BS ISO 6953-1:2015

BSI Standards Publication

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

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National foreword

This British Standard is the UK implementation of ISO 6953-1:2015. It supersedes BS ISO 6953-1:2000 which is withdrawn.

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

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INTERNATIONAL STANDARD

ISO 6953-1

Third edition
2015-03-01

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

Transmissions pneumatiques — Régulateurs de pression et filtres-régulateurs pour air comprimé —

Partie 1: Principales caractéristiques à inclure dans la documentation des fournisseurs et exigences de marquage du produit

Reference number
ISO 6953-1:2015(E)

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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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 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 131, *Fluid power systems*, Subcommittee SC 5, *Control products and components*.

This third edition cancels and replaces the second edition (ISO 6953-1:2000), which has been technically revised. It also incorporates ISO 6953-1:2000/Cor 1:2006.

ISO 6953 consists of the following parts, under the general title *Pneumatic fluid power — Compressed air pressure regulators and filter-regulators*:

— *Part 1: Main characteristics to be included in the supplier's literature and product-marking requirements*

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

— *Part 3: Alternative test methods for measuring the flow-rate characteristics of pressure regulators*

Introduction

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

When pressure reduction or pressure regulation is required, regulators and filter-regulators are components designed to maintain the pressure of the gas at an approximately constant level.

It is therefore necessary to know some performance characteristics of these components in order to determine their suitability for an application.

INTERNATIONAL STANDARD **ISO 6953-1:2015(E)**

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

1 Scope

This part of ISO 6953 specifies which characteristics of compressed air pressure regulators are to be included in literature from their suppliers. It also applies to filter-regulators.

This part of ISO 6953 applies to

— manually controlled direct operated types (with or without relieving mechanism),

— manually controlled internal pilot operating types (e.g. nozzle flapper), and

— external pilot operated types.

In addition, it specifies the product marking requirements for pressure regulators and filter-regulators.

This part of ISO 6953 is applicable to compressed air pressure regulators with a rated inlet pressure of up to 2 500 kPa (25 bar) and an outlet adjustment pressure of up to 1 600 kPa (16 bar); and to filter-regulators with rated inlet and outlet pressures of up to 1 600 kPa (16 bar), in which the major contaminants are removed by mechanical means.

NOTE 1 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

The rated pressure should be selected from the preferred pressures listed in ISO 2944.

NOTE 2 The main characteristics to be included in the supplier's literature related to electrically modulated pneumatic continuous pressure control valves are specified in ISO 10094-1.

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.

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 2944, *Fluid power systems and components — Nominal pressures*

ISO 5598, *Fluid power systems and components — Vocabulary*

ISO 5782-2:1997, *Pneumatic fluid power — Compressed-air filters — Part 2: Test methods to determine the main characteristics to be included in supplier's literature*

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

ISO 6953-2:2015, *Pneumatic fluid power — Compressed air pressure regulators and filter-regulators — Part 2: Test methods to determine the main characteristics to be included in literature from suppliers*

ISO 10094-1, *Pneumatic fluid power — Electro-pneumatic pressure control valves — Part 1: Main characteristics to include in the supplier's literature*

ISO 11727, *Pneumatic fluid power — Identification of ports and control mechanisms of control valves and other components*

3 Terms and definitions

For the purposes of this part of ISO 6953, the terms and definitions given in ISO 5598, ISO 6358-1, ISO 10094-1, and the following apply.

3.1
compressed air pressure regulator
component designed to maintain compressed air pressure, approximately constant within an enclosed circuit despite variation in operating flow rate and inlet pressure

3.2
relieving pressure regulator
pressure regulator equipped with an unloading device that opens if the regulated pressure exceeds the original setting by a sufficient degree, and exhausts a limited flow rate of air from the outlet circuit to the atmosphere

3.3
filter-regulator
device that combines the filter and regulator onto one body as a single unit

Note 1 to entry: In such a device, the filter is always on the upstream side of the regulator.

3.4
pilot-operated regulator with air bleed
regulator designed to minimize the variation of regulated pressure from its set point during flow, using a pilot supply that continuously flows through the pilot chamber and is exhausted

3.5
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 outlet set pressure and the inlet pressure are maintained constant

3.5.1
forward flow/pressure characteristic curve
flow/pressure characteristic curve in accordance with 3.5 only for the forward flow rate

3.5.2
relief flow/pressure characteristic curve
flow/pressure characteristic curve in accordance with 3.5 only for the relief flow rate

3.6
pressure regulation characteristic curve
graphical representation of regulated pressure variation caused by changes in inlet (supply) pressure, at a constant small air flow rate and low regulated pressure

4 Technical requirements

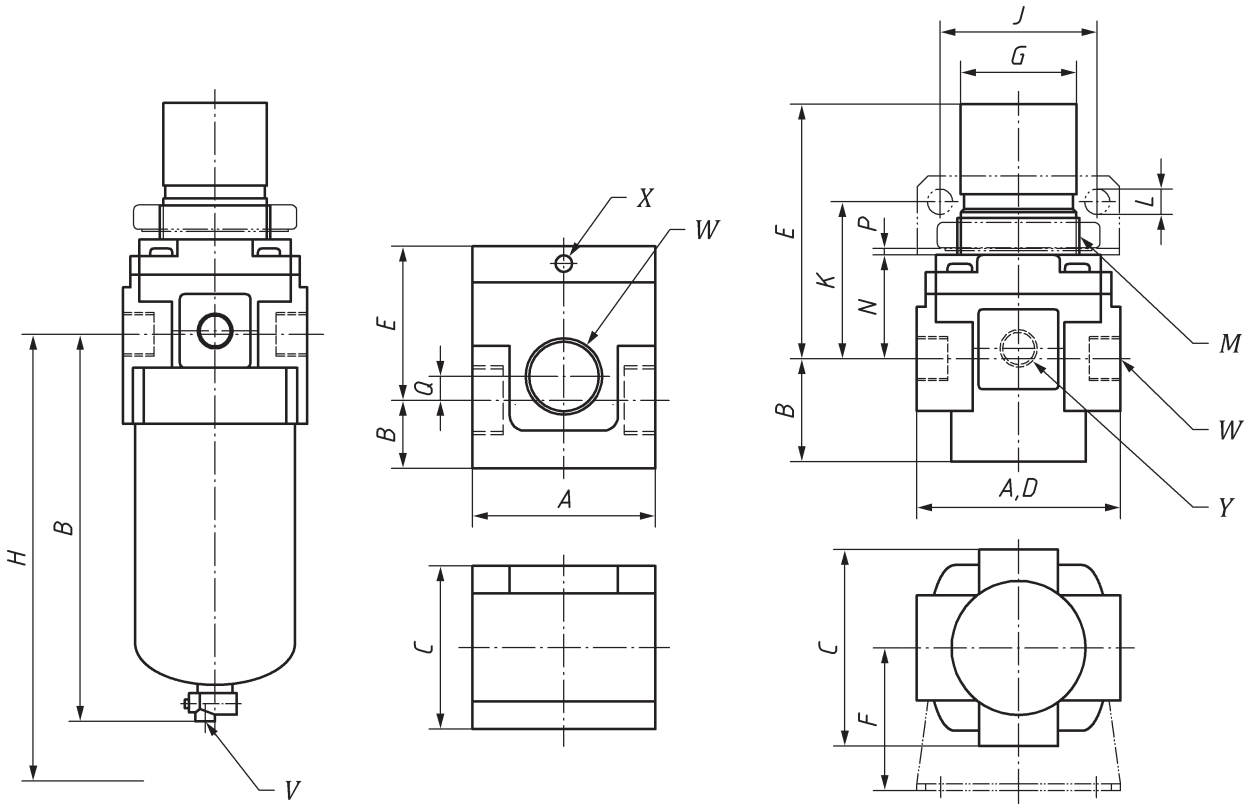
4.1 General

Descriptive literature covering compressed air pressure regulators and filter-regulators shall include the following characteristics given in 4.2 and 4.3.

4.2 General characteristics

4.2.1 General dimensions

The dimensions shown on Figure 1 shall be given in millimetres. For ports, see 4.2.2.



Key

A maximum overall width
B maximum installation height below the port centre line
C maximum overall depth, excluding pressure gauge
D distance between the faces of the compressed air connection (inlet/outlet)
E maximum height above the port centre line
F[a] maximum installation depth from the port centre line
G maximum dimension of the regulated pressure adjusting device
H minimum clearance from the port centre line to permit dismantling
J[a] distance between mounting holes
K[a] distance between the port centre line and mounting holes
L[a] minimum recommended diameter and length of mounting holes
M[a] panel mounting thread
N[a] panel mounting height above the port centre line
P[a] maximum panel thickness
Q[b] distance between the port centre line to gage port
V drain hole description
W port description
X[b] pilot port description
Y pressure gauge port description

NOTE [a] dimensions, *F, J, K, L, M, N,* and *P* shall be indicated only if the device has provisions for mounting;
[b] optional

Figure 1 — Dimensions of compressed air regulators and filter-regulators

4.2.2 Port forms

Port forms should be selected from ISO 16030 or ISO 1179 (all parts) for ports with pipe parallel threads, or from ISO 7-1 for ports with pipe-tapered threads.

The connecting interface for flange-mounted designs can be plain ported and counter bored to accept O-rings.

For certain applications and connections, other port forms can be employed.

NOTE Annex A describes thread forms from the former ISO 1179:1981.

4.2.3 Rated pressure

Compressed air pressure regulators and filter-regulators shall be classified according to their rated pressure, selected from ISO 2944.

The rated pressure shall be verified using the test procedure specified in ISO 6953-2: 2015, Clause 6. This procedure verifies the pressure rating of the pressure-containing envelope but does not cover the limitation that can be imposed by the diaphragm. The range of duties and sensitivities of the diaphragm used vary widely and their strength can be limited to achieve the accuracy required by the application.

4.2.4 Range of operating temperatures

4.2.4.1 The temperature range in which the material and the operation of the pressure regulator and filter-regulator are not impaired shall be stated.

4.2.4.2 Other combinations of pressure and temperature ratings for optional designs that could require a different rating shall be specified.

4.3 Particular requirements

4.3.1 General

The data provided by the supplier shall assist the user in selecting the compressed air pressure regulator and filter-regulator best suited for the particular application.

4.3.2 Adjustable pressure ranges (outlet regulated pressure)

The upper limit of the recommended adjustable pressure range should normally be chosen from the following preferred ranges but not to exceed the inlet rated pressure:

— up to 100 kPa (1 bar);

— up to 200 kPa (2 bar);

— up to 400 kPa (4 bar);

— up to 800 kPa (8 bar);

— up to 1 000 kPa (10 bar);

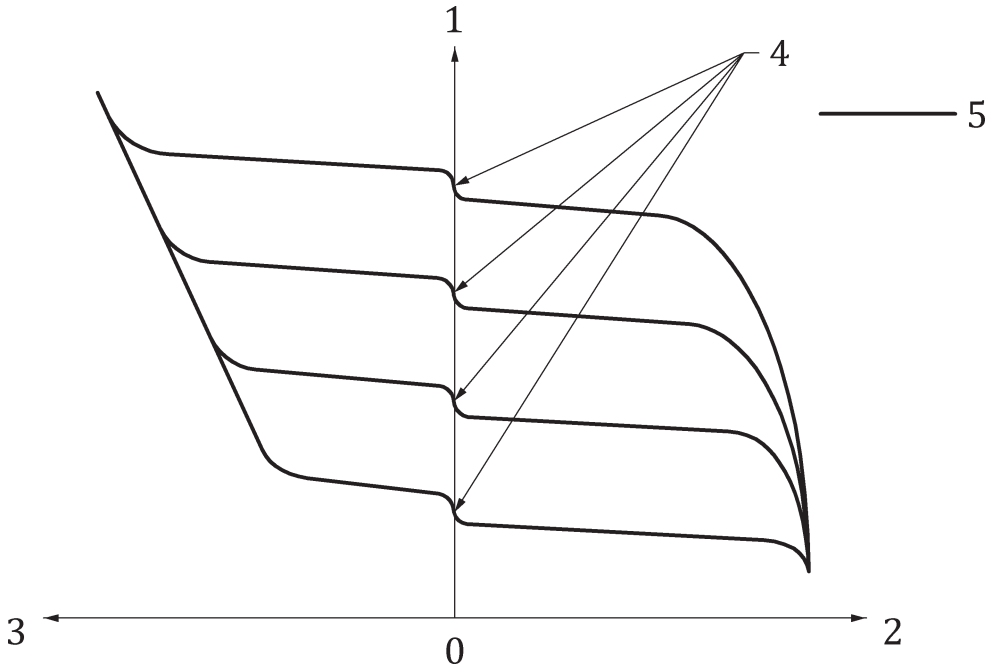
— up to 1 600 kPa (16 bar).

Special ranges can also be available.

The adjustability of the upper limit of the pressure range is a minimum and the upper limit should not be regarded as a limiting pressure.

4.3.3 Flow-pressure characteristics

4.3.3.1 Curves describing the regulated pressure versus air flow rate for different set pressures shall be plotted on a graph as shown in Figure 2; and the entire graph is applicable to a given inlet pressure.



Key

1	regulated pressure	kPa (bar)
2	forward flow rate	dm^3/min (ANR)
3	relief flow rate	dm^3/min (ANR)
4	set pressures	kPa (bar)
5	inlet pressure	kPa (bar) – one value applies to the entire figure

NOTE Figure 2 is only an example of flow-pressure characteristic curves. For some components, the several flow- pressure curves might not terminate at the same point at maximum forward flow rate.

Figure 2 — Flow-pressure characteristic curves

4.3.3.2 Each curve is plotted in accordance with ISO 6953-2:2015, 7.4.1. Each value of the regulated pressure is the mean value between the regulated pressures measured for increasing and decreasing flow rates.

NOTE Use ISO 6953-3 for an alternate dynamic test method for determining flow-rate characteristics using an isothermal tank instead of a flow meter. This method only enables the capturing of decreasing flow rate part of the hysteresis curves for forward and relief flow characteristics.

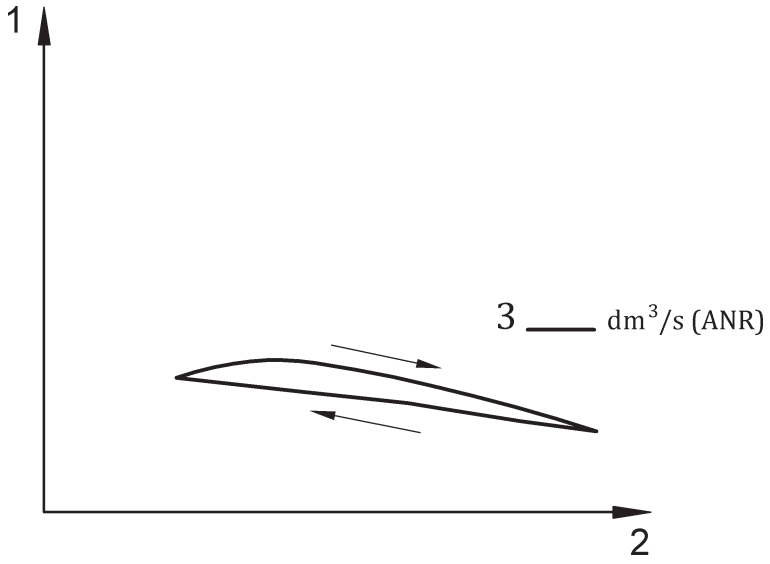
4.3.3.3 The hysteresis, expressed in percentage, of the regulated pressure full scale shall be calculated according to ISO 6953-2:2015, 7.4.2. The obtained value gives the maximum difference between the regulated pressure values measured with both increasing and decreasing flow rate.

4.3.3.4 The maximum forward sonic conductance is calculated according to ISO 6953-2:2015, 7.4.3.

4.3.3.5 The maximum relief sonic conductance is calculated according to ISO 6953-2:2015, 7.4.4.

4.3.4 Pressure regulation characteristic

4.3.4.1 The effect of inlet pressure variations upon the regulated pressure shall be indicated by a hysteresis curve on a graph, as shown in Figure 3. This curve describes the regulated pressure variation versus the inlet pressure for an approximately constant flow rate.



Key

1	regulated pressure	kPa (bar)
2	inlet pressure	kPa (bar)
3	forward flow rate	dm^3/min (ANR)

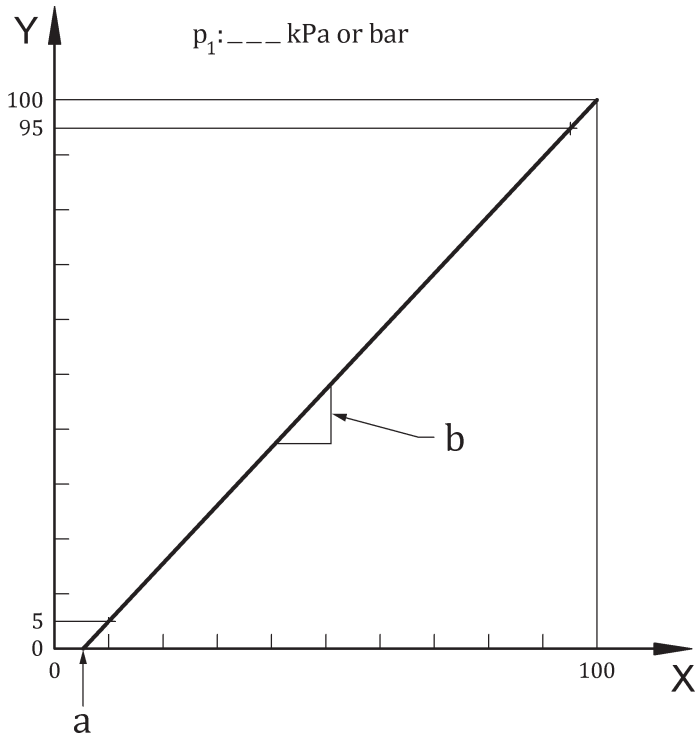
Figure 3 — Pressure regulation characteristic

4.3.4.2 Testing shall be conducted in accordance with ISO 6953-2:2015, 8.2.

4.3.5 Pilot pressure/regulated pressure characteristics

4.3.5.1 Pressure control characteristic curve

The regulated pressure, p_2, at null forward or relief flow rate shall be indicated on a graph, as shown in Figure 4.



Key

X pilot pressure, in %
Y regulated pressure, in %
p_1 inlet pressure
a offset
b slope

Figure 4 — Pilot pressure/regulated pressure characteristic

This curve describes the processed data of the measured regulated pressure versus the external pilot pressure on its full scale, for a given inlet pressure, p_1, indicated as a relative value, as shown in Figure 4.

NOTE For the purpose of this part of ISO 6953, pressures are gauge pressures.

The test shall be performed in accordance with ISO 6953-2:2015, 10.1.2.

The characteristic straight line shall be plotted in accordance with ISO 6953-2:2015, 10.1.3.1. Each value of the pressure curve is the mean value of the two corresponding measured regulated pressures, p_2, for increasing and decreasing pilot pressures.

The offset value and slope of the characteristic straight line shall be indicated on the graph, as shown in Figure 4.

4.3.5.2 Linearity

The linearity, Δp_l, expressed as a percentage of the regulated pressure full-scale, shall be calculated in accordance with ISO 6953-2:2015, Formula (4).

The value obtained gives the maximum difference between the regulated pressure mean values and the characteristic straight line shown in Figure 4.

4.3.5.3 Pilot pressure/regulated pressure hysteresis

The hysteresis, Δp_h, expressed as a percentage of the regulated pressure full-scale, shall be calculated in accordance with ISO 6953-2:2015, Formula (5).

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

The hysteresis can also be expressed as an absolute value.

4.3.6 Repeatability (optional characteristic)

The repeatability, *r*, corresponds to the maximal dispersion in regulated pressure for a given set pressure.

The test shall be performed in accordance with ISO 6953-2:2015, 10.3.4.

The repeatability, *r*, expressed as a percentage of the regulated pressure full-scale, shall be determined in accordance with ISO 6953-2:2015, 10.3.4.

4.3.7 Resolution in the case of pilot operated regulator with air bleed

The resolution, *S*, corresponds to the minimal difference between two rotating positions of the adjustable handle or two pilot pressure (set pressure) values for which there is a difference in the corresponding regulated pressure values.

The test shall be performed in accordance with ISO 6953-2:2015, 10.2.4.

The resolution, *S*, expressed in percentage of the regulated pressure full-scale, shall be determined in accordance with ISO 6953-2:2015, 10.2.4.

4.3.8 Maximum air consumption at null forward flow rate or relief flow rate for pilot operated regulator with air bleed

The maximum air consumption flow rate indicates the maximum air consumption when the component under test is closed (i.e. leakage at null forward flow rate or relief flow rate).

The air consumption rate shall be measured at the inlet port versus the regulated pressure on its full-scale, with both increasing and decreasing regulated pressure for a given inlet pressure.

The test shall be performed in accordance with ISO 6953-2:2015, 9.2.

The maximum value of the air consumption rate is determined in accordance with ISO 6953-2:2015, 9.3.

4.3.9 Useful retention capacity of the reservoir

4.3.9.1 Provide the data as described in 4.3.9.2 if the unit is a filter-regulator.

4.3.9.2 The useful retention capacity of the reservoir shall be measured in accordance with ISO 5782-2:1997, Clause 8, for every combination of filter reservoir size. The results shall be published together with other descriptive specifications for filter-regulators.

4.3.10 Filter-regulator draining devices

The type of drain (manual, automatic, or other) shall be stated.

4.3.11 Materials of construction

The generic materials of construction (for example, body, spring cage, bottom plug and internal parts, elastomers and bowl) shall be listed.

5 Operation and maintenance

Information required for application, operation, examination, and maintenance shall be provided, including the following:

a) adjustment requirements;

b) the conditions under which it is desirable that the filter element be changed in order to avoid malfunction (for filter-regulators);

c) the products that can be used for cleaning the filter-regulator parts (filter element, reservoir, etc.);

d) the minimum operating temperature, with a warning of the effects of condensate freezing, if applicable;

e) the minimum pressure for operating the drain mechanism (for filter-regulator);

f) a pressure rating, possibly less than that verified through the test requirements in ISO 6953-2:2015, if the diaphragm has application limitations (see 4.2.3).

6 Marking

6.1 The compressed air pressure regulator or filter-regulator shall be marked with the following information:

a) manufacturer's or supplier's name or trademark;

b) manufacturer's or supplier's model or type number;

c) rated pressure;

d) maximum temperature;

e) warning about use of cleaning products, if necessary;

f) flow direction in accordance with ISO 11727;

g) maximum fluid levels (if needed);

h) code indicating time of manufacture.

6.2 Other data can also be marked on the compressed air pressure regulator and filter-regulator (for example, recommended regulated pressure adjustment range).

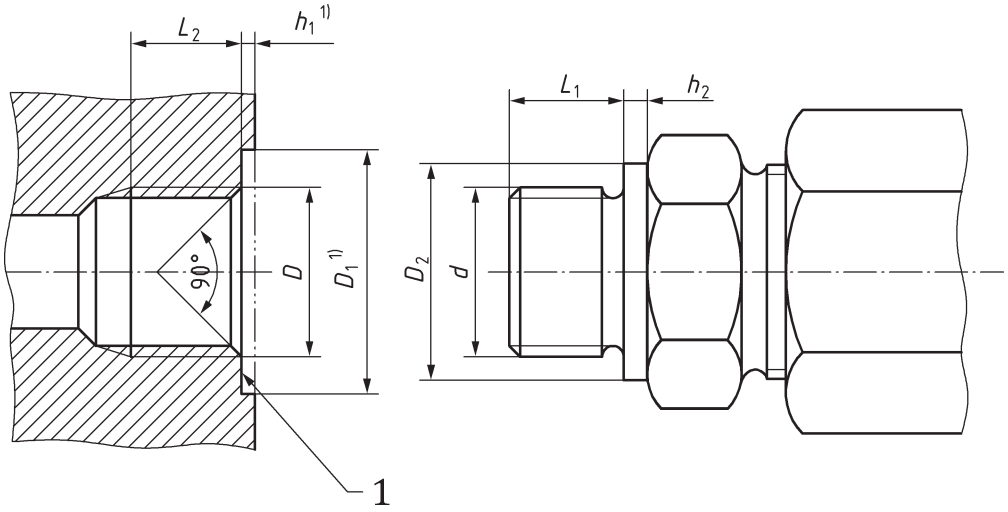
7 Identification statement (Reference to ISO 6953)

It is strongly recommended that manufacturers use the following statement in test reports, catalogues, and sales literature when electing to comply with ISO 6953:

"Characteristics and requirements for compressed air pressure regulators (or filter-regulators) are in accordance with ISO 6953-1, *Pneumatic fluid power — Compressed air pressure regulators and filter-regulators — Part 1: Main characteristics to include in the supplier's literature and product-marking requirements.*"

Annex A
(informative)

Port forms from ISO 1179-1:1981



Key

1 joint surface flat and square to the axis of the thread

Figure A.1 — Port forms

Table A.1 — Port forms

Designation of thread according to ISO 228-1[6]		**Thread length**	**Dimensions of recess** [a]		**Dimensions of collar**	
D	d	L_1 male max. L_2 female min.	D_1 min.	h_1 max.	D_2 h_{14}	h_2 min.
G 1/16	G 1/16 A	7,4	13	1	12	1
G 1/8	G 1/8 A	7,4	15	1	14	1
G 1/4	G 1/4 A	11,0	19	1,5	18	1,5
G 3/8	G 3/8 A	11,4	23	2	22	2
G 1/2	G 1/2 A	15,0	27	2,5	26	2,5
G 3/4	G 3/4 A	16,3	33	2,5	32	2,5
G 1	G 1 A	19,1	40	2,5	39	2,5
G 1 1/4	G 1 1/4 A	21,4	50	2,5	49	2,5
G 1 1/2	G 1 1/2 A	21,4	56	2,5	55	2,5
G 2	G 2 A	25,7	59	3	68	3

[a] 1 bar = 0,1 MPa = 10^5 Pa; 1MPa = 1 N/mm^2

The lengths L_2 of the female threads given in Table A.1 are also suitable for assembly with male threads, in accordance with ISO 7-1.

Bibliography

[1] ISO 1179:1981, *Pipe connections, threaded to ISO 228/1, for plain end steel and other metal tubes in industrial applications*

[2] ISO 1179 (all parts), *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing*

[3] ISO 6353-2, *Reagents for chemical analysis — Part 2: Specifications — First series*

[4] ISO 8778, *Pneumatic fluid power — Standard reference atmosphere*

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

[6] ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

[7] ISO 16030, *Pneumatic fluid power — Connections — Ports and stud ends*

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