Indian Standard

RECOMMENDATION FOR ESTIMATION OF FLOW OF LIQUIDS IN CLOSED CONDUITS

PART I HEAD LOSS IN STRAIGHT PIPES DUE TO FRICTIONAL RESISTANCE

1. SCOPE

1.1 This standard recommends a method for estimating the loss of head due to friction in straight pipes having uniform flow of liquids.

FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 24 March 1965, after the draft finalized by the Fluid Flow Measurement Sectional Committee had been approved by the Building Division Council.

0.2 An important effect of fluid friction is experienced in the resistance to the Bow of liquids through pipe lines. This resistance can only be overcome by a gradual fall of pressure in the liquid, in the direction of motion. A back-ground of the nature and magnitude of the frictional resistance to the flow; experienced under different conditions occurring in practice, would be essential for proper designing of pipe lines.

0.3 The classical equation for the resistance to the flow of liquids in long, straight, uniform pipes, as proposed by Darcy is followed widely. However, in this equation proper choice has to be made for the dimensionless friction. factor in order to arrive at the correct .assessment of losses. Several empirical formulae based on experiments carried out during the last 100 years are available with their limited applicability. Later analyses are based on the roughness factor and Reynolds number of flow. For example, Hydraulic Institute at New York has made systematic work for the revision of pipe friction data. This standard, therefore, recommends the values for friction factor for a wide range of temperature, velocity and diameter of pipe. It is hoped that the universal pipe friction diagram with its nomograms, suggested in this standard would be useful in obtaining a complete solution rapidly without lengthy calculations.

0.4 One more salient feature which affects the friction factor is the deterioration of pipes with age. The internal fouling of pipes due to corrosion or tuberculation which in turn is due to factors like chemical characteristics of the liquid, iron bacteria, will increase the friction factor with time and reduce the available area for flow. Approximate curves for different growth rates of absolute roughness and their effect on discharge in cast iron plpe5carrymg water are given as an example.

0.5 The Sectional Committee responsible for the preparation of this standard has taken into consideration the views of users and technologists and has related the standard to the practices followed in the country in this field. Due weightage has also been given to the need for international co-ordination among standards prevailing in different countries of the world These considerations led the Sectional Committee to derive assistance from the following publications:

ISO Draft Recommendation No. 532 Measurement of fluid flow by means of orifice plates and nozzles
Pipe Friction Manual 1954 Hydraulic Institute, New York

0.6 This standard is one of a series of Indian Standards covering fluid flow in closed conduits. Other standards in the series are:

IS: 2951 (Part II)-1965 Recommendation for estimation of flow of liquids in closed conduits, Part II Head loss in valves and fittings
IS: 2952 (Part I)-1964 Measurement of fluid flow by means of orifice plates and nozzles, Part I Incompressible fluids

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.