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Experimental study of influence of density of fluid on Minor losses

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ABSTRACT

The study of influence of density on minor losses coefficient of incompressible fluid run through pipes. The experimental test rig fabricated with all necessary attachments. The head losses due to minor pipe fittings were estimated, at specific points for the specified mass flow rate. By using the manometers head loss due to minor loss was measured. All the measurements were calibrated and validated in a maximum difference of standard 5%. The head losses decrease as the mass flow rate decreases, for all pipe fittings.

Keywords

Minor head losses, Standard deviation difference, Mass flow rate.

INTRODUCTION

Due to friction between the fluid & pipe walls, internal friction, between fluid particles are occurred due to conflict in energy losses. Secondary minor losses may be occurring at any point of pipe system where streamlines are linear. In case of pipe junction, valves, bends, contraction, expansion & inlet & out let reservoir.

There may be frictional losses at the pipe entry, valves and fittings. The frictional losses other than pipe friction are called minor losses.

In case of long pipes the minor losses are small as compared with the loss of head due to friction and hence they are called minor losses and even may be neglected. But in case of short pipe, these losses are comparable with the loss of head due to friction.

1. Objectives of the study

- To determine minor loss co-efficient and associated loss in head for various pipe components like valves bends, etc.
- To study the influence of density of flowing fluid on Minor losses in a pipe flow.
- To compute the energy losses in valves, fittings, pipe bends, difference in pipe sizes.
- To narrate the energy dropping that occurs in a typical fluid flow in a pipe system.

2. METHODOLOGY

1. Ascertain the barometric pressure and the water temperature.
2. Determine the density of water/fluid by Gravimetric Method.
3. Check the minor loss co-efficient by regular method

3 DESIGNS AND FABRICATION OF TEST RIG

There are many factors are considered for designing the piping fluid flow for the selection of material for different code application, standards, environmental, safety, performance of the requirements, economics of the design & different parameters which constrain work. Fluid process failure usually occurs within interconnect points near piping, flanges, values, fittings.

These failures may include cost & availability. Following are the various key evaluation factors like strength, ductile, toughness & corrosion resistance.Pipping material is selected by cultivating the basic design to enumerate operational requirements. Following service conditions must be reviewed such as fluid velocity for the application, liquid characteristics, viscosity, temperature, suspended solids concentration, solid density, abrasiveness, corrosively & settling velocity.

3.1 Density of fluid

Following are the physical properties of fluid & accuracy values are affected by the flow of fluid in pipeline. Basically it has been named as viscosity which as described as fluid viscosity it can also described as dynamic viscosity or kinematics viscosity.

Kinematic viscosity = Dynamic viscosity/ fluid density/ (density, specific volume & specify gravity)

Different fluid density are used in the experiment as specified below

Table 1: Densities of different fluids used in the experiment.

Liquid	Temperature in degrees	Density(kg/m^3)
Clear water	25	979
Mud water (10%)	25	1044
Mud water (20%)	25	1050
Grease oil	25	1020

3.1.1 Expansion

Consider a liquid drizzling through a pipe which is subjected to sudden enlargement. There will be sudden reform in diameter from d1 to d2 the liquid spill from the smallest pipe is not able to follow the rapid changes in margin. Thus the flow separates from boundary and turbulent are expressed as below

$h_e=(V_1-V_2)^2/2_g$

Let p_1 = Section 1-1 pressure intensity,

V_1 = Section 1-1 at flow of velocity,

A_1 = Section 1-1 area of pipe,

p_2, V_2 and A_2 = Section 2-2 corresponding values

3.1.2 Contraction

In case of fluid flows through a tube has sudden contraction in region as shown in fig is liquid of flow from large conduit to smaller tube of zone which flow goes on reducing .

$h_c=0.5 * (V_2^2/2g)$

Let Ac= region of flow at section c-c

V_c= momentum of flow of section c-c

A_2= district of flow at section 2-2

V_2= velocity of flow at section 2-2

H_c=loss of head due to sudden contraction

Now h_c= actual loss of head due to enlargement from section-C to section 2-2

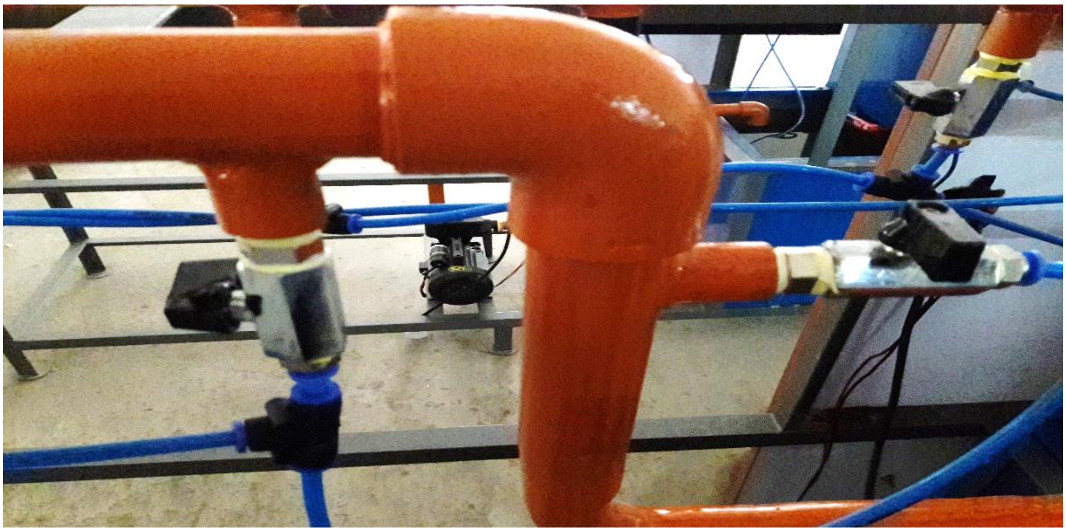
3.1.3 Bend

When there is bend in a tube the momentum of flow changes due to which disconnection of the flow from the margin and also formation of eddies takes place. Thus the energy is drift. Loss of head in tube due to bend is expressed as

$H_b = (kV^2)/2g$

V=velocity of flow

K=co-efficient of bend



4. RESULTS AND DISCUSSION

Table 4.1 Loss of head in sudden contraction

Type of fitting	Manometer reading			Loss of head hl (mm)
Sudden contraction	**h1 (mm)**	**h2 (mm)**	**(h1-h2) mm**	
Clear water	**340**	**270**	**7**	**882**
	355	258	9.7	787
	368	252	11.6	766
Mud water	**321**	**291**	**30**	**373.8**
	325	288	37	461.02
	337	278	59	531.9
Crude oil	**306**	**288**	**18**	**215.1**
	301	295	6	717
	300	298	2	1025

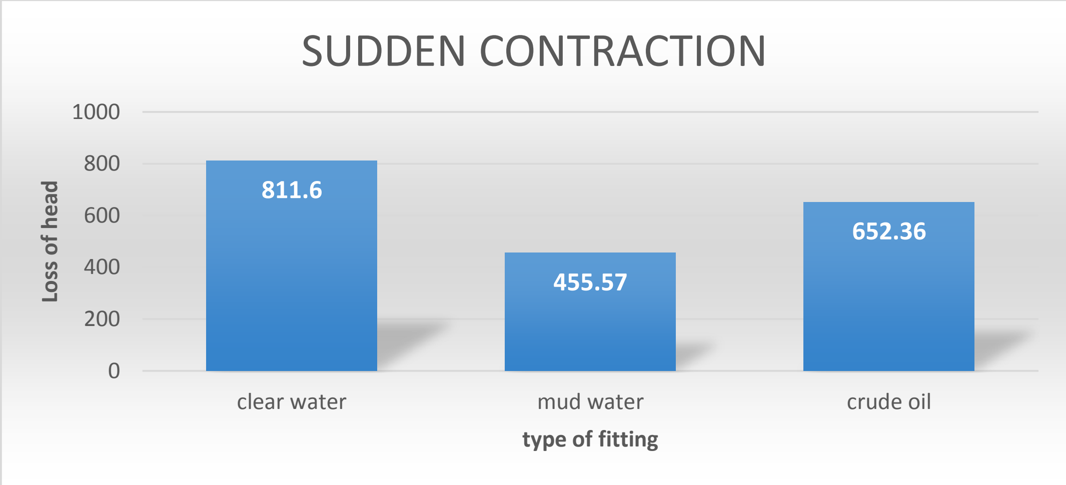


Fig 4.1Loss of head in sudden contraction

Type of fitting	Manometer reading			Loss of head hl (mm)
Sudden expansion	**h1 (mm)**	**h2 (mm)**	**(h1-h2) mm**	
Clear water	**311**	**299**	**1**	**151.2**
	313	298	1.5	189
	313	297	1.6	195
Mud water	**306**	**305**	**1**	**12.46**
	307	304	3	37.38
	309	302	7	69.8
Crude oil	**298**	**297**	**1**	**11.95**
	299	294	5	59.75
	300	293	7	83.65

Table 4.2Loss of head in sudden expansion

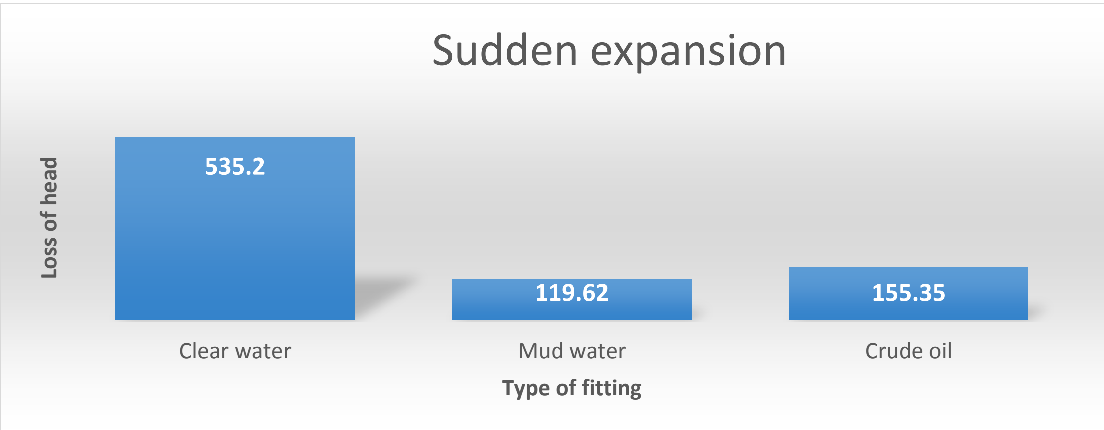


Fig 4.2 Loss of head in sudden expansion

Table 4.3Loss of head in Bend

Type of fitting	Manometer reading			Loss of head hl (mm)
Bend	**h1 (mm)**	**h2 (mm)**	**(h1-h2) mm**	
Clear water	**310**	**302**	**8**	**100.8**
	311	289	22	**272.2**
	312	298	14	**165**
Mud water	**309**	**303**	**6**	**74.76**
	310	302	8	**99.68**
	312	301	11	**137.06**
crude oil	**297**	**296**	**1**	**11.95**
	299	295	4	**47.8**
	300	295	5	**59.75**

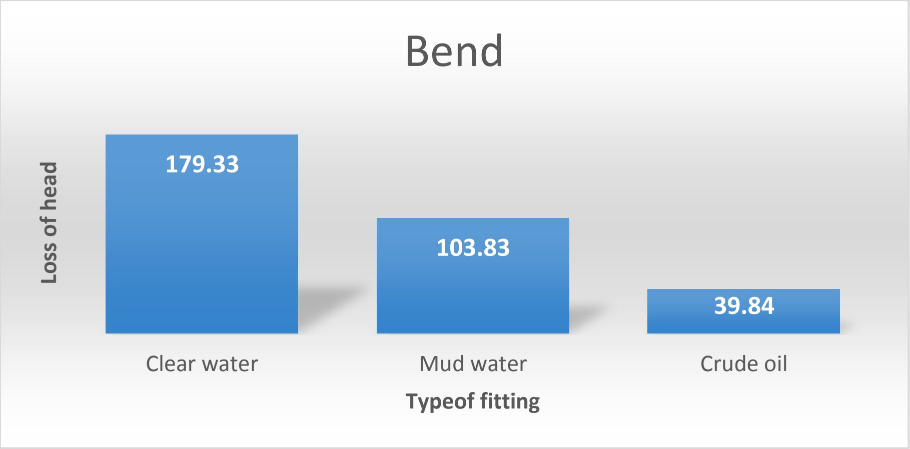


Fig 4.3 Loss of head in Bend

5. CONCLUSION

For all the these cases it has been observed that minor losses coefficients decreased with increase of density of flowing fluid. Further study can be carried out to find the correlation factor or correction factor for minor losses coefficients. For a Bend Radius increase in bending angle increases Minor loss coefficient. For a given Bend angle Minor loss coefficient increases with the ratio of Pipe Diameter and Bend Radius until it reaches a maximum value, then it decreases.

Scope for Future Works

Further study can be carried out to find the correlation factor or correction factor for minor losses coefficients.

REFERENCES

[1] M.H. Khan, Md. Quamrul Islam, "An Experimental Investigation of Flow Through Flexible Pipes and Bends", Journal of Institution of Engineers, Bangladesh, Vol7,No. 3 July,1979.

[2] Md. Hafizur rahman, A. K. Roy, Md. S. Hossain,"Determination of Minor head Loss and Friction Factor for locally Available PVC pipe Reducers".BUET, September-2009

[3] Md. Rokonuzzaman Khan, Saad Ahmed, A. S. M.Jonayat, "Determination of friction Factor of Flow through Flexible Pipes and Minor Loss Coefficient of Flexible Bends", BUET, February-2011

[4] J. Hydr. Engrg., "Energy Losses in Cross Junctions", *American Society of civil Engineers, ASCE*, Vol. 136,Issue 1, pp. 50-55, January 2010.

[5] Kindsvater, C. E., and Carter, R. W., 1959, Discharge characteristics of rectangular thin-plate weirs: Am. Soc., Civil Engineers Trans., v. 124, p. 772.

[6] B. R. Munson, D.F Young and T. H. Okiisshi, 1998. *Fundamentals of Fluid Mechanics*, John Wiley and Sons, Inc.

[7] International Standards Organization, 1975, Liquid flow measurement in open channels using thin-plate weirs and venture flumes (ISO 1438-1975).

[8] S. G. Kandlikar and L. A. Campbell, ‘‘Effect of entrance condition on frictional losses and transition to turbulence,’’ Proceedings of IMECE2002,17–22 November, 2002, New Orleans. IMECE2002-34573.Available at ^http://www.rit.edu/;taleme/papers/conference%20papers/ C058.pdf&.

[9] G. T. Hageseth, ‘‘Surface and kinetic energy densities: A fluid dynamics laboratory exercise,’’ Am. J. Phys. **54**, 1011–1014 ~1986!.