



BSI Standards Publication

Pneumatic fluid power — Determination of flow-rate characteristics of components using compressible fluids

Part 2: Alternative test methods

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National foreword

This British Standard is the UK implementation of ISO 6358-2:2019. It supersedes BS ISO 6358-2:2013, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/18/-/5, Control components.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Pneumatic fluid power — Determination of flow-rate characteristics of components using compressible fluids —

Part 2:

Alternative test methods

*Transmissions pneumatiques — Détermination des caractéristiques
de débit des composants traversés par un fluide compressible —*

Partie 2: Méthodes d'essai alternatives



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Foreword

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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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 5, *Control products and components*.

This second edition cancels and replaces the first edition (ISO 6358-2:2013), which has been technically revised.

A list of all parts in the ISO 6358 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

In pneumatic fluid power systems, power is transmitted and controlled through a gas under pressure within a circuit. Components that make up such a circuit are inherently resistive to the flow of the gas and it is necessary, therefore, to define and determine the flow-rate characteristics that describe their performance.

ISO 6358:1989¹⁾ was developed to determine the flow-rate characteristics of pneumatic valves, based upon a model of converging nozzles. The method included two characteristic parameters: sonic conductance, C , and critical pressure ratio, b , used in a proposed mathematical approximation of the flow behaviour. The result described flow performance of a pneumatic valve from choked flow to subsonic flow, based on static pressure. This new edition uses stagnation pressure instead, to take into account the influence of flow velocity on the measurement of pressures.

Experience has demonstrated that many pneumatic valves have converging–diverging characteristics that do not fit the ISO 6358:1989 model very well. Furthermore, new developments have allowed the application of this method to additional components beyond pneumatic valves. However, this now requires the use of four parameters (C , b , m , and Δp_c) to define the flow performance in both the choked and subsonic flow regions.

This document describes a set of three flow-rate characteristic parameters determined from test results. These parameters are described as follows and are listed in decreasing order of priority:

- The sonic conductance, C , corresponding to the maximum flow rate (choked) is the most important parameter. This parameter is defined by the upstream stagnation conditions.
- The critical back-pressure ratio, b , representing the boundary between choked and subsonic flow is second in importance. Its definition differs here from the one in ISO 6358:1989 because it corresponds to the ratio of downstream to upstream stagnation pressures.
- The subsonic index, m , is used if necessary to represent more accurately the subsonic flow behaviour. For components with a fixed flow path, m is distributed around 0,5. In these cases, only the first two characteristic parameters C and b are necessary. For many other components, m will vary widely. In these cases, it is necessary to determine C , b , and m .

Several changes to the test equipment were made to overcome apparent violations of the theory of compressible fluid flow. This included expanded inlet pressure-measuring tubes to satisfy the assumptions of negligible inlet velocity to the item under test and to allow the inlet stagnation pressure to be measured directly. Expanded outlet tubes allow the direct measurement of downstream stagnation pressure to better accommodate the different component models. The difference between stagnation pressure at upstream and downstream of component means a loss of pressure energy.

ISO 6358-3 can be used to calculate without measurements an estimate of the overall flow-rate characteristics of an assembly of components and piping, using the characteristics of each component and piping determined in accordance with this document or ISO 6358-1.

The discharge and charge test methods specified in this document have the following advantages over the test method specified in ISO 6358-1:

- a) an air source with a large flow-rate capacity is not required;
- b) components with larger flow-rate capacity can be tested more easily;
- c) energy consumption is minimised; and
- d) test time is shortened in the discharge and charge tests, and noise level is decreased in the charge test.

1) Withdrawn standard.

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Performance characteristics measured in accordance with this edition of the ISO 6358 series will differ from those measured in accordance with ISO 6358:1989.

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Pneumatic fluid power — Determination of flow-rate characteristics of components using compressible fluids —

Part 2: Alternative test methods

1 Scope

This document specifies a discharge test and a charge test as alternative methods for testing pneumatic fluid power components that use compressible fluids, i.e. gases, and that have internal flow passages that can be either fixed or variable in size to determine their flow-rate characteristics. However, this document does not apply to components whose flow coefficient is unstable during use, i.e. components that exhibit remarkable hysteretic behaviour (because they can contain flexible parts that deform under the flow) or that have an internal feedback phenomenon (such as regulators), or components that have a cracking pressure such as non-return (check) valves and quick-exhaust valves. In addition, it does not apply to components that exchange energy with the fluid during flow-rate measurement, e.g. cylinders, accumulators.

NOTE This document does not provide a method to determine if a component has hysteretic behaviour; ISO 6358-1 does provide such a method.

[Table 1](#) provides a summary of which parts of the ISO 6358 series can be applied to various components.

Table 1 — Application of the ISO 6358 series test methods to components

Components		Constant upstream pressure test		Variable upstream pressure test	
		ISO 6358-1 constant upstream pressure test	ISO 6358-2 charge test	ISO 6358-1 variable upstream pressure test	ISO 6358-2 discharge test
Group 1	Directional control valves	yes	yes	yes	yes
	Flow control valves	yes	yes	yes	yes
	Connectors	yes	yes	yes	yes
	Valve manifolds	yes	yes	yes	yes
	Group of components	yes	yes	yes	yes
Group 2	Filters and lubricators	yes	no	no	no
	Non-return (check) valves	yes	no	no	no
	Quick-exhaust valves	yes	no	no	no
	Tubes and hoses	yes	no	no	no
Group 3	Silencers and exhaust oil mist separators	no	no	yes	yes
	Blow nozzles	no	no	yes	yes
	Cylinder end heads	no	no	yes	yes

The charge test cannot be performed on components that do not have downstream port connections.

This document specifies requirements for the test installation, the test procedure, and the presentation of results.