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(JWES)

**Pressure regulator for welding,
cutting and allied processes**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Welding Engineering Society (JWES) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS B 6803 : 1994** is replaced with this Standard.

This revision has been made based on **ISO 2503 : 1998** *Gas welding equipment—Pressure regulators for gas cylinders used in welding, cutting and allied processes up to 300 bar* for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
3 Definitions	2
4 Symbols	2
5 Name	3
6 Units	4
6.1 Pressure	4
6.2 Discharge	4
6.3 Temperature	5
7 Requirements for manufacture	5
7.1 Materials	5
7.2 Design, machining and assembly	6
8 Connection	7
8.1 Inlet connection	7
8.2 Outlet connection	8
9 Physical characteristics	10
9.1 Flow rate	10
9.2 Class	10
9.3 Operational characteristics	10
10 Operational temperature range	12
11 Marking	12
12 Instruction manual	13
13 Tests	13
13.1 General	13

13.2	Test conditions	14
13.3	Functional tests	16
13.4	Mechanical tests	20
13.5	Ignition test (only for oxygen pressure regulator)	21
13.6	Safety valves	23
13.7	Marking durability test	23
14	Designation	24
15	Related standards.....	24
Annex A (informative)	Names of components of pressure regulator for welding, cutting and allied processes	34
Annex B (informative)	Comparison table between JIS and corresponding International Standard	35

Pressure regulator for welding, cutting and allied processes

Introduction This Japanese Industrial Standard has been prepared based on the first edition of **ISO 2503** *Gas welding equipment—Pressure regulators for gas cylinders used in welding, cutting and allied processes up to 300 bar*, published in 1998 by modifying the technical contents to meet the service mode in Japan.

Besides, the portions underlined with dots in this Standard are the matters modified from International Standard. Annex B (informative) shows a table of modifications with the explanation thereof.

1 Scope This Standard specifies single or two-stage pressure regulators to be used for compressed gases, dissolved acetylene gas, liquefied petroleum gas (hereafter referred to as “LPG”) and carbon dioxide gas used in welding, cutting and allied processes. This Standard shall not apply to any pressure regulators fitted to a siphon type carbon dioxide gas pressure cylinder.

Remarks : The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are **IDT** (identical), **MOD** (modified), and **NEQ** (not equivalent) according to **ISO/IEC Guide 21**.

ISO 2503 : 1998 *Gas welding equipment—Pressure regulators for gas cylinders used in welding, cutting and allied processes up to 300 bar* (MOD)

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of coming into effect or the year of publication is given to these referred standards, only the edition of the indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative references without the indication of the year of coming into effect apply only to the most recent edition (including amendments).

JIS B 0208 Unified fine screw threads

JIS B 0212 Limits of sizes and tolerances for unified fine screw threads

JIS B 0255 Limit gauges for unified screw threads

JIS B 0405 General tolerances—Part 1 : Tolerances for linear and angular dimensions without individual tolerance indications

JIS B 6805 Rubber hose connections for equipment for welding, cutting and allied processes

JIS B 7502 Micrometer callipers

JIS B 7505 : 1999 Bourdon tube pressure gauges

JIS B 7507 Vernier, dial and digital callipers

JIS B 8244 : 1994 Valves for dissolved acetylene cylinder

JIS B 8245 : 1994 Valves for liquefied petroleum gas cylinder

JIS B 8246 : 1996 High pressure gas cylinders—Valves

JIS G 3521 Hard drawn steel wires

JIS G 3522 Piano wires

JIS G 4314 Stainless steel wires for springs

JIS G 4801 Spring steels

JIS H 3250 Copper and copper alloy rods and bars

JIS H 4040 Aluminium and aluminium alloy rods, bars and wires

JIS H 4140 Aluminium and aluminium alloy forgings

JIS H 5120 Copper and copper alloy castings

JIS H 5202 Aluminium alloy castings

JIS H 5301 Zinc alloy die castings

JIS H 5302 Aluminium alloy die castings

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

3 Definitions The definitions of terms used in this Standard shall be as follows.

- a) **pressure regulator** A valve to reduce the high pressure of gases to the pre-determined value.
- b) **test pressure regulator** A pressure regulator sampled from products to carry out the test.
- c) **type test** A test carried out to check the design quality.
- d) **qualification test** A test carried out to check the manufacture quality.
- e) **compressed gas** Gases filled in a high-pressure gas cylinder such as oxygen, nitrogen, hydrogen and argon.
- f) **pressure regulating mechanism** A unit of the pressure regulator to adjust the pressure.
- g) **performance test** Tests, among the tests for the pressure regulator, carried out on the irregularity coefficient, the coefficient of pressure increase upon closure, the maximum discharge and the standard discharge.
- h) **discharge capacity** Gas flow rate to be discharged by the pressure regulator, and evaluated by the maximum discharge and the standard discharge.

4 Symbols The meaning of symbols used in this Standard shall be as follows.

- a) **P_1** Inlet pressure. Pressure supplied to the inlet side of the pressure regulator.

- b) P_{1m} Maximum inlet pressure. Maximum value of the inlet pressure P_1 .
- c) P_2 Adjusted pressure. Outlet pressure determined to carry out the performance test of the pressure regulator except Class IIAC acetylene pressure regulator.
- d) P_{2R} Outlet pressure determined to carry out tests for the discharge capacity and the coefficient of pressure increase upon closure of Class IIAC acetylene pressure regulator.
- e) P_{2i} Outlet pressure determined to carry out tests for the irregularity coefficient of Class IIAC acetylene pressure regulator.
- f) P_3 Rated inlet pressure. Inlet pressure determined to carry out the test for the discharge capacity of pressure regulator specified in this Standard.
- g) P_4 Increased pressure upon closure. Outlet pressure increased by closing the outlet in the test for the coefficient of pressure increase upon closure.
- h) R Coefficient of pressure increase upon closure. The adjusted pressure P_2 set in the beginning of the test subtracted from the increased pressure upon closure P_4 in the test for the coefficient of pressure increase upon closure, divided by the adjusted pressure P_2 set in the beginning of the test. However, $P_2 = P_{2R}$ in the case of a Class IIAC acetylene pressure regulator.
- i) P_5 Irregularity. Maximum or minimum outlet pressure in the test for the irregularity coefficient.
- j) i Irregularity coefficient. Adjusted pressure P_2 set in the beginning of the test subtracted from the irregularity P_5 , divided by the adjusted pressure P_2 set in the beginning of the test when the inlet pressure P_1 is dropped from the maximum inlet pressure P_{1m} to the rated inlet pressure P_3 in the irregularity test. However, $P_2 = P_{2i}$ in the case of a Class IIAC acetylene pressure regulator.
- k) P_6 Maximum service pressure.
- l) Q_{max} Maximum discharge. Maximum flow rate (0 °C, 0.101 3 MPa) to be discharged by the pressure regulator at the rated inlet pressure P_3 and the adjusted pressure P_2 in the discharge capacity test. However, $P_2 = P_{2R}$ in the case of a Class IIAC acetylene pressure regulator.
- m) Q_1 Standard discharge. Flow rate (0 °C, 0.101 3 MPa) to be discharged by the pressure regulator at the rated inlet pressure P_3 and the adjusted pressure P_2 in the discharge capacity test. However, $P_2 = P_{2R}$ in the case of a Class IIAC acetylene pressure regulator.

5 Name Names of components of the pressure regulator shall be as shown in Fig. 1.

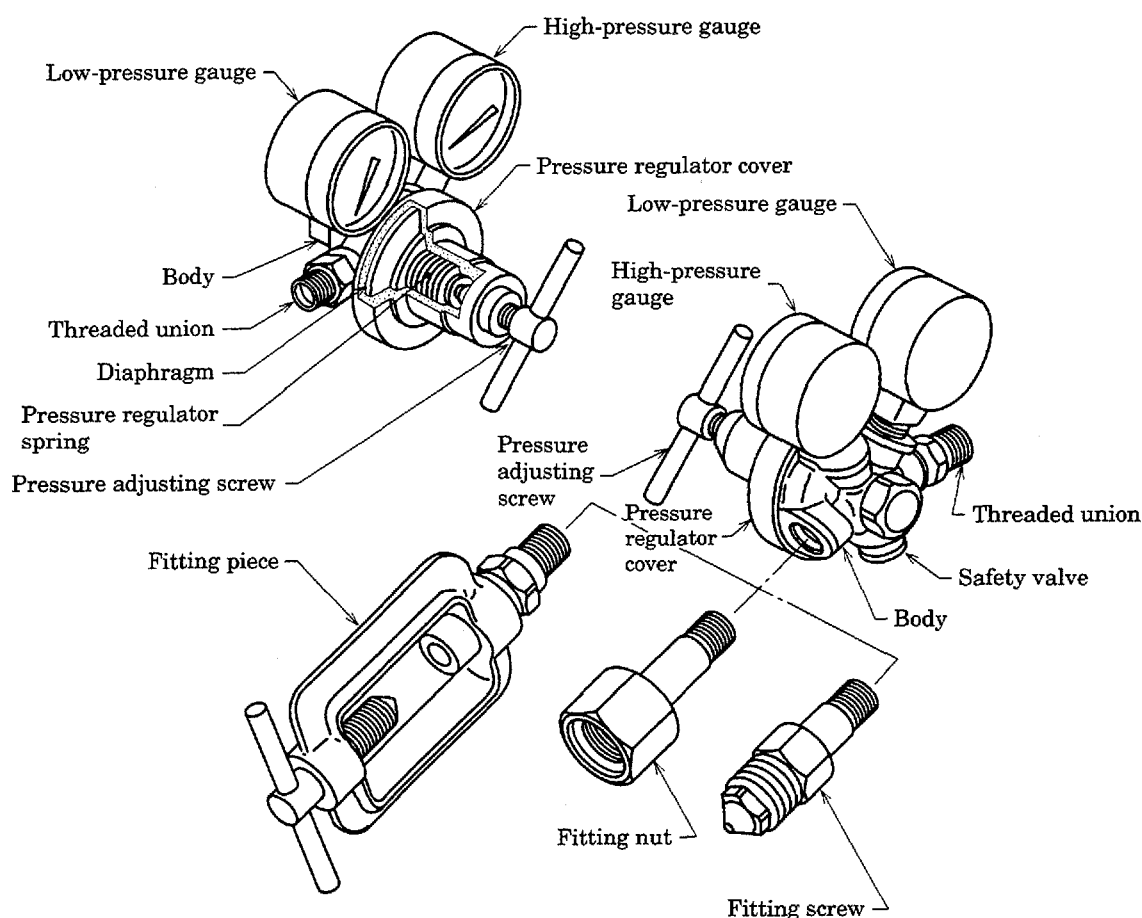


Fig. 1 Names of components of pressure regulator

Remarks : This figure does not specify the structure of the pressure regulator.

6 Units

6.1 Pressure The pressure shall be gauge pressure, and expressed by MPa.

6.2 Discharge The discharge shall be expressed in m³/h at 0 °C, 0.101 3 MPa, considering an adequate correction factor for the gas used (see Table 1).

Table 1 Correction factor *U*

Test gas	Correction factor								
	Air	Oxygen	Nitrogen	Argon	Hydrogen	Helium	Acetylene	LPG	Carbon dioxide gas
Air	1	0.950	1.02	0.851	3.81	2.695	1.05	0.800	0.808
Nitrogen	0.983	0.930	1	0.837	3.75	2.65	1.03	0.784	0.792

Correction factor *U* shall be as specified by the following formula:

$$U = (\gamma_0/\gamma_1)^{1/2}$$

where, γ_0 is the specific weight of test gas
 γ_1 is the specific weight of gas used for the pressure regulator.

Information : Generally, the formula of conversion of the float type flowmeter shall be expressed as follows:

$$Q_0 = Q \times (P/P_0)^{1/2} \times (m_0/m)^{1/2} \times (T_0/T)^{1/2}$$

where, Q_0 : true discharge
 Q : indicated value of the flowmeter
 P_0 : pressure set to the flowmeter (absolute pressure = gauge pressure + 0.101 3 MPa)
 P : pressure on the flowmeter (absolute pressure = gauge pressure + 0.101 3 MPa)
 m_0 : specific gravity of the gas set to the flowmeter
 m : specific gravity of the gas flowing in the flowmeter
 T_0 : temperature set to the flowmeter (absolute temperature: temperature + 273 °C)
 T : temperature of the gas flowing in the flowmeter (absolute temperature: temperature + 273 °C)

6.3 Temperature Temperature shall be expressed by Celsius (°C).

7 Requirements for manufacture

7.1 Materials The materials used for the pressure regulator and for the parts exposed to each gas shall satisfy a) to e) below, and shall have the mechanical properties and the chemical properties specified in **ISO 9539 : 1988**, or Attached Table 1, or equivalent thereto.

- a) Materials corrosion-resistant against oxygen or, surface-treated corrosion-resistant materials shall be used for parts exposed to oxygen.

If any lubricant is used for parts exposed to oxygen, the lubricant shall be suitable for the pressure and the temperature under the service condition.

- b) No copper or copper alloy of copper content exceeding 70 % (by mass) shall be used for parts exposed to acetylene of the acetylene pressure regulator. In addition, if Law of High Pressure Gas Security is applied, no copper or copper alloy of copper content exceeding 62 % (by mass) shall be used for a part exposed to acetylene of the acetylene pressure regulator.
- c) Organic materials used for the acetylene pressure regulator shall be sufficiently durable to acetylene gas and solvent exposure.
- d) Organic materials used for the LPG pressure regulator shall be sufficiently durable to LPG exposure.

- e) Silver content and copper content of brazing filler metals shall not exceed 46 % (by mass) and 37 % (by mass), respectively.

7.2 Design, machining and assembly

7.2.1 Oxygen pressure regulator The oxygen pressure regulator shall be designed, machined and assembled so that no internal combustion occurs (see 13.5). All components and accessories shall be completely cleaned before assembly, and greases shall be removed therefrom, except the lubricant specified in 7.1 a).

7.2.2 Acetylene pressure regulator The acetylene pressure regulator shall be designed and manufactured so that the outlet pressure does not exceed 0.15 MPa including the pressure increase upon closure.

7.2.3 Filter The filter shall have sufficient sectional area for the gas discharge, and shall be fitted to the inlet side of the pressure regulator. The filter shall not be detached unless a tool is used. The filter shall capture particles of the size of 0.1 mm or over.

7.2.4 Outlet valve An outlet valve shall be fitted to the pressure regulator, and if fitted, a spindle thereof shall not come off.

7.2.5 Pressure regulating mechanism

- a) The pressure regulator shall be designed so that the pressure regulator spring is not fully compressed, or the valve or the valve seat is not in an open condition.
- b) The pressure adjusting screw shall not be removed, except when the pressure regulator spring is not fully compressed by the pressure adjusting screw.
- c) The pressure regulator shall not be set to the pressure at which the safety valve is operated by using the pressure regulator screw attached to the pressure regulator.

7.2.6 Safety valve

7.2.6.1 General

- a) The safety valve shall be equipped on every pressure regulator for compressed gases and carbon dioxide gas except the LPG pressure regulator, the acetylene pressure regulator and the pressure regulator for pipes. A safety valve is optional for the LPG pressure regulator, the acetylene pressure regulator and the pressure regulator for pipes.
- b) The safety valve shall not be adjusted by users.

7.2.6.2 Safety valve of compressed gas pressure regulator, and carbon dioxide gas pressure regulator

- a) The safety valve shall maintain gas-tightness at the maximum service pressure P_6 when the residual pressure of the cylinder (or the pressure in pipes) is dropped, and when the gas is stopped.

- b) The safety valve shall be fitted so that the gas is safely discharged.

7.2.6.3 Safety valve of acetylene pressure regulator

- a) If the safety valve is fitted, the safety valve shall maintain gas-tightness at 0.15 MPa when the residual pressure of the cylinder (or the pressure in pipes) is dropped, and when the gas is stopped.
- b) The safety valve shall be fitted so as not to discharge gases toward workers.

7.2.6.4 Safety valve of LPG pressure regulator, and carbon dioxide gas pressure regulator When the safety valve is fitted, the specification in 7.2.6.2 shall be satisfied.

7.2.7 Pressure gauge Requirements for operation and safety specified in JIS B 7505 : 1999 shall apply.

7.2.8 Airtightness The pressure regulator shall satisfy the following items at the pressure of the high-pressure part and the low-pressure part shown in Table 6.

- a) The pressure regulator shall be airtight to the atmosphere.
- b) The pressure regulator shall be airtight between the high-pressure part and the low-pressure part.

7.2.9 Pressure tightness The pressure regulator shall satisfy the following items at the pressure of the high-pressure part and the low-pressure part shown in Table 6.

- a) The pressure regulator shall be designed, and assembled so as not to generate any permanent deformation.
- b) The high-pressure gas in the pressure regulator shall be safely kept or exhausted if the low-pressure part of the pressure regulator or the middle part of the two-stage type pressure regulator is directly connected to the maximum inlet pressure P_{1m} , for example, when the pressure adjustment mechanism is kept in an open condition, and the outlet is closed (by the attached valve or plug) (see 13.4.2).

8 Connection Screws of the joint part of the pressure regulator shall be as specified in Table 2.

8.1 Inlet connection

8.1.1 Connection to cylinder When the pressure regulator is fitted to the cylinder, the inlet joint shall be as follows.

- a) Type A or Type B in JIS B 8246 shall be used when the pressure regulator is fitted to cylinders of S1, S2, 0S-VS, 0CO, ICO and CO2.
- b) Fitting pieces in compliance with JIS B 8244 shall be used if the pressure regulator is fitted to cylinders of IAC, IIAC and AC2.
- c) The pressure regulator shall be fitted to cylinders of 0LP, ILP and LP2 in compliance with JIS B 8245.

8.1.2 Connection to outlet of pipes The pressure regulators for pipes S3, AC3, LP3 and CO3 shall be connected to the pipe outlets by using screws in compliance with Fig. 2 and Table 2.

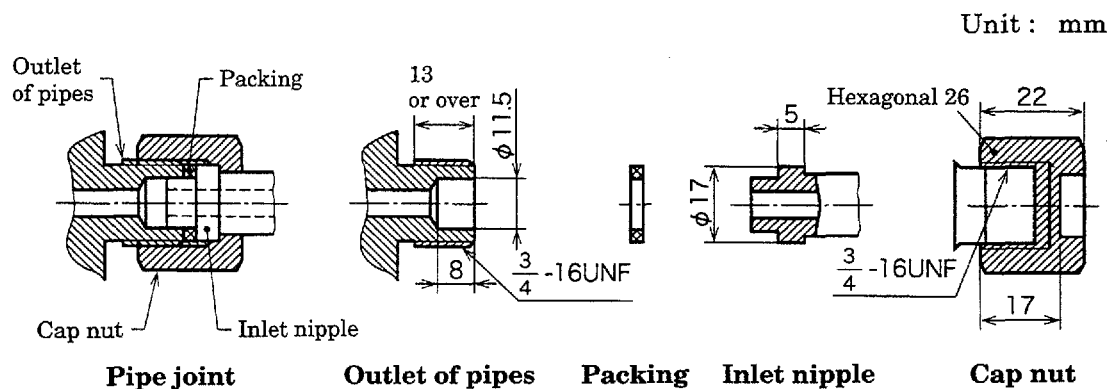


Fig. 2 Connection to pipes

- Remarks 1 Unified threads shall be as specified in **JIS B 0208**.
- 2 Allowable dimensions and tolerances of unified threads shall be as specified in **JIS B 0212**.
- 3 Gauge of unified threads shall be as specified in **JIS B 0255**.
- 4 The allowance in dimension not specified shall be the tolerance class m in **JIS B 0405**.

8.2 Outlet connection The outlet connection of the pressure regulator shall be as follows.

- a) The outlet joint shall comply with **JIS B 6805**.
- b) The direction of the threaded union shall be downward, and away from the cylinder.
- c) Any bent hose connection shall not be used.

Table 2 Screws of joint part of pressure regulator

Gas	Class	Inlet connection		Outlet connection	Nominal size of fitting screw of pressure gauge	Remarks	
		Nominal designation of screw thread	Number of threads (for 25.4 mm)				
Oxygen and other compressed gas	S1	W22	14	M16 × 1.5	G1/4	Oxygen, nitrogen, etc. for Type A valve for cylinder	
	S2						
	OS	W23				Oxygen, nitrogen, etc. for Type B valve for cylinder	
	IS						
	IIS	.830-14-NGO-LH	16	M16 × 1.5 left		Helium	
	IIIS	INT					
	IVS	W22 left				Hydrogen for Type A valve for cylinder	
	VS						
S3	3/4–16UNF	16	M16 × 1.5	Oxygen, nitrogen, etc. for pipes			
	3/4–16UNF left		M16 × 1.5 left	Hydrogen for pipes			
Acetylene gas	AC2	By fitting pieces		M16 × 1.5 left		Dissolved acetylene for cylinder	
	IAC						
	IIAC						
LPG	AC3	3/4–16UNF left	16	M16 × 1.5 left		Acetylene for pipes	
	LP2	W22 left	14			LPG for cylinder	
	OLP						
	ILP						
	LP3	3/4–16UNF left	16			LPG for pipes	
	Carbon dioxide gas	CO2	W22	14		M16 × 1.5 M12 × 1.0	Carbon dioxide gas for cylinder
OCO							
ICO							
	CO3	3/4–16UNF	16		Carbon dioxide gas for pipes		

- Remarks 1 Threads of the inlet connection shall comply with **JIS B 0208**, Attached Table 2, and CGA350.
- 2 Allowable dimensions and tolerances of threads of the inlet connection shall comply with **JIS B 0212**, Attached Table 3 and CGA350.
- 3 Limit gauges of threads of the inlet connection shall comply with **JIS B 0255** and Attached Tables 5 to 10.
- 4 Threads of the outlet connection shall comply with **JIS B 0205-1** and **JIS B 0205-4**.
- 5 Allowable dimensions and tolerances of threads of the outlet connection shall comply with **JIS B 0209-2**.