جامعة تكريت

كلية الهندسة قسم الميكانيك

محاضرة تصميم الانابيب وخزان التمدد للمرحلة الرابعة

المادة: تكييف التاريخ ١١ شباط 2025

Example

Find the total pressure drop of a 60 m pipe length of a small building, if there are 3 open gate valve and 4 standard elbow as a fitting when a water flow through a pipe at a rate of 240 l/min. at 80 ^{o}C.

Solution

Pressure drop for a water flow through a pipe Found from chart (Figure 7-6) at (Q=240 l/min =4 l/s). the pressure drop per unit length ΔP/l value must be in the range (74 ≤ ΔP/l ≤ 392) and when ΔP/l was chosen to be ΔP/l= 150 Pa the suitable value for the diameter will be D= (75 mm=3 inch).

At water temperature, Temp.=80 ^{o}C the correction factor value found from (Figure 7-7) after found the water velocity from Q= 4 l/s and D= 75 mm, so that velocity=Q/Area= 1 m/s, so that correction factor value=0.88

Equivalent lengths of fitting found from Figure A5.5

Equivalent lengths for 3 open gate value=3*(1.7/3.28) =1.54m

Equivalent lengths for 4 stander elbow=4*(8/3.28) =4.84m

L_T= (60+4.84+1.54) =66.38 m

Δ P/l=150 *0.88

ΔP = (150*0.88) * 66.38=8424 Pa

ΔP =8.424 kPa

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Example: Find the volume of the Closed Expansion Tank for Chilled (Chiller) and Hot (Boiler) systems by using the following equation

$$\frac{v_t}{v_s} = (4.1 \times 10^{-4} \times t_m - 4.66 \times 10^{-3}) \times \frac{1}{\frac{p_i}{p_c} - \frac{p_i}{p_h}}$$

Where

v_t: volume of the closed expansion tank (m^3)

t_m: Maximum water temperature in the system (^oC)

p_i: Pressure of expansion tank when water first enters 101 kPa

p_c: Pressure of expansion tank before rising water temperature (kPa)

p_h: Pressure of expansion tank when water temperature be hot or change. (kPa)

t_m: maximum water temp. in the cooler Chilled system = 15 ^oC

or

t_m: maximum water temp. in the heater Boiler = 80 ^oC

Volume of Closed Expansion Tank for cooler Chilled system

p_c Pressure of expansion tank before rising water temperature in the chilled system = 621 kPa

p_c Pressure of expansion tank before rising water temperature in the Boiler system = 550 kPa

p_h Pressure of expansion tank when water temperature be hot or change in the chilled system

p_h = 671 kPa

p_h Pressure of expansion tank when water temperature be hot or change in the Boiler system

p_h = 659 kPa

Where

v_s volume of the Chilled system = 4.5 m^3

and

v_s volume of the Boiler system = 1.7 m^3

Closed Expansion Tank volume for Chilled system

$$\frac{v_t}{4.5} = (4.1 \times 10^{-4} \times 15 - 4.66 \times 10^{-3}) \times \frac{1}{\frac{100}{621} - \frac{100}{671}}$$

Expansion tank volume for Chilled system v_t = 0.57 m^3

Closed Expansion Tank volume for Boiler system

$$\frac{v_t}{1.7} = (4.1 \times 10^{-4} \times 80 - 4.66 \times 10^{-3}) \times \frac{1}{\frac{100}{550} - \frac{100}{659}}$$

Expansion tank volume for hot system v_t = 1.59 m^3

Expansion Tank volume for condenser system

Closed Expansion Tank not suitable for condenser system, because the cooling tower is open, so its connect directly to the tank to operate as Open Expansion Tank.

	Zone	Expansion Tank Volume m^3	Standard Volume m^3
1	chiller	0.57	1
2	Boiler	1.59	1.5
3	Condenser	Connect with Tank	Open Expansion Tank