ME224 Experiment 8

Experiment 8- Losses in Pipe fittings

Aim: To experimentally determine the head losses in pipe fittings like elbow, bend, sudden expansion and contraction

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Roll Number - 200100094

* Working and Calculations

Sr No 14

→ Discharge = $V/t = 5\times10^{-3}/8.58s = 0.0005827\ m^3/s$

→ Velocity = $Q/A = \dfrac{0.000582}{\pi\times\left(\frac{15\times10^{-3}}{2}\right)^2} = 3.297694\ m/s$

→ $\Delta p = S_g \Delta h = 9.8\times12.6\times(220-207)\times10^{-3} = 1606.878\ Pa$

→ $h_e = \dfrac{\Delta p}{S_g} + \dfrac{(v_2^2-v_1^2)}{2g} = \dfrac{-1606.878}{2\times9.81} + \dfrac{v_2^2-v_1^2}{2g} = 0.107486674$

→ $K = \dfrac{2g}{v_2^2}(h_e) = 0.272015$

* Sources of Error

→ Parallax error in the measurement of height difference in manometer readings

→ Flow may not have reached the steady state and may fluctuate.

→ Air bubbles may be present and cause inaccuracy in pressure readings.

* Observations and Calculations

→ The value of K is in the order

$$K_{bend} > K_{elbow} > K_{sudden\ contraction} > K_{sudden\ expansion}$$

→ For a pipe $K_{sudden\ contraction}$ is always constant

→ K_{elbow} and K_{bend} increases as Re decreases

→ $K_{sudden\ expansion}$ decreases and Re decreases

It is important to account for minor losses due to changes in pipe structure or other reasons such as change in cross section, to achieve good accuracy.

* Questions and Answers

Q1)

→ Fluid flow in a pipe has major losses and minor losses. The major losses are due to frictional losses and minor losses are due to the pipe fittings

Q2) K remains constant in sudden contraction, but in sudden expansion, it is dependent on pressure difference and velocity and hence is not constant.

Fitting	Sr. No.	Time for 5 liters to fill 't' (sec)	Discharge 'Q' (m^s/sec)	Velocity 'V' (m/s)	Manometer reading '*hm*' (mm of Hg)		Δp (pa)	Re	K
					h1	*h2*			
Elbow	0	6.34	0.00078864	4.462809	170	257	10753.72	83939.99023	1.079872
	1	7.09	0.00070522	3.990721	183	245	7663.572	75060.58364	0.962406
	2	7.99	0.00062578	3.541203	188	240	6427.512	66605.69938	1.025112
	3	11.93	0.00041911	2.371686	198	229	3831.786	44608.51115	1.362439
	4	39.88	0.00012538	0.709484	212	215	370.818	13344.52202	1.47335
Bend	5	6.5	0.00076923	4.352956	275	152	15203.54	81873.77508	1.604745
	6	7.49	0.00066756	3.777598	255	172	10259.3	71052.00775	1.437858
	7	10.53	0.00047483	2.68701	235	190	5562.27	50539.36733	1.540791
	8	9.36	0.00053419	3.022886	240	185	6798.33	56856.78825	1.487951
Sudden Expansion	9	6.54	0.00076453	4.326332	230	197	4078.998	81373.01805	0.248101
	10	8.02	0.00062344	3.527957	223	204	2348.514	66356.55088	0.30658
	11	13.18	0.00037936	2.146754	218	210	988.848	40377.81017	0.254821
	12	10.13	0.00049358	2.793111	220	207	1606.878	52534.99882	0.272015
Sudden Contraction	13	6.55	0.00076336	4.319727	183	245	7663.572	81248.78443	1242.438
	14	8.58	0.00058275	3.297694	197	230	4078.998	62025.58718	1878.842
	15	13.63	0.00036684	2.075878	207	219	1483.272	39044.72032	4298.727

v1	v2	he
3.80244	1.287173	0.236684
3.100743	1.04964	0.194487
1.886795	0.638704	0.059855
2.454883	0.831008	0.108161
	v2	hc
	215.332	1181.648
	202.1484	1041.386
	192.4805	944.1573