



Standard Method of FLOW MEASUREMENT OF WATER BY THE VENTURI METER TUBE¹

This Standard is issued under the fixed designation D 2458; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

1. Scope

1.1 This method covers the measurement of the rate of flow of water in pipelines using the Herschel Standard Venturi meter tube.

1.2 Venturi² meter tubes are applicable for the measurement of industrial water flow and particularly for slurries or similar nonhomogeneous liquids containing large concentrations of suspended solids. Individually calibrated, the Venturi tube is used as a standard of measurement for acceptance tests on pumping and similar equipment. Pressure losses through Venturi tubes are less than for other primary flow measuring devices installed in pipelines. Thus, substantial savings in pumping power consumption can be realized by its use.

2. Definitions

2.1 *head, H* —the energy (capacity to do work) possessed by a liquid because of its elevation, velocity, pressure, or any combination of these. Each source of energy may be expressed in terms of equivalent head in feet, inches of water, or pounds per square inch, and each can be converted into the other two.

2.2 *differential head, H_D* —the difference in pressure head H_D in Fig. 2 between the inlet and the throat of the Venturi tube.

2.3 *loss of head*—the difference in line pressure at the inlet end and just downstream from the Venturi tube. It is also termed “non-recoverable head.”

2.4 *hydraulic gradient*—a line in any selected plane, connecting all points representing pressure head in any system.

2.5 *beta ratio*—the ratio of throat diame-

ter, d , to the inlet diameter, D . The quantity d/D is expressed as a decimal and represented by the Greek letter Beta.

3. General Principles

3.1 The standard (long-type) Herschel³ Venturi meter tube is a specially constructed primary differential producer and flow-measuring device which is installed between two flanges in a pipeline to form a constricted section (Fig. 1). The device operates on the principle that when a fluid passes through a reduced cross sectional area, an increase in velocity and a corresponding decrease in pressure (head) will occur (Fig. 2). This reduction in pressure is a simple function of the rate of flow. Two pressure measurements are made, one each at the high-pressure inlet point and at the low-pressure throat section. The difference in head, H_D (h_{v2}), expressed either as inches of water column or feet of water, is a measure of velocity, which is a measure of rate of flow, with the flow varying as the square root of the differential.

3.1.1 The increase in velocity is given as follows:

$$V = C(2gh_{v2})^{0.5}$$

¹ This method is under the jurisdiction of ASTM Committee D-19 on Water.

Current edition effective Oct. 3, 1969. Originally issued 1966. Replaces D 2458 – 66 T.

² The principle of the Venturi meter was first stated in 1797 by J. B. Venturi, an Italian, and was first applied by Clemens Herschel to the measurement of flow in pipes in 1887.

³ Herschel, Clemens, “Fluid Meters: Their Theory and Application,” Report of Special Research Committee on Fluid Meters, ASME, 1924.