INTERNATIONAL STANDARD ISO 2503

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Welding — Regulators for gas cylinders used in welding, cutting and related processes

First edition — 1972-10-01

UDC 621.791 : 621.646.4

Ref. No. ISO 2503-1972 (E)

Descriptors : welding, gas cutting, gas cylinders, pressure regulators, characteristics, tests, marking.

Price based on 5 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2503 was drawn up by Technical Committee ISO/TC 44, *Welding.*

It was approved in March 1972 by the Member Bodies of the following countries :

Austria	Hungary	Spain
Belgium	India	Sweden
Canada	Ireland	Switzerland
Czechoslovakia	Israel	Turkey
Egypt, Arab Rep. of	Italy	United Kingdom
Finland	New Zealand	U.S.A.
France	Romania	U.S.S.R.
Germany	South Africa, Rep. of	

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Australia
Norway

Printed in Switzerland

Welding — Regulators for gas cylinders used in welding, cutting and related processes

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies requirements for pressure regulators normally used for compressed gases at pressures up to 200×10^5 N/m^2 (or 200 bar) and for dissolved acetylene, but does not apply to pipeline regulators.

2 REFERENCES

ISO/R 554, *Standard atmospheres for conditioning and/or testing — Standard reference atmosphere — Specifications.*

ISO 2442, *Welding — Hoses for gas welding and allied processes.* (At present at the stage of draft.)

3 DEFINITION

pressure regulator : A device for regulating a generally variable inlet pressure to as constant as possible an outlet pressure by setting a valve by means of a control knob.

NOTE — The terminology relative to pressure regulators will be the subject of a future International Standard.

4 UNIT OF PRESSURE

The pressures measured are gauge pressures[1].

They are expressed in 10^5 N/m^2 (or bar)[2].

5 MANUFACTURING REQUIREMENTS

5.1 Materials

The materials of regulator components liable to come into contact with the gases shall have adequate resistance to the chemical action of these gases under operating conditions.

NOTE — In most countries regulations exist which limit the maximum copper content of components coming directly into contact with acetylene.

5.2 Design, machining and assembly

5.2.1 *Oxygen regulators*

Regulators for oxygen shall be so designed, machined and assembled as to avoid internal burning; all components and accessories shall be thoroughly cleaned and degreased before assembly.

5.2.2 *Filter*

A dust filter having an effective cross-section compatible with the discharge shall be mounted within the regulator upstream of the pressure regulating valve.

5.2.3 *Outlet valve*

The regulators can be fitted with an outlet valve. When fitted, valve spindles shall be captive.

5.2.4 *Regulator cover*

The cover position is left to the choice of the manufacturer.

NOTE — In some countries regulations exist for the position of the spring cover.

5.2.5 *Pressure adjusting device*

This device shall be designed in such a way that the valve will not be held in the open position, for example, as a consequence of the spring going solid.

5.2.6 *Relief valve*

The relief valve shall remain gas-tight up to the pressure p_4 (see 7.4.1). It shall open sufficiently and ensure a gas discharge such that the pressure in the low pressure chamber of the regulator cannot exceed $2\,p_2$ (see 7.1.2). It shall be fitted in such a way that the gas discharges safely.

1) Pressure exceeding the atmospheric pressure.
2) 1 bar = 10^5 Pa = 10^5 N/m^2.

5.2.7 *Pressure gauges*

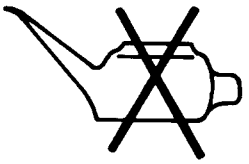
5.2.7.1 Specification and tolerances

In the absence of an International Standard concerning the specification and tolerances of gauges, existing national standards shall be applied.

5.2.7.2 Marking

Oxygen pressure gauges shall be marked :

"OXYGEN – use no oil", or with the symbol : a deleted oil-can.



Acetylene pressure gauges shall be marked :

"ACETYLENE".

6 CHARACTERISTICS OF CONNECTIONS

6.1 Inlet connections

All regulators shall be made in such a way that the inlet connection is compatible with the cylinder valve outlet designed for the gas contained. Cylinder valve connections are specified in national standards.

6.2 Outlet connections

Pending the results of the current ISO work, only the following requirements apply :

– hose nipple bearing cone angle : 45°;

– hose nipple orientation : downwards, away from the cylinder;

– curved hose nipples are prohibited.

7 PHYSICAL CHARACTERISTICS

7.1 Pressures

7.1.1 *Nominal (maximum) inlet pressure* p_1

Nominal (maximum) upstream pressure for which the regulator is designed.

7.1.2 *Nominal (maximum) outlet pressure* p_2

Nominal (maximum) downstream pressure for the standard discharge specified in the table of equipment classes given below.

NOTE – For acetylene, there exist in certain countries national specifications in which it is forbidden to exceed certain values of maximum outlet pressure.

7.2 Flows

7.2.1 *Maximum discharge* Q_{max}

The maximum discharge of the gas concerned, expressed in cubic metres per hour[1], which the regulator can provide for an upstream pressure p_3 defined by the expression :

$$p_3 = 2p_2 + 1 \text{ bar}$$

This discharge is obtained for an outlet pressure p_2.

7.2.2 *Standard discharge* Q_1

The standard discharge is given in the table.

7.3 Equipment classes

Performance is measured at a standard discharge Q_1, shown in the table of equipment classes.

TABLE – **Equipment classes**

Gas	Class	Nominal (maximum) inlet pressure p_1	Nominal (maximum) outlet pressure p_2	Standard discharge[1] Q_1
		bar	bar	m^3/h
Oxygen and other compressed gases at 150 or 200 bar	I II	150 or 200 150 or 200	3,5 8	5 25
Dissolved acetylene	I II	15 to 18 15 to 18	1,5 1,5	1 5

A regulator is considered to belong to one of the classes specified above if its maximum discharge Q_{max} is not less than the standard discharge Q_1 of the class concerned.

1) The reference conditions are defined in 9.2.

7.4 Operating characteristics

7.4.1 *Coefficient of pressure increase upon closure, R (Definition)*

This is defined by

$$R = \frac{p_4 - p_2}{p_2}$$

where p_4 is the stabilized outlet pressure (stabilization pressure) noted 1 min after discharge ceases, with the regulator set to the standard initial conditions p_2, p_3, Q_1.

For standard discharge the coefficient of pressure increase upon closure, R, shall be less than 0,3.

7.4.2 *Irregularity coefficient, i (Definition)*

This is defined by

$$i = \frac{p_5 - p_2}{p_2}$$

where p_5 is the highest or lowest value of the outlet pressure during a test in which the inlet pressure varies from p_1 to p_3 for a flow equal to the standard discharge Q_1 in accordance with the table in 7.3.

The limits shall be

$$-0{,}3 \leqslant i \leqslant +0{,}3$$

7.4.3 *Behaviour at operating temperatures*

Under ordinary operating conditions, the regulators shall be capable of operating normally at the temperatures to which they may be subjected.

8 MARKING

8.1 Colour coding

Regulators shall be clearly and permanently identified by the colours specified for the various gases in ISO 2442.

8.2 Other information

The following information shall be clearly and permanently marked on the regulator body or cover or on a plate permanently fixed to the regulator :

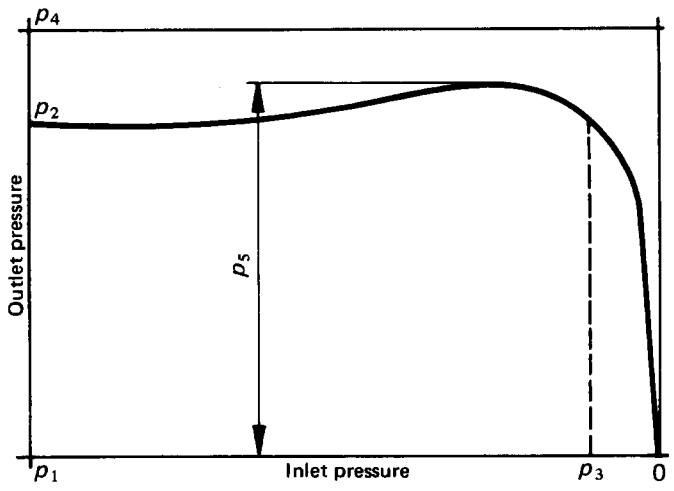
- maker's name or symbol;
- regulator class in accordance with 7.3.

In addition, the national marking specifications shall be respected.

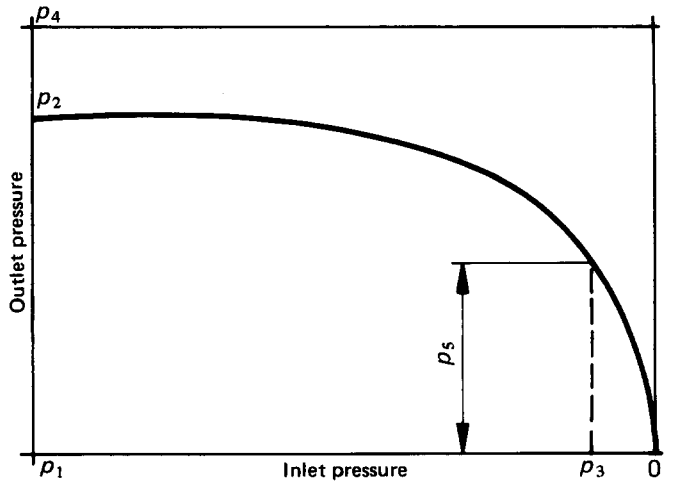
9 TESTING

9.1 Type of gas

Tests should generally be made with oil-free compressed air, except that oxygen shall be used for the test given in 9.6.2.2. In all cases the tests shall be made with dry gas, maximum 50 p.p.m. of moisture, corresponding to a dewpoint of about −48 °C. The results thus obtained shall be adjusted for the gas for which the regulator is designed, assuming by convention that the discharges are inversely proportional to the square roots of the densities.



a) **with rising characteristic**



b) **with falling characteristic**

FIGURE — **Typical dynamic expansion curves**

9.2 Discharge and pressure measurements

The results of measurements shall be related to conditions of normal temperature and pressure (20 °C and 1,013 bar)[1]. It is necessary to observe the maximum tolerances related to pressure and flow measurements, especially to determine the coefficients i and R (see 9.4 and 9.5).

9.3 Rating tests

9.3.1 *Maximum discharge Q_{max}*

The discharge Q_{max} shall be found by discharging to atmosphere, with the regulator set to maximum outlet pressure p_2 as defined in 7.1.2, and the upstream pressure p_3.

9.3.2 *Standard discharge Q_1*

The rating tests shall be made at the standard discharge Q_1 specified in the table in 7.3. In the case of other gases, the corresponding discharge for the gas actually used shall be calculated.

9.3.3 *Expansion curve with rising or falling characteristic, plotted during continuous discharge*

The curve (see 7.4.2) gives the downstream pressure as a function of the upstream pressure. It shall be plotted during a test starting with the initial values of p_1, p_2 and Q_1 shown in the table in 7.3.

The test shall last for at least 15 min and continue until the upstream pressure is no greater than p_3.

The curve shall show no sudden variations between p_1 and p_3.

9.4 Coefficient of pressure increase upon closure, R (Measurement)

With the regulator set to the same conditions as for the discharge Q_1, proceed as follows :

When the discharge is blocked, the pointer of the low pressure gauge moves to a higher value and stabilizes. Note the stabilization pressure p_4 after 1 min and from it determine the value of R in accordance with the formula of 7.4.1 :

$$R = \frac{p_4 - p_2}{p_2}$$

9.5 Irregularity coefficient, i (Measurement)

This coefficient is determined from the dynamic expansion curve by the formula of 7.4.2 :

$$i = \frac{p_5 - p_2}{p_2}$$

9.6 Mechanical tests

9.6.1 *Internal pressure test*

For this test the opening shall be closed, and the relief valve, diaphragm and pressure gauges replaced by blank flanges.

The hydraulic test shall be performed for the high pressure part at 300×10^5 N/m^2 (bar) and for the low pressure part at 30×10^5 N/m^2 (bar).

NOTE – In some countries, consideration is being given to a higher test pressure for the low pressure part.

9.6.2 *Leakage and ignition tests*

9.6.2.1 Leakage

Regulators shall be gas-tight externally, i.e. to atmosphere, and internally, i.e. between the high pressure and low pressure parts, for all pressures or pressure differences normally occurring with the gases concerned.

To check this gas-tightness, the following tests shall be made :

a) The pressure adjusting screw is loosened, the pressure gauges suitably damped or isolated, and the regulator subjected to the maximum inlet pressure p_1.

b) Under the same conditions as above, the regulator is suddenly pressurized and suddenly discharged to atmosphere, twenty times, possibly by means of a three-way cock fitted on the inlet.

c) Tests a) and b) are repeated, but at the upstream pressure p_3, which shall remain constant throughout the tests.

During and after these three tests there shall be no leak at the outlet orifice for a period of at least 2 min.

d) With the inlet pressure at its maximum value p_1, the regulator is discharged to atmosphere through an orifice set to the regulator's standard discharge Q_1 at the maximum outlet pressure p_2. The low pressure side is then given the cycle of tests described in b). After this test the pointer of the low pressure gauge shall be completely stabilized and the regulator shall be internally gas-tight for a pressure p_4 not more than 1.3 times p_2, the observation being made 1 min after the closure of the outlet control valve.

This test is repeated with an inlet pressure equal to p_3.

1) In conformity with ISO/R 554, conditions of normal temperature and pressure are 27 ° C and 1,013 bar for tropical countries.

9.6.2.2 Ignition safety (oxygen regulators)

Oxygen regulators shall be designed to be safe against internal ignition. These tests shall be made with oxygen at 60 °C, under the conditions specified in 9.6.2.1 a) and b), the pressure being applied every 30 s and held for 10 s.

For all the tests mentioned in 9.6.2.1 and 9.6.2.2 the regulators shall be fitted with the filter specified in 5.2.2.

Published 1973-12-15

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Welding — Regulators for gas cylinders used in welding, cutting and related processes

AMENDMENT 1

Amendment 1 to International Standard ISO 2503-1972 was drawn up by Technical Committee ISO/TC 44, *Welding*.

Having been approved by the majority of the P-members of the Technical Committee, and the modification involved having been considered by ISO/TC 44 as being of minor importance, this Amendment 1 was submitted directly to the ISO Council for acceptance, in accordance with Clause 6.12.1 of the Directives for the technical work of ISO.

Page 3

Sub-clause 8.1 : Delete "in ISO 2442" and substitute "in the national standards or regulations concerning compressed gases".

UDC 621.791 : 621.646.4 **Ref. No. ISO 2503-1972/A1-1973 (E)**

Descriptors : welding, gas cutting, gas cylinders, pressure regulators, characteristics, tests, marking.