10 YEARS

NFPA

Fluid Power Vehicle Challenge

NFPA
Education and
Technology
Foundation

FINAL PRESENTATION & DESIGN REVIEW

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Captain/Hydraulics

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Other Team Members:
Jayden Boyd
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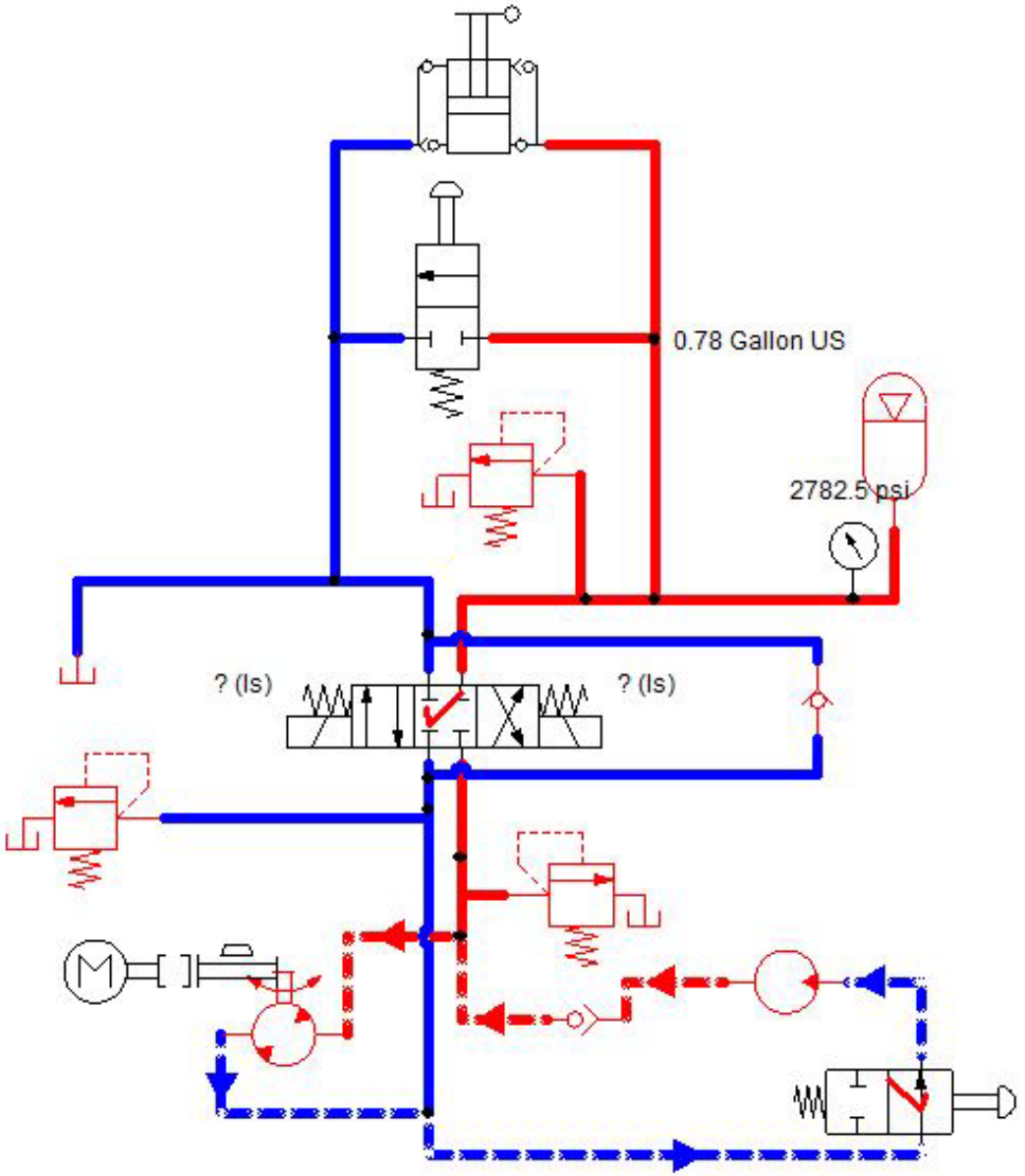
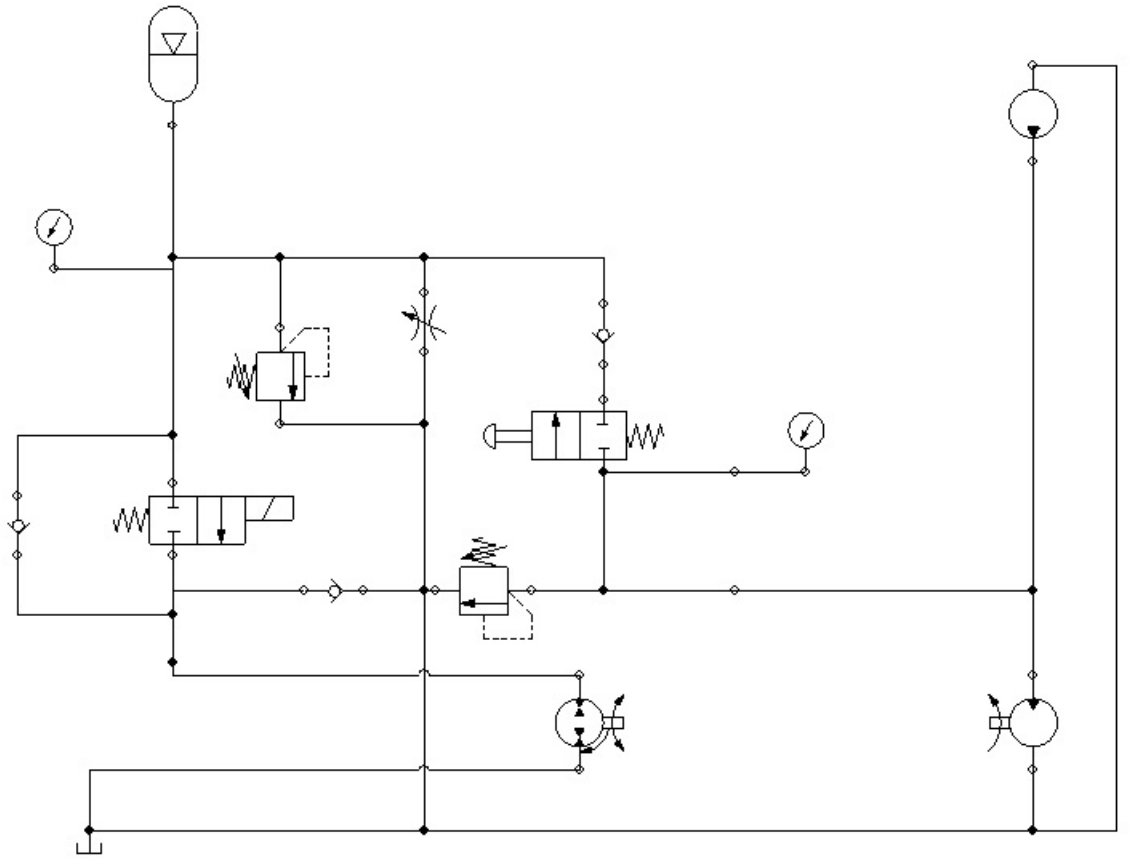
Old Schematic

- 2025 pedaling system
  - 4 way solenoid valve
  - Electronic heavy



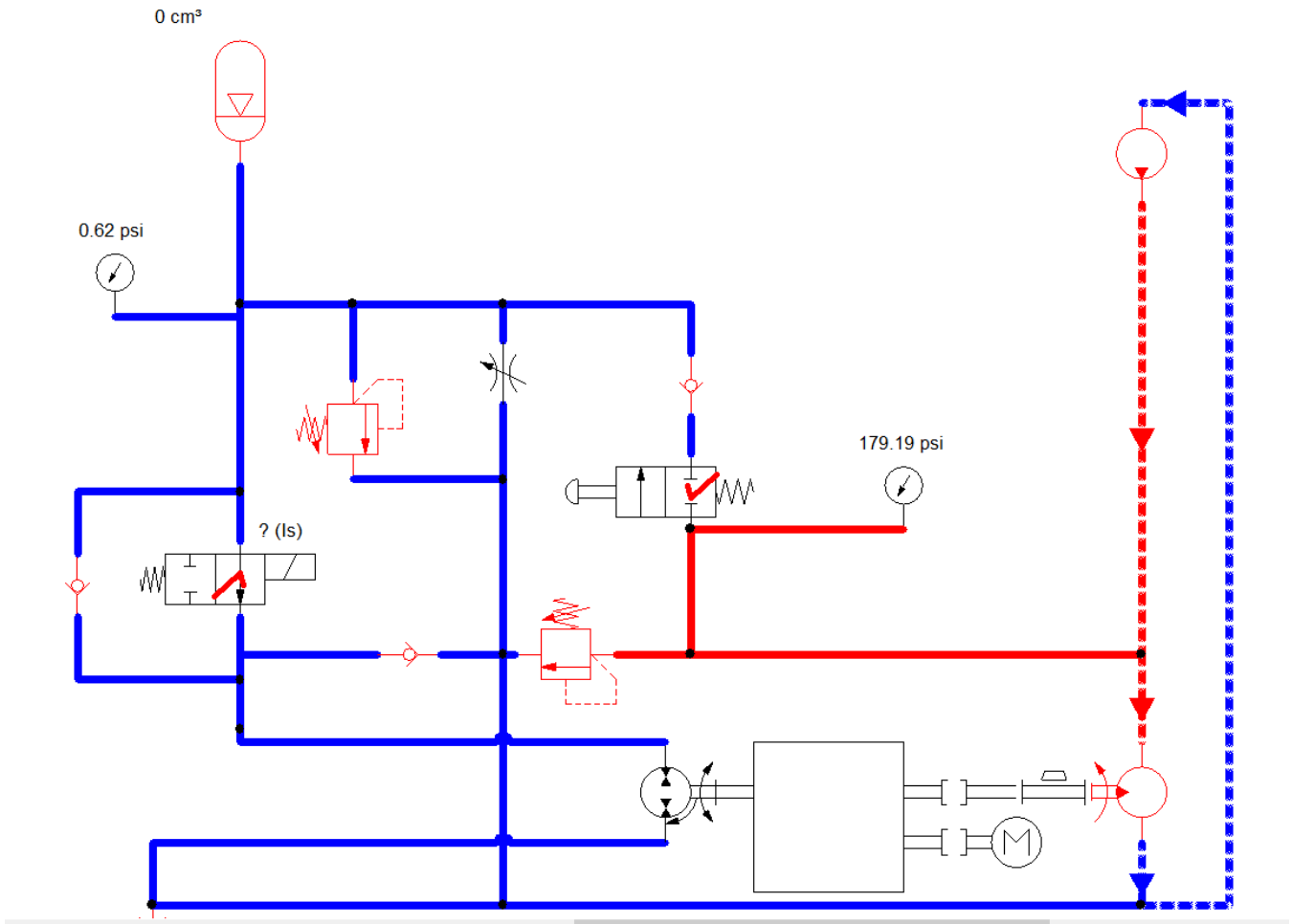
New Schematic

- Minimized complexity of circuit
- Effectively divides circuit into two “sides”:
  - Human Loop
  - Accumulator



Human Loop

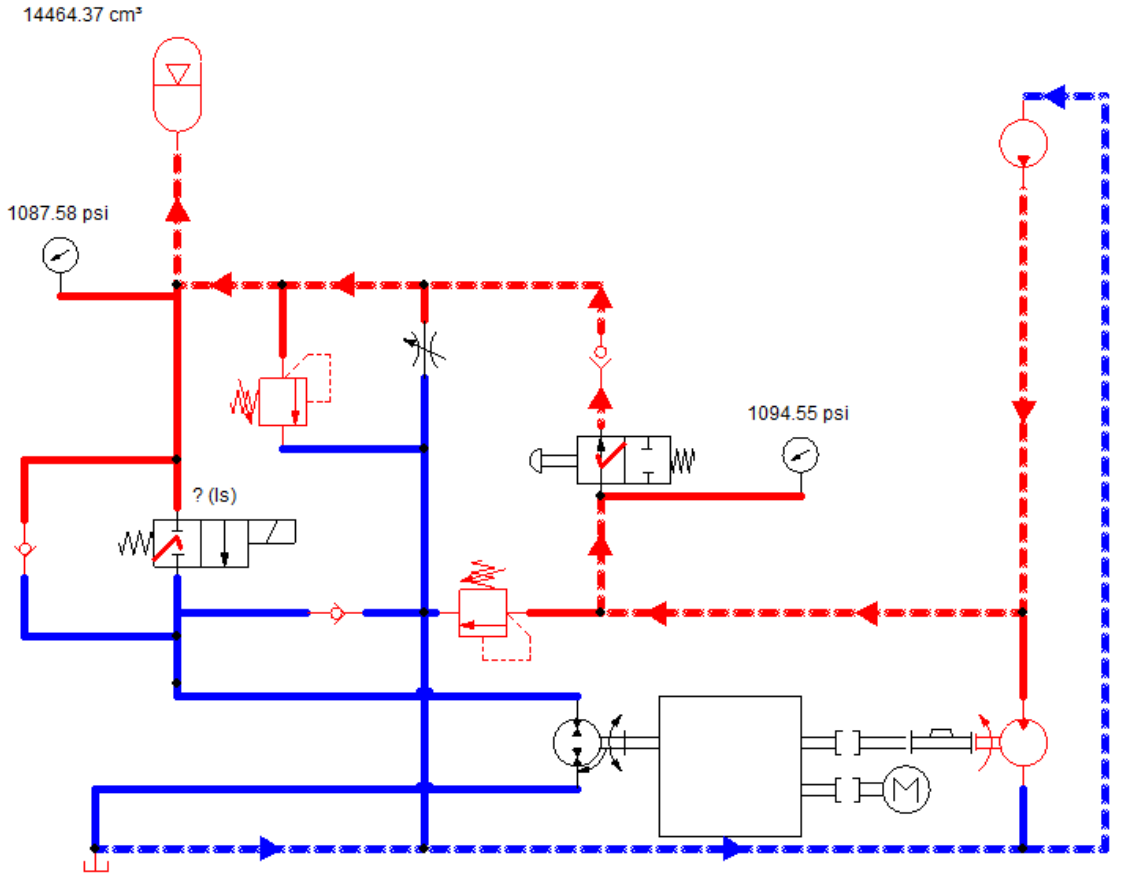
- Used to move fluid from the gear pump to the HEM which turns the wheel.
- Can charge accumulator, if bike is held stationary



Moving-Human Power

Human Loop

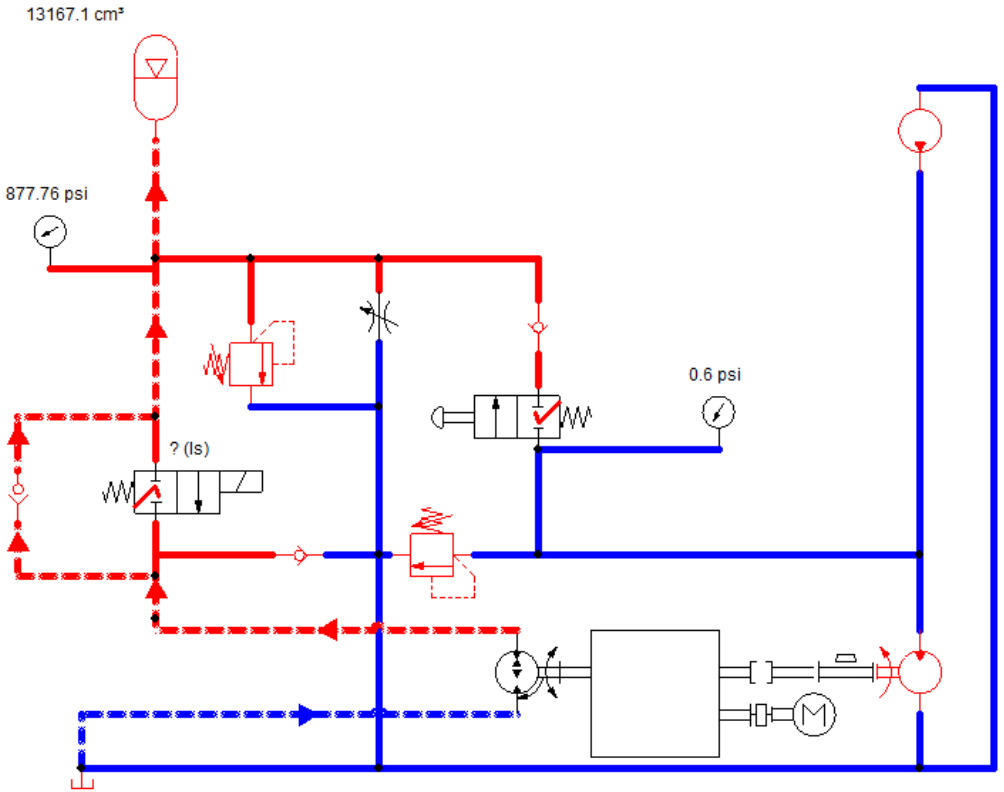
- Used to move fluid from the gear pump to the HEM which turns the wheel.
- Can charge accumulator, if bike is held stationary



Charging-Human Power

Accumulator Side

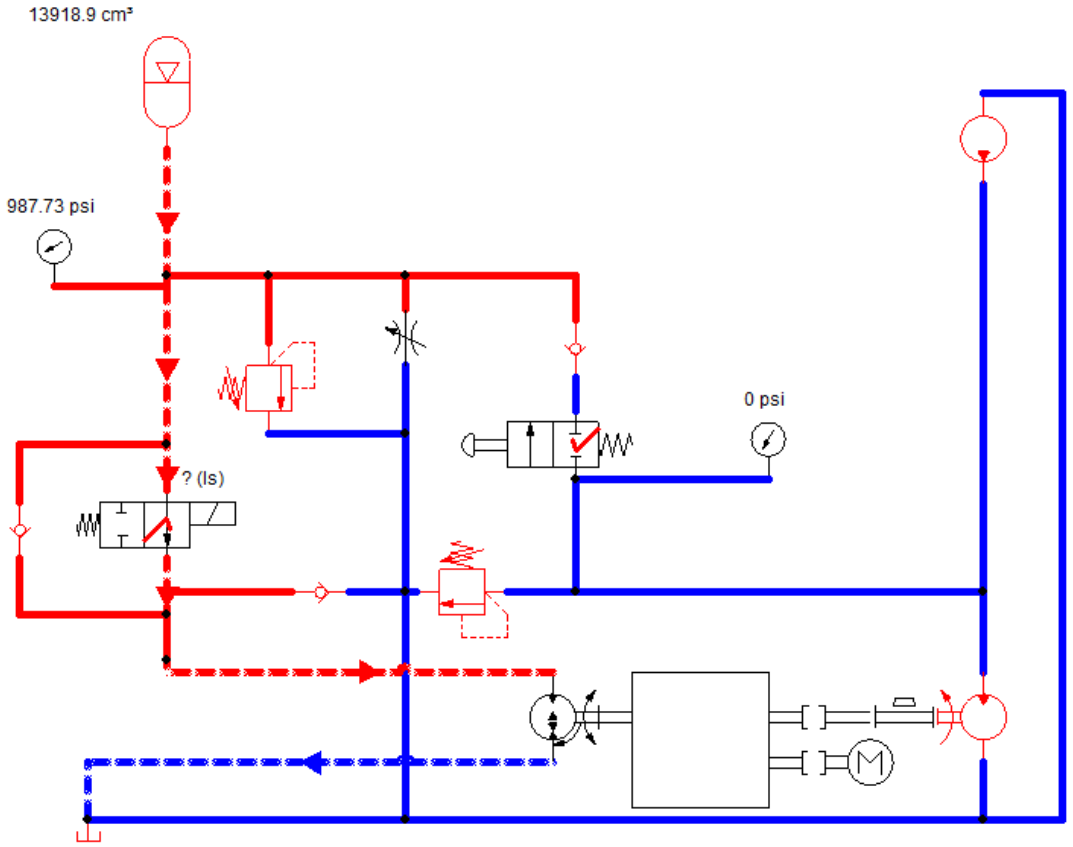
- The overpressure section for the accumulator dumps through the pressure relieving valve
- Putting the system into charge mode allows the motion of the vehicle turn the HEM to fill the accumulator
- Discharging it spins the HEM the opposite direction (rotation direction is reversed by transmission)



Charging-Regen Mode

Accumulator Side

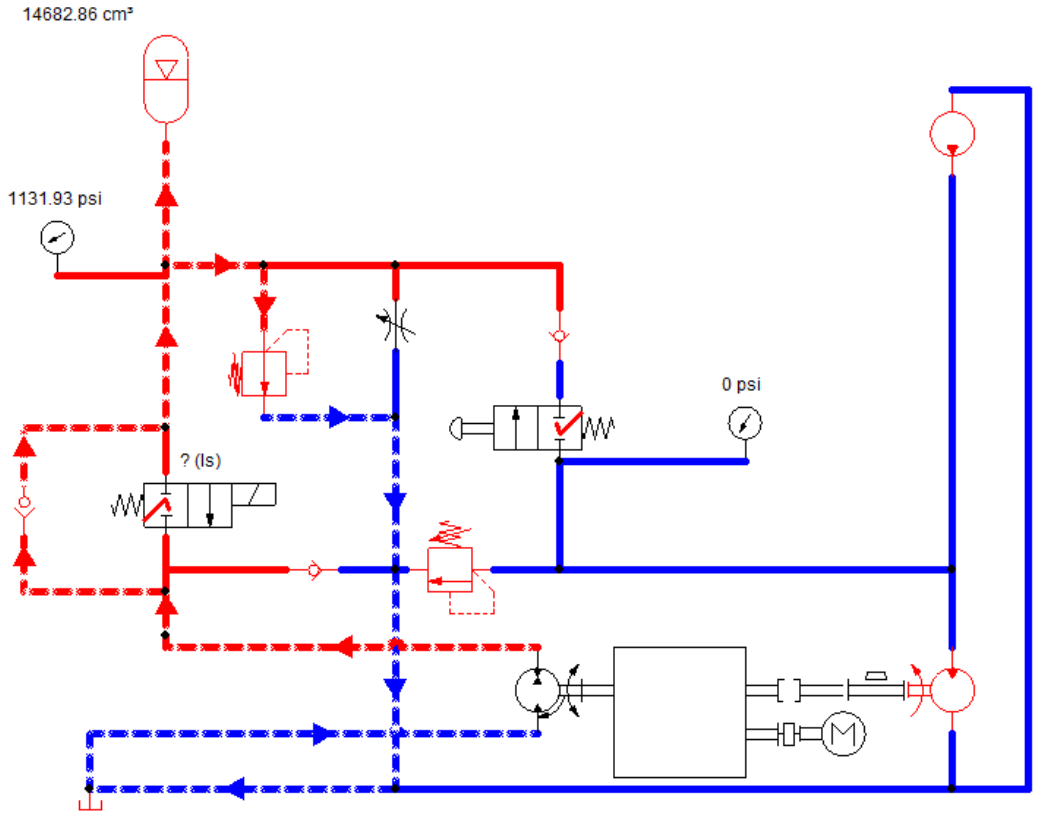
- The overpressure section for the accumulator dumps through the pressure relieving valve
- Putting the system into charge mode allows the motion of the vehicle turn the HEM to fill the accumulator
- Discharging it spins the HEM the opposite direction (rotation direction is reversed by transmission)



Accumulator Discharging

Accumulator Side

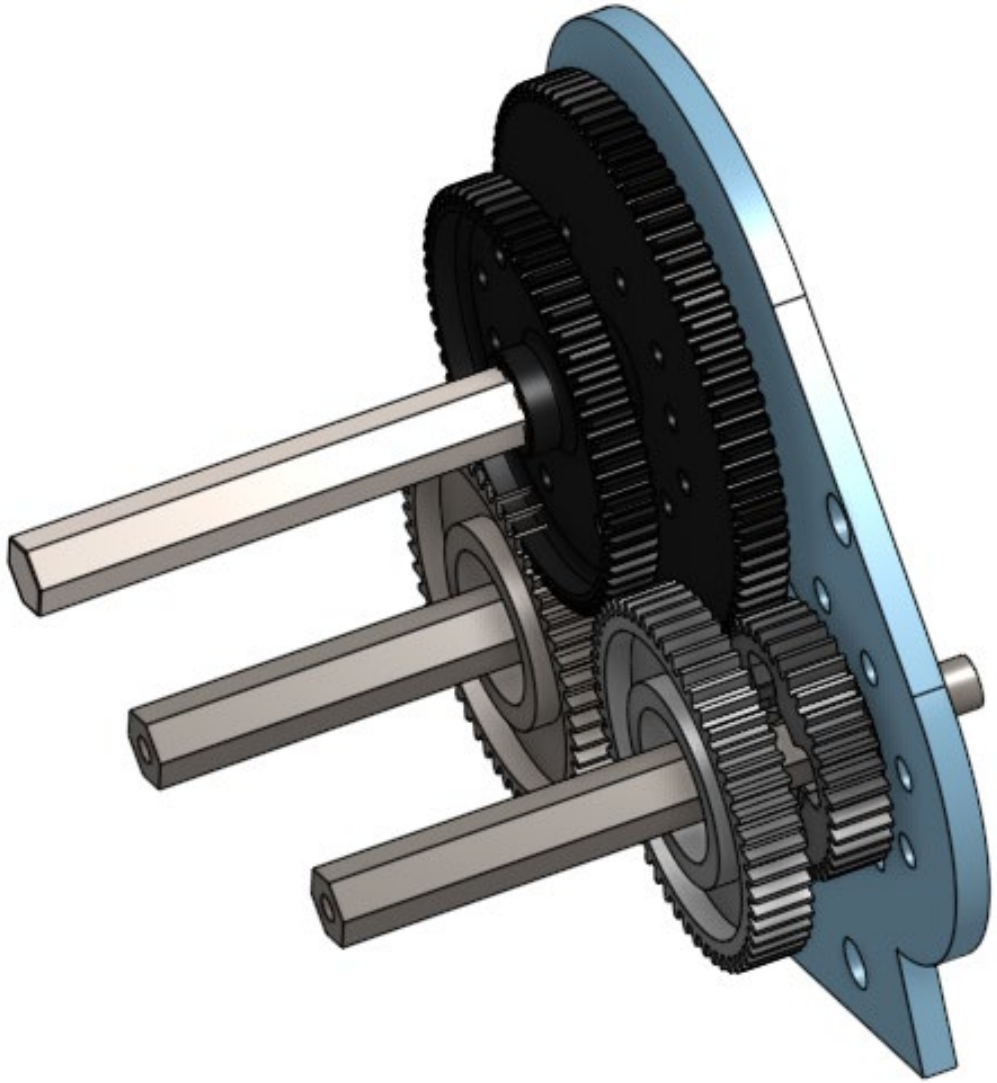
- The overpressure section for the accumulator dumps through the pressure relieving valve
- Putting the system into charge mode allows the motion of the vehicle turn the HEM to fill the accumulator
- Discharging it spins the HEM the opposite direction (rotation direction is reversed by transmission)



Overpressure Dumping

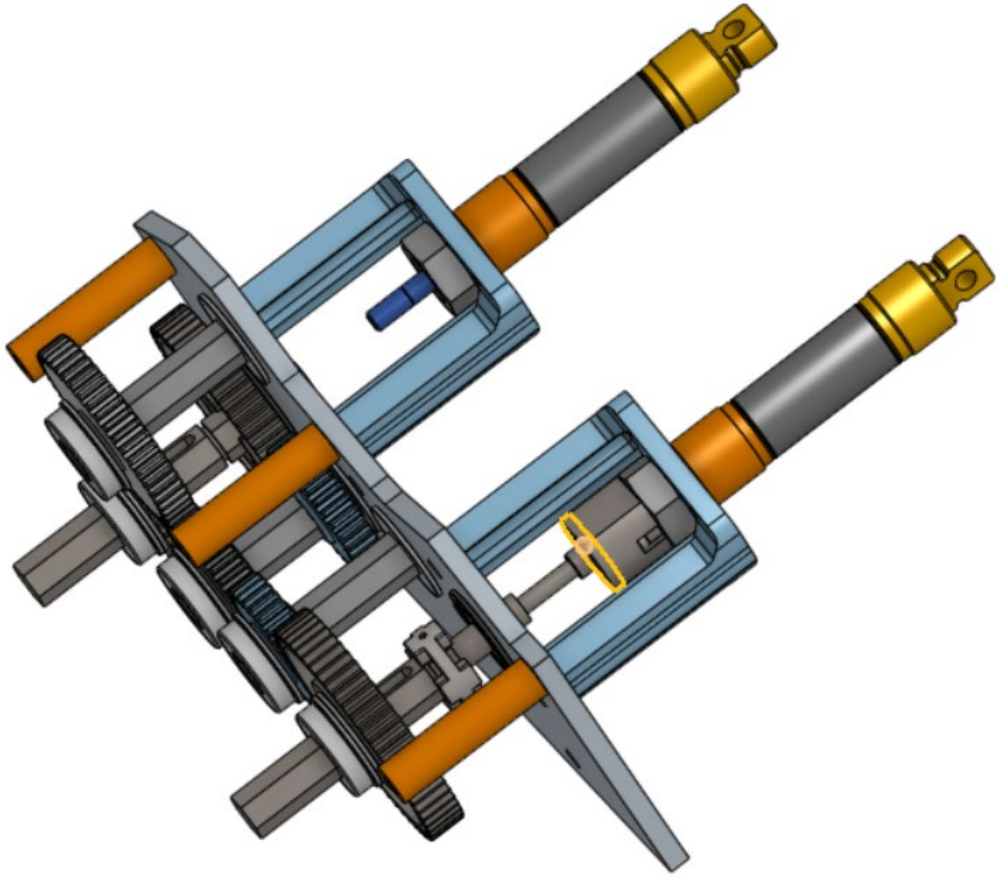
Old Powertrain

- Four-Speed manual transmission used for optimizing the gears for each race.
- Used a dynamic braking system for regen



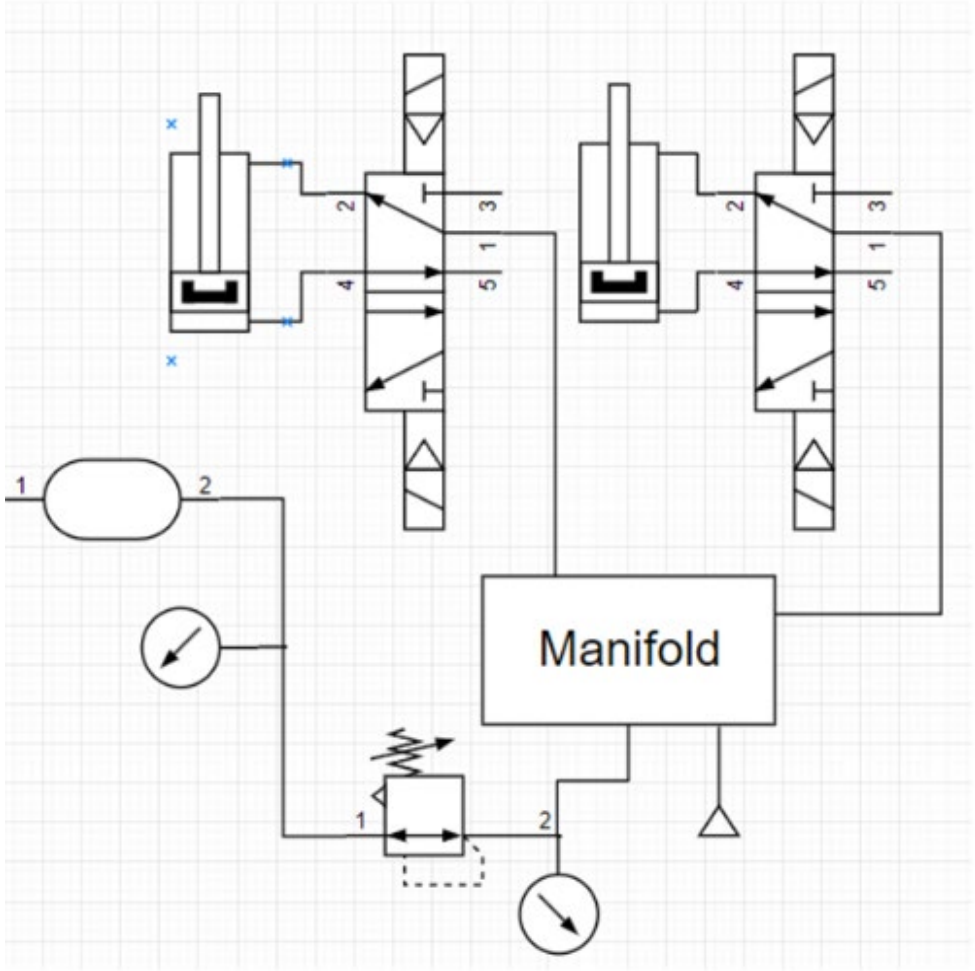
Powertrain

- The gearbox allows for a much simpler hydraulic circuit.
- Forward Gear provides the accumulator to discharge and make the bike move forward.
- Reverse Gear allows the system to regen into the accumulator while the bike moves forward.
- Coast gear disengages the wheel from the accumulator motor.



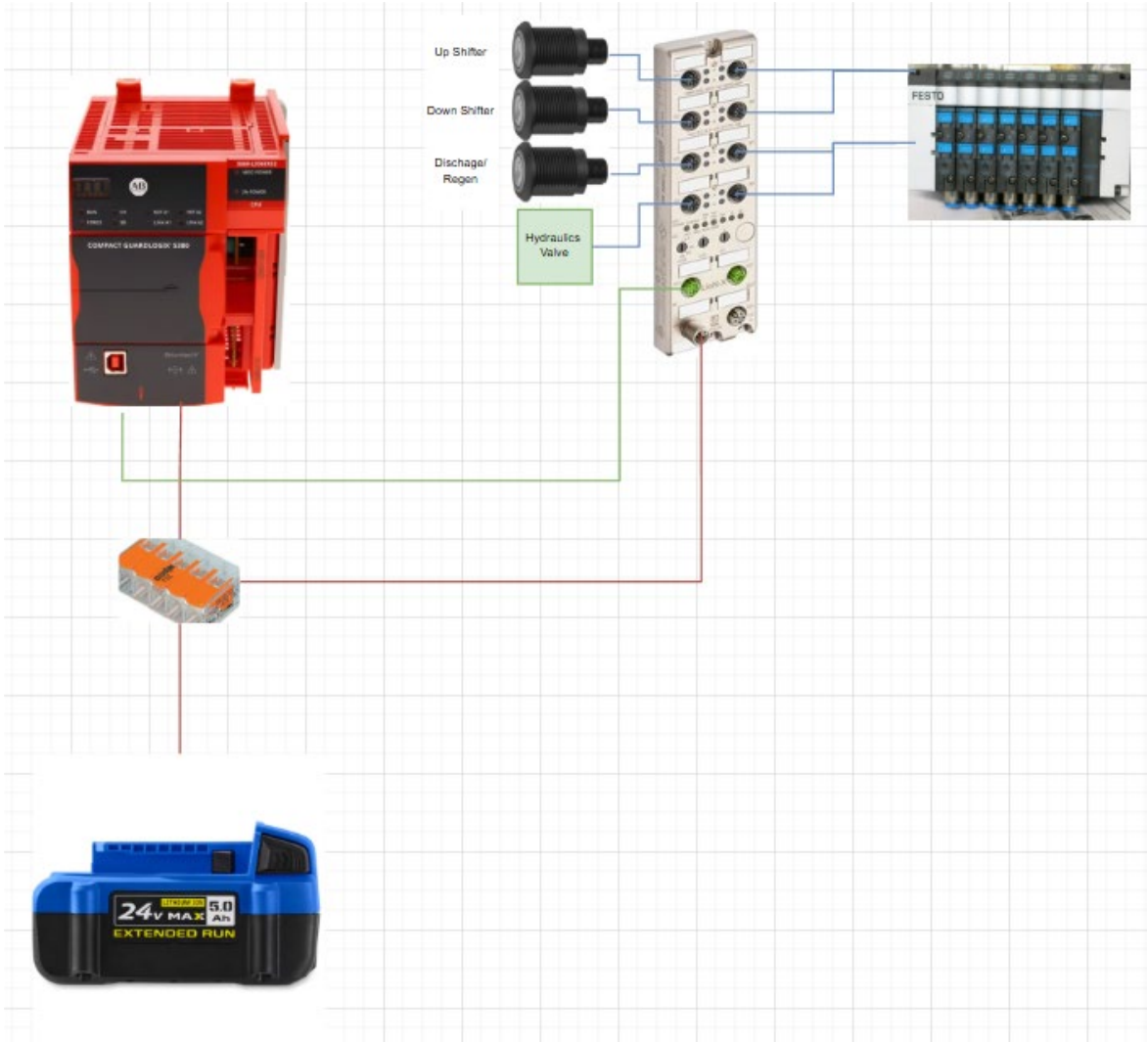
Pneumatics

- Using pneumatic shifters with brass dogs to shift between different gears
- Using two air tanks for the shifters
- The image is the schematic used for the pneumatic shifters



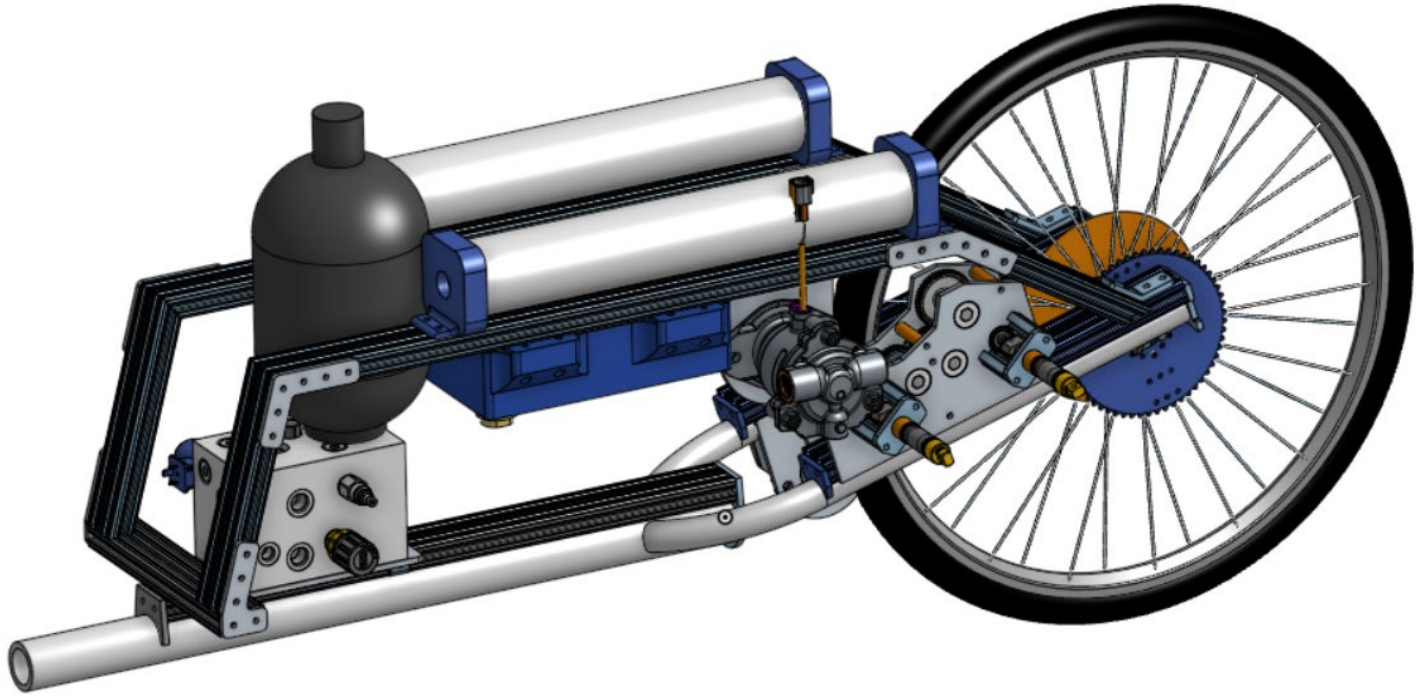
Controls

- Based on simplicity of controls, changed from the original PLC based system (shown) to button/relays
- Using two relays to trigger pneumatic solenoid valves
- Kobalt battery for power



Frame

- Frame Goals
  - Keep it Simple
  - Adjustability
  - Increase Mounting Points
  - Competition Aesthetic
  - Prioritize CAD
  - Chain Routing



Frame

- Frame Changes
  - New welded base frame with angled fork
  - Supporting the derailleur
  - Attaching transmission to back fork
  - Attaching trapezoid frame structure to the end of the fork
  - Extrusion on the fork
  - Extrusion held together using water jetted aluminum brackets

Lessons Learned

- Sometimes it is needed to go back to the basics
- Deadlines are still important despite facing setbacks
- Teamwork is better when we each have a general knowledge of the bike
- We possess the most comprehensive understanding of this project
- We are capable of making a working bike