

JIS

JAPANESE INDUSTRIAL STANDARD

Calcium Carbide

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JAPANESE INDUSTRIAL STANDARD

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Calcium Carbide

K 1901-1983

 CaC_2 FW: 64.101. Scope

This Japanese Industrial Standard specifies the calcium carbide for use in production of acetylene.

Remark: The units and numerical values given in { } in this standard are in accordance with the International System of Units (SI) and are appended for reference.

2. Classification

2.1 Classification According to Size of Lump The calcium carbide shall be classified into the following 4 classes, in accordance with the size of lump:

- (1) Extra large lump
- (2) Large lump
- (3) Medium lump
- (4) Small lump

Applicable Standards:

JIS B 7411-Etched-Stem Liquid-in-Glass Thermometers, Total Immersion Type

JIS G 3302-Galvanized Sheets

JIS K 0050-General Rules for Chemical Analysis

JIS K 8002-Preparation of Test Solutions

JIS K 8006-Fundamental Articles on Volumetric Determinations

JIS M 8100-General Rules for Methods of Sampling of Bulk Materials

JIS P 3801-Filter Paper (for Chemical Analysis)

JIS R 3505-Volumetric Glassware

JIS Z 8401-Rules for Rounding off of Numerical Values

JIS Z 8801-Test Sieves

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2.2 Classification According to Generated Amount of Gas The calcium carbide shall be classified into the following 3 classes, in accordance with the amount of gas produced:

- (1) No. 1
- (2) No. 2
- (3) No. 3

2.3 Classification According to Impurities in Gas The calcium carbide shall be classified into the following 2 classes, in accordance with the impurities in produced gas:

- (1) Class 1
- (2) Class 2

3. Quality

3.1 Size of Lump The size of lump of calcium carbide shall be tested in accordance with 4.2 and conform to the requirements specified in Table 1. However, when special specification is required, it shall be subjected to the agreement between the parties concerned.

Table 1

Classification	Size of lump		Amount of lump within limits %	Powder content %
	Maximum limit mm	Minimum limit mm		
Extra large lump	200	80	85 min.	5 max.
Large lump	120	80	85 min.	5 max.
Medium lump	80	25	85 min.	5 max.
Small lump	25	5	85 min.	5 max.

3.2 Generated Amount of Gas The generated amount of gas from calcium carbide shall be tested in accordance with 4.3 and conform to the requirements specified in Table 2.

Table 2

Unit: l/kg

Classification	Generated amount of gas
No. 1	290 min.
No. 2	270 min.
No. 3	250 min.

Remark: The generated amount of gas is indicated in l/kg by such method that the amount of gas generated from 1 kg calcium carbide is converted into the volume in the dry state at 15°C and 760 mmHg {101.3 kPa}.

3.3 Impurities in Gas The impurities in gas generated from calcium carbide shall be tested in accordance with 4.4 and conform to the requirements specified in Table 3. However, when special specification is required, it shall be subjected to the agreement between the parties concerned.

Table 3

Classification	Hydrogen phosphide v/v %	Hydrogen sulphide v/v %
Class 1	0.06 max.	0.20 max.
Class 2	0.10 max.	0.20 max.

4. Test Method

4.1 General Matters The general matters common to the tests shall be, in addition to compliance with JIS K 0050, as follows:

- (1) The test shall be quickly carried out at dry place so that the calcium carbide is not weathered as possible.
- (2) The calcium carbide shall not be touched with bare hands in any case.
- (3) The instruments to be used shall be completely dried in advance.

4.2 Size of Lump

4.2.1 Summary The sample is filtered by using a filter and the amount of lump within limits and the powder content is obtained by weighing its mass.

4.2.2 Sampling Method The sampling method shall be as follows:

- (1) For Small Container (Drum Can, Square Can, etc) The containers in a unit wagon shall be made as one lot for truck or railway transportation, and 20 t or its fraction as one lot for ship transportation. Three containers shall be sampled at random from each lot to make the samples. In this procedure, the sampled containers shall, before the cans are opened, be confirmed that they are perfect.
- (2) For Large Container (Tank Truck, Container, Tank Lorry, etc) The product in a unit wagon shall be made as one lot. Each about 10 kg of the product shall be sampled 5 times at a certain interval, then mixed, when the product is loaded on or unloaded from such large container and the product so prepared shall be made as the sample.

4.2.3 Instruments The instruments shall be as follows:

- (1) Plate Sieve and Mesh Sieve They are the plate sieve and mesh sieve specified in Appendix of JIS Z 8801.

The sieve opening size, its tolerance, central distance between round bores and thickness of plate of the sieve of 200 mm and 120 mm in nominal size shall be as given in Table 4 and the number of round bore may be one.

Table 4

Nominal size mm	Sieve opening		Central distance between round bores mm	Thickness of plate mm
	Size mm	Tolerances %		
200	200	± 1	260	2.3
120	120	± 1	156	2.3

- (2) Platform Balance or Simple Balance It is a platform or simple balance of 300 kg or 50 kg in weighing capacity and 0.1 kg in reciprocal sensibility.

4.2.4 Operation The operation shall be carried out as follows:

(1) For Small Container For small container, the following operation shall be carried out:

- (a) Weigh the mass of sample in one container to 0.1 kg.
- (b) Weigh each of the mass of substance passed through the plate sieve corresponding to the upper limit of size of lump specified in Table 1 and remained at the plate sieve corresponding to the lower limit thereof and the mass of powder passed through the mesh sieve of 2830 μm , to 0.1 kg.
- (c) Calculate the amount of lump within limits and the powder content from the following formula:

$$W = \frac{A}{m} \times 100$$

$$w = \frac{B}{m} \times 100$$

where

W : amount of lump within limits (%)

w : powder content (%)

A : mass of substance passed through the plate sieve corresponding to the upper limit of size of lump specified in Table 1 and remained at the plate sieve corresponding to the lower limit thereof (kg)

B : mass of powder passed through the mesh sieve of 2830 μm (kg)

m : mass of sample (kg)

- (d) For the other two samples, obtain the amount of lump within limits and of powder content according to the procedure from (a) to (c) and judge from the average value on 3 samples.

(2) For Large Container For large container, the following operation shall be carried out:

- (a) Weigh each mass of the sample to 0.1 kg.
- (b) Weigh each of the mass of substance passed through the plate sieve corresponding to the upper limit of size of lump specified in Table 1 and remained at the plate sieve corresponding to the lower limit thereof, and the mass of powder passed through the mesh sieve of 2830 μm , to 0.1 kg.
- (c) Calculate the amount of lump within limits and the powder content from the formula of (1) (c).

4.3 Generated Amount of Gas

4.3.1 Summary The volume of gas generated by dipping the sample into water is measured and it is made as the generated amount of gas.

4.3.2 Sampling Method The sampling method shall be as follows:

- (1) For Small Container Take the sample according to 4.2.2 (1). Provided that the number of sampled containers is 5 per 1 lot, about 5 kg is sampled from each container at random and mixed to prepare the test sample in accordance with 4.3.3.
- (2) For Large Container Take the sample according to 4.2.2 (2). Provided that, each about 5 kg is sampled 5 times at a certain interval and mixed to prepare the test sample in accordance with 4.3.3.

4.3.3 Preparation of Sample After crushing whole amount sampled according to 4.3.2 into lumps of not more than 30 mm in size reduce it two times to about 6 kg by quatering, further crush it into lumps of not more than 12 mm in size, reduce it three times by using the riffle divider specified in JIS M 8100, pass it through the plate sieve of 12 mm specified in Appendix of JIS Z 8801 and take the substance remained at the plate sieve of 5 mm as the sample. Immediately thereafter put about 500 g of the sample so prepared into a dry container and store it by sealing.

4.3.4 Apparatus The apparatus shall be as given in Attached Fig. 1 and Attached Fig. 2 and preliminarily corrected in accordance with 4.3.5.

4.3.5 Verification and Correction of Apparatus The graduation of scale of gas tank shall be verified and corrected in accordance with (1) to (8).

- (1) Reference Instrument The reference instrument shown in Attached Fig. 3 shall be used. The reference instrument shall be manufactured with galvanized sheets ⁽¹⁾ specified in JIS G 3302 and graduated with the marked line by the method given below.

Note ⁽¹⁾ When thin galvanized sheets are used, there is a risk of changing volume by deformation due to volume change of water. Therefore, those of 0.6 mm or more in thickness shall be used.

Further, its bottom shall be flat instead of raised one and manufactured so as to be closely contact to the stand.

- (a) Preparation for Graduation Horizontally install the reference instrument and make an appropriate point on the graduation plate as the zero point. Put the correction water preliminarily prepared at the same temperature as room temperature to this zero point and saturate the inside of reference instrument with steam.

(b) Graduation of Marked Line Additionally pour the correction water accurately 1l by 1l using the measuring flask of 1000 ml specified in JIS R 3505, record the marked line every time and repeat this procedure in the same way until additional 19l is poured.

(c) Recording on Graduation Make the level of water to the zero point again by flowing out water, additionally pour water accurately 1l by 1l in the same way as in (b) and confirm that the difference between the water level and the respective marked lines recorded in (b) is not more than 0.5 mm ⁽²⁾. Put down numerals equal to 20 times added amount (0, 20, 40 ... 380l/kg) on respective marked lines.

Note ⁽²⁾ When any difference is exceeding 0.5 mm, all the marked lines are discarded and the graduation of marked lines shall be carried out again.

(2) Supplementary Instruments Supplementary instruments shall be as follows:

(a) Thermometer It is the thermometer of 50°C or that of 100°C specified in JIS B 7411.

Provided that one set of two thermometers having no difference in the scale spacing shall be used in combination.

(b) Bottle for Substitution It is a bottle of about 20l in capacity.

(c) Connecting Fittings They are glass tube, rubber tube, rubber stopper, etc.

(3) Correction Chamber It shall be a chamber not influenced by direct sunlight having as little change of temperature as possible.

Reference: When temperature change is large in daytime, the correction should be preferably carried out at night.

(4) Preparation All the instruments and water necessary for correction shall be left as they are in the correction chamber since the previous day. The apparatus shall be connected by using connection fittings of (2) (c) given in Attached Fig. 4 and the height of bottle for substitution shall be so adjusted that 15l water may flow down within 20 min ⁽³⁾.

Note ⁽³⁾ To return the correction water into the correction chamber, the bottle for substitution is brought down lower than the height of reference instrument as it is connected and back-flow is caused by opening the cock.

- (5) Preliminary Operation (Attached Fig. 4) Confirm that both gas tank and reference instrument are not inclining. Quietly raise and lower the gas tank and accurately make the pointer (a) to coincide with the zero point. Regulate the quantity of saturated brine so that the liquid surface (e) in water tank accurately coincides with the marked line of water level gauge (c) and the horizontal marked line of gas tank (d). After confirming that the internal pressure of gas tank becomes equal to atmospheric pressure with the manometer (b), close the blowoff cock (g). Slowly send the correction water (about 20 l) in the bottle for substitution into the reference instrument and accurately make the water level of reference instrument to coincide with the zero point.
- (6) Leakage Test (Attached Fig. 4) Open the blowoff cock of gas tank, quietly pull up the gas tank, stop it at a position where the pointer indicates almost 300 l/kg in the scale and close the cock. Regulate the dead-weight (f) of counter balance, so that the inner pressure of gas tank becomes in pressurised state at about 200 mmH₂O {about 1.961 kPa} and read the position of pointer on the scale (A l/kg). After leaving the equipment as it is for 20 min, read the position of pointer (B l/kg) again. When there is almost no difference (A-B=0), between the two read values, the equipment is accepted by this leakage test. When there is some difference between them (A-B>0), that means there is leakage at anyplace of whole apparatus, therefore carry out sealing after finding out its leakage position ⁽⁴⁾ and then carry out the leakage test in the same way as before-mentioned again.
- Note ⁽⁴⁾ When the leakage is a little, finding out of leakage position at the pressurised position of 200 mmH₂O {1.961 kPa} is difficult even though soap solution is used. In such case, when the inner pressure of gas tank is raised by utilizing foot bellows or the like, the leakage position can be comparatively easily found out with soap solution.
- (7) Correction Operation of Apparatus (Attached Fig. 4) Confirm that the water level (i) of reference instrument coincides with the zero point and that the pointer of gas tank coincides with the zero point of scale. Flow down correction water from the bottle for substitution to the reference instrument, regulate the dead weight of gas tank and keep the water column of manometer horizontal. When the water level of reference instrument reaches 300 l/kg ⁽⁵⁾ (15 l in amount of water), close the cock (h) and confirm that the water column of manometer is horizontal. Thereafter, read the position of pointer on the scale. Return the water inside reference instrument to the bottle for substitution by lowering the bottle and repeat the same operation 3 times. When the difference between the maximum value and the minimum value in this three read values is not more than 0.5 l/kg in the scale, obtain average value of them and utilize the value for marking the correction line. When that difference exceeds 0.5 l/kg, throw away all these records, try the correction operation again from the beginning, carry out the operation until such three read values coincide each other within 0.5 l/kg is obtained and utilize the average value of them for marking the correction line.

Note (⁵) If necessary, the operation above-mentioned shall be carried out in the completely same way for each graduation.

Reference: For the coincidence of readings of correction values within 0.5 l/kg, temperature change of each part should preferably be little.

- (8) Judgment When the difference between the graduation of scale and the correction line is not more than 0.3 l/kg, the graduation is acceptable. When the difference exceeds 0.3 l/kg, the graduation shall be rejected and the scale shall be graduated again by making the correction line as the new marked line.

4.3.6 Measurement The measurement shall be carried out as follows:

- (1) Preparation After confirming the sealing of equipment connected as given in Attached Fig. 1, open the lid of generator, put about 2 l water therein, raise the sample receiving dish and sufficiently wipe the dish and its inner wall with dry cloth.
- (2) Operation Rapidly weigh out 50 g of the sample prepared by 4.3.3 to 0.1 g, put it on the sample receiving dish, quickly close the lid, and completely throw the sample into the water by gradually turning the handle reversely to generate gas.

Transfer the generated gas into the gas tank sealed with saturated brine (⁶) through bubble separation trap and then, leave it as it is for about 20 min from putting-in of the sample. After confirming completion of gas generation with the pointer, make the pressure within gas tank to coincide with atmospheric pressure, read its volume with the graduation (⁷) of scale and read the temperature at that time with the thermometer attached to the gas tank.

Notes (⁶) The saturated brine put into water tank is preliminarily saturated with acetylene.

- (⁷) The graduation of scale indicates the amount of gas generated from 50 g of the sample in the unit of l/kg by converting it into the volume per 1 kg the sample (equivalent to 20 times actual volume).

- (3) Calculation of Measured Value Calculate the generated amount of gas in dry condition at 15°C and 760 mmHg {101.3 kPa} from the read volume and temperature of gas, and the atmospheric pressure at that time by using the following formula and round off it to integral number in accordance with JIS Z 8401.

$$G = \frac{50 V}{m} \times \frac{P - P'}{760} \times \frac{273 + 15}{273 + t} \quad \left\{ G = \frac{50 V}{m} \times \frac{P - P'}{101.3} \times \frac{273 + 15}{273 + t} \right\}$$

where

G : generated amount of gas (l/kg)

V : read volume of gas (l/kg)

P : atmospheric pressure [mmHg {kPa}]

P' : vapour pressure of saturated brine
[mmHg {kPa}]

m : mass of sample (g)

t : measured temperature (°C)

- (4) Number of Times of Measurement Repeat this measurement three times on the same sample by using the same water, throw away the measured value at the first time ⁽⁸⁾ and adopt the measured values at the second and third times. When the difference between those two measured values exceeds the tolerance of 4.3.6 (5), try the measurement again from the beginning.

Note ⁽⁸⁾ Because a portion of generated gas is dissolved with water, the measured value at the first time deviates lower.

- (5) Tolerance The difference between the two measured values shall be not more than 4 l/kg.

- (6) Results of Measurement Obtain average value of the two measured values, rounded off it to integral number in accordance with JIS Z 8401 and make it as the generated amount of gas.

- Remarks
1. The relation between the vapour pressure (P') and the temperature (t) of saturated brine used for this calculation is as given in Table 5.
 2. For the atmospheric pressure used for this calculation, the atmospheric pressure corrected with temperature shall be used.
Further, when more accuracy is required, the atmospheric pressure corrected with gravity may be used.
 3. When this generated gas is subjected to measurement of impurities, the sample receiving dish shall be closely attached to the upside, the lid is opened and the successive operation shall be quickly carried out, every time.