

Chiller Demonstration Unit

Team #46: Binh Dang, Bryan Falgout, Austin Gaudet, Kos Mosley, Christopher Pham, Mitchell Quebedeaux, Colleen Slade, Ryan Troendle, Jason Tullos



College of Engineering
Cain Department of Chemical Engineering

Background

The Dow Chemical Engineering Unit Operations Lab at Louisiana State University currently uses a chiller demonstration unit to allow students in Engineering Measurements Lab (CHE 3104) to work simulated problems which concern the sizing of required cooling loads for process equipment and buildings.

Objective

Design a chiller with automated controls that can demonstrate Thermodynamic, Heat Transfer, Fluid Mechanics, and Process Controls concepts

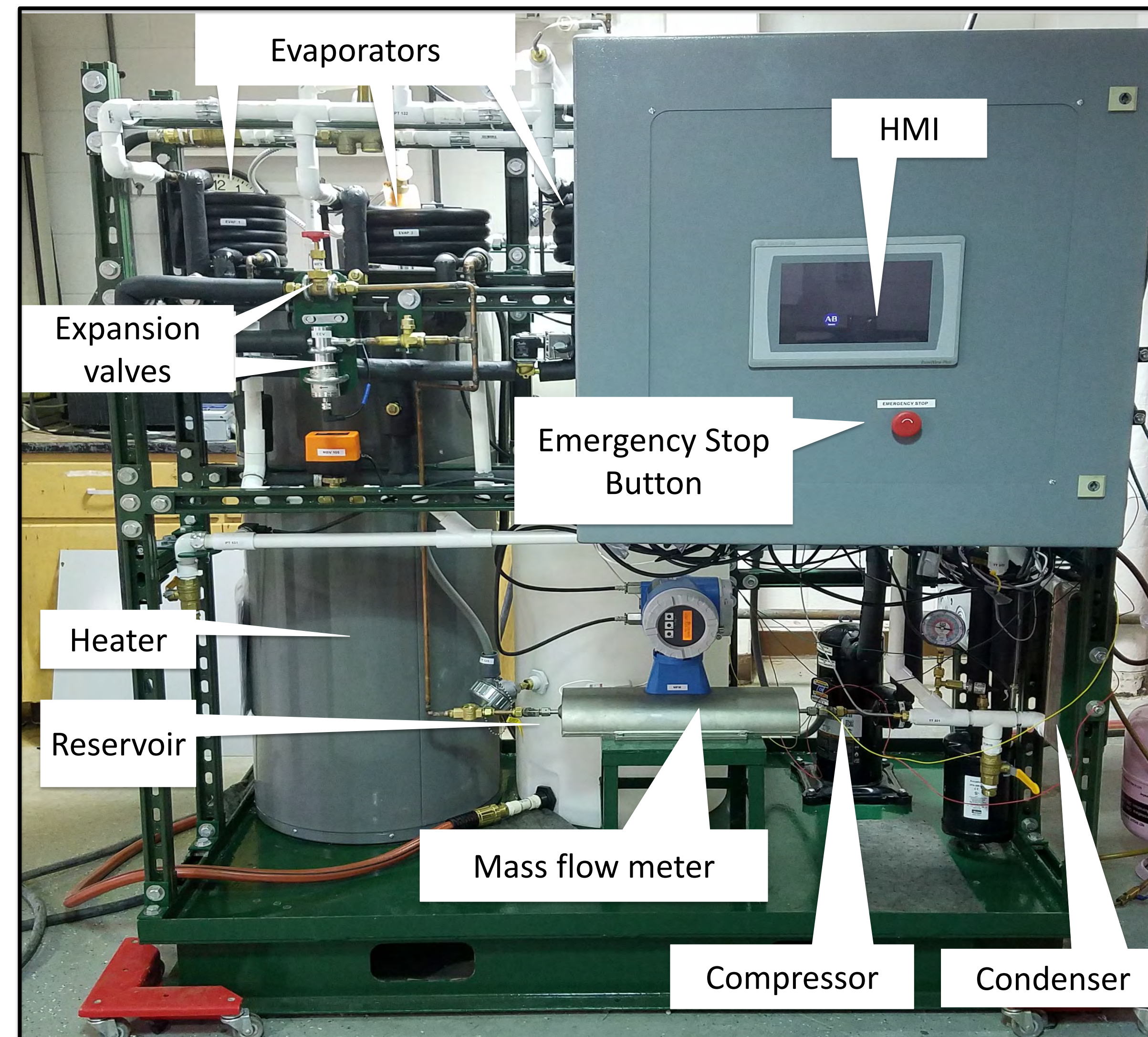
Engineering Specifications

- Not to exceed 80"x56"x102"
- Provide up to 2 tons of cooling
- Compatible with existing utilities (Power: 20 kW, Water: 40 psig 15 gpm, Compressed Air: 90 psig)
- Utilize 4-20 mA & 0-10V standard instrumentation

Testing & Validation

Test	Outcome	Validation
<u>Water subsystem test</u>	Measure water flow rates 5.6 GPM	Provides adequate cooling
<u>Refrigeration purge</u>	Vacuum test Pulled vacuum to 800 microns	Safe & reliable operation
<u>Refrigeration pressure test</u>	Pressurize refrigeration system Maintain 375 psig for 24 hours	Safe & reliable operation
<u>Transmitter test</u>	Verify transmitter function Transmitter data received & calibrated	Reliable data acquisition

Design



Concept Generation & Selection

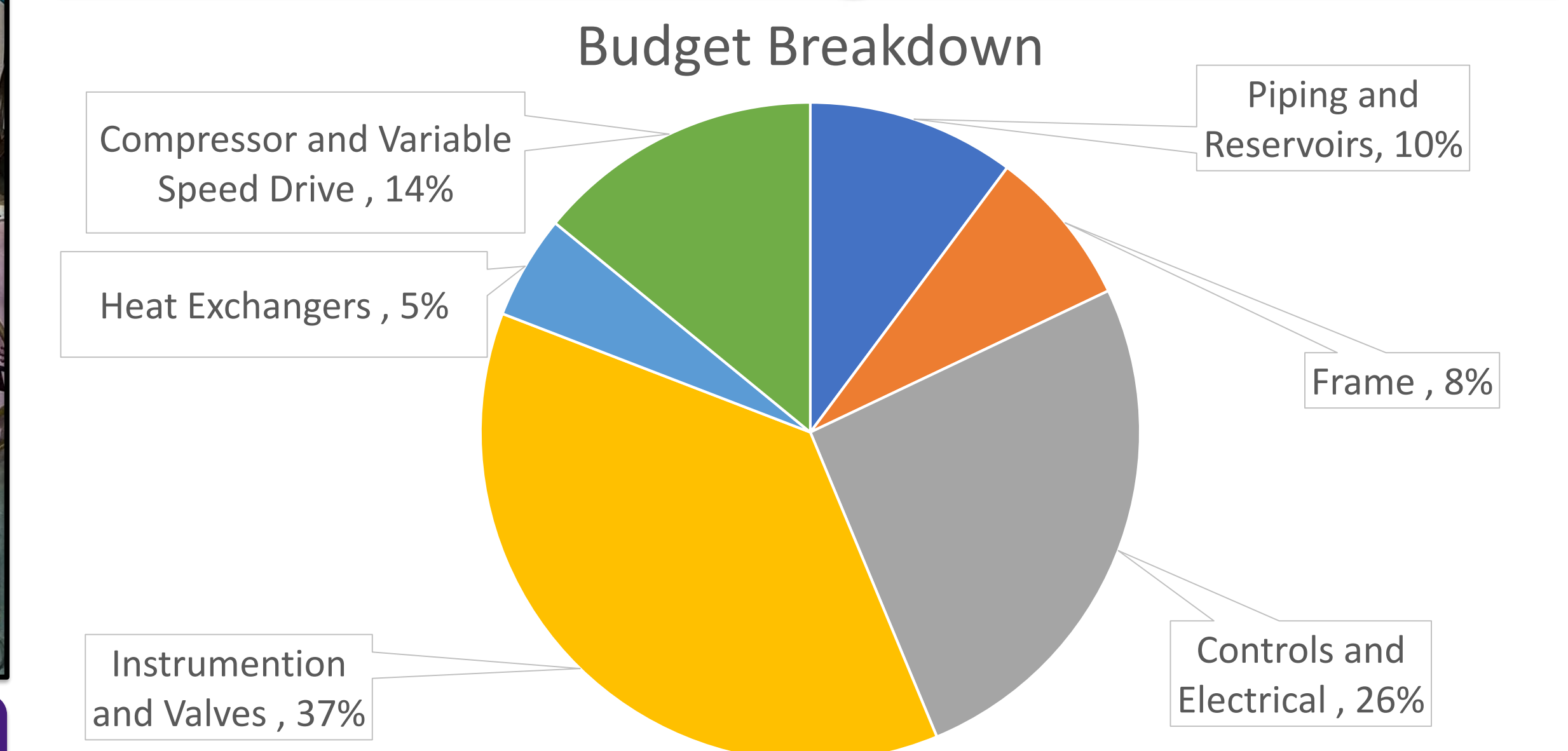
Key Concepts Selected

- | | |
|---|---|
| <p><u>Heat Transfer Subsystem</u></p> <ul style="list-style-type: none"> • Open loop configuration • Recycled waste heat to simulate process heat • Heater to provide disturbances | <p><u>Refrigeration Subsystem</u></p> <ul style="list-style-type: none"> • Liquid-Liquid condenser • Variable speed compressor to vary cooling capacity • Electronic expansion valve |
|---|---|

Safety

Key Hazards	Mitigation
Hot fluid operator contact	Material flow rates limited to allow maximum achievable temperature of 120 °F
Unsafe process conditions	Alarms and shutoffs to prevent equipment damage. Emergency stop button.

Budget



Category	Amount
Piping and Reservoirs	\$1,593.63
Frame	\$1,216.56
Controls and Electrical	\$4,037.68
Instrumentation and Valves	\$5,812.39
Heat Exchangers	\$795.80
Compressor and Variable Speed Drive	\$2,202.73
Total Spent:	\$15,658.79
Total Budget:	\$15,000

