BS ISO 10041-2:2010

BSI Standards Publication

# Pneumatic fluid power — Electro-pneumatic continuous flow control valves

## Part 2: Test methods to determine main characteristics to include in the supplier's literature

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## National foreword

This British Standard is the UK implementation of ISO 10041-2:2010.

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.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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# INTERNATIONAL STANDARD

# ISO 10041-2

First edition
2010-10-15

## Pneumatic fluid power — Electro-pneumatic continuous flow control valves —

## Part 2: Test methods to determine main characteristics to include in the supplier's literature

*Transmissions pneumatiques — Distributeurs électropneumatiques à commande continue de débit —*

*Partie 2: Méthodes d'essai pour déterminer les principales caractéristiques à inclure dans la documentation du fournisseur*

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# Contents

Page

**Foreword** ..... iv
**Introduction** ..... v
**1 Scope** ..... 1
**2 Normative references** ..... 1
**3 Terms and definitions** ..... 2
**4 Symbols and units** ..... 2
**5 Test conditions** ..... 3
**5.1 Gas supply** ..... 3
**5.2 Temperature** ..... 3
**5.3 Pressures** ..... 3
**5.4 Electrical supply** ..... 3
**6 Test procedure** ..... 3
**6.1 Test conditions** ..... 3
**6.2 Inlet pressure** ..... 3
**6.3 Static tests** ..... 3
**7 Tests to determine control signal-flow rate characteristics** ..... 4
**7.1 Test circuits** ..... 4
**7.2 Test procedures** ..... 7
**7.3 Calculation of characteristics** ..... 12
**8 Test to determine flow rate characteristics** ..... 14
**8.1 Test circuit** ..... 14
**8.2 Test procedures** ..... 14
**8.3 Calculation of global characteristics** ..... 15
**9 Test to determine pressure gain characteristics** ..... 16
**9.1 General** ..... 16
**9.2 Test circuit** ..... 16
**9.3 Test procedure** ..... 17
**9.4 Characteristic curve of pressure gain at null operating flow rate** ..... 17
**10 Test to determine leakage at null operating flow rate characteristics** ..... 18
**10.1 Test circuit** ..... 18
**10.2 Test procedure** ..... 18
**10.3 Calculation of characteristic** ..... 18
**11 Test to determine dynamic characteristics** ..... 19
**11.1 Test installation** ..... 19
**11.2 Test to determine frequency response** ..... 19
**11.3 Test to determine step responses** ..... 20
**12 Presentation of test results** ..... 22
**12.1 General** ..... 22
**12.2 Control signal-flow rate characteristics** ..... 22
**12.3 Global flow rate characteristics** ..... 23
**12.4 Pressure gain characteristics at null operating flow rate** ..... 23
**12.5 Leakage characteristic at null operating flow rate** ..... 23
**12.6 Dynamic characteristics** ..... 23
**13 Identification statement** (reference to this part of ISO 10041) ..... 24
**Bibliography** ..... 25

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10041-2 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 5, *Control products and components*.

ISO 10041 consists of the following parts, under the general title *Pneumatic fluid power — Electro-pneumatic continuous flow control valves*:

— *Part 1: Main characteristics to include in the supplier's literature*

— *Part 2: Test methods to determine main characteristics to include in the supplier's literature*


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## Introduction

In pneumatic fluid power systems, power is transmitted and controlled through a gas under pressure within a circuit.

Electro-pneumatic continuous flow control valves continuously modulate the pneumatic power of a system in response to a continuous electrical control signal and link the electrical control quantity to the effective section of each variable port of the output stage (flow rate stage). The mass flow rate that crosses each restriction depends on the downstream and upstream pressures and the type of gas.

When control of position or force, including position- or force-tracking of a pneumatic cylinder, is required, electro-pneumatic continuous flow control valves can be used to precisely modulate the mass flow rates entering or exiting each cylinder chamber, resulting in a precise positioning. It is therefore necessary to know some performance characteristics of these electro-pneumatic continuous flow control valves in order to determine their suitability for a particular application.

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INTERNATIONAL STANDARD ISO 10041-2:2010(E)

# Pneumatic fluid power — Electro-pneumatic continuous flow control valves —

## Part 2: Test methods to determine main characteristics to include in the supplier's literature

## 1 Scope

This part of ISO 10041 specifies the test procedures and a method of presenting the results concerning the parameters that define the main characteristics to be included in the supplier's literature of electro-pneumatic continuous flow control valves, in accordance with ISO 10041-1.

This part of ISO 10041 is intended to

— facilitate the comparison of these types of valves by standardizing test methods and the presentation of test results, and

— assist in the proper application of these valves in pneumatic systems.

The specified tests are not production tests to be carried out on each valve manufactured.

NOTE 1 Tests related to electro-pneumatic continuous pressure control valves are specified in ISO 10094-2.

NOTE 2 Tests described in this part of ISO 10041 are performed on valves with exhaust port(s) connected to the atmosphere except for two-port valves.

## 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, *Fluid power system and components — Vocabulary*

ISO 6358-1[1)], *Pneumatic fluid power — Determination of flow-rate characteristics of components — Part 1: General rules and test methods for steady-state flow*

ISO 10041-1:2010, *Pneumatic fluid power — Electro-pneumatic continuous flow control valves — Part 1: Main characteristics to include in the supplier's literature*

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## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and ISO 10041-1 apply.

## 4 Symbols and units

For the purposes of this document, the symbols and units listed in Table 1 apply.

**Table 1 — Symbols and units**

| Description | Symbol | SI Unit |
|---|---|---|
| Critical back-pressure ratio[a] | $b$ | — |
| Sonic conductance | $C$ | $m^3/(s \cdot Pa)$ (ANR)[c] |
| Subsonic index | $m$ | — |
| Atmospheric pressure | $p_{atm}$ | Pa |
| Reference pressure[c] | $p_0$ | Pa |
| Inlet port stagnation gauge pressure[b] | $p_1$ | Pa |
| Working port stagnation gauge pressure[b] | $p_2$, $p_4$ | Pa |
| Air exhaust port stagnation gauge pressure[b] | $p_3$, $p_5$ | Pa |
| Cracking pressure | $\Delta p_c$ | Pa |
| Hysteresis | $H$ | % |
| Maximum hysteresis difference | $\Delta p_{2,h,max}$ | Pa |
| Linearity | $L$ | % |
| Maximum linearity difference | $\Delta p_{2,l,max}$ | Pa |
| Volume flow rate at standard reference atmosphere | $q_V$ | $m^3/s$ (ANR)[c] |
| Volume flow rate related to the relief flow rate | $q_{V,r}$ | $m^3/s$ (ANR)[c] |
| Maximum volume flow rate related to the forward flow rate | $q_{V,f,max}$ | $m^3/s$ (ANR)[a] |
| Repeatability | $r$ | % |
| Reference temperature | $T_0$ | K |
| Inlet port temperature[a] | $T_1$ | K |
| Working port temperature[a] | $T_2$ | K |
| Electrical control signal | $w$ ($w_{start}$, $w_{stop}$) | V, mA or digital signal |
| Resolution | $S$ | % |

[a] Defined in ISO 6358-1.

[b] See ISO 11727[4].

[c] Reference atmosphere is defined in ISO 8778[2], i.e.: $T_0 = 293{,}15$ K, $p_0 = 100$ kPa (1 bar) and relative humidity of 65 %.

The graphic symbols used in Figures 1 to 4 and in Figures 6 to 8 are in accordance with ISO 1219-1.



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# 5 Test conditions

## 5.1 Gas supply

Unless otherwise specified, testing shall be conducted with compressed air. If another gas is used, it shall be noted in the test report.

## 5.2 Temperature

The ambient, fluid and the control valve temperatures shall be maintained at 23 °C ± 10 °C during all the tests.

## 5.3 Pressures

### 5.3.1 General

The specified pressures shall be maintained within ± 2 %.

### 5.3.2 Inlet pressure

If possible, testing should be conducted at an inlet pressure of 630 kPa (6,3 bar). If this is not possible, the inlet pressure shall be selected from the values given in ISO 2944.

### 5.3.3 Verification

It shall be periodically verified that no pressure bleed of measuring instruments is obstructed by solid or liquid particles.

## 5.4 Electrical supply

The tests shall be carried out under nominal electrical conditions.

# 6 Test procedure

## 6.1 Test conditions

The valve under test shall be installed and operated in accordance with the manufacturer's application instructions.

## 6.2 Inlet pressure

During the static and dynamic tests specified in Clauses 7 to 11, the inlet pressure shall be maintained constant.

During the dynamic tests specified in Clause 11, a tank buffer as indicated in Figure 8 shall be used in order to reduce fluctuations in the inlet pressure.

## 6.3 Static tests

During the static tests specified in Clauses 7 to 10, as soon as steady-state conditions are reached, every series of measurements obtained under related specified test conditions shall be recorded. When these measurements are performed in a step-by-step manner, the test conditions shall be modified slowly to prevent instability.

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