PIPELINE SYSTEM FOR CONTINENTAL AG

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Group #8

JOB PHILOSOPHY

- The goal in this project was effective simplicity. The design was made to be easy to manufacture while still completing the required tasks without lacking anything

REQUIREMENTS OF THE SYSTEM

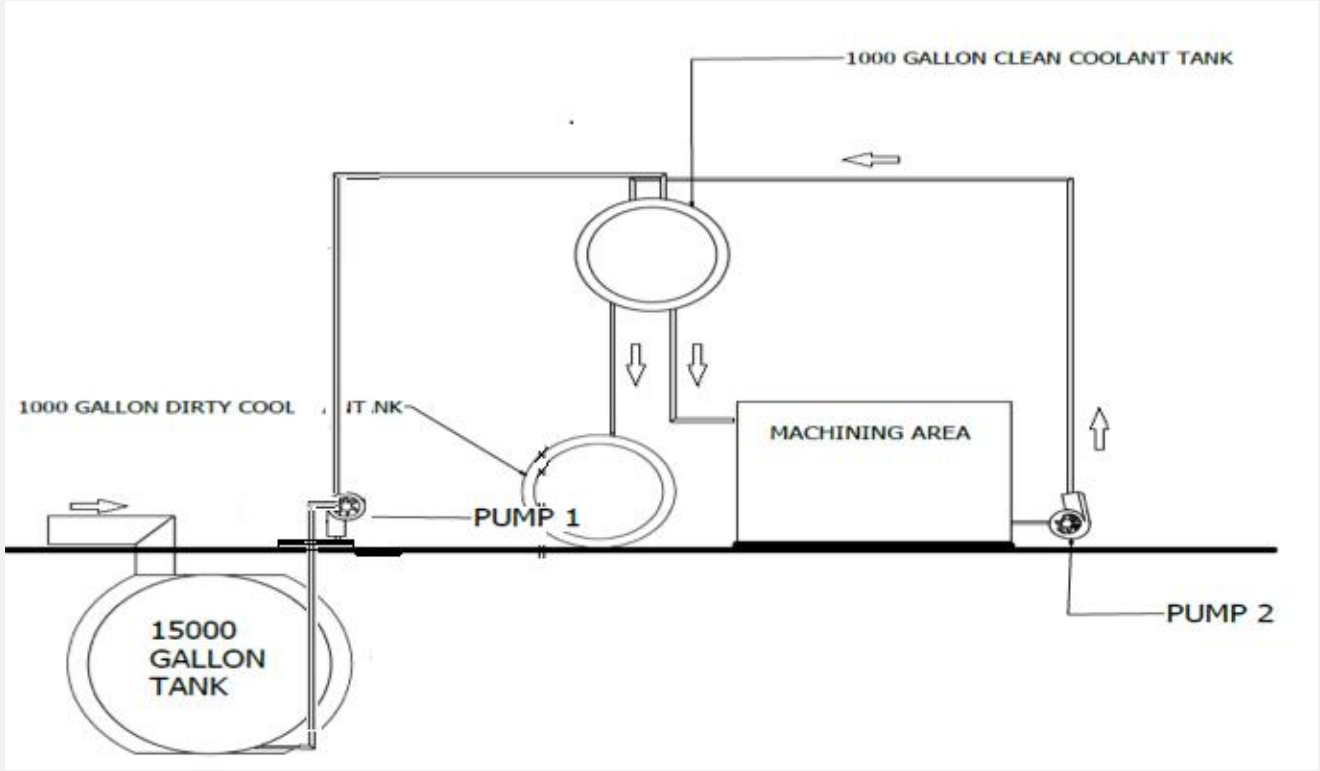
- To design a coolant system for a new manufacturing facility. Major tasks included:
  - Designing the tanks for the coolant
  - Designing the layout of the pipe system
  - Selecting proper valves, elbows, and fittings
  - Developing a hydraulic analysis of the entire system
  - Selecting pumps
  - Designing an open channel in the event one of the tanks fail
  - Designing supports for a pipe system
  - Preparing a bill of material (cost was not included for this project)

LOCATION AND JOBSITE

- The jobsite for this project is located in Dayton, Ohio where temperatures range from -20°F to 105°F and the frostline is 30 inches below ground

OUR SYSTEM

- Our system comprised of three tanks. One for clean coolant, a 1,000 gallon reservoir, and a 4,000 gallon tank for dirty coolant, two pumps, and approximately 700 feet of piping.



TANK DESIGN CALCULATIONS (TANK 2)

Calculating size and wall thickness

The tank with clean coolant will be close to the machine and attached to the roof while

For safety purpose, we will be using tank of 1100 gallon, taking 10% safety into consideration

Considering its height to be 5 ft

So the tank diameter will be

1100 gal = 147.0486ft^3

So $V = \pi r^2 * h$

$147.0486 = \pi * r^2 * 5$

r = 3.1 ft

Tank 2

We know in second tank 1000 gallon of coolant will be there

1000 Gal = 133.681ft^3

$133.681 ft^3 = \pi * 3.1^2 * h$

h = 4.430 ft

$P = \gamma h$

= 59*4.430

P = 265.8 lb/ft^2

P = 1.845 psi (https://coolconversion.com/pressure/lbf/ft2-to-psi)

t =P R/FS* S
t = (1.8 45*37.2)/15000
t = 0.0045756 in

CALCULATING PIPE THICKNESS

For pipe of 3.5-inch thickness

$$\frac{P1}{\gamma} + \frac{V1}{2g} + Z_1 = \frac{P2}{\gamma} + \frac{V2}{2g} + Z_2$$

$$P_1 = 859.36 \text{ lbf/ft}^2$$

$$t = \left(\frac{Pd}{2(\sigma - 0.2 * p)} \right)$$

$$t = \frac{859.36 * 0.190}{2(1085904 - 0.2 * 859.36)}$$

$$t = 0.1163 \text{ in}$$

Schedule 30 diameter pipe size	Max pressure	Thickness	Thickness specified by manufacturer
3.5	2257.895 lbf/ft^2	0.134 in	0.188 in
1.5	859.36 lbf/ft^2	0.116 in	0.124 in

HYDRAULIC ANALYSIS

Reynolds number =Re = pVD/u

= (59) (9.81) (0.4)/ (13.35*10^4)

=4.03*10^3

f= (0.25)/ [(log (1/ (3.7)) ((D)/ (K)) + (5.74)/ (RE)] ^2

f = (0.25)/[(log(1/(3.7))((0.4)/(5*10^{-6}))+(5.74)/(4.03*10^3)]^2

f= 0.01045

Head loss pipe (section 1) = (f) (L/D) ((V^2)/ (2g))

Head loss pipe (section 1) = (0.01045) ((609)/ (0.4)) ((9.83^2)/ ((2) (32.18))

Head loss pipe (section 1) = 16.19

Head loss valve (section 1) = (2) (0.256) (9.83^2) (2*32.18)

Head loss valve (section 1) = 0.0084

Head loss elbow (section 1) = (4) (0.313) ((9.83^2) (2*32.18))

Head loss elbow (section 1) =0.0061

Head loss (section 1) = 16.219

Summary

	Reynolds number	Friction Factor	Head loss pipe	Head loss valve	Head loss elbow	Total head loss
section 1-2	4.03*10^3	0.01045	16.2045	0.0084	0.0061	16.219
section 2-3	4.03*103	0.00965	11.25	0.0042	0.0016	11.2558
section 3-4	4.03*103	0.00825	9.03	0.0084	0.0045	9.0429
section 4-5	4.03*103	0.00912	8.15	0.0042	0	8.1542

Table 7.1

BILL OF MATERIALS

Bill of material				
	Amount	Size	Description	Material
15000 Gallon tank Components				
Tank	1	18000	Main storage tank	Fiber glass
Flange	1	0.0795 in	-	Forged steel
PVC pipe	1	1.5 in	-	PVC
PUMP	1		Sulzer pump	Standard
Elbow	3	1.5 in	Standard 90	PVC
Gate valve	2	1.5 in	-	Steel
1000 Gallon tank Components				
Tank	1	1100	Main storage tank	Fiber glass
PVC pipe	1	3.5 in	-	PVC
Elbow	2	3.5 in	Standard 90	PVC
Gate valve	1	3.5 in	-	Steel
Machining Area				
PVC pipe	1	1.5 in	-	PVC
PUMP	1		Sulzer pump	Standard
Elbow	3	1.5 in	Standard 90	PVC
Gate valve	2	1.5 in	-	Steel
4000 Gallon tank Components				
Tank	1	4000	Main storage tank	Fiber glass
PVC pipe	1	3.5 in	-	PVC
Elbow	1	3.5 in	Standard 90	PVC
Gate valve	1	3.5 in	-	Steel

THANK YOU WATCHING