INTERNATIONAL STANDARD

ISO 5171

Second edition
1995-07-15

Pressure gauges used in welding, cutting and allied processes

Manomètres utilisés pour le soudage, le coupage et les techniques connexes

Reference number
ISO 5171:1995(E)

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.

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.

International Standard 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*.

International Standard ISO 5171 is, with the exception of the normative references, identical to EN 562:1994, *"Gas welding equipment — Pressure gauges used in welding, cutting and allied processes"*.

This second edition cancels and replaces the first edition (ISO 5171:1980), which has been technically revised.

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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 gases at pressures up to 300 bar (30 MPa) 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 standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 228-1:1994, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation.*

ISO 497:1973, *Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers.*

ISO 2503:1983, *Pressure regulators for gas cylinders used in welding, cutting and allied processes.*

ISO 4589:1984, *Plastics — Determination of flammability by oxygen index.*

ISO 7000:1989, *Graphical symbols for use on equipment — Index and synopsis.*

ISO 9539:1988, *Materials for equipment used in gas welding, cutting and allied processes.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 Bourdon-tube pressure gauge: Device incorporating elastic tubes with direct indication by pointer and graduated scale of the pressure being measured.

3.2 case: Outer housing that contains the Bourdon tube and the movement.

3.3 vent or 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.

3.4 window: Transparent front throught which the dial is observed.

3.5 dial: Plate or area on which the scale is marked.

3.6 scale: Array of marks together with any associated figuring, in relation to which the position of the pointer is observed.

3.7 pointer: Indicator, the position of which in relation to the scale, indicates the value of the measured pressure.

3.8 pointer stop: Projection that stops the travel of the pointer.

3.9 flange: Circular extension of the case used for mounting.

4 Pressure

4.1 Unit of pressure

All pressures given are gauge (effective) pressures in bars.

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 it is not practicable, the maximum scale reading shall be selected from the R10 series of preferred numbers or more rounded values given in ISO 497.

Table 1 — Maximum scale reading

Values in bars

Pressure level	Acetylene	Oxygen and other gases
Low pressure (LP)	1 1,6 2,5	2,5 4 6 10 16 25 40
High pressure (HP)	40	250[1] 315[2] 400[3]

1) 250 bar pressure gauge for use with CO_2 and compressed gas cylinders filled to a maximum settled filling pressure of 185 bar at 15 °C.

2) 315 bar pressure gauge for use with compressed gas cylinders filled to a maximum settled filling pressure of 230 bar at 15 °C.

3) 400 bar pressure gauge for use with compressed gas cylinders filled to a maximum settled filling pressure of 300 bar at 15 °C.

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 1 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 2503:1983, table 2.

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 requirements

5.2.1.1 Accuracy

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

5.2.1.2 Strength

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 1,5 times the maximum scale reading (see 8.7).

5.2.1.3 Torsion

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

After the application of the torque of 25 Nm according to 8.4.2 for a period of not less than 30 s, the pressure gauge shall be leaktight at a pressure corresponding to the maximum scale reading.

5.2.1.4 Bending

After the application of the load of 1 kN according to 8.5, the pressure gauge shall be leaktight 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 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.

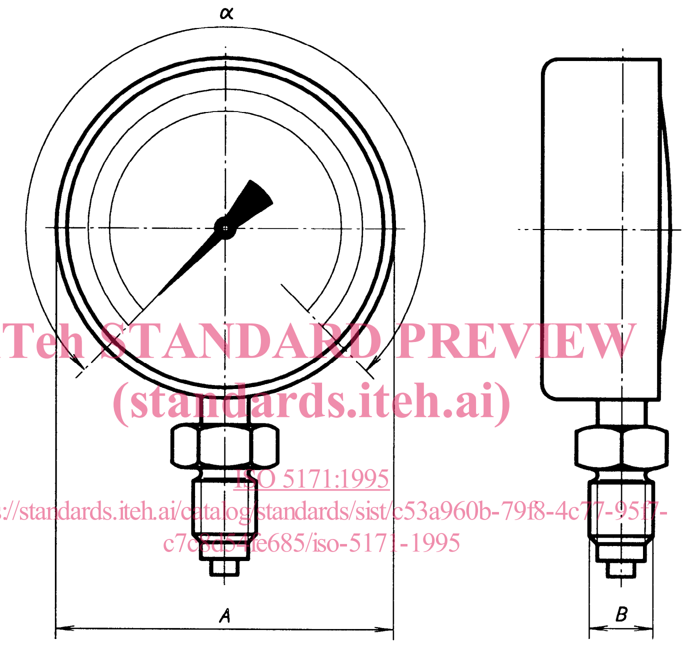

Figure 1 — Pressure gauge with bottom entry

Table 2 — Dimensions of pressure gauge with bottom entry

Nominal size	α °	*A* mm	*B*
50	270	50^{+7}_{-2}	R 1/4 or G 1/4 A
63	270	63^{+7}_{-2}	R 1/4 or G 1/4 A

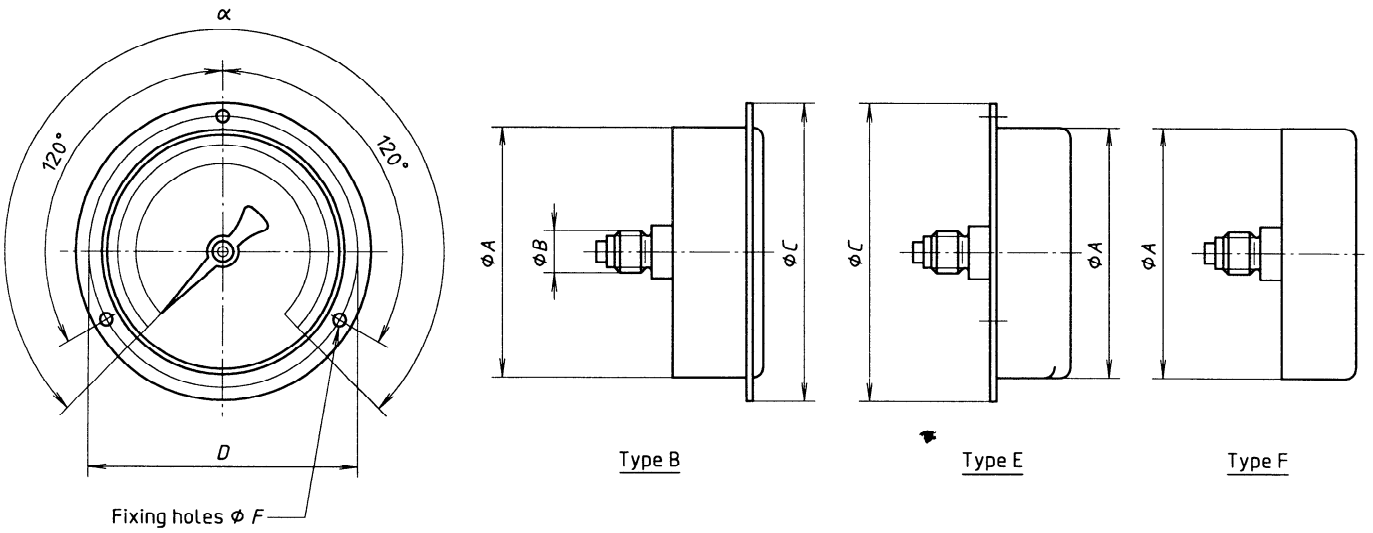

Figure 2 — Pressure gauge with rear entry

Table 3 — Dimensions of pressure gauge with rear entry

Nominal size	α °	A max. mm	B	C max. mm	D mm	F min. mm
50	270	52	R 1/4 or G 1/4 A	68	60	3,6
63	270	67	R 1/4 or G 1/4 A	81	75	3,6

The thread connection (see figure 3) may be of the parallel type or taper type, complying respectively with ISO 228-1 class A or ISO 7-1.

Widths across flats (S) for wrenching shall conform to the dimensions shown in figure 3.

NOTE 2 Welding and cutting equipment manufacturers in some countries use the 1/4 NPT taper thread. While there is close similarity between 1/4 NPT and ISO 7-1 threads in pitch and diameter, there is significant difference in thread form. No mis-matching of threads should be used, for reasons of safety.

The maximum values for the turning radius, R, shall be as given in table 4 and figure 4.

Table 4 — Maximum values of turning radius, R

Pressure gauge size	R max. mm
50	37
63	45

Dimensions in millimetres

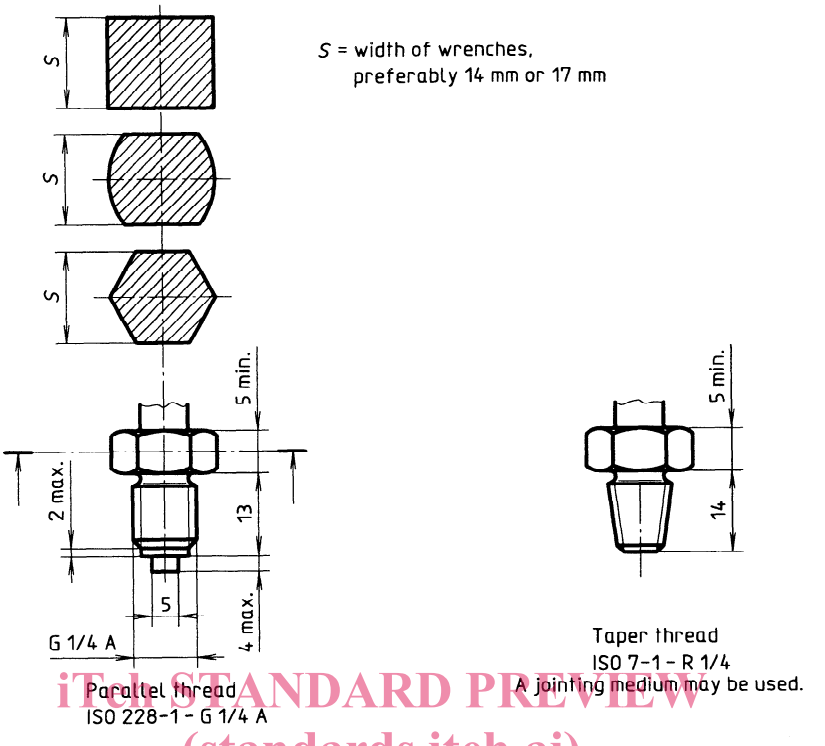

Figure 3 — Thread connection

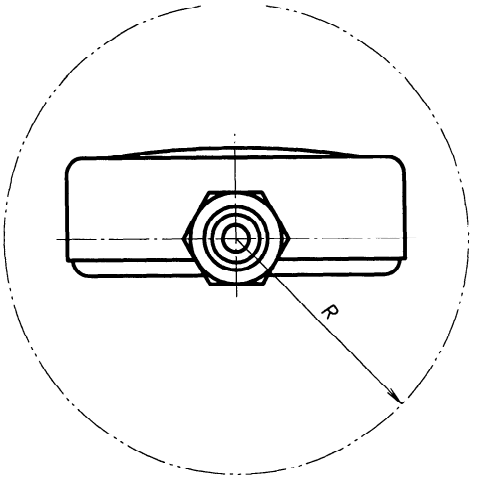

Figure 4 — Turning radius

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 dial background colour shall be white. The markings and pointer shall be black.

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 in any case the distance shall not exceed 2 mm.

6 Safety

All pressure gauges shall be degreased.

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

The inlet orifice to the Bourdon tube of pressure gauges whose maximum scale reading is less than 40 bar shall be limited to a maximum of 0,2 mm^2. For pressure gauges whose maximum scale is equal to or greater than 40 bar, the orifice shall be limited to 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, disc or a similar closure which shall withstand normal handling.

7 Marking

The dial shall be marked with the following:

a) the symbol for the unit of pressure;

b) the name or trademark of the manufacturer and/or suppliers;

c) for an acetylene pressure gauge, the word "acetylene" or the letter "A";

d) for an oxygen pressure gauge, the word "oxygen" or the letter "O" and the symbol (0248 according to ISO 7000, but crossed out) as shown below.

The words "acetylene" and "oxygen" shall not be translated into any other language.

Pressure gauges with ISO 7-1 taper threads shall be marked with "R 1/4", either on the dial or shank to indicate the type of thread.

8 Tests

8.1 General

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

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 test

The test shall be carried out using a test pressure gauge of class at least 0,6 and at 23 °C ± 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 5). 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 operating 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.

8.4 Torsion test

8.4.1 With the gauge mounted by its thread, a torque of 10 Nm shall be applied to the gauge casing, in the tightening direction for a period of not less than 30 s, using a device that does not support the casing (see figure 6). Immediately after this loading, check the pressure gauge for accuracy in accordance with 5.2.1.1.

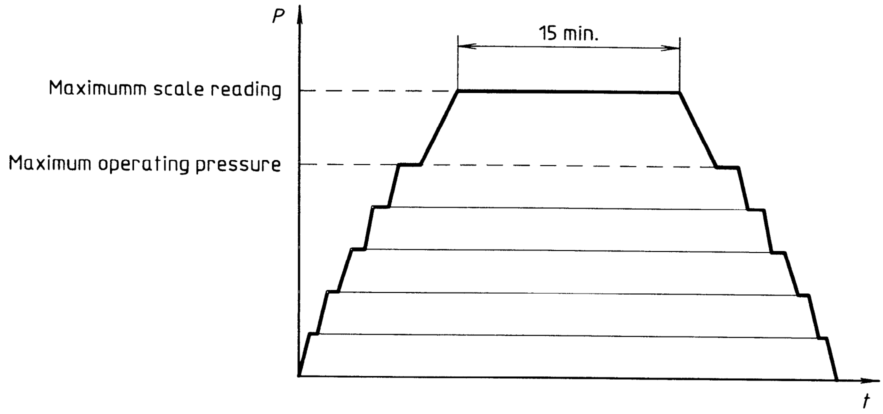

Figure 5 — Accuracy test

8.4.2 A torque of 25 Nm shall be applied in the same manner as in 8.4.1. Immediately after this loading, check the 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 using an appropriate device successively on the face, back and on one side of the case (see figure 7). Immediately after this loading, check the gauge for gas tightness at a pressure corresponding to its maximum scale reading. The failure of the gauge window shall be permitted.

8.6 Case vent test

8.6.1 The complete pressure gauge shall be connected to a gas source of a pressure equal to its maximum scale reading or 200 bar (20 MPa) whichever is the greater. The pressure shall suddenly be released into the pressure gauge inlet connection.

If gas is vented during this test the direction of the vented gas shall be noted or if any parts are thrown from the pressure gauge this shall also be noted. The test is discontinued.

If no gas is vented or no parts are thrown from the gauge during this test proceed in accordance with 8.6.2.

8.6.2 The pressure gauge shall be prepared to allow a gas energy $E = pV$ to be suddenly released into the gauge casing (where p is the pressure equal to its maximum scale reading and V is the internal gas volume of the Bourdon tube and stem). However, the product of pV shall refer to the highest energy content of the pressure measuring system. Energy E shall suddenly be released into the pressure gauge case.

If for this test the energy E is introduced from outside the case, the entry passage into the gauge case shall not be less than 5 mm diameter and the energy source shall be as close as practical to the gauge case under test.

If gas is vented during this test the direction of the vented gas shall be noted or if any parts are thrown from the pressure gauge this shall also be noted. The test is discontinued.

If no gas is vented or no parts are thrown from the gauge during this test proceed in accordance with 8.6.3.

8.6.3 The gauge case shall be prepared to allow direct internal pressurization by a high pressure gas source. The gauge case shall be pressurized internally and the pressure increased until gas is vented. The direction of the vented gas shall be noted and if any parts are thrown from the pressure gauge this shall also be noted.

8.7 Strength test

The pressure gauge shall be submitted to a pressure of 1,5 times the maximum scale reading for a period of not less than 1 min. Immediately after this pressurization, check the gauge for gas tightness at a pressure corresponding to its maximum scale reading.