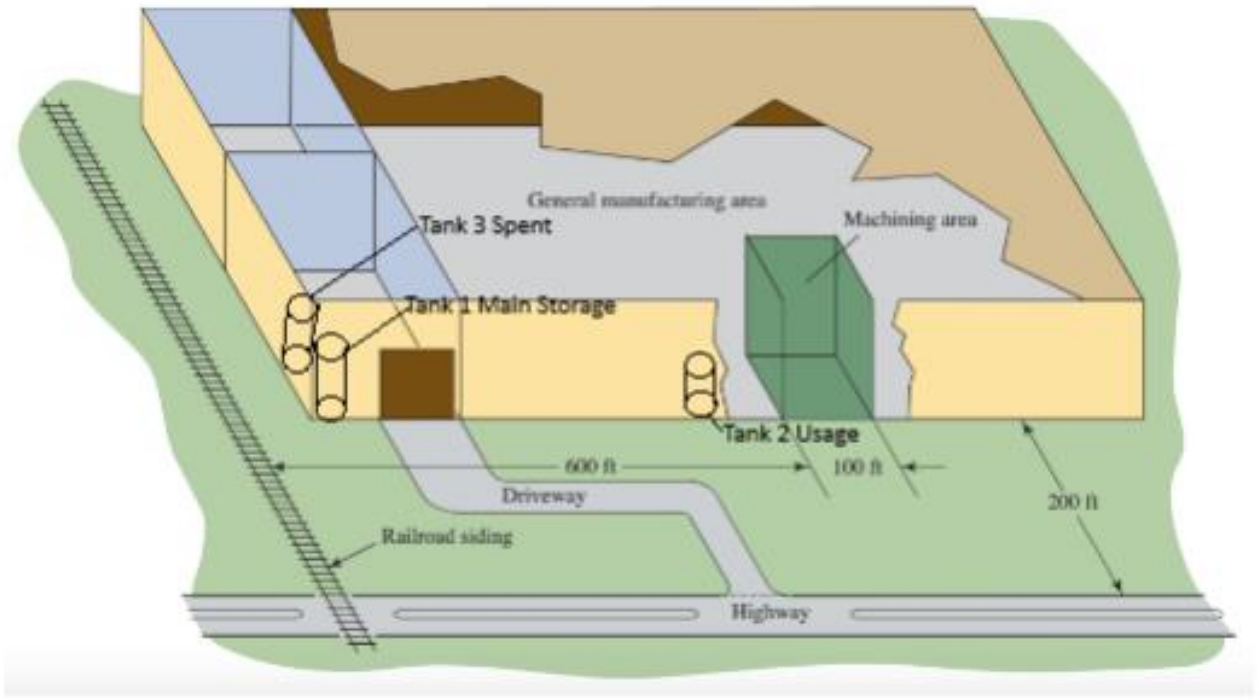
MET 330
Pipeline System Design Project
Continental AG Manufacturing Plant
Green – Overbey – Smith

Abstract

- Continental AG will be constructing a new manufacturing plant in Dayton, Ohio. This plant will include a new automated machining line which require that five separate machines be required with coolant. In addition to providing coolant to the machinery this project will show how our team plans to store, transport, and dispose of the coolant throughout the plant. Several factors were considered in our design such as location, production schedules/needs, staffing, as well as delivery and removal methods for the coolant. The intent of this project is to meet the needs of the customer while also being fiscally feasible



Drawings and Diagrams

Open Channel System

- Purpose: To design an open channel system that will be able to take fluid from the tank to a far away location.

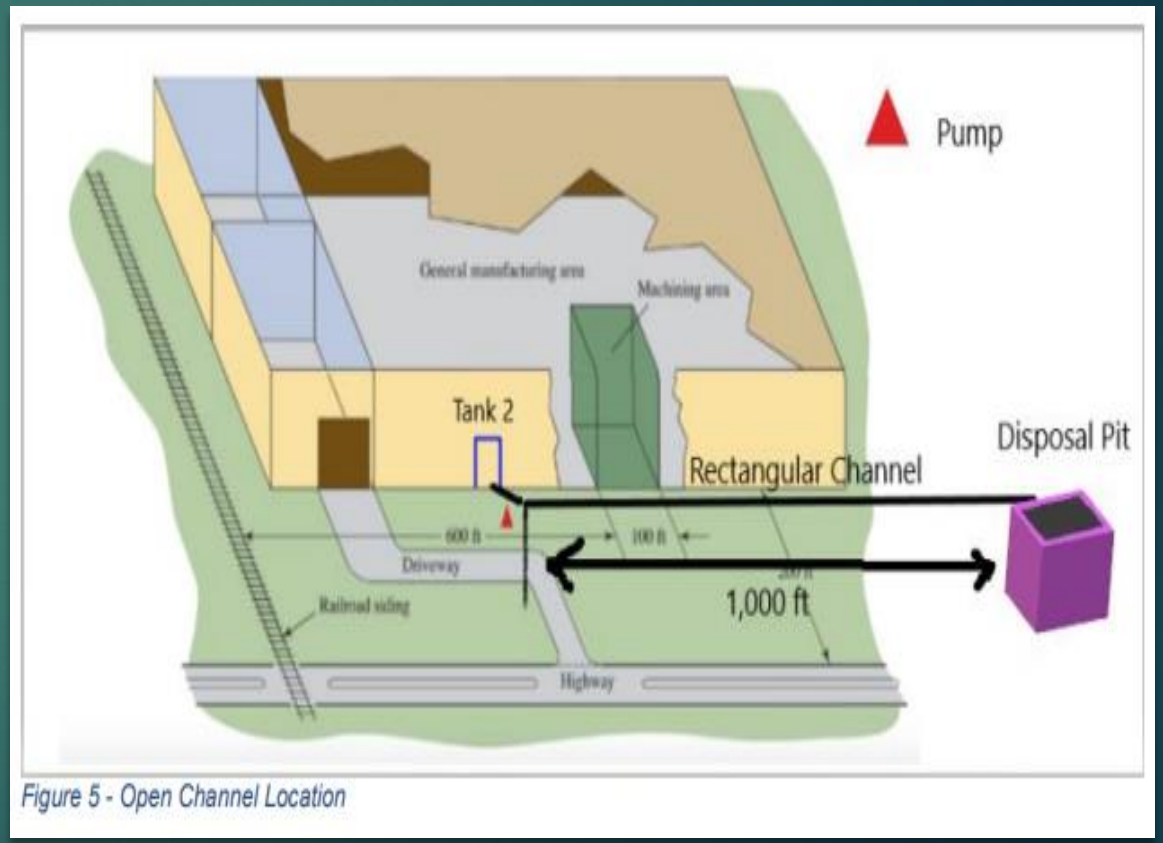


Figure 5 - Open Channel Location

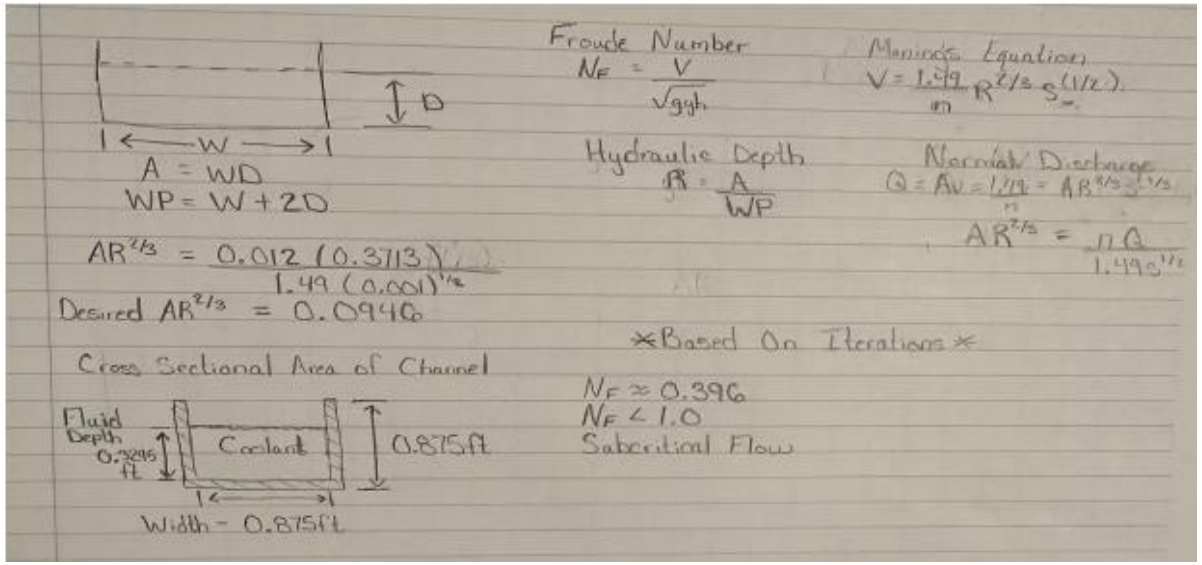


Table 8 - Open Channel Calculations

W(ft)	D(ft)	WP(ft)	A(ft^2)	R	v(ft/s)	$Q_{max}(\frac{ft^3}{s})$	$AR^{2/3}$	yh	N_F
1.500	0.750	3.000	1.125	0.375	2.042	2.2971	0.5850	0.750	0.415
1.250	0.625	2.500	0.781	0.313	1.808	1.4126	0.3598	0.625	0.403
1.125	0.563	2.250	0.633	0.281	1.686	1.0666	0.2716	0.563	0.396
1.000	0.500	2.000	0.500	0.250	1.558	0.7791	0.1984	0.500	0.388
1.000	0.375	1.750	0.375	0.214	1.406	0.5273	0.1343	0.375	0.405
0.875	0.375	1.625	0.328	0.202	1.351	0.4434	0.1129	0.375	0.389
0.875	0.350	1.575	0.306	0.194	1.318	0.4036	0.1028	0.350	0.393
0.875	0.340	1.555	0.298	0.191	1.304	0.3878	0.0988	0.340	0.394
0.875	0.330	1.535	0.289	0.188	1.289	0.3722	0.0948	0.330	0.395
0.875	0.330	1.534	0.288	0.188	1.288	0.3714	0.0946	0.330	0.396

Channel Calculations

B3198H - Hinged Extension Split Pipe Clamp

Size Range: 3/8" (10mm) to 3" (80mm) pipe

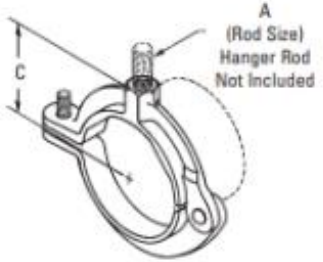
Material: Malleable Iron

Function: Designed for suspending non-insulated pipe horizontally or vertically.

Approvals: Conforms to Federal Specification WW-H-171E & A-A-1192A, Type 25 and Manufacturers Standardization Society ANSI/MSS SP-69 & SP-58, Type 12.

Standard Finish: Plain or Electro-Galvanized

Order By: Part number and finish.



Part No.	Pipe Size in.	(mm)	Rod Size A	C in.	(mm)	Design Load Lbs.	(kN)	Approx. Wt./100 Lbs.	(kg)
B3198H-3/8	3/8"	(10)	3/8"-16	31/32"	(24.6)	180	(.80)	9	(4.1)
B3198H-1/2	1/2"	(15)	3/8"-16	1 1/16"	(27.0)	180	(.80)	12	(5.4)
B3198H-3/4	3/4"	(20)	3/8"-16	1 7/32"	(30.9)	180	(.80)	12	(5.4)
B3198H-1	1"	(25)	3/8"-16	1 11/32"	(34.1)	180	(.80)	13	(5.9)
B3198H-1 1/4	1 1/4"	(32)	3/8"-16	1 19/32"	(39.7)	180	(.80)	18	(8.1)
B3198H-1 1/2	1 1/2"	(40)	3/8"-16	1 23/32"	(43.6)	180	(.80)	21	(9.5)
B3198H-2	2"	(50)	3/8"-16	2"	(50.8)	180	(.80)	44	(19.9)
B3198H-2 1/2	2 1/2"	(65)	1/2"-13	2 11/32"	(59.5)	300	(1.33)	73	(33.1)
B3198H-3	3"	(80)	1/2"-13	2 23/32"	(69.0)	300	(1.33)	95	(43.1)

Figure 11 - Pipe Support Information

Support on Pipelines

Support Calculations

Design Considerations: The weight of the fluid and the steel pipes must be considered. Depending on the orientation of the pipe it may experience various vertical and horizontal forces. Design with a standard of maximum pipe deflection of about 5%, In between ranges of 1% - 10%. Assume pipes are full of coolant. Will utilize a hinged extension split pipe clamp has the hanger support.

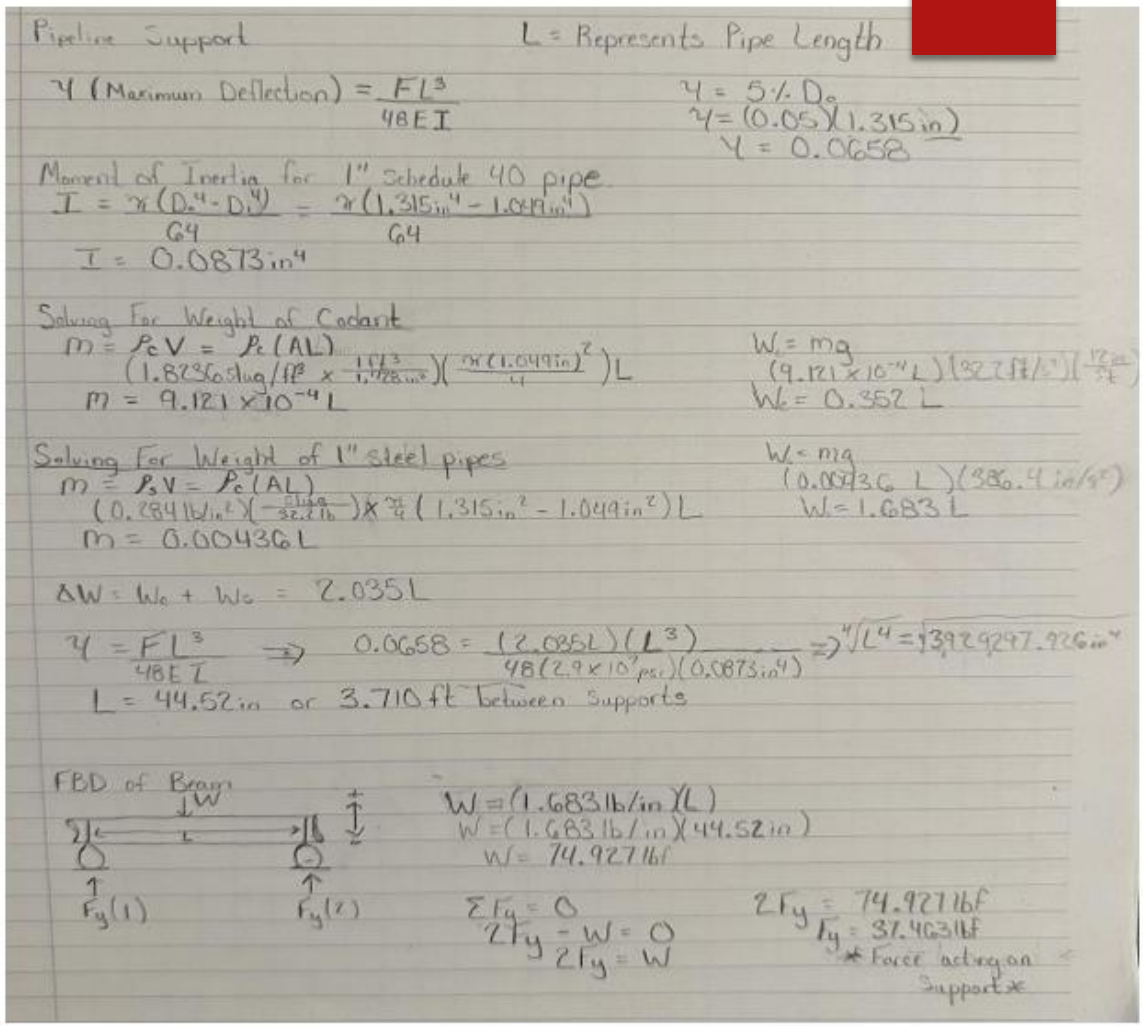
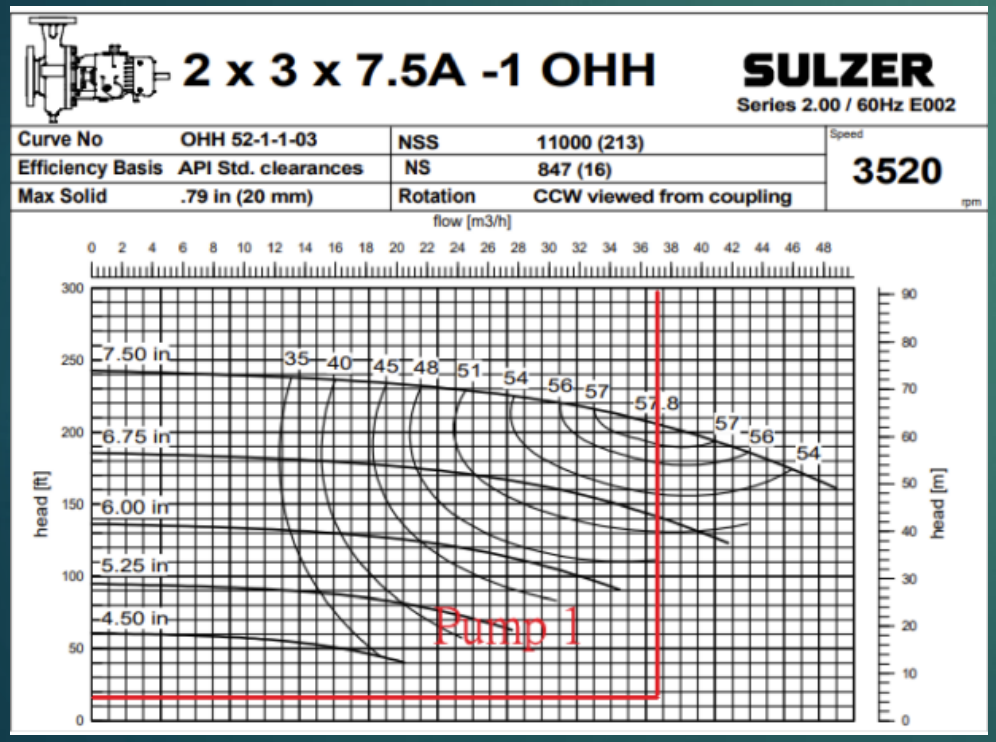
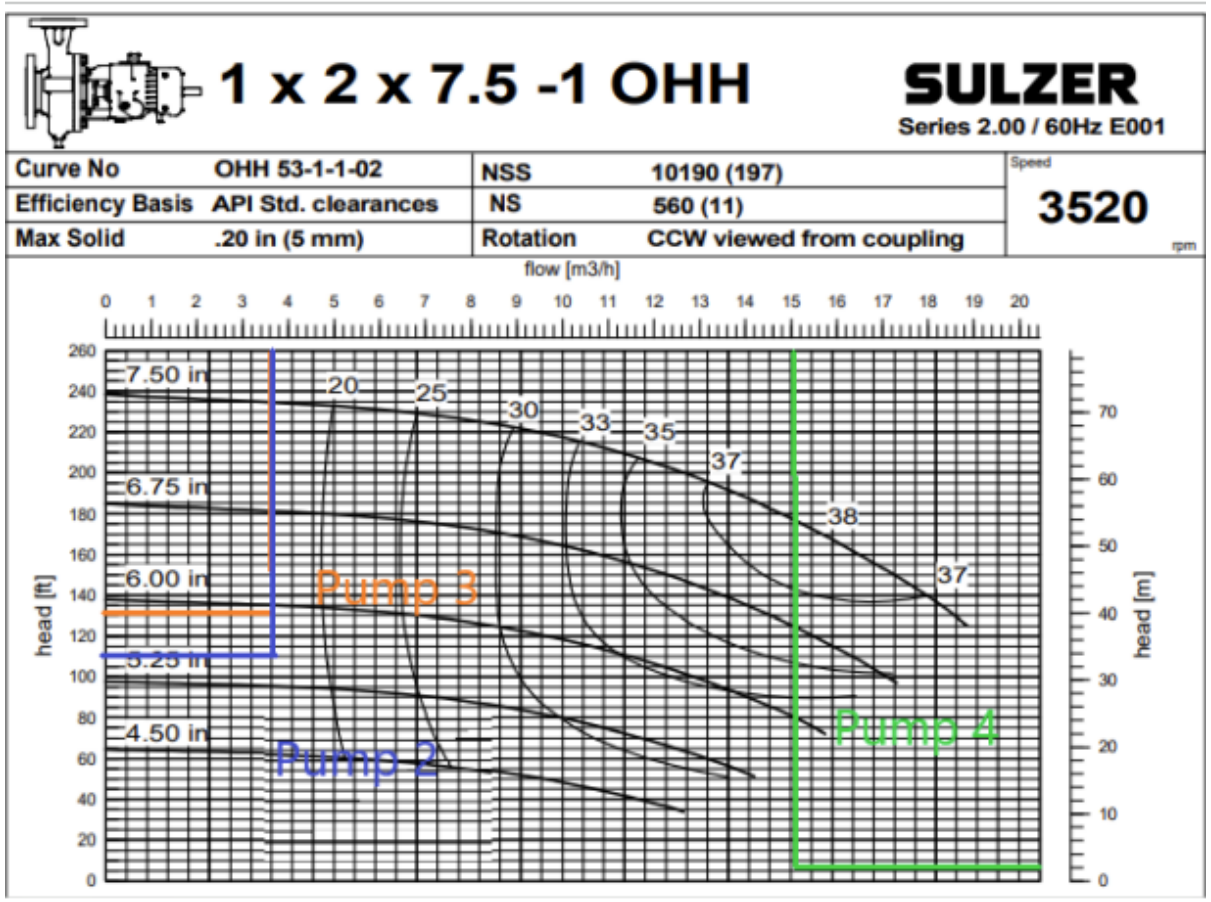


Figure 12 - Pipe Support Calculations

Pump Selection

- Pump Curves





Pump Power Requirements

Table 30 - Pump Power

Pump #	H_A (ft)	$Q(\frac{ft^3}{s})$	Pa(Required Power)HP
Pump 1	21.34843	0.371	0.932
Pump 2	111.5343	0.0371	0.4870
Pump 3	129.1409	0.0371	0.5639
Pump 4	5.27894	0.1485	0.0923

Bill of Materials

ID #	Item Description	UOM	Quantity
1	Tank 1 , Fabricated 20000 Gallon Tank, D 15', H 16', 16 Guage 304 Stainless Steel	EA	1
2	Tank 2, Fabricated 1000 Gallon Tank, D 5.5', H 6.5', 16 Guage 304 Stainless Steel	EA	1
3	Tank 3, Fabricated 1000 Gallon Tank, D 10', H 11', 16 Guage 304 Stainless Steel	EA	1
4	Blind Flange McMaster Carr, 44685K164	EA	1
5	Hex Head Bolts, .5"-13, 304 Stainless Steel	EA	4
6	2.5" NPS S40 Pipe, 10' Sections	EA	3
7	2.5" NPS S40 Gate Valves	EA	2
8	2.5" NPS S40 Couplings.	EA	2
9	2.5" NPS Unions	EA	2
10	2.5" NPS 90 elbows	EA	2
11	2.5" NPS Swing Check Vlave	EA	1
12	1" NPS S40 Pipe, 10' Sections	EA	130
13	1" NPS S40 Gate Valves	EA	4
14	1" NPS S40 Couplings.	EA	130
15	1" NPS Unions	EA	4
16	1" NPS 90 elbows	EA	9
17	1" NPS Swing Check Vlave	EA	2
18	2" NPS S40 Pipe, 10' Sections	EA	2
19	2" NPS S40 Gate Valves	EA	2
20	2" NPS S40 Couplings.	EA	2
21	2" NPS Unions	EA	2
22	2" NPS 90 elbows	EA	2
23	2" NPS Swing Check Vlave	EA	1
24	Split Pipe Clamp, B3198H-2.5"	EA	30
25	Split Pipe Clamp, B3198H-1"	EA	650
26	Split Pipe Clamp, B3198H-2"	EA	10
27	Threaded Rod 3/8"-16	FT	1000
28	Threaded Rod 1/2"-13	FT	20
29	Flat Washer, 1/2"	EA	100
30	Lock Washer, 1/2"	EA	100
31	Nuts, 1/2"	EA	100
32	Flat Washer, 3/8"	EA	1000
33	Lock Washer, 3/8"	EA	1000
34	Nuts, 3/8"	EA	1000
35	Sulzer Pump 2 x 3 x 7.5A-1 OHH 5.25" Impeller	EA	1
36	Sulzer Pump 1 x 2 x 7.5-1 OHH 6" Impeller	EA	2
37	Sulzer Pump 2 x 3 x 7.5-1 OHH 5.25" Impeller	EA	1
38	Flow Nozzel for 1" pipe D/d of 0.5 with manometer	EA	1

Reflection

- One of my biggest takeaways from this project was the importance of effective teamwork. I joined their team on the latter part of the semester. They welcomed me with open arms and appreciated being able to contribute to an actual team. This project taught me how to hit the ground running. Since I wasn't there at the start of the semester, I had to play catch up to familiarize myself with the direction they were already going. Fitting in and being flexible to work towards the common goal of designing this piping system. Working on this project will benefit me in my career being able to problem solve methodically. Navigating the various technical demands and intricacies put it into a real-life perspective that I will be able to take with me forever. My knowledge of piping system increased working with two other brilliant minds that have more industry experience. As a student there is so much that you can take away than just in the classroom