
**Pneumatic fluid power — Electro-
pneumatic pressure control valves —**

Part 1:

**Main characteristics to include
in the supplier's literature**

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*Transmissions pneumatiques — Appareils électropneumatiques de
distribution à commande continue de pression —*

*Partie 1: Principales caractéristiques à inclure dans la documentation
des fournisseurs*

ISO 10094-1:2010

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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 Characteristics	3
5.1 General	3
5.2 Electric characteristics	3
5.3 Static characteristics	3
5.4 Dynamic characteristics	8
6 Identification statement (reference to this part of ISO 10094)	14
Bibliography	15

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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 10094-1 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 5, *Control products and components*.

ISO 10094 consists of the following parts, under the general title *Pneumatic fluid power — Electro-pneumatic pressure 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.

When it is required to track precisely a variable pressure set point or when precise pressure regulation is needed, electro-pneumatic continuous pressure control valves can be used.

These control valves continuously modulate the pneumatic power of a system in response to a continuous electrical input signal and link the electrical input value to a proportional pressure value.

It is therefore necessary to know some performance characteristics of these electro-pneumatic continuous pressure control valves in order to determine their suitability.

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Pneumatic fluid power — Electro-pneumatic pressure control valves —

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

1 Scope

This part of ISO 10094 specifies which characteristics of electro-pneumatic continuous pressure control valves are to be included in the supplier's literature.

In accordance with ISO 5598, these control valves include

- electrically modulated pneumatic proportional pressure valves,
- pressure proportional control valves, and
- pressure servo-valves (closed loop).

NOTE 1 The characteristics of non-electrically modulated pneumatic pressure control valves are specified in ISO 6953-1.

NOTE 2 The characteristics of electro-pneumatic continuous flow control valves are specified in ISO 10041-1.

NOTE 3 This part of ISO 10094 is limited to the characterization of components with an exhaust port to the atmosphere.

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 5598, *Fluid power systems and components — Vocabulary*

ISO 6953-1, *Pneumatic fluid power — Compressed air pressure regulators and filter-regulators — Part 1: Main characteristics to be included in literature from suppliers and product-marking requirements*

ISO 10094-2:2010, *Pneumatic fluid power — Electro-pneumatic pressure control valves — Part 2: Test methods to determine main characteristics to include in the supplier's literature*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598, ISO 6953-1 and the following apply.

3.1 electro-pneumatic continuous pressure control valve
control valve which continuously modulates the pneumatic power of a system in response to a continuous electrical input signal and which links the electrical input quantity to a pressure value

3.2 inlet pressure
pressure at inlet port of a component, piping or system

3.3 electrical control signal
electrical signal applied to a control device, also called set signal

3.4 control signal/pressure characteristic curve
graphical representation of the relationship between the regulated pressure and the electrical control signal on its full scale while the forward flow rate or the relief flow rate is null, at constant inlet pressure

3.5 minimum regulated pressure
pressure at the first point of the control signal/pressure characteristic curve

3.6 flow/pressure characteristic curve
graphical representation of the relationship between the regulated pressure and the forward flow rate or the relief flow rate while the control signal and the inlet pressure are maintained constant

3.7 pressure regulation characteristic
variation of the regulated pressure for a given control signal, under the effect of an inlet pressure variation, measured for a defined flow

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
Total relative pressure at the inlet port ^a	p_1	Pa
Total relative pressure at the outlet port ^a	p_2	Pa
Total relative pressure at the exhaust port ^a	p_3	Pa
Hysteresis	H	%
Linearity	L	%
Repeatability	r	—
Resolution	S	—
^a In accordance with ISO 11727.		

5 Characteristics

5.1 General

Descriptive literature covering electro-pneumatic continuous pressure control valves shall include the characteristics given in 5.2 to 5.4.

The data provided by the supplier shall assist the user to select the best-suited electro-pneumatic continuous pressure control valve for the particular application.

5.2 Electric characteristics

The required minimum voltage, the required minimum current and the required minimum power of the power supply shall be given.

5.3 Static characteristics

5.3.1 Control signal/pressure characteristics at null forward flow rate or relief flow rate

5.3.1.1 Characteristic curve

The regulated pressure, p_2 , at null forward or relief flow rate shall be indicated on a graph as shown in Figure 1.

This curve describes the measured regulated pressure versus the electrical control signal on its full scale, for a given inlet pressure, p_1 , indicated as a relative value as shown in Figure 1.

The test shall be performed in accordance with ISO 10094-2:2010, 7.2.1.

The characteristic straight line shall be plotted in accordance with ISO 10094-2:2010, 7.3.1, taking, for each value of control signal, the mean value of two measured pressures with respectively an increasing and decreasing control signal.

The offset value and the slope of the characteristic straight line shall be indicated on the graph as shown in Figure 1.

5.3.1.2 Linearity

The linearity, L , expressed as a percentage of the regulated pressure full-scale, shall be calculated in accordance with ISO 10094-2:2010, Equation (1).

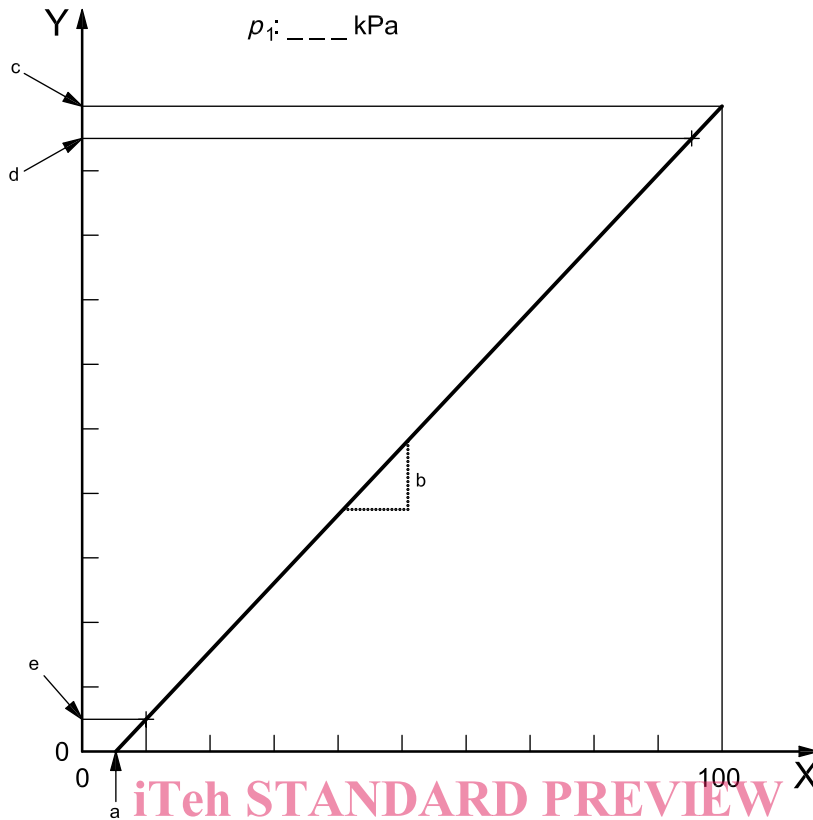
The obtained value gives the maximum difference between the regulated pressure mean values and the characteristic straight line shown in Figure 1.

5.3.1.3 Control signal/pressure hysteresis

The hysteresis, H , expressed as a percentage of the regulated pressure full-scale, shall be calculated in accordance with ISO 10094-2:2010, Equation (2).

The obtained value gives the maximum difference between the regulated pressure values measured with both an increasing and decreasing control signal.

The hysteresis can also be expressed as an absolute value.



Key

- X electrical control signal, %
- Y regulated pressure p_2 , in kPa
- p_1 inlet pressure

- a Offset.
 - b Slope
 - c $p_2, \text{max.}$
 - d 95 % of $p_2, \text{max.}$
 - e 5 % of $p_2, \text{max.}$
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Figure 1 — Control signal/pressure characteristic curve at null forward flow rate or relief flow rate

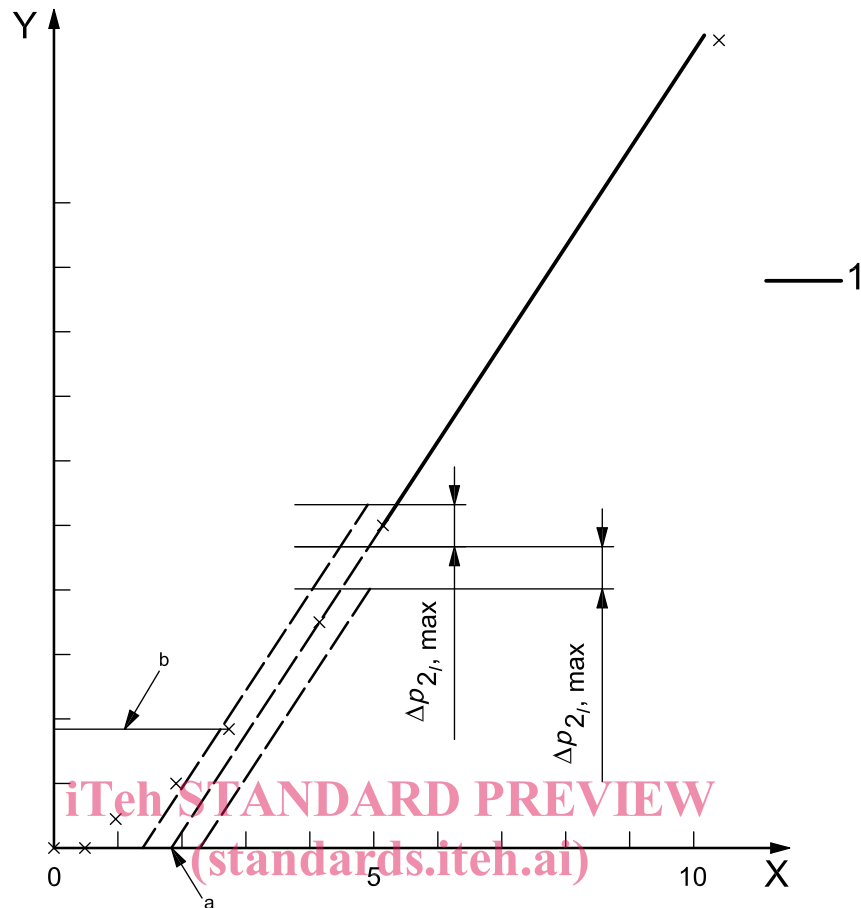
5.3.1.4 Minimum regulated pressure

The test shall be performed in accordance with ISO 10094-2:2010, 7.2.2.

The minimum regulated pressure corresponds to the pressure at the first point which is within the allowable limits of linearity of the control signal/pressure characteristic curve determined in 5.3.1.2, as shown in Figure 2.

The minimum regulated pressure, expressed as a percentage of the regulated pressure full-scale, shall be determined in accordance with ISO 10094-2:2010, 7.3.4.

The measured points corresponding to the test of ISO 10094-2:2010, 7.2.2, the minimum regulated pressure, as well as the offset, shall be indicated on a graph as shown in Figure 2.

**Key**

X electrical control signal, %

Y regulated pressure p_2 , in kPa

1 characteristic line

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Offset.

b Minimum regulated pressure.

Figure 2 — Definition of the minimum regulated pressure and of the offset on the control signal/pressure characteristic curve at null flow rate

5.3.1.5 Resolution

The resolution, Δw , corresponds to the minimal difference between two control signal values for which there is a difference in the corresponding regulated pressure values.

The test shall be performed in accordance with ISO 10094-2:2010, 7.2.3.

The resolution, Δw , expressed in percentage of the control signal full-scale, shall be determined in accordance with ISO 10094-2:2010, 7.3.5.

5.3.1.6 Repeatability

The repeatability, r , corresponds to the maximal dispersion in regulated pressure, for a given electrical control signal.

The test shall be performed in accordance with ISO 10094-2:2010, 7.2.4.

The repeatability, r , expressed as a percentage of the regulated pressure full-scale, shall be determined in accordance with ISO 10094-2:2010, 7.3.6.