

JIS

JAPANESE INDUSTRIAL STANDARD

**Refillable Welded Steel Cylinders
for Dissolved Acetylene**

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Refillable Welded Steel Cylinders
For Dissolved Acetylene

B 8234-1988

1. Scope

This Japanese Industrial Standard specifies refillable welded steel cylinders for dissolved acetylene (hereinafter referred to as acetylene cylinders) of inner capacities from 3 l up to and including 48 l.

Further, the welded steel cylinders used as component parts (hereinafter referred to as cylinders) are specified in Appendix 1, screw threads of neck of valve attaching part, in Appendix 2, screw threads of necks and seats of fusible plug attaching part, in Appendix 3, screw threads of cylinder attaching part of fusible plug, in Appendix 4, and screw threads of neck-and-cap attaching part, in Appendix 5.

Remark: In this Standard the units and numerical values shown in { } are in accordance with the conventional units and, the Standard values.

2. Definitions

For the purposes of this Standard following definitions apply:

- (1) acetylene cylinder The cylinder equipped with valve and fusible plug, having porous substance, solvent and saturated acetylene under the atmospheric pressure at 15°C in temperature within (hereinafter referred to as saturated acetylene) to be used for storage of acetylene gas.
- (2) cylinder The welded steel cylinder not containing porous substances, valve, fusible plug, etc.
- (3) porous substances and the like Contents of cylinder consisting of porous substances, solvents and saturated acetylene.
- (4) tare mass Total mass of cylinder, valve, fusible plug, porous substances, etc.
- (5) highest filling pressure The highest value of pressure (gauge pressure) capable of filling acetylene gas at 15°C in temperature into the acetylene cylinder. It shall be 1.52 MPa{15.5 kgf/cm²}.
- (6) cylinder manufacturer The person to manufacture cylinders.
- (7) porous substance manufacturer The person to manufacture acetylene cylinders (these may be not filled with saturated acetylene).

Applicable Standards and Corresponding International Standards:
See pages 12 and 13.

3. Classification of Acetylene Cylinders and Solvents

3.1 Classification of Acetylene Cylinders Acetylene cylinders shall be classified according to solvents to be filled into class A and class D, and, according to reference internal volume of cylinder, divided into as shown in Table 1.

Table 1. Classification of Acetylene Cylinders

Classification	Classification of solvent	Reference internal volume (l)	Classification	Classification of solvent	Reference internal volume (l)
3 A	Acetone	3	3 D	Dimethylformamide	3
3.6 A	Acetone	3.6	3.6 D	Dimethylformamide	3.6
12.5 A	Acetone	12.5	12.5 D	Dimethylformamide	12.5
24-1 A	Acetone	24	24-1 D	Dimethylformamide	24
24-2 A	Acetone		24-2 D	Dimethylformamide	
24-3 A	Acetone		24-3 D	Dimethylformamide	
41 A	Acetone	41	41 D	Dimethylformamide	41
45 A	Acetone	45	45 D	Dimethylformamide	45
48 A	Acetone	48	48 D	Dimethylformamide	48

3.2 Classification of Solvents Classes of solvents to be filled in acetylene cylinder shall comply with the specifications of Table 2.

Further, the filling amount of solvent shall not exceed the numerical value calculated according to the following formula.

Table 2. Classes of Solvents

Nominal symbol	Class	Quality
A	Acetone	No. 1 product of JIS K 1503 or that equivalent or superior thereto.
D	Dimethylformamide	Special grade product of JIS K 8500 or that equivalent or superior thereto.

$$W = V \times a \times \rho$$

where W : the permissible maximum filling amount of solvent (kg)

V : inner volume of cylinder (l)

a : the maximum filling ratio of solvent relative to inner volume of cylinder at 15°C in temperature (l/l)
.....according to Table 3

ρ : specific gravity of solvent at 15°C in temperature (kg/l)

Acetone 0.796

Dimethylformamide 0.954

Table 3. Maximum Filling Ratio

Nominal symbol	Class	Maximum filling ratio	
		Not more than 10 l in inner volume	Over 10 l in inner volume
A	Acetone	0.415	0.431
D	Dimethylformamide	0.432	0.434

4. Performance

4.1 Physical Characteristics of Porous Substance

4.1.1 The porous substance, when subjected to the compression strength test of 8.2.2, shall be not less than 1.96 N/mm²{20 kgf/cm²} in compression strength.

4.1.2 The porous substance, when subjected to porosity test of 8.2.3, shall be 90 to 92 % in porosity.

4.2 Performance of Acetylene Cylinder

4.2.1 Vibration Resistance The acetylene cylinder when subjected to vibration test of 8.2.4, shall comply with the following:

- (1) The clearance between the porous substance and the inner wall of cylinder is not more than 1/200 of inner diameter of cylinder. Provided that it is not more than 3 mm at the shoulder part.
- (2) The porous substance is free from settling, void, generation of cracking, and the like.

4.2.2 Fire Resistance The acetylene cylinder, when subjected to circumference heating test of 8.2.5, shall not be bursted during heating, and the advancing of decomposition of acetylene in inside of cylinder longitudinally cut, not be affirmed.

4.2.3 Backfire Resistance The acetylene cylinder, when subjected to backfire test of 8.2.6, shall not be affirmed with the decomposition of acetylene in backfire tube and with advancing of acetylene decomposition insides the cylinder cut longitudinally.

4.2.4 Impact Resistance The acetylene cylinder, when subjected to impact test of 8.2.7, shall be free from defects such as cracking of porous substance insides the cylinder cut longitudinally, and, not be affirmed with advancing of decomposition of acetylene.

5. Structure

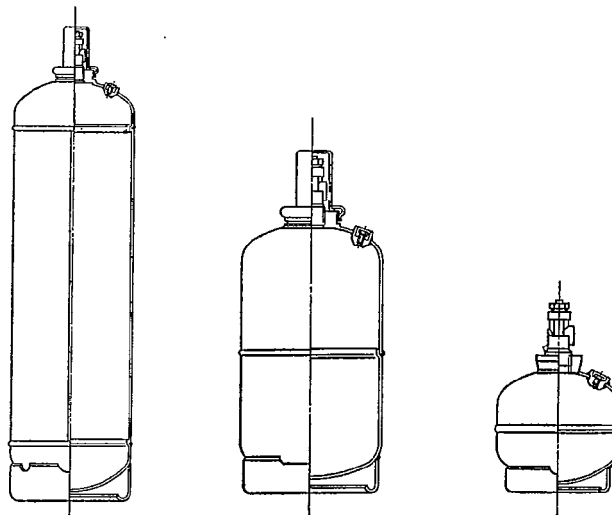
5.1 Structure General The acetylene cylinder shall be composed of elements of Table 4.

Further, Fig. 1 is an example and does not specify the details of structure.

Table 4. Elements

Classification	Condition
Cylinder	To comply with Appendix 1.
Valve	To comply with JIS B 8244.
Fusible plug	To comply with Appendix 1.
Cap	To comply with Appendix 1.
Porous substance	To comply with 4.
Solvent	To comply with 3.2.
Saturated acetylene	(Temperature 15°C, under atmospheric pressure)

Fig. 1. An Example of Structure



- Remarks 1. As to the threaded portion of valve to be attached to classes 3 A and 3 D of Table 1, the cylinder attaching part symbol V_1 of JIS B 8246 applies.
2. As to the cylinder not more than 3.6 l in reference inner capacity, the cap is not provided.

5.2 Chemical Characteristics of Porous Substance and Clearance from Cylinder Wall The chemical characteristics of porous substance and clearance from the cylinder wall shall be as follows:

- (1) The porous substance is made by generating calcium silicate by water heat reaction to solidify and thereafter by drying and the substance shall not react harmfully with cylinder, solvent and acetylene.
- (2) The porous substance shall be filled into gas taking-in part and taking-out part just under the valve of cylinder without clearance. However, the clearance not exceeding 1/200 of inner diameter of cylinder along the cylinder wall and that not exceeding 3 mm at shoulder part may be generated.

5.3 Clamping Torque and Gas Tightness of Valve and Fusible Plug The clamping torque and gas tightness of valve and fusible plug shall be as follows:

- (1) The clamping torque when the valve and fusible plug are attached with the acetylene cylinder shall be as follows:

Valve: clamping torque $392 \pm 49 \text{ N}\cdot\text{m}$ { $40 \pm 5 \text{ kgf}\cdot\text{m}$ }

Fusible plug: clamping torque $27.5 \pm 2.9 \text{ N}\cdot\text{m}$ { $2.8 \pm 0.3 \text{ kgf}\cdot\text{m}$ }

- (2) The attaching part of valve and fusible plug, when subjected to gas tightness test of 8.4, shall be free from leakage.

6. Appearance

The cylinder, valve, fusible plug and cap shall be free from defects such as cracks, flaws, deformation, etc. having fear of interference to use.

7. Painting

Painting shall be applied on whole outer surface of the cylinder and cap.

7.1 Pretreatment The cylinder shall, as required before executing painting, be applied with the following treatment or that equivalent or superior thereto.

- (1) Shot blast (class 1 keren finishing)
- (2) Coating film formation treatment

7.2 Execution of Painting The execution of painting shall be as follows:

- (1) The upper coating painting shall be of brown colour, and, as a rule, be of standard colour chart 5 R 4/4 or 4/6, or 5 YR 4/4 or 4/6 specified in JIS Z 8721.
- (2) Kind of paint and coating film thickness shall be those shown in Table 5 or those having rust preventive effect equivalent or superior thereto.

Table 5. Painting

Process	Kind of paint	Thickness of coating film (μm)
Rust prevention	Primer of aminoalkyd resin series or primer surfacer	25 min.
Upper coating	JIS K 5652	20 min.

Remarks 1. For diluent, the diluent for paint shall be used.

2. In the case of powder painting system, the rust prevention and upper coating may be carried out at once simultaneously.

8. Tests

8.1 Appearance-and-Painting Test The test for appearance and painting shall be as follows:

- (1) The appearance and painting colour shall be examined by suitable method such as visual observation, limit sample, etc.
- (2) The thickness of coated film shall be measured by means of a film thickness gauge.

8.2 Performance Test of Acetylene Cylinder

8.2.1 Specimen Cylinder For the specimen cylinder for test of 8.2.4 to 8.2.7, the acetylene cylinder filled with acetylene of the amount calculated according to the following formula and having been stood still for not less than 24 h shall be used.

$$G = C \times w$$

where

G : filling amount of acetylene (kg)

C : acetylene filling constant (maximum acetylene filling amount per 1 kg of solvent kg/kg)

w : permissible maximum filling amount of solvent according to specification of 3.2 (kg)

Table 6. Acetylene Filling Constant (C)

Nominal symbol	Classification of solvent	Acetylene filling constant (c)
A	Acetone	0.55
D	Dimethylformamide	0.50

8.2.2 Compressive Strength Test of Porous Substance Cut the cylinder filled with only porous substance, take out the porous substance from the upper part, middle part and lower part of the cylinder, prepare each one piece of sample⁽¹⁾ of cube, put into a dryer at a temperature of 110 to 150°C and dry until becoming constant amount⁽²⁾.

By using a compressive tester, when having increased the load so that the average compressing speed from beginning of pressing until detecting the maximum load becomes 0.098 to 0.98 MPa{1 to 10 kgf/cm²}, the maximum load (N{kgf}) detected at first shall be measured and the compressive strength (N/mm²{kgf/cm²}), calculated according to the following formula:

$$\text{Compressive strength (N/mm}^2\{\text{kgf/cm}^2\}) = \frac{\text{maximum load (N\{kgf\}) during 10 \% of height of sample is collapsed}}{\text{sectional area of sample (mm}^2\{\text{cm}^2\})}$$

Notes (1) Dimensions of sample shall be 100 mm x 100 mm x 100 mm or 50 mm x 50 mm x 50 mm. The dimensional permissible deviation shall be ± 1 mm.

In the case of acetylene cylinder of 3 A, 3.6 A, 3 D or 3.6 D and further height/outer diameter is less than 2, prepare the sample of each one piece from upper part and lower part.

(2) When the difference of measured masses becomes not more than 2 %, take it as constant amount.

8.2.3 Porosity Test Attach a valve to the cylinder filled with only porous substance, and weigh it (A kg). Next, after reducing pressure in the cylinder by using a vacuum pump until the vacuum becomes not more than 2666 Pa{20 mmHg} by means of mercury manometer, pour solvent (acetone or dimethylamide) into the cylinder to stand as it is, and thereafter again reduce the pressure to pour the solvent.

After repeating this operation until the cylinder becomes constant amount⁽³⁾, immerse the cylinder into a water tank at a definite temperature, and connect with the solvent reserving tank with the valve opened as it is to leave for not less than 12 h.

After the solvent in the cylinder has reached the equilibrium temperature, close the valve, immediately detach the connection with the solvent reserving tank, and take out the acetylene cylinder from the water tank to weigh (B kg).

Take the specific gravity of solvent at the temperature $t^{\circ}\text{C}$ of water tank as d , and the inner volume of cylinder, as E (l), and calculate the porosity β % according to the following formula:

$$\beta(\%) = \frac{B-A}{E \times d} \times 100$$

Note (3) When the difference of measured masses becomes not more than 2 %, take it as constant amount.

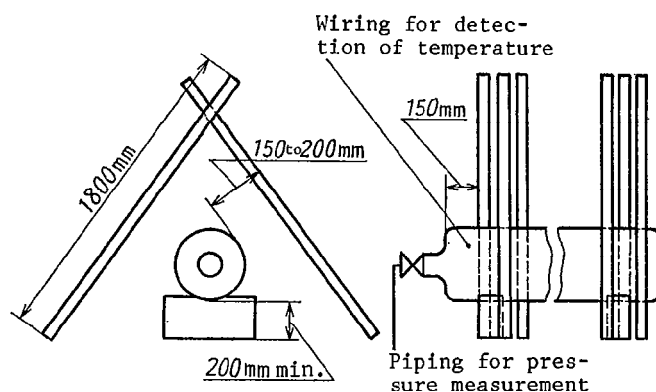
8.2.4 Vibration Test After discharging acetylene in the acetylene cylinder, fall down the cylinder on the steel plate of not less than 25 mm in thickness, and not less than 400 mm x 400 mm placed on the concrete from a height not less than 75 mm in a vertical posture by not less than 1000 times, thereafter cut longitudinally the cylinder and affirm visually existence of defects such as settling, fallow space, cracks of the porous substance.

8.2.5 Circumferential Heating Test Fix the acetylene cylinder on a stand of not less than 200 mm in height horizontally, place on its periphery a timber for heating of about 30 mm x 30 mm in section, and heat by igniting it so that the flame touches uniformly on the whole surface of the cylinder. In this case, the fusible plug shall be so made that it does not receive the flame directly.

After beginning of heating, the pressure rise in cylinder is not less than 196 kPa{2 kgf/cm²} and so heat that the fusible plug actuates within 10 min. During heating measure the pressure in the cylinder and the temperature of outer surface of cylinder to affirm the pressure rise in cylinder of not less than 196 kPa{2 kgf/cm²} and the heating state conforms to test conditions, and affirm visually that the fusible plug has actuated. After completion of heating, stand as it is for 24 h, then cut longitudinally the cylinder and affirm visually existence of decomposition advancing of acetylene in cylinder.

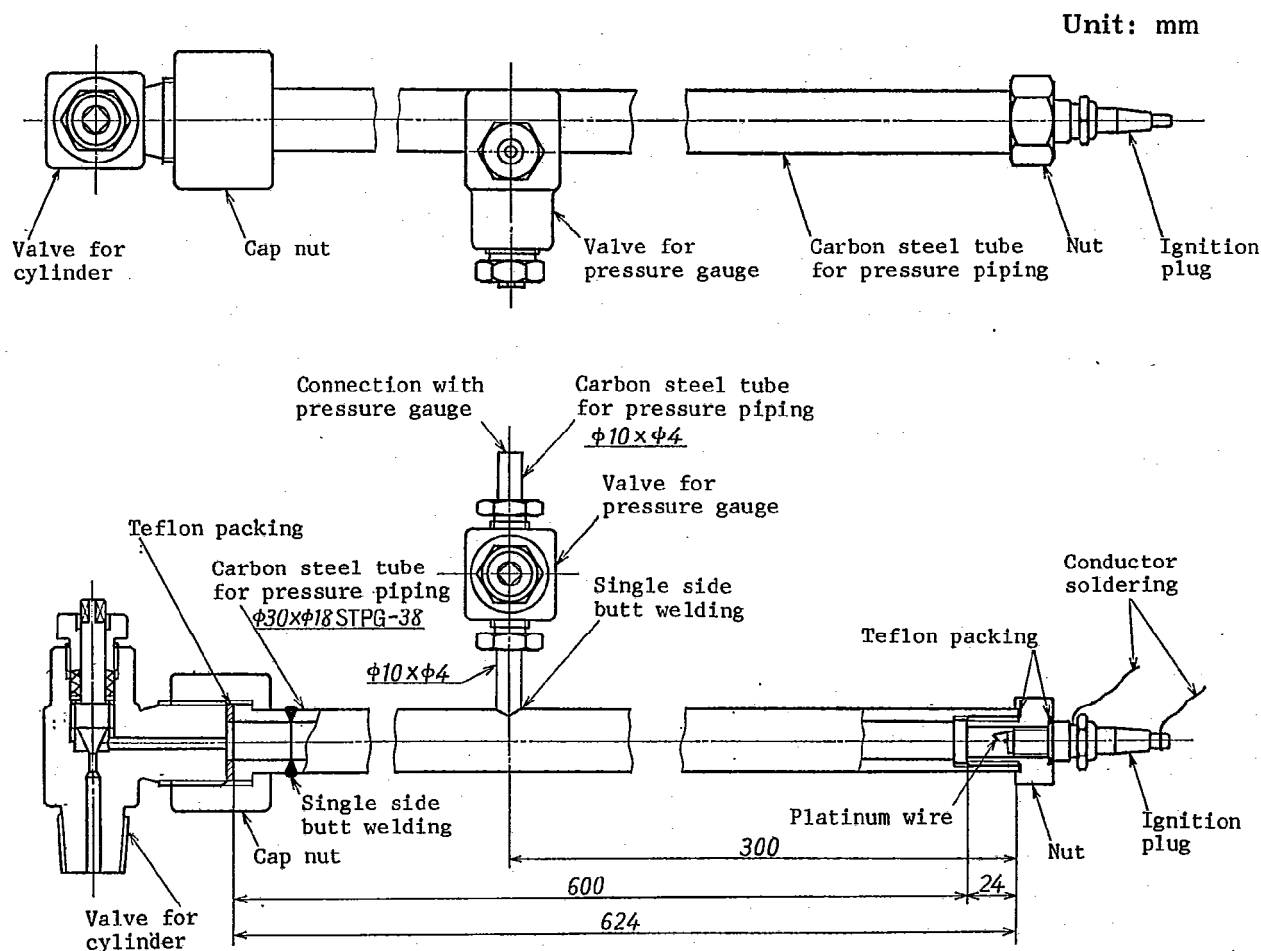
The execution example in this case is shown in Fig. 2.

Fig. 2. Example of Circumferential Heating Test Apparatus



8.2.6 Backfire Test After immersing the acetylene cylinder in warm water at a temperature of $35 \pm 1^\circ \text{C}$ for not less than 3 h⁽⁴⁾, take it out to stand immediately vertically, and attach the steel backfire tube of 18 mm in bore, and 600 mm in length attached with ignition wire such as platinum wire or the like to the filling opening of cylinder valve with the other end closed as shown in Fig. 3.

Fig. 3. One Example of Backfire Test Apparatus



Next, substitute the air in backfire tube by acetylene, and affirm that the purity of acetylene is not less than 98 %.

After affirming that leakage of acetylene from each connecting part does not exist and the pressure lowering in acetylene cylinder is within 5 % of the maximum pressure during immersion in warm water, ignite the acetylene in backfire tube and affirm the ignition according to the measuring result of dynamic pressure by means of a strain gauge.

Stand the cylinder as it is not less than 8 h, and affirm existence of decomposing advancing of acetylene in acetylene cylinder by measuring the pressure in the cylinder and the temperature of cylinder outer wall during that time.

Thereafter, discharge acetylene, longitudinally cut the cylinder and affirm visually existence of decomposition advancing of acetylene in the cylinder.

Note (4) In the case of cylinders of 3 A, 3.6 A, 3 D and 3.6 D, the time of warm water immersion shall be not less than 1.5 h.

8.2.7 Impact Test Fix an acetylene cylinder horizontally, load carlit 30 g or dynamite having explosion force equivalent thereto on the outer surface of shell part, and explode it to give impact the acetylene cylinder. After explosion, affirm visually the state of deformation of its part, further cut longitudinally the cylinder passing through approximately the middle part of deformation and affirm visually existence of defects such as cracking of porous material and existence of decomposition advancing of acetylene in cylinder.

8.3 Clearance Test As to the clearance test, before equipping of valve, insert a clearance gauge from the valve attaching opening of cylinder and measure the clearance between the inner wall of cylinder and the porous substance.

8.4 Gas Tightness Test As to the method for gas tightness test, apply a pressure of not less than 2.75 MPa{28 kgf/cm²} by air or inert gas to the cylinder equipped with valve and fusible plug and coat the gas tightness test liquid on respective screwing parts to examine existence of leakage.

9. Inspection

9.1 General For inspection of acetylene cylinder, concerning the inspection item of 9.2, carry out the test of 8. on the cylinder sampled according to 9.3, and take that complied with the specifications of 4. to 7. as acceptable.

9.2 Classification of Inspection and Inspection Items Inspections of acetylene cylinders shall be divided into two types of type inspection and delivery inspection.

- (1) The type inspection is the inspection for affirming the performance in the case where the porous substance is made newly or at each 5 years after beginning of manufacture, and shall be carried out on the compressive strength and porosity of porous substance, vibration resistance, fire resistance, backfire resistance and impact resistance of acetylene cylinder.
- (2) The delivery inspection shall be carried out on the appearance, thickness of coating film, clearance between the porous substance and the inner wall (shoulder part) of acetylene cylinder, and gas tightness.

9.3 Inspection Lot and Number of Samplings The inspection lot and number of samplings in each inspection of acetylene cylinder shall be as follows:

- (1) Type inspection
 - (a) The type of acetylene cylinder shall be of combination of each type of acetylene cylinder (classified by inner capacity and shape), each class of porous substance and each class of solvent.

- (b) As to specimen cylinder, for each type of acetylene cylinders, sample, at random, 100 units from the cylinders and further sample, at random, 6 acetylene cylinders from them and arrange them each one unit for each test item of 8.2.2 to 8.2.7.
- (c) In case where the inspection results do not satisfy the required conditions specified in 4., take the porous substance of specimen lot as not acceptable and discard.
- (2) Each inspection on appearance, clearance between the inner wall of acetylene cylinder (shoulder part) and the porous substance, and gas tightness shall be carried out on 100 %.
- (3) As to the thickness of painting film, shall be carried out, as required, such as requirement of purchaser.

10. Reinspection

The reinspection of type inspection shall be as follows:

- (1) In cases where the test can not be executed according to the method of 8.2 due to inconsistency of weather and testing apparatus, or where doubt is generated on execution method of test, reinspection may be carried out on other acetylene cylinder of the same inspection lot as the specimen cylinder.
- (2) In case where the sample does not satisfy the required conditions, take all porous substances of the lot of which specimen cylinder belongs as not acceptable and shall be discarded.

11. Marking

11.1 Stamping The manufacturer of porous substances shall stamp the tare mass (symbol TW, unit kg) clearly on the shoulder part.

Example: TW 53.5

11.2 Marking of Name of Gas and the Like The name of gas and the like shall be marked on a legible place on the surface of acetylene cylinder as given in Table 7 by the manufacturer of porous substances.

Table 7. Marking of Name of Gas and the Like

Marking item	Gist of marking	
Property of gas	Indicate the letter of "燃" clearly by white colour.	The size of letter for acetylene cylinder of not less than 4l / in inner volume shall be not less than 50 mm ² , and for acetylene cylinder less than 4l /, it shall be in accordance with this, as appropriate.
Name of filling gas	Indicate the letter of acetylene gas clearly with white colour.	
Marking for use of dimethylformamide as solvent	Attach a white band at the parallel part just under the shoulder part of acetylene cylinder	It shall be white band line of not less than 30 cm in width.

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12. Record

The manufacturer of porous substance shall prepare and store the details of porous substance filling recorded with the following items concerning the completed acetylene cylinders.

- (1) Class and mass of porous substance, range of porosity, class of solvent and its filled amount, mass of valve, amount of saturated acetylene, tare mass shall be recorded for each symbol No. of acetylene cylinder.
- (2) Name of manufacturer of porous substances and date of manufacture

Applicable Standards:

- JIS B 8244-Valves for Dissolved Acetylene Cylinder
- JIS B 8246-Valves for High Pressure Gas Cylinder
- JIS G 3101-Rolled Steel for General Structure
- JIS G 3106-Rolled Steels for Welded Structure
- JIS G 3116-Steel Sheets, Plates and Strip for Gas Cylinders
- JIS G 4051-Carbon Steels for Machine Structural Use
- JIS H 3250-Copper and Copper Alloy-Rods and Bars
- JIS K 1503-Acetone
- JIS K 5652-Aminoalkyd Resin Enamel
- JIS K 8500-N, N-Dimethylformamide
- JIS Z 2201-Test Pieces for Tensile Test for Metallic Materials
- JIS Z 2204-Bend Test Pieces for Metallic Materials
- JIS Z 2241-Method of Tensile Test for Metallic Materials
- JIS Z 2248-Method of Bend Test for Metallic Materials
- JIS Z 3104-Methods of Radiography and Classification for Steel Welds
- JIS Z 3122-Method of Guide Bend Test for Butt Welded Joint
- JIS Z 3124-Method of Roller Bend Test for Butt Welded Joint
- JIS Z 3211-Covered Electrodes for Mild Steel
- JIS Z 3212-Covered Electrodes for High Tensile Strength Steel

JIS Z 3312-Solid Wires for MAG Welding of Mild Steel and High Strength Steel

JIS Z 3313-Arc Welding Flux Cored Wires for Mild Steel and High Strength Steel

JIS Z 3351-Submerged Arc Welding Wires for Carbon Steel and Low Alloy Steel

JIS Z 3352-Submerged Arc Welding Fluxes for Carbon Steel and Low Alloy Steel

JIS Z 8721-Specification of Colours According to their Three Attributes

Corresponding International Standards:

ISO 3807 Dissolved acetylene cylinders-Basic requirements

ISO/DIS 4706.2 Refillable welded steel gas cylinders