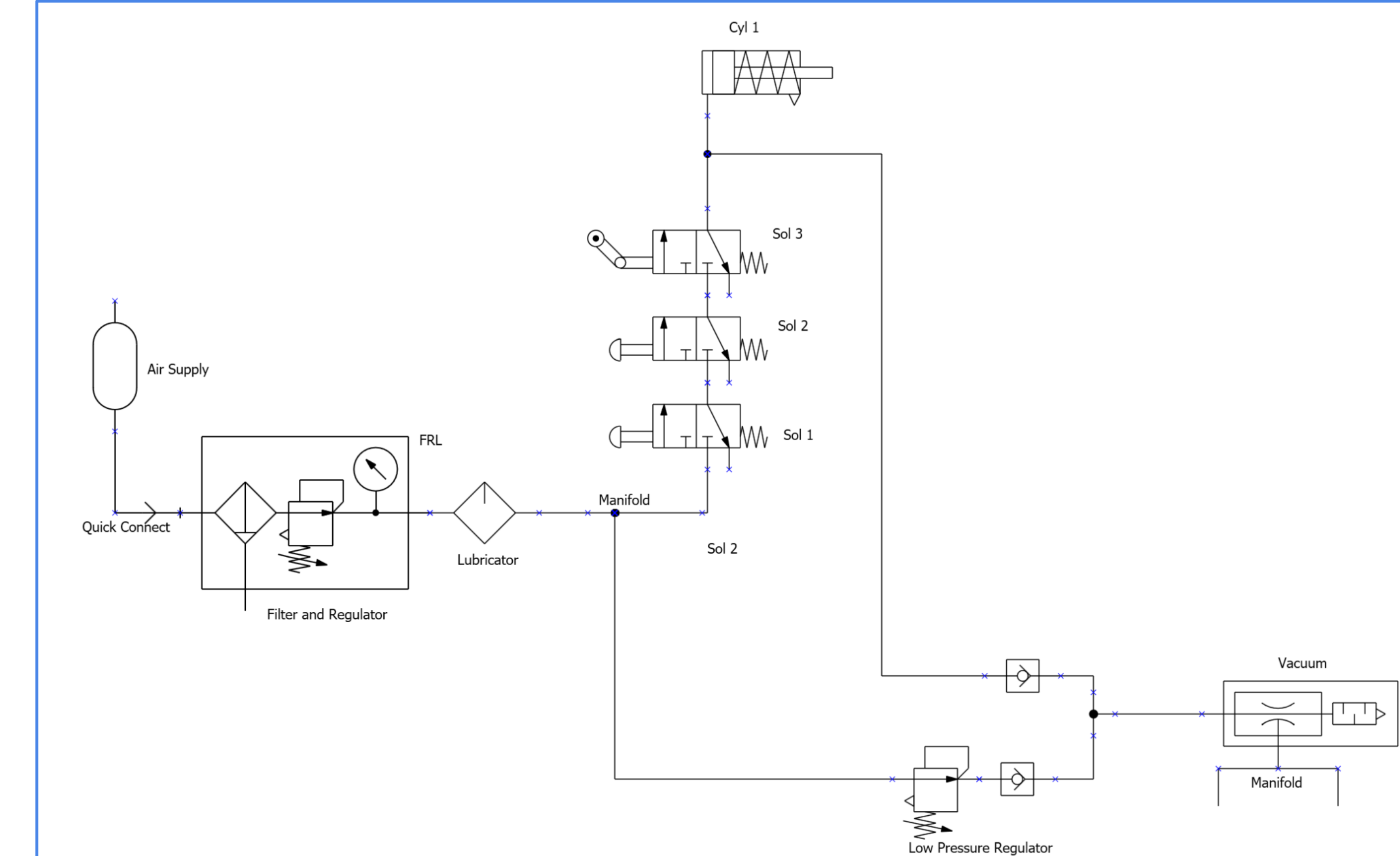
The design approach for the Raybend cord wrapper centered on user-centric principles, aiming to create a product that was functional, intuitive, and budget-friendly. Extensive research was conducted to understand the features and limitations of current cord wrapper assembly machines in industry. Based on these insights, prototypes were developed and tested. Iterative improvements were made to ensure that the final design met the desired criteria for usability and cost-effectiveness.

### Prototype Phase:

Throughout the prototype phase, the Raybend cord wrapper underwent several iterations. The initial prototypes focused on testing the core functionality of the folding plate mechanism. Subsequent versions aimed to enhance durability, user-friendliness, and operational efficiency while reducing costs. Utilizing 3D printing for initial prototypes allowed for swift design testing and refinement.

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### Fully Mechanical System:

The pneumatics system of the label machine features an exclusively mechanical design. 3 mechanical solenoids, 2 pushbuttons, and a foot pedal are utilized in series to create a safety check to ensure the operator's hands are outside of the folding area before the folding cylinder can actuate

### High/Low Pressure Venturi Vacuum:

A venturi vacuum generates a force on the label when placed on the folding plates to prevent slipping. Low vacuum pressure is the natural state of the vacuum achieved using an additional regulator that always enters the venturi vacuum. This low pressure allows for easier alignment of the label. High vacuum pressure is achieved when all three solenoids are actuated, allowing a higher-pressure air flow to reach the venturi vacuum generating a higher vacuum force when the folding actuation occurs. This high pressure prevents any label movement as the plates fold together

### Key Specifications:

1. Budget: \$3500
2. Cycle Time: The label application will take no longer than 45 seconds.
3. Success Rate: 99%, entirely legible with minimal or no overhang.
4. Label Specs: Overhang - 1/16 inches | Sides - 0.02 inches
5. Hole Punch Manufacturing Date on Label
  - I. Needs to be one month ahead of the current date