INTERNATIONAL STANDARD

ISO 17778

First edition
2015-03-15

Plastics piping systems — Fittings, valves and ancillaries — Determination of gaseous flow rate/pressure drop relationships

Systèmes de canalisations en plastiques — Raccords, robinets et équipements auxiliaires — Détermination du rapport débit gazeux/perte de charge

Reference number
ISO 17778:2015(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 5, *General properties of pipes, fittings and valves of plastics materials and their accessories — Test methods and basic specifications.*

This is the first version of this International Standard. This edition of ISO 17778 is prepared under Vienna Agreement so that the content is aligned with the EN 12117:1997, which will be replaced.

Plastics piping systems — Fittings, valves and ancillaries — Determination of gaseous flow rate/pressure drop relationships

WARNING — Persons using this International Standard should be familiar with normal laboratory practice, if applicable. The use of this International Standard can involve hazardous materials, operations, and equipment. This International Standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard specifies a method for determining the flow rate/pressure drop relationship of components for plastics piping systems when tested using air at 25 mbar.

NOTE 1 bar = 10^5 N/m^2.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 837-1, *Pressure gauges — Part 1: Bourdon tube pressure gauges — Dimensions, metrology, requirements and testing*

3 Principle

Utilizing a constant main pressure, the flow rate through a piping component is varied between specific limits to assess the pressure drop. The average value of the air flow rate for a pressure drop appropriate to the size of the component is then determined. The value for other gases can be calculated on the basis of density differences.

NOTE It is assumed that the following test parameters are set by the standard making reference to this International Standard:

a) the relevant value(s) for pressure drop, Δp_n (see 7.2);

b) the relevant value to be used for ρ_{air} and the relevant temperature and pressure if not as given in 7.3;

c) the relevant value to be used for ρ_{gas} and the relevant temperature and pressure if not as given in 7.3.

4 Apparatus

4.1 Schematic test arrangement for determination of flow rate/pressure drop relationship is shown in Figure 1.

4.2 A source of air.

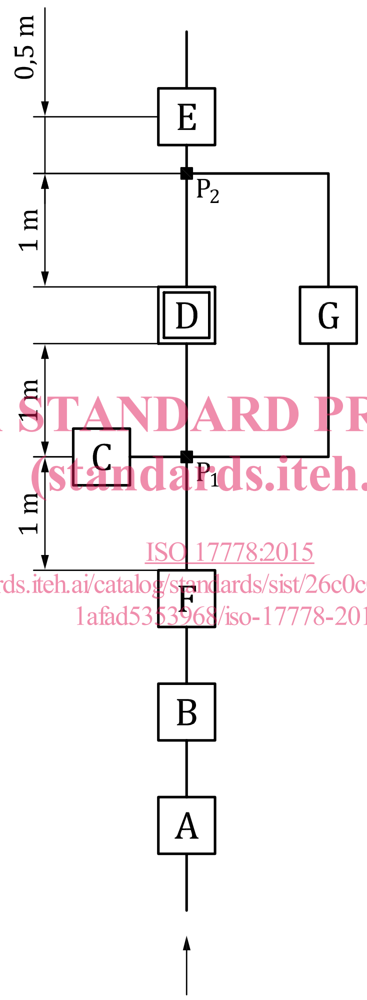
4.3 Pressure controller (A), capable of maintaining an output pressure of (25 ± 0,5) mbar.

4.4 Flow meter (B), accurate to ±2 % and of the positive displacement or turbine type.

4.5 Manometer (C), for measuring the gas pressure in the main line and capable of checking conformity to 4.2, 6.4, and 6.7 (class 0,6 or better as specified in EN 837-1).

4.6 Manometer (G), for measuring differential pressure Δ*p*, conforming to class 0,25 of EN 837-1.

4.7 Outlet valve (E).



Key

A	pressure controller	E	outlet valve
B	flow meter	F	reservoir
C	pressure manometer	G	differential pressure manometer
D	component under test		

Figure 1 — Schematic test arrangement for determination of flow rate/pressure drop relationship

NOTE The differential pressure Δ*p* is the pressure difference between that at point P_1 and that at point P_2.

5 Test pieces preparation

The test piece shall comprise the component to be tested fused or connected between two pieces of plastic pipe that fits the component and provided with connectors appropriate to the pressure drop apparatus.

The free lengths of the plastic pipe and the geometry of the test arrangement shall conform to Figure 1.

For tapping tees, the arrangement shall be such that the pressure drop can be measured through the outlet branch.

Pressure tang points upstream and downstream of the component under test shall be flush with the pipe bore and free from burrs.

6 Procedure

6.1 Carry out the following procedure at an ambient temperature of (23 ± 2) °C.

6.2 Partially open the outlet valve (E).

6.3 Open the inlet valve to the pressure controller (A) so that air starts to flow and ensure that the air flows from the outlet valve only.

6.4 By means of the pressure controller (A), regulate the air pressure in the main line at point P_1 as shown by manometer (C), to (25 ± 0,5) mbar.

6.5 Measure and record the flow rate, Q, on flow meter (B) (see 6.9) and the pressure drop, Δp, on manometer (G) (see Figure 1).

6.6 Open the outlet valve (E) such that the air pressure at point P_1 in the main line is reduced at manometer (C) by approximately 5 mbar.

6.7 Increase the flow rate until the air pressure in the main line at manometer (C) returns to (25 ± 0,5) mbar.

6.8 Measure and record the flow rate, Q, and the pressure drop, Δp.

6.9 Repeat operations 6.6, 6.7, and 6.8 until the outlet valve (E) is fully open. For tapping tees, the pressure drop shall be measured through the outlet branch.

6.10 Consider the data acceptable if the following conditions are fulfilled:

a) at least five sets of data for Q and Δp, and hence differing values for V (see 7.1) have been obtained;

b) at least one value of V is ≤2,5m/s;

c) at least one value of V is ≥7,5m/s.

Otherwise, adjust the inlet valve opening and repeat 6.4 and 6.5, as necessary, to obtain the missing value(s).

If it is not possible for V to be ≥7,5m/s using a pressure of (25 ± 0,5) mbar, stop the test and report this observation.

7 Calculation of results

7.1 Using each set of pressure drop values and the corresponding flow rates, obtained in accordance with 6.5, 6.8, and 6.9, calculate the following:

a) The velocity, V, of the flow, in metres per second (m/s), through the outlet pipe component of the test piece (see Clause 5) using Formula (1):

$$V = \frac{Q}{A} \tag{1}$$

where

Q is the air flow rate, in cubic metres per hour (m^3/h);

A is the bore area of the outlet pipe, in square metres (m^2).

b) The factor, F, for each set of readings, based on Formula (2):

$$F = \frac{\Delta p}{Q^2} \tag{2}$$

where

Δp is the measured pressure drop, in millibars (mbar);

Q is the air flow rate, in cubic metres per hour (m^3/h).

Calculate the average value of F.

7.2 Using the average value of F and the specified pressure drop, Δp_n, calculate the average air flow rate, Q_a, at that pressure drop.

7.3 Calculate the equivalent flow rate(s) for any other gas Q_{gas} (e.g. natural gas), in cubic metres per hour, using Formula (3):

$$Q_{gas} = Q_a \times \sqrt{\frac{\rho_{air}}{\rho_{gas}}} \tag{3}$$

where

Q_a is the average air flow rate at the relevant pressure drop(s) cubic metres per hour (m^3/h);

ρ_{air} is the density of air at 23 °C and 1 bar, unless otherwise specified by the referring standard (kg/m^3);

ρ_{gas} is the density of the other gas at 23 °C and 1 bar, unless otherwise specified by the referring standard (kg/m^3).

i.e. $Q_{gas} = (f)Q$.

8 Test report

The test report shall include the following information:

a) a reference to this International Standard (i.e. ISO 17778) and the referring standard;

b) all details necessary for identification of the test pieces, including the nominal size of the pipes and fittings used to produce the test pieces, the type of material, and the manufacturer's code;

c) the pressure drop, flow rate, and corresponding velocity for each set of data (see 7.1) measured;

d) the average value of *F*, i.e. the relationship between pressure drop and flow rate (see 7.1);

e) the calculated flow rate(s) at the specified pressure drop(s) for air (see 7.2) and for the other gas (see 7.3);

f) factors that could have affected the results such as deviations from temperature limits, incidents, or operating details not specified in this International Standard;

g) the date of the test.