NAU Mixing Valve Team

Rob Stevenson: Project Manager
Stephon Lane: Client Contact
Jorge Renova: Budget Liaison
Summer Johnson: Document Manager
Connor Mebius: Website Developer

Background

- General Atomics requested our NAU Capstone Team to design a mixing valve to be used in one of their products.
- The goal of the project is to design a lighter mixing valve to replace G.A. current mixing valve. The new mixing valve must perform as well as the current valve and maintain the same level of reliability
- Generally atomics has already modified an OTS ARMSTRONG mixing valve by 36 pounds. They would like us to reduce this modified valve by an additional 60 lbs. A total of 96 lbs from the original mixing valve.

Customer Requirements

- Design Reliability
  - Valve must be able to withstand many cycles at conditions specified in the engineering requirements
- Design may use EMECH/Armstrong G1 actuator or other design
- If alternate actuator is selected, power and interfaces must be same as the G1 unit
- Max budget of $2500

Figure 1: EMECH/ARMSTRONG G1 Actuator [1]

Plumbing Schematic

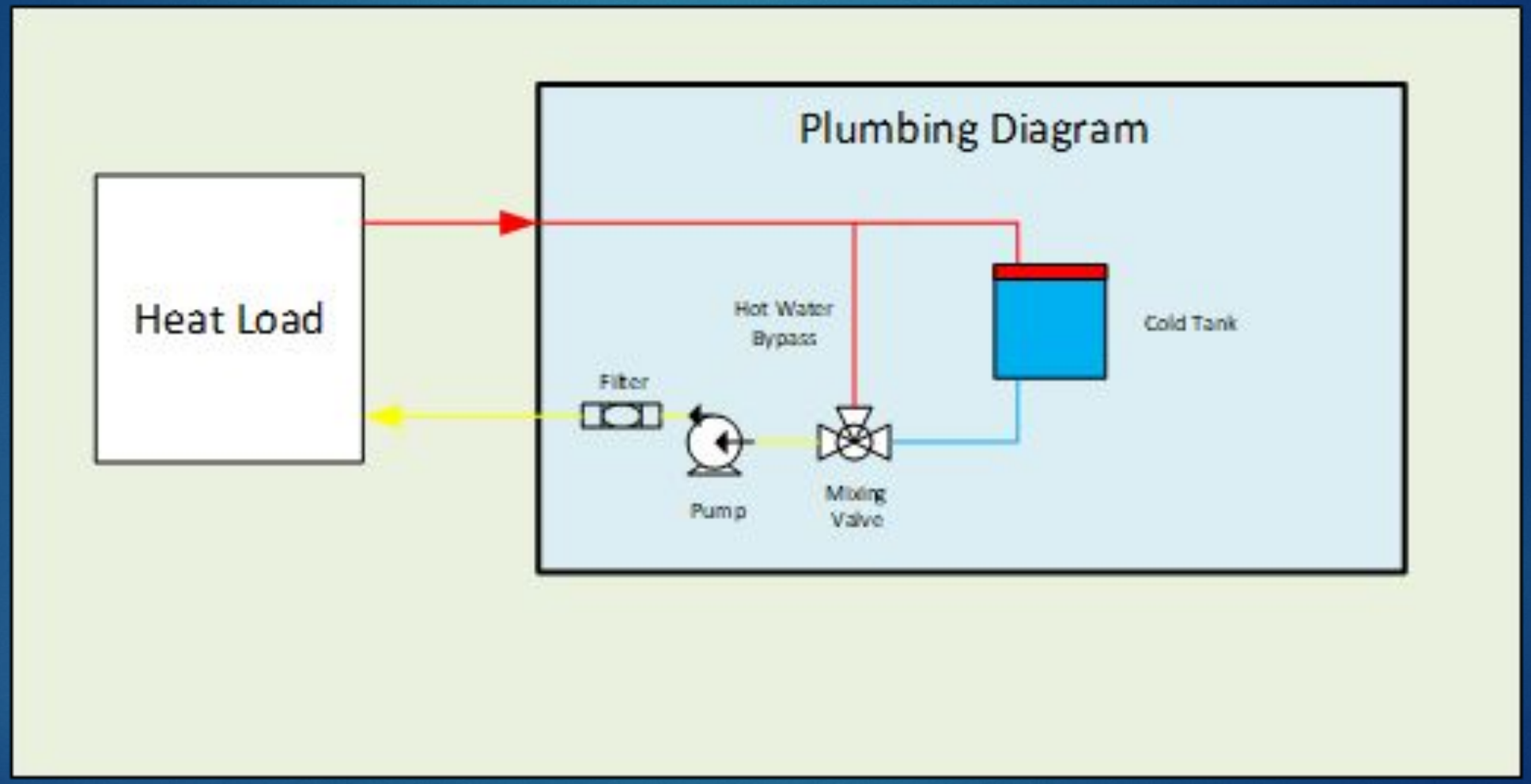

Figure 2: Plumbing Diagram for mixing valve

E100WR Mixing Valve

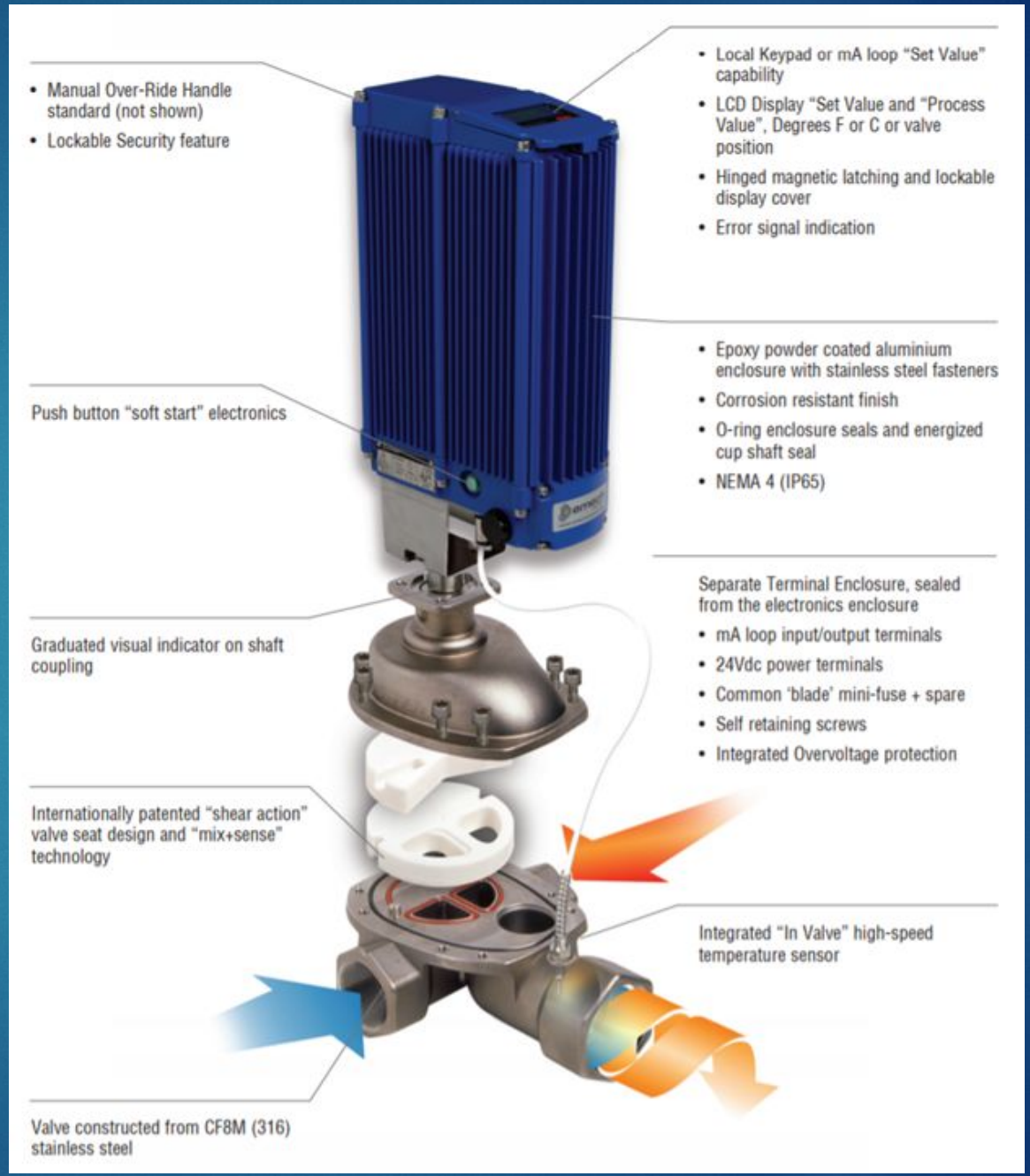

Figure 3: Valve Functions [2]

SolidWorks

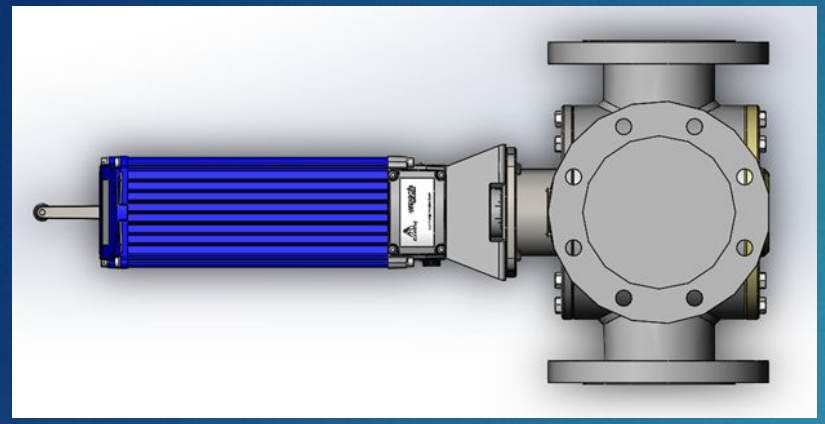

Figure 5: Armstrong Mixing Valve (Top View)

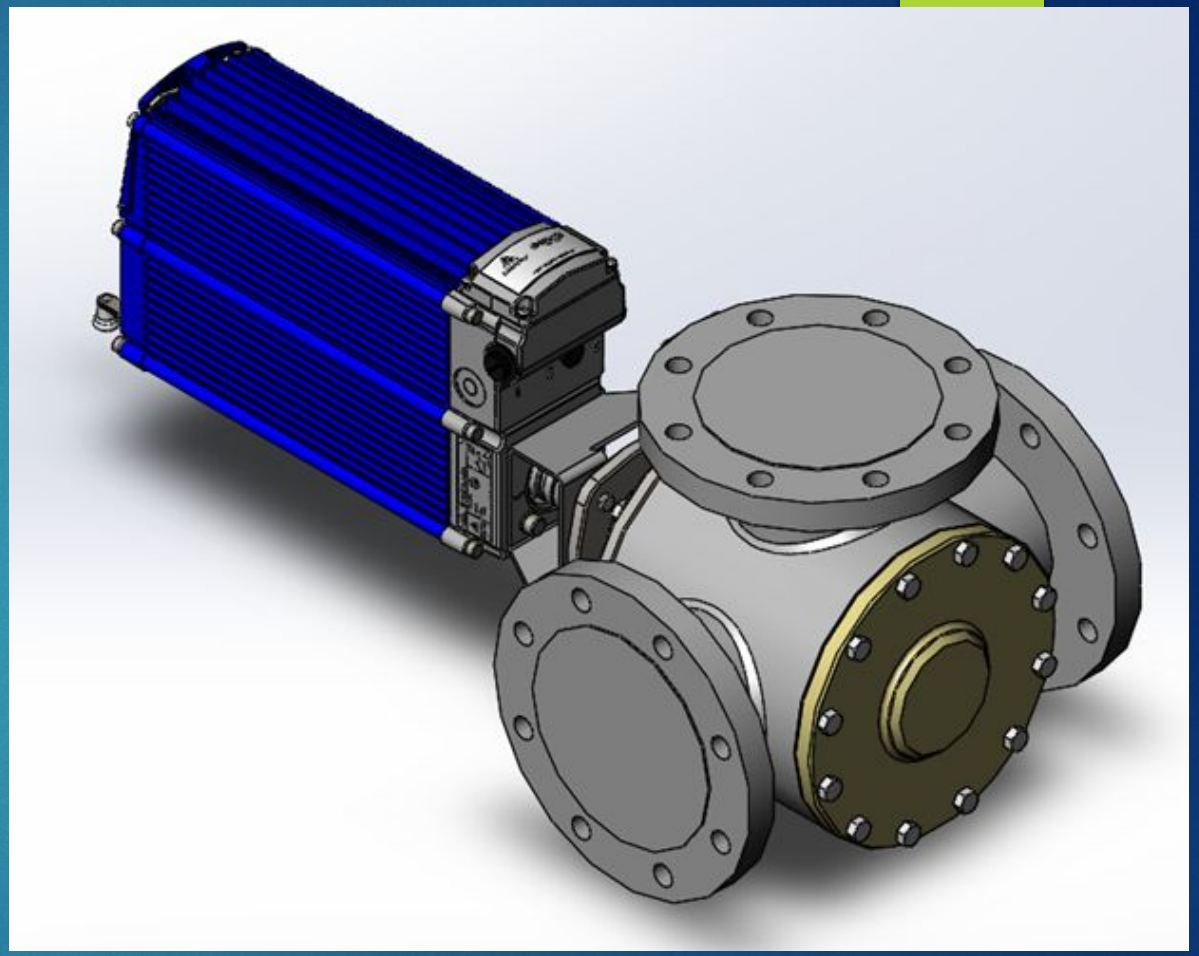

Figure 4: Armstrong Mixing Valve (ISO View)

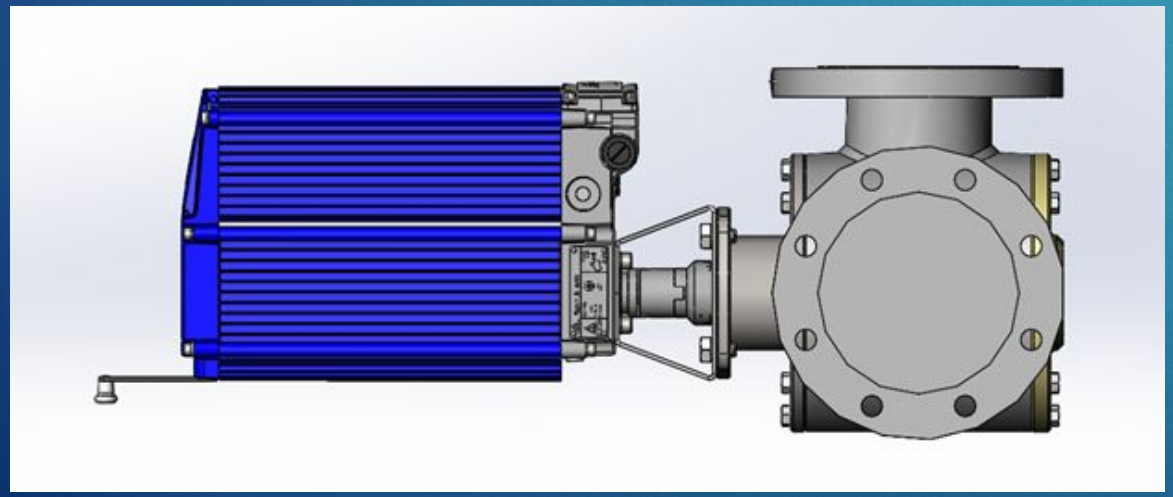

Figure 6: Armstrong Mixing Valve (Front View)

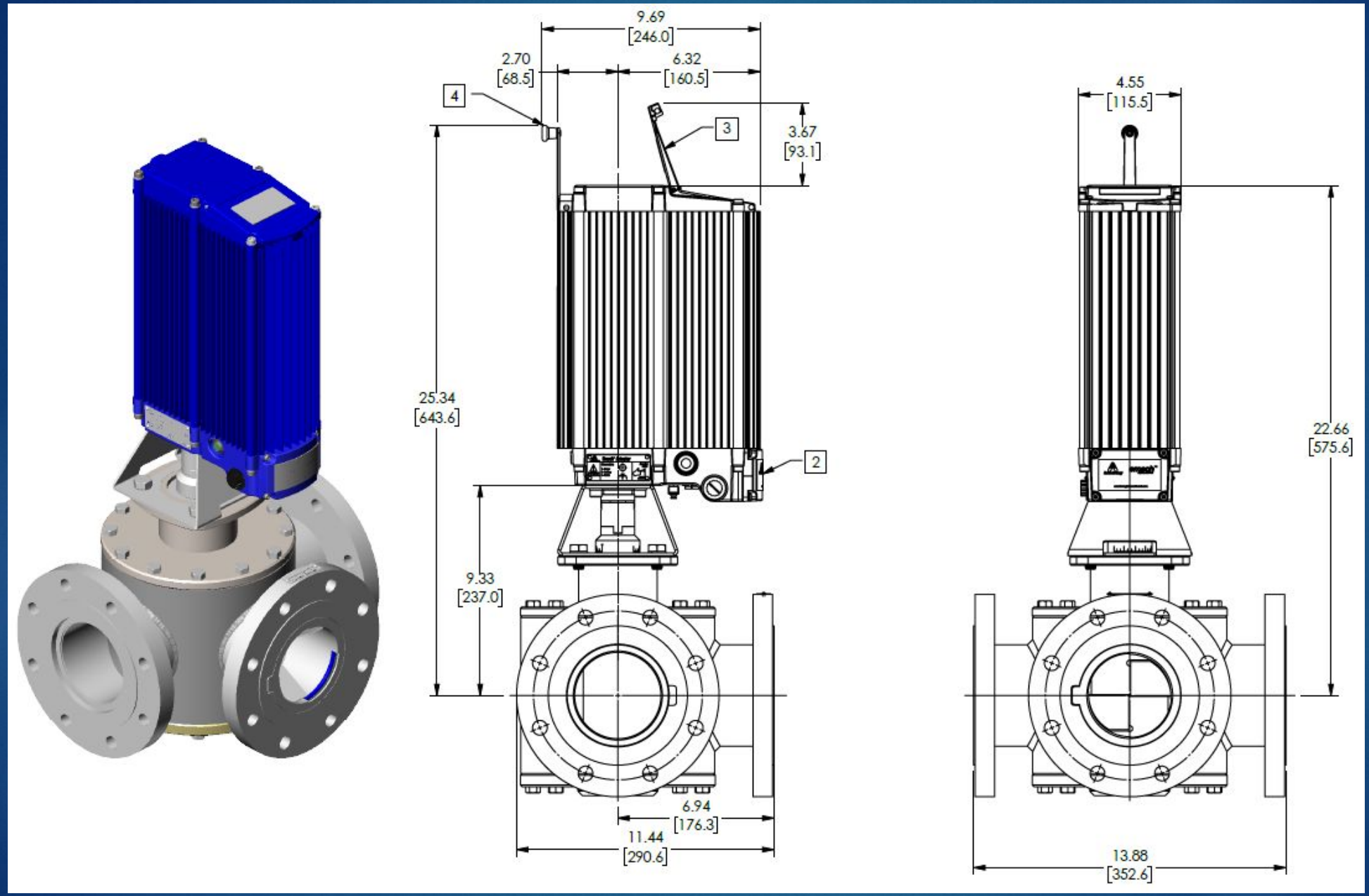

Figure 7: Armstrong Mixing Valve Drawing [2]

Engineering Requirements

- Provide additional 60 pounds of weight savings from a modified (108 pounds) mixing valve
  - Unmodified design weighs 144 pounds
- Max internal fluid pressure of 125 psi gauge
- Testing to 185 psi gauge with no deformations
- Max flow rate of 450 gal/min
- Max pressure drop 8 psid at high flow rates 450 gal/min

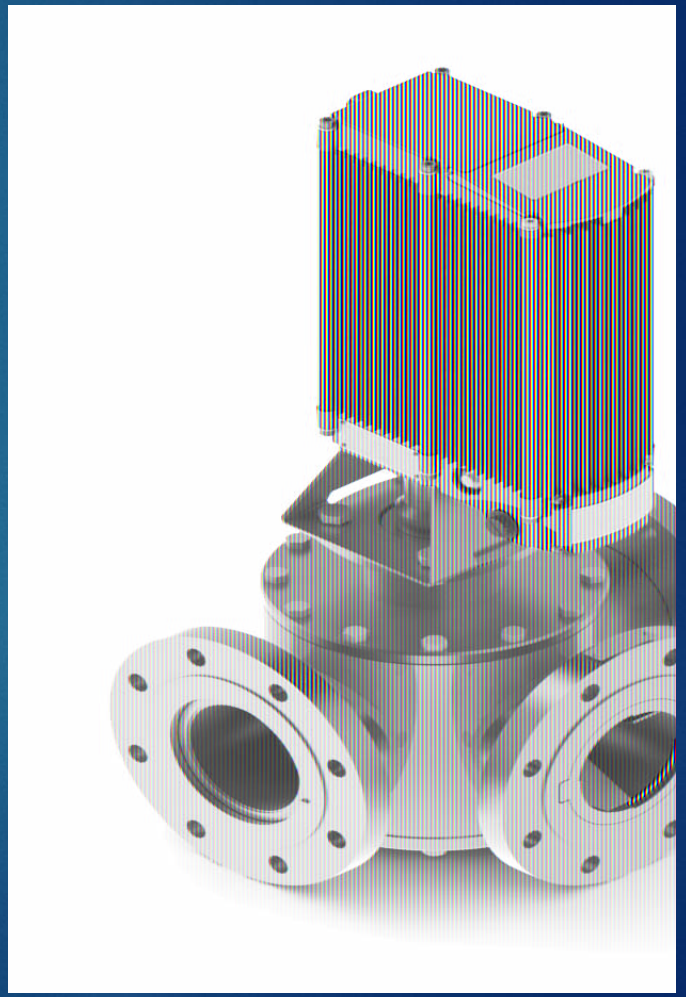

Figure 8: Sample mixing valve [3]

Engineering Requirements

- Four operational Fluids including water
- Two Allowable metal materials
- Two Allowable Polymers
- Constant flow through valve swing

Benchmarking

- High flow mixing valve
- Thermostatic valve
  - Assures constant outlet water temperature

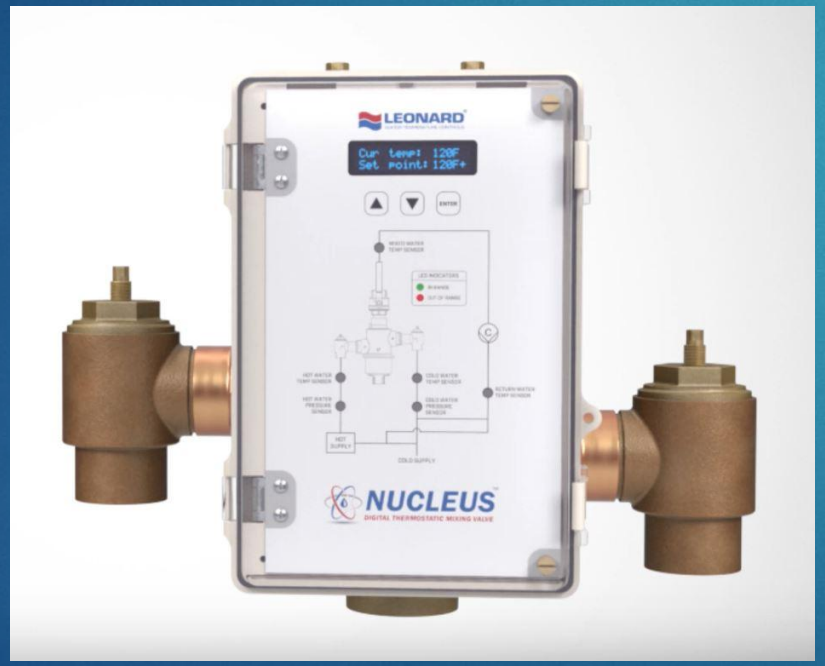

Figure 9: Leonard mixing valve [5]

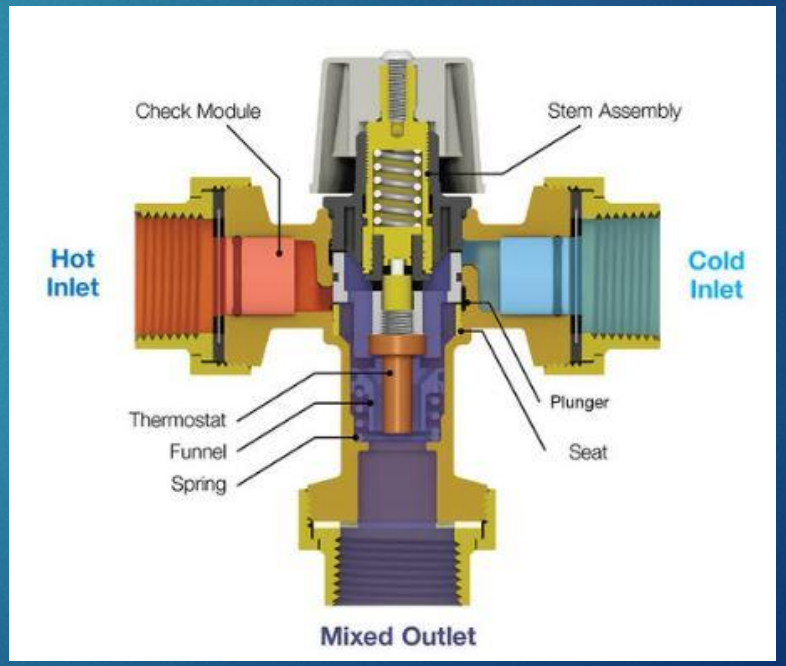

Figure 10: Internal working of thermostatic mixing valve [4]

Upcoming

General Atomics requests the team to have:

- Preliminary Design Review
  - March 27th
  - Proposed lightweight analysis
- Critical Design Review
  - April 30th
  - Refined lightweight analysis
  - Material costs
- Design package by the end of the semester
  - Ability to machine at their facility
  - Utilize immediately

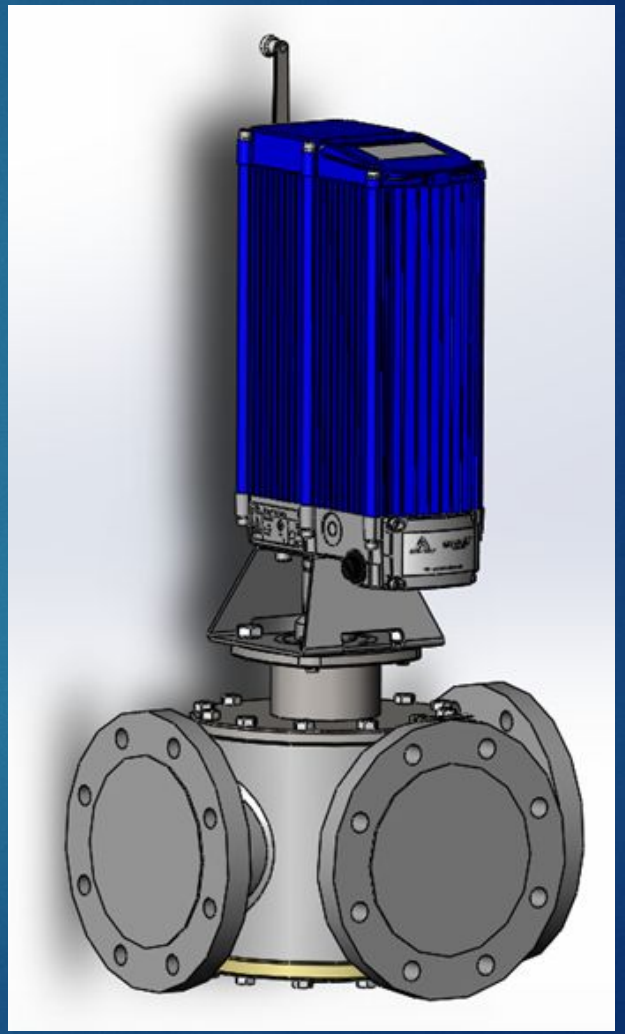

Figure 11: Valve

Questions?

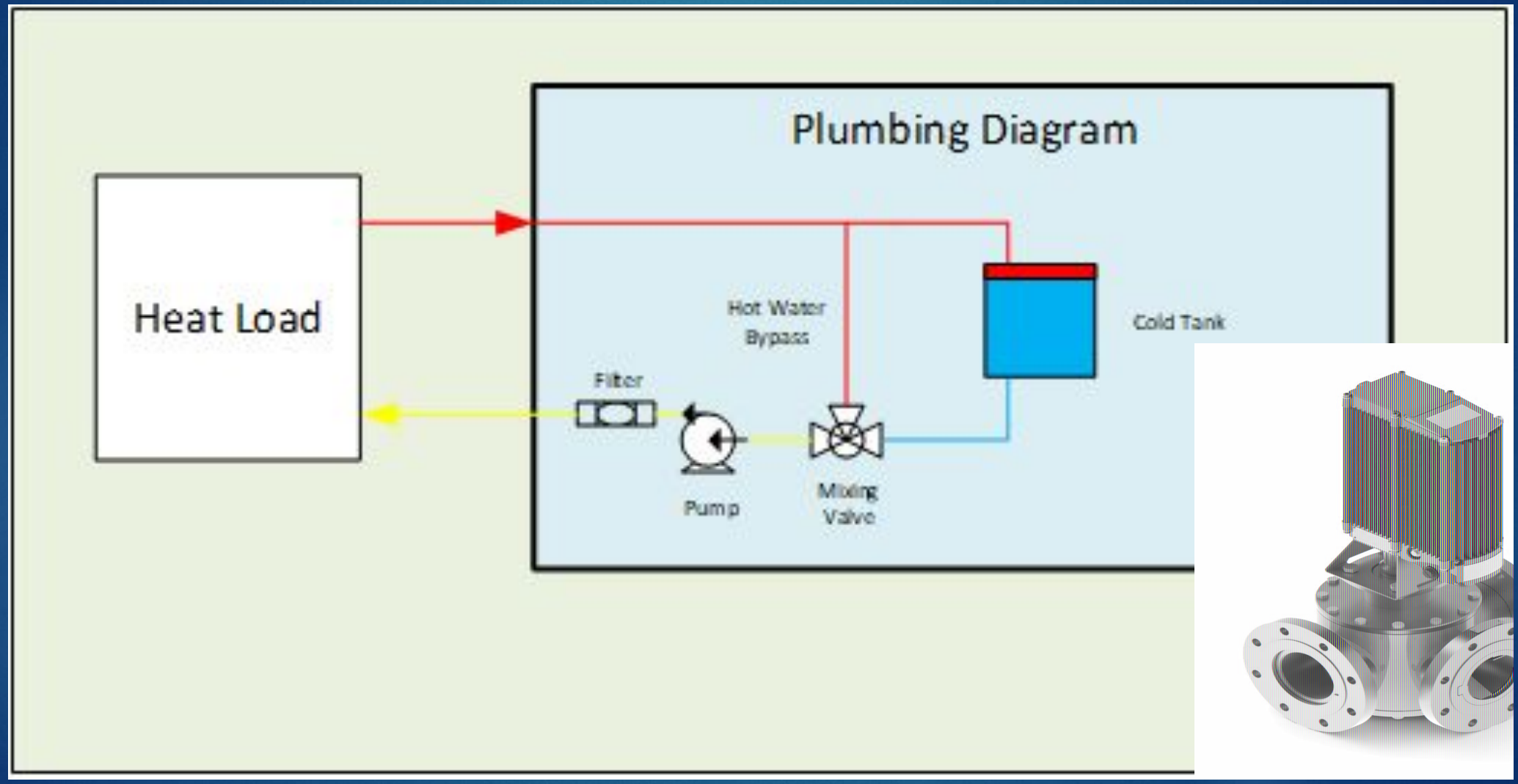

Figure 12: Plumbing Diagram with mixing valve example photo

References

[1]"Actuators | Armstrong International", *Armstronginternational.com*, 2020. [Online]. Available: https://www.armstronginternational.com/products-systems/hot-water-industry/water-temperature-controls/emech®-digital-control-valves/actuators. [Accessed: 05- Feb- 2020].

[2] Armstrong International, Inc. “Emech® Digital Control Valves.” *Armstrong*, 2017, www.armstronginternational.com/sites/default/files/resources/documents/HW-430.pdf [Accessed: 05- Feb- 2020].

[3] "Model E100WR | Armstrong International", *Armstronginternational.com*, 2020. [Online]. Available: https://www.armstronginternational.com/products-systems/hot-water-industry/water-temperature-controls/emech®-digital-control-valves/hot-cold-water/model-e100wr. [Accessed: 04- Feb- 2020]

[4] “Products Products” Watts. [Online]. Available: https://www.watts.com/resources/references-tools/thermostaic-mixing-valves. [Accessed: 06-Feb-2020].

[5] L. V. Company, "YouTube," February 2019. [Online]. Available: https://www.youtube.com/watch?v=LILR1igCVnM&feature=youtu.be . [Accessed February 2020].