INTERNATIONAL STANDARD

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Gas welding equipment — Pressure gauges used in welding, cutting and allied processes

Matériel de soudage au gaz — Manomètres utilisés pour le soudage, le coupage et les techniques connexes

Reference number
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Contents

Page

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 5171 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 8, *Equipment for gas welding, cutting and allied processes*.

This third edition cancels and replaces the second edition (ISO 5171:1995), which has been technically revised.

Requests for official interpretations of any aspect of this International Standard should be directed to the Secretariat of ISO/TC 44/SC 8 via your national standards body. A complete listing of these bodies can be found at http://www.iso.org/.

Gas welding equipment — Pressure gauges used in welding, cutting and allied processes

1 Scope

This International Standard specifies requirements for Bourdon-tube pressure gauges normally used with compressed gas systems at pressures up to 30 MPa (300 bar) in welding, cutting and allied processes. It also covers use for dissolved acetylene and for liquefied gases under pressure.

It does not cover gauges for acetylene in acetylene-manufacturing plants.

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

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

ISO 497, *Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers*

ISO 4589-2:1996, *Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient-temperature test*

ISO 9539, *Materials for equipment used in gas welding, cutting and allied processes*

ISO 10102, *Assembly tools for screws and nuts — Double-headed open-ended engineers' wrenches — Length of wrenches and thickness of the heads*

ANSI/ASME B1.20.1, *Pipe threads, general purpose (inch)* [1)]

3 Terms and definitions

For the purposes of this document, the following definitions apply.

3.1
Bourdon-tube pressure gauges
device incorporating elastic tube with direct indication by pointer and graduated scale of the pressure being measured

1) Published by and available from the American National Standards Institute (ANSI), 11 West 42nd Street, New York, NY 10036.

3.2
case
outer housing that contains the Bourdon tube and the movement

3.3
dial
plate or area on which the scale is marked

3.4
flange
circular extension of the case used for mounting

3.5
pointer
indicator whose position in relation to the scale indicates the value of the measured pressure

3.6
pointer stop
projection that stops the travel of the pointer

3.7
scale
array of marks, together with any associated figuring, in relation to which the position of the pointer is observed

3.8
vent
blowout device
safety device or venting area incorporated in the case or backplate to permit the rapid safe dissipation of internal pressure in the event of a leakage or burst in the Bourdon tube

3.9
window
transparent front through which the dial is observed

4 Pressure

4.1 Unit of pressure

All pressures given are gauge (effective) pressures in megapascals (MPa) and bar.

4.2 Maximum scale reading

Where practical, the maximum scale reading for a particular gas and pressure level shall be selected from the values given in Table 1. Where not practical, the maximum scale reading shall be selected from the R10 series of preferred numbers or the more rounded values given in ISO 497.

4.3 Maximum pressure mark

The maximum operating pressure shall be indicated on the dial by a symbol or coloured mark and shall not exceed 3/4 of the maximum scale reading.

NOTE For pressure gauges used with regulators conforming to ISO 2503, the maximum pressure mark is normally p_2 for low-pressure gauges and p_1 for high-pressure gauges, as defined in ISO 2503:1998, Table 4.

Table 1 — Maximum scale reading

Values in megapascals (bar)

Pressure level	Acetylene	Oxygen and other gases
Low-pressure (LP)	0,1 (1) 0,16 (1,6) 0,25 (2,5)	0,25 (2,5) 0,4 (4) 0,6 (6) 1,0 (10) 1,6 (16) 2,5 (25) 4,0 (40)
High-pressure (HP) [a, b, c]	4 (40)	25 (250) 31,5 (315) 40 (400)

[a] 25 MPa (250 bar) pressure gauge for use with CO^2 and compressed gas cylinders filled to a maximum settled filling pressure of 18,5 MPa (185 bar) at 15 °C.

[b] 31,5 MPa (315 bar) pressure gauge for use with compressed gas cylinders filled to a maximum settled filling pressure of 23 MPa (230 bar) at 15 °C.

[c] 40 MPa (400 bar) pressure gauge for use with compressed gas cylinders filled to a maximum settled filling pressure of 30 MPa (300 bar) at 15 °C.

5 Manufacturing requirements

5.1 Materials

5.1.1 General

The materials of the pressure gauge components liable to come into contact with the gas shall have adequate resistance to the chemical action of the gas under operating conditions.

Bourdon tubes and other parts in contact with acetylene gas shall conform to ISO 9539.

5.1.2 Oxygen pressure gauges

Bourdon tubes and other parts in contact with the gas shall be resistant to the chemical action of the oxygen and shall not be flammable under operating conditions.

Thread sealants or sealing rings shall also be resistant to the chemical action of the oxygen and shall not be flammable under operating conditions.

Components in contact with oxygen gas shall conform to ISO 9539.

Only lubricants suitable for use in oxygen at the service pressure and temperature shall be used.

5.2 Design and dimensions

5.2.1 Operational requirement

5.2.1.1 Accuracy

The pressure gauge accuracy shall be at least that of class 2,5, i.e. with a maximum deviation within the tolerance, ± 2,5 % (of full-scale reading), over the entire scale.

5.2.1.2 Overpressure requirements

Those parts of the pressure gauge that are in contact with the gas shall not burst or leak when tested to a pressure corresponding to 2,5 times the maximum scale reading (see 8.7).

5.2.1.3 Torsion

After application of the torque of 10 N·m according to 8.4.1 for a period of not less than 30 s, the pressure gauge shall satisfy the conditions of accuracy specified in 5.2.1.1.

After application of the torque of 25 N·m according to 8.4.2 for a period of not less than 30 s, the pressure gauge shall be leak-tight at a pressure corresponding to the maximum scale reading.

The tests above apply to gauges with connecting threads of a nominal size of 1/4. Connecting threads of nominal size 1/8 shall only be used when equivalent safety can be demonstrated.

5.2.1.4 Bending

After application of the load of 1 kN according to 8.5, the pressure gauge shall be leak-tight to atmosphere at a pressure corresponding to the maximum scale reading.

5.2.2 Dimensions

The nominal size is based on the diameter of the casing (dimension *A* in Figures 1 and 2). The values 40, 50 and 63 are standardized.

The dimensions shall be in accordance with Figure 1 and Table 2, or Figure 2 and Table 3, as appropriate. The connecting dimensions are shown in Figure 3 and Table 4.

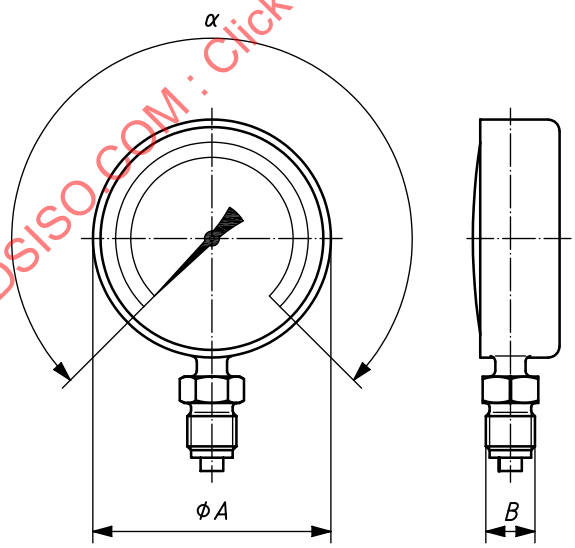


Figure 1 — Pressure gauge with bottom entry

Table 2 — Dimensions of pressure gauge with bottom radial entry

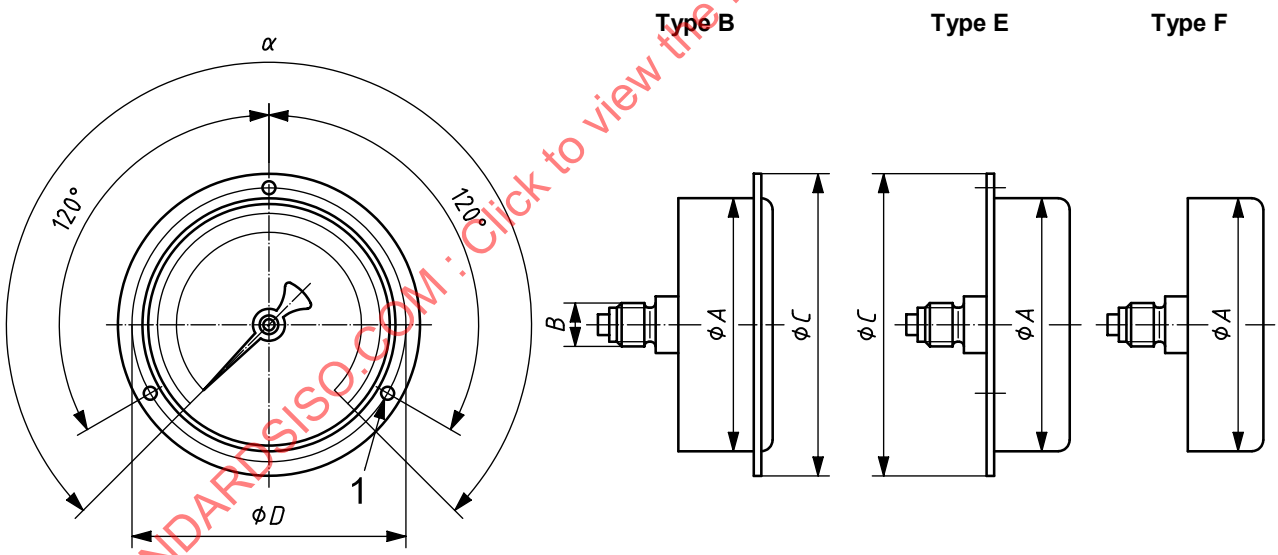
Normal size	α degrees	A mm	B	
			Parallel thread	Tapered thread
40	270	40^{+5}_{-2}	G1/8 B or G1/4 B	R1/8 or 1/8-27 NPT EXT or R1/4 or 1/4-18 NPT EXT
50	270	50^{+7}_{-2}	G1/8 B or G1/4 B	R1/8 or 1/8-27 NPT EXT or R1/4 or 1/4-18 NPT EXT
63	270	63^{+7}_{-2}	G1/4 B	R1/4 or 1/4-18 NPT EXT

The thread connection (see Figure 3), according to the type, shall conform to the following standards:

— for parallel thread, ISO 228-1;

— for tapered thread (Symbol R), ISO 7-1;

— for tapered thread (Symbol NPT), ANSI/ASME B1.20.1.



Key

1 fixing holes, F

Figure 2 — Pressure gauge with rear entry

Table 3 — Dimensions of pressure gauge with rear entry

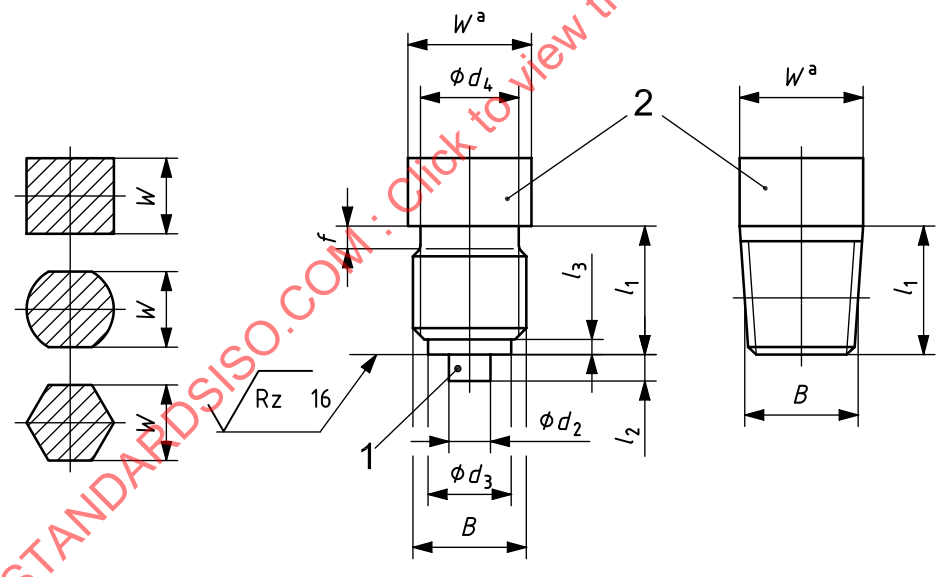
Normal size	α	A_{max}	B		C_{max}	D	F_{min}
	degrees	mm	Parallel thread	Tapered thread	mm	mm	mm
40	270	42	G1/8 *B* or G1/4 *B*	R1/8 or 1/8-27 NPT EXT or R1/4 or 1/4-18 NPT EXT	61	51	3,6
50	270	52	G1/8 *B* or G1/4 *B*	R1/8 or 1/8-27 NPT EXT or R1/4 or 1/4-18 NPT EXT	68	60	3,6
63	270	67	G1/4 *B*	R1/4 or 1/4-18 NPT EXT	81	75	3,6

The thread connection (see Figure 3), according to the type, shall conform to the following standards:

— for parallel thread, ISO 228-1;

— for tapered thread (symbol R), ISO 7-1;

— for tapered thread (Symbol NPT), ANSI/ASME B1.20.1.



Key

1 spigot

2 wrench flats (square, hexagon or other form)

W width of wrench flats

[a] The minimum height of flats shall be compatible with the use of standard spanners according to ISO 10102.

Figure 3 — Thread connection

Table 4 — Dimensions of threads

Dimensions in millimetres

Thread size B	$\varnothing d_2$	$\varnothing d_3$	$\varnothing d_{4\min}$	l_1	l_2	l_3	f	$W_{\min}$
G1/8 B	4	8	8	$10^{+0,5}_{0}$	2	$2^{+0,5}_{0}$	1,6	8 [a]
G1/4 B	5	9,5	9,5	$13^{+0,5}_{0}$	2	$2^{+0,5}_{0}$	2	10 [a]
R1/8	—	—	—	min. 10	—	—	—	8 [a]
R1/4	—	—	—	min. 13	—	—	—	10 [a]
1/8-27 NPT EXT	—	—	—	min. 10	—	—	—	8 [a]
1/4-18 NPT EXT	—	—	—	min. 13	—	—	—	10 [a]
G1/8 B may be made without spigot. G1/8 B may be made without groove f. In that case, the length of threading shall be equal to l_1.								
[a] Preferably 14 mm.								

The maximum values for the turning radius, R, shall be as given in Figure 4 and Table 5.

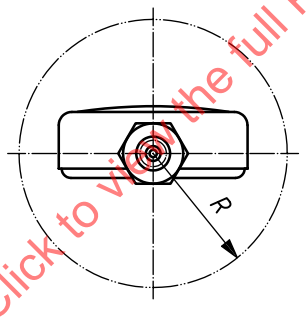


Figure 4 — Turning radius

Table 5 — Maximum values of turning radius, R

Pressure gauge size mm	$R_{\max}$ mm
40	30
50	37
63	45

5.2.3 Dial and pointer

The graduations and markings shall be clear and legible, and it shall be possible to read the indicated pressure easily.

The scale shall be numbered on at least every tenth mark but with a minimum of four numbered marks over the scale range.

The tip of the pointer shall be as near as practical to the dial, but the distance shall in no case exceed 2 mm.

6 Safety

All pressure gauges shall be degreased.

Substances that could react violently with oxygen, e.g. hydrocarbon-based solvents and oils, shall not be used for pressure testing gauges, irrespective of gas service.

The inlet orifice of the Bourdon tube pressure gauge shall be limited to a maximum 0,1 mm^2.

In case of rupture of the Bourdon tube, e.g. due to overpressure or fatigue, the vent on the pressure gauge shall allow the escape of gas in a direction away from the face of the gauge (see 8.6). Furthermore, the face of the gauge shall not burst and no parts shall be thrown from the gauge in any direction.

All non-metallic external materials shall be self-extinguishing (see 8.8).

Under normal operating conditions, the vent shall be closed with a membrane, disk or similar closure which shall withstand normal handling.

7 Marking

The dial shall be marked with the following:

— a reference to this International Standard (i.e. ISO 5171:2009);

— the symbol for the unit of pressure;

— the name or trademark of the manufacturer and/or suppliers;

— for an acetylene pressure gauge, the word “acetylene” [2] or the letter “A”;

— for an oxygen pressure gauge, the word “oxygen” [3] or the letter “O” and the symbol 0248 according to ISO 7000:2004, but crossed out, as shown in Figure 5.

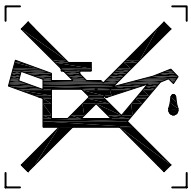


Figure 5 — Engine oil (crossed out)

8 Tests

8.1 General

The following tests are not intended as a production inspection procedure, but are to be applied to the sample gauges submitted to check compliance with this International Standard.

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2) The word “acetylene” is not to be translated into any other language.

3) The word “oxygen” is not to be translated into any other language.

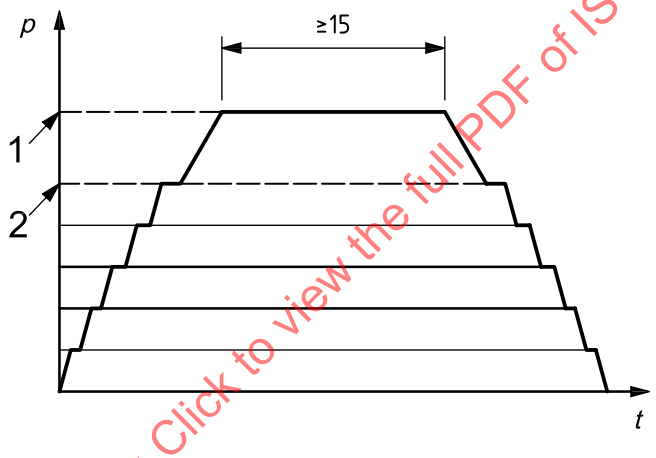
8.2 Design and manufacturing standard

The pressure gauges shall be checked for compliance with the manufacturing drawings and with this International Standard.

8.3 Accuracy

The test shall be carried out using a test pressure gauge of at least class 0,6 and at a temperature of (23 ± 2) °C. Each sample gauge shall be tested over its entire scale, the pressure being increased in at least five steps to the maximum operating pressure (see Figure 6). The pressure shall then be increased to the maximum scale reading after which it shall be decreased in at least five steps. The accuracy shall be compared only over the operation pressure range (see 5.2.1.1). The pressure gauge may be lightly tapped during this test.

If a pointer stop is incorporated, the accuracy shall meet the conditions of class 2,5 at the bottom of the scale.



Key

1 maximum scale reading
2 maximum operating pressure
p pressure
t time, s

Figure 6 — Accuracy test

8.4 Torsion test

8.4.1 With the gauge mounted by its thread, a torque of 10 N·m shall be applied in the tightening direction to the gauge casing for a period of not less than 30 s, using a device that does not support the casing (see Figures 7 and 8). Immediately after this loading, check the pressure gauge for accuracy in accordance with 5.2.1.1.

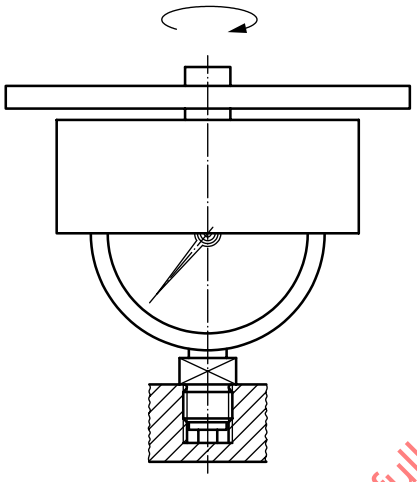


Figure 7 — Torsion test — Pressure gauge with bottom entry

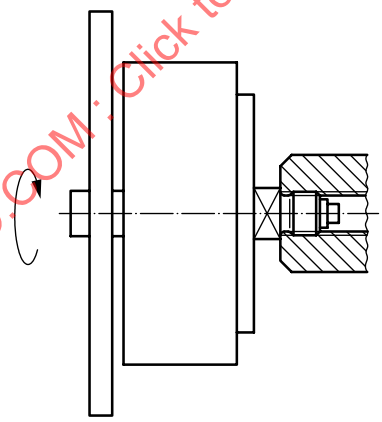


Figure 8 — Torsion test — Pressure gauge with rear entry

8.4.2 A torque of 25 N·m shall be applied in the same manner as specified in 8.4.1. Immediately after this loading, check the pressure gauge for gas tightness at a pressure corresponding to its maximum scale reading.

8.5 Bend test

With the gauge mounted by its thread, a force of 1 kN shall be applied in an appropriate device to the face, back and one side of the case successively (see Figures 9 and 10). Immediately after this loading, check the pressure gauge for gas tightness at a pressure corresponding to its maximum scale reading. The failure of the gauge window is permitted.