

N F P A

Fluid Power

VEHICLE

Challenge



NFPA
Education and
Technology
Foundation

FINAL PRESENTATION & DESIGN REVIEW

University of Louisiana at Lafayette Team

Yasmeen Qudsi and John Carroll

April 24th 2025



Team Introductions



Dadrian Day



Macey LeBlanc



Haley LaGarde



Mary Hymel



Dauntae Gloud



**Mechanical
Engineering**

Vehicle Construction



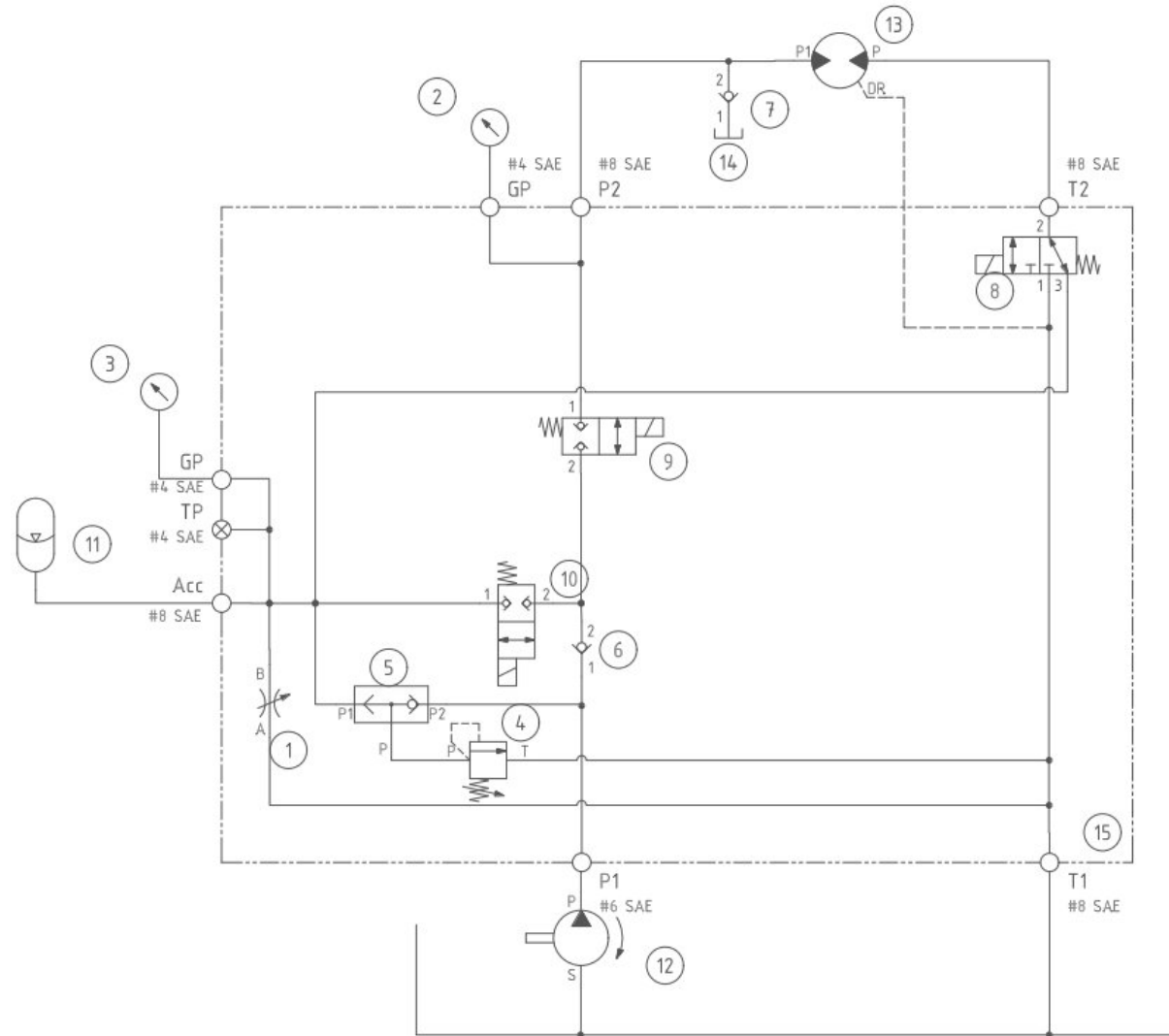
Component Selection



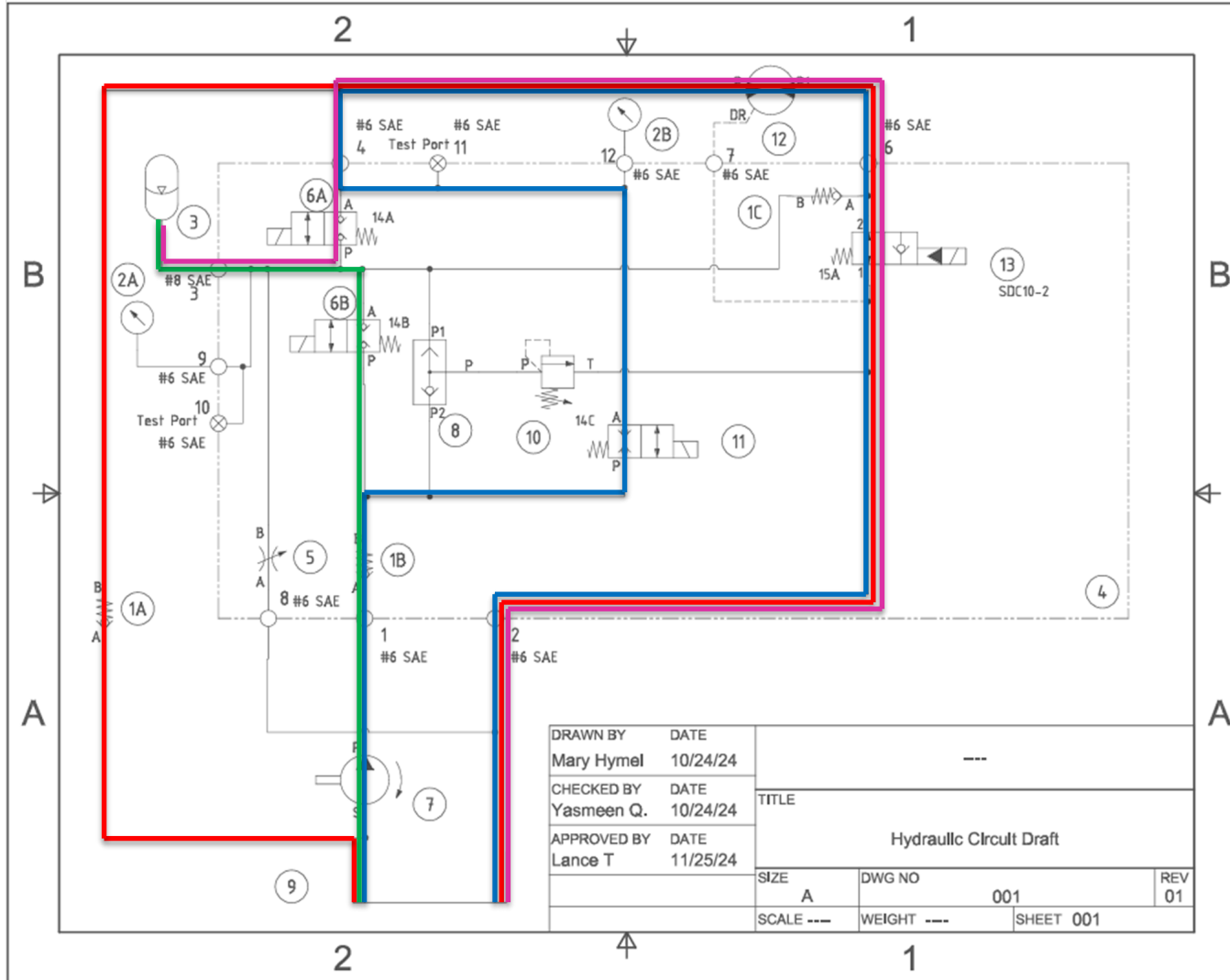
Component	Calculated Value	Final Calculated Value
θ	1.72° (3% grade)	1.73 (3% grade)
Force of Pull	12.49 lb (390 lb vehicle)	11.37 lb (355 lb vehicle)
τ	124.9 in lb	113.7 in lb
CIR _{90%(M)}	0.87 CIR (1000 psi)	0.53 CIR (1500 psi)
RPM (Drive Wheel)	504 RPM (30 mph)	504 RPM (30 mph)
GPM _M	1.90 GPM	1.15 GPM
Area (Lines)	0.0304 in ²	0.0184 in ²
Line Diameter	0.20 in (1/5)"	0.15 in (3/20)"
CIR _{90% (P)}	1.22 CIR (19.66 cc)	0.74 CIR (12.13 cc)

Component	Specification
Pump	10.8 cc Danfoss Gear Pump
Motor	16.8 cc Danfoss Gear Motor
Hosing	3/8" & 1/2" lines
Reservoir	2.5 gal Aluminum Fuel Tank
Accumulator	1 gal

Previous Teams Hydraulic Circuit



Hydraulic Circuit



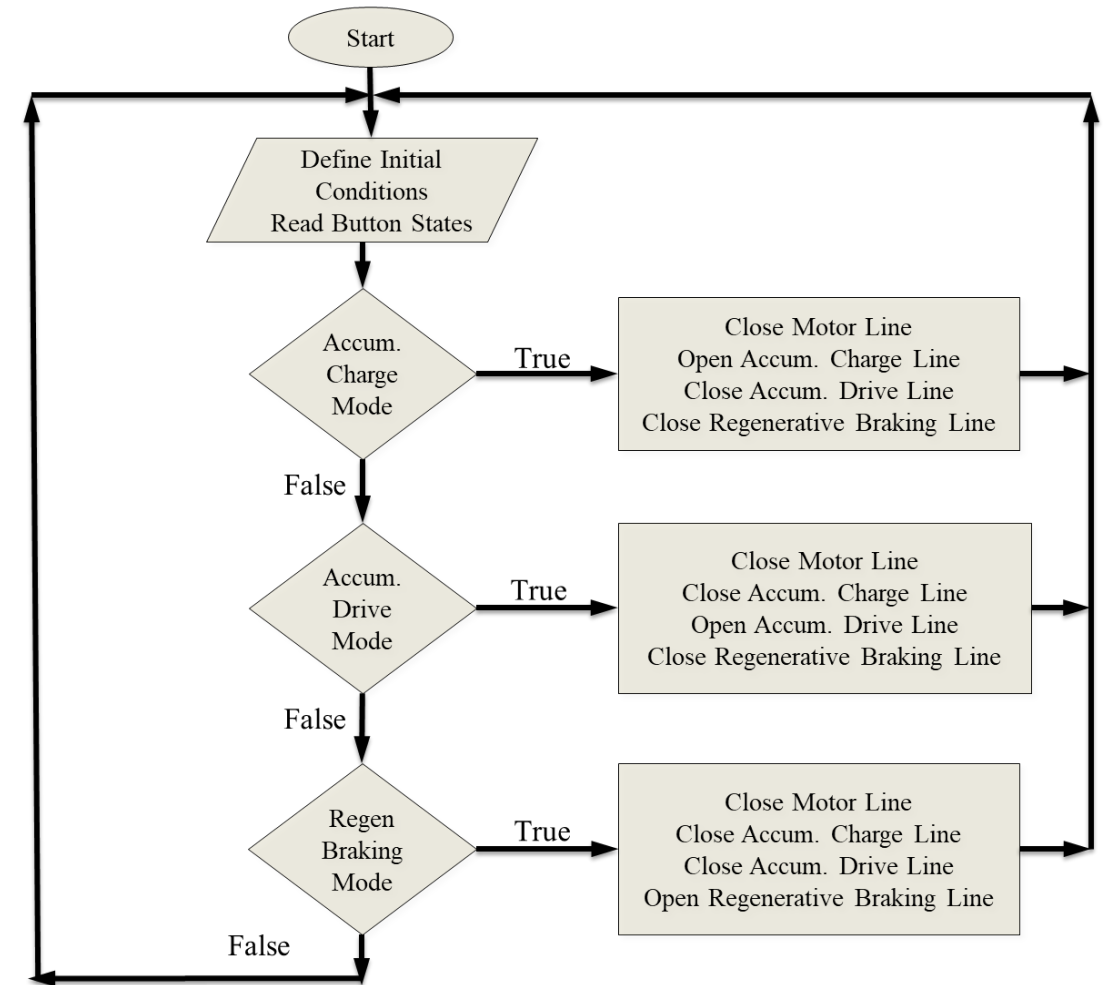
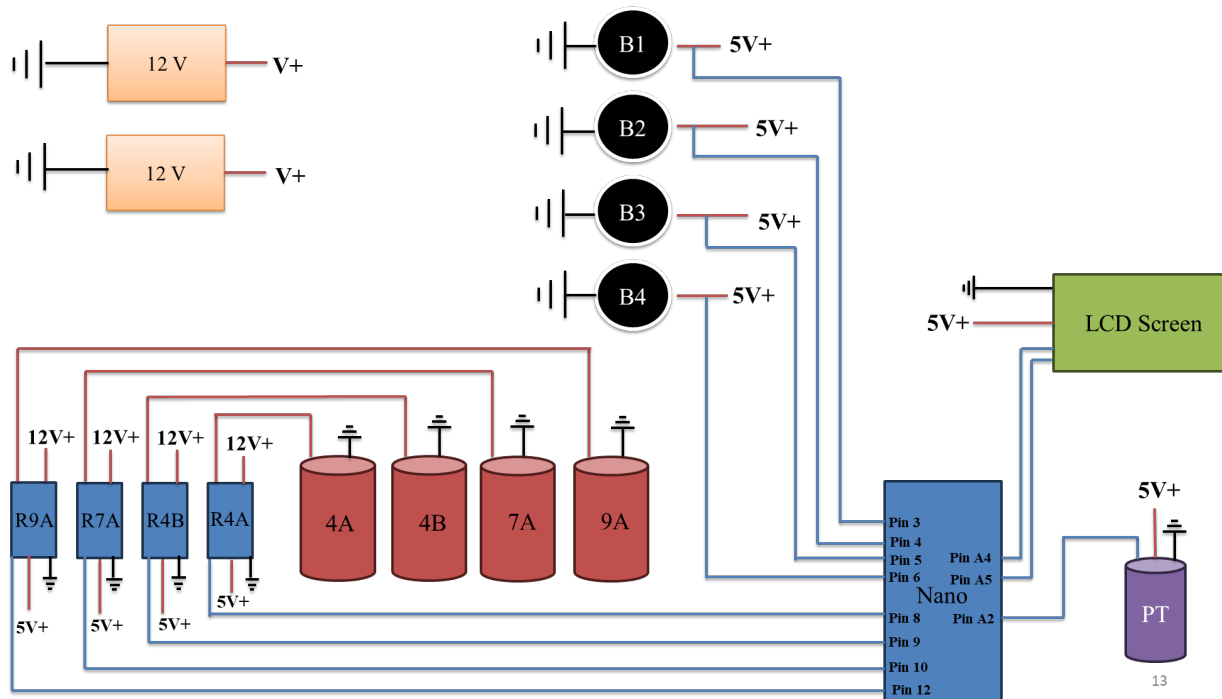
Drive Mode	Valve 4A	Valve 7A	Valve 9A	Valve 4B
Direct Drive	0	0	0	0
Accumulator Charge	1	1	0	0
Accumulator Drive	0	1	0	1
Regenerative Braking	0	1	1	0

Legend

Button On	1 => LOW
Button Off	0 => HIGH

- Main components: Reservoir (9), Pump (7), Accumulator (3), Motor (12), and Manifold (4)

Electronics



Vehicle Testing



- Shortage of time and nitrogen supply, did not get to mirror competition values exactly

Sprint Race	
Nitrogen Pre-Charge	500 psi
Accumulator Pressure	1700 psi
Top Speed	9.2 mph
600 ft time	44.5 s
Endurance Race	
Testing Time	15 min
Total Distance Travelled	12852 ft
Efficiency	
Nitrogen Pre-Charge	500 psi
Accumulator Charge	1430 psi
Total Distance Travelled	455.4 ft
Efficiency	7.00%
Regenerative Braking	
Nitrogen Pre-Charge	500 psi
Accumulator Charge	350 psi
Distance Travelled	41.3 ft

Hydraulic Line Losses

Line size (in)	0.375
Line size (ft)	0.0313
Total Length of Tubing (ft)	5.5
Density of Hydraulic Oil (kg/m ³)	870
# of fittings	6
Loss coefficient	3
Flow rate	1.9
Flow rate (CFS)	0.0042
Cross Sectional Area (ft ²)	0.0008
Velocity of Fluid (ft/s)	5.5193
Head Loss (ft)	2.4975
Head Loss (m)	0.7612
Pressure Loss Due to Friction (Pa)	6497
Pressure Loss Due to Friction (psi)	0.9423
Minor Loss (ft)	1.419
Minor Loss (m)	0.4325
Pressure Loss from Minor Loss (Pa)	3691.5
Pressure Loss from Minor Loss (psi)	0.5354
Total Pressure Loss (psi)	1.4777

Lessons Learned

- Time management to finish the bike earlier in the semester
- More testing and validation
- Pump installation and handling
- Make sure the manifold ports are in desired regions
- Make sure the rear axle can withstand all stresses

Thank you



• Thank you to all our
sponsors and advisors!



References



- [1] Educational Webinars. NFPA Foundation. (2024). <https://nfpa-foundation.org/universities/programs-resources/fluid-power-vehicle-challenge/educational-webinars/>
- [2] Overview & Rules. NFPA Foundation. (2024). <https://nfpa-foundation.org/wp-content/uploads/2024/10/2025-FPVC-Overview-Rules-and-Awards-v.5.pdf>