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

Part 3:
Discharge test as an alternate test method

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

Partie 3: Essai de décharge comme méthode d'essai alternative

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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.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 6358-3 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 5, *Control products and components*.

ISO 6358 consists of the following parts, under the general title *Pneumatic fluid power — Determination of flow-rate characteristics of components using compressible fluids*:

— *Part 1: General rules for components with internal flow passages that are fixed*

— *Part 2: General rules*

— *Part 3: Alternative test methods — Discharge test*

— *Part 4: Alternative test methods — Charge test*

Introduction

This part of ISO 6358 defines a discharge test to determine the flow-rate characteristics of pneumatic components as an alternative to the test method specified in ISO 6358-2. This alternative test method tests a component by discharging compressed air to atmosphere from a tank that is pre-charged with compressed air at a specified pressure. The method allows the determination of sonic conductance, critical pressure ratio and subsonic index of the component under test, based on pressure response in the tank during discharge.

The discharge test method specified in this part of ISO 6358 has the following advantages over the test method specified in ISO 6358-2:

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) air consumption is minimised; and

d) test time is shortened.

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

Part 3: Discharge test as an alternate test method

1 Scope

This part of ISO 6358 specifies an alternative, discharge method for testing pneumatic fluid power components that use compressible fluids, i.e. gases. It specifies requirements for the test installation, the test procedure and the presentation of results.

Accuracy of measurement is divided into two classes (A and B), which are explained in Annex A. Test procedures for a hybrid test are given in Annex B. Requirements for a method to test isothermal performance is given in Annex C. Guidance on the tank is given in Annex D. Guidance on the equation for calculation of characteristics is given in Annex E. Guidance on the procedures for calculating flow-rate characteristics is given in Annex F.

This part of ISO 6358 applies to the following components:

— directional control valves, such as solenoid valves;

— flow control valves;

— air treatment components, such as silencers;

— piping components, such as connectors and flexible tubes;

— combined components, such as valve manifolds and cylinder end heads; and

— other devices and combined systems that have inlet and exhaust ports;

This part of ISO 6358 does not apply to any components whose flow-rate coefficient is unstable during use (i.e., those that exhibit hysteretic behaviour or have an internal feedback phenomenon) and components that have a cracking pressure, such as non-return (check) valves and quick-exhaust valves.

This part of ISO 6358 allows the determination of three sets of characteristic parameters: *C*, *b* and *m*, which may be calculated from the test results. The sonic conductance, *C*, represents the choked flow rate. The critical pressure ratio, *b*, represents the range of choked flow. The subsonic index, *m*, is the characteristic index, which represents several conditions flow in a component such as a variable orifice.

2 Normative references

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

ISO 1219-1, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols for conventional use and data-processing applications*

ISO 5598[1)], *Fluid power systems and components — Vocabulary*

ISO 6358-2[2)], *Pneumatic fluid power — Determination of flow-rate characteristics of components using compressible fluids — Part 2: General rules*

3 Terms and definitions

For the purpose of this part of ISO 6358, the terms and definitions in ISO 5598 and part 2 of ISO 6358 apply.

4 Symbols and units

4.1 The symbols and units shall be in accordance with part 2 of ISO 6358 except as given in Table 1.

Table 1 — Symbols and units

Reference	Description	Symbol	Dimension [a]	SI units	Practical units
6.3	Time	t	T	s	s
5.3.3	Tank volume	V	L^3	m^3	dm^3
[a] T = time; L = length					

4.2 The numerals used as subscripts to the symbols shall be in accordance with part 2 of ISO 6358 except as given in Table 2.

Table 2 — Subscripts

Subscript	Meaning
s	Initial conditions
3	Tank conditions

4.3 The graphical symbols used in Figure 1 are in accordance with ISO 1219-1.

1) Under revision.

2) To be published.

5 Test installation

5.1 Test circuit

A suitable test circuit as shown in Figure 1 shall be used.

NOTE Figure 1 illustrates basic circuit that does not incorporate all the safety devices necessary to protect against damage in the event of component failure. It is important that those responsible for carrying out the test give due consideration to safeguarding both personnel and equipment.

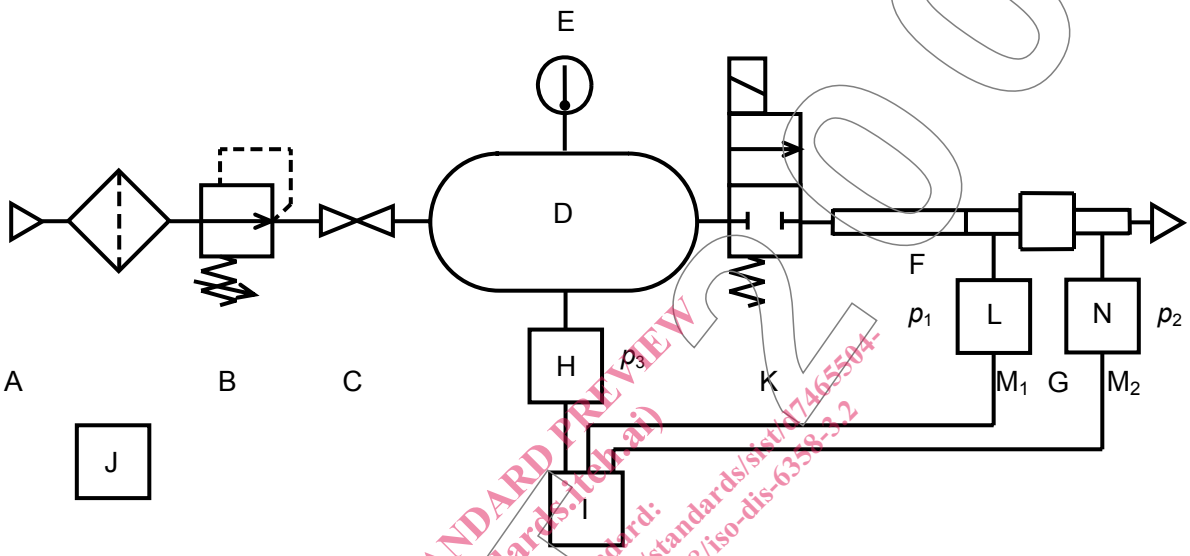

Figure 1 — Test circuit

Table 3 — Key to test circuit components

Reference letter	Relevant subclause or paragraph	Description
A	5.2.2	Air source and filter
B	6.2.1	Pressure regulator
C	6.2.1 and 6.2.2	Shut-off valve
D	5.3	Tank
E	6.2.2	Temperature measuring instrument
F	5.2	Rectifier tube
G	5.2.4	Component under test
H	6.2.3	Pressure transducer
I	6.2.3	Digital recorder
J	6.2.1	Barometer
K	5.2.4	Solenoid valve
L	6.2.3	Pressure transducer
M_1	5.2.3 through 5.2.6	Upstream pressure-measuring connector
M_2	5.2.3 through 5.2.6	Downstream pressure-measuring connector
N	6.2.3	Pressure transducer

5.2 General requirements

5.2.1 The component under test shall be installed and operated in the test circuit in accordance with the manufacturer's operating instructions.

5.2.2 A filter shall be installed which provides a standard of filtration approved by the component under test manufacturer.

5.2.3 A test set-up shall be constructed from the items listed in Table 3. Items A to J, L and M_1 inclusive are essential, and the remaining items K, M_2 and N may be chosen by the test operator if necessary.

5.2.4 If the component under test G has no control mechanism for shifting its position, install a solenoid valve K upstream of rectifier tube F in order to shift the valve and start the test. The port size of solenoid valve K shall be equal to that of rectifier tube F.

5.2.5 The distance between tank D and rectifier tube F shall be as short as possible.

5.2.6 The rectifier tube F and pressure-measuring connectors $M_1$and M_2 shall be in accordance with part 2 of ISO 6358. It is not necessary to have a temperature measuring connection in the rectifier because, in this test method, the temperature is measured in the tank.

5.2.7 For the places where liquid is collected, installation of drain exhaust valve is preferred.

5.2.8 The solenoid valve K shall have a shifting time that ensures that test data collection starts only after the solenoid valve K shifts.

5.3 Requirements for the tank (item D)

5.3.1 Structure

The tank shall be suitably structured as shown in Figure 2 and consist of the components listed in Table 4. Dimensions of the flow port shall conform to the dimensions given in Table 5.

NOTE 1 The tank shall conform to local, national and/or regional regulations and standards related to pneumatic containers.

NOTE 2 The junction of the flow port with the internal surface of the tank shall be convergent shaped so as to avoid pressure loss.

NOTE 3 The dimensions and arrangement of connection ports other than the flow port are determined by the test operator.