JIS

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS G 3442 : 2023

(JISF)

Galvanized steel pipes for ordinary piping

ICS 23.040.10;77.140.10 ; 77.140.75;91.140.60
Reference number : **JIS G 3442 : 2023 (E)**

Date of Establishment: 1957-10-30
Date of Revision: 2023-05-22
Date of Public Notice in Official Gazette: 2023-05-22
Developed by: The Japan Iron and Steel Federation
Investigated by: The Japan Iron and Steel Federation, Standardization Center

JIS G 3442 : 2023, First English edition published in 2023-08

Translated and published by: Japanese Standards Association
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

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

Printed in Japan HN

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry based on the provision of Article 14, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act in response to a proposal for revision of Japanese Industrial Standard with a draft being attached, submitted by The Japan Iron and Steel Federation (JISF), an accredited standards development organization. This edition replaces the previous edition (**JIS G 3442** : 2016), which has been technically revised.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, published patent application or utility model rights. The relevant Minister is not responsible for identifying any of such patent rights, published patent application or utility model rights.

Galvanized steel pipes for ordinary piping

1 Scope

This Japanese Industrial Standard specifies requirements for galvanized steel pipes (hereafter referred to as pipes) used for water pipes other than those for public water supply (e.g. air conditioning, fire extinction, drain).

NOTE This Standard applies to the pipes of outside diameters 17.3 mm to 508.0 mm (Table 2).

2 Normative references

Part or all of the provisions of the following standards, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0203 *Taper pipe threads*

JIS B 2301 *Screwed type malleable cast iron pipe fittings*

JIS B 2302 *Screwed type steel pipe fittings*

JIS G 0202 *Glossary of terms used in iron and steel (Testing)*

JIS G 0203 *Glossary of terms used in iron and steel (Products and quality)*

JIS G 0404 *Steel and steel products — General technical delivery requirements*

JIS G 0415 *Steel and steel products — Inspection documents*

JIS G 3452 *Carbon steel pipes for ordinary piping*

JIS H 2107 *Zinc ingots*

JIS K 8574 *Potassium hydroxide (Reagent)*

JIS K 8576 *Sodium hydroxide (Reagent)*

JIS K 8847 *Hexamethylenetetramine (Reagent)*

JIS Z 8401 *Rounding of numbers*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS G 0202** and **JIS G 0203** apply.

4 Symbol of grade

This Standard covers one grade of pipe, and its symbol shall be as given in Table 1.

Table 1 Symbol of grade and material of pipe

Symbol of grade	Material of pipe		
	Applicable standard	Type of coating	Pipe ends
SGPW	**JIS G 3452**	Black pipe	Plain end

5 Materials and manufacturing method

5.1 Materials

The materials shall be as follows.

a) The pipes shall be made of the material given in Table 1.

b) The sockets shall conform to **JIS B 2301** or **JIS B 2302**, and be given hot dip galvanized coatings.

5.2 Hot dip galvanized coatings

The hot dip galvanized coatings to be applied to the pipes shall be as follows.

a) Zinc used for galvanized coatings shall be the distilled zinc ingot class 1 specified in **JIS H 2107** or zinc ingot at least equivalent thereto in quality.

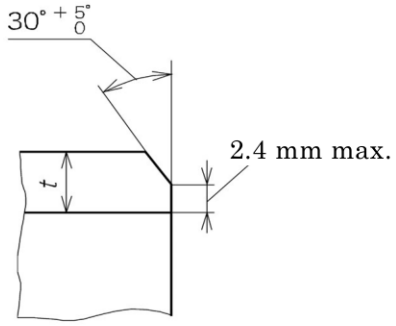
b) Prior to threading and tapping, the pipes shall be thoroughly cleaned of rust, scale and other adherents on the internal and external surfaces by alkali-washing, water rinsing and pickling, then of residue of acid by water rinsing, and then treated with flux and dried.

c) After the treatment of **b)**, the pipes shall be galvanized by being immersed in zinc bath heated to a proper temperature.

5.3 Pipe ends

The pipe ends shall be as follows.

a) Both ends of the pipes shall be threaded or plain-ended. When requested by the purchaser, the pipes may be furnished with bevel ends shaped as shown in Figure 1, unless other bevel end shape is agreed between the purchaser and the manufacturer.



Key
t : wall thickness

Figure 1 Shape of bevel end

b) For threaded pipes, both ends shall be given taper threads specified in **JIS B 0203** after hot dip galvanized coating, and a socket shall be screwed into one of the threaded ends. The other end shall be protected with a thread protecting ring or by other suitable means.

6 Characteristics of galvanized coatings

The characteristics of galvanized coatings shall be as follows.

a) The coating mass shall be tested in accordance with **9.2.2 a)**, and the mean of two values obtained from one sample pipe shall be 600 g/m^2 or over, and each value shall be 550 g/m^2 or over.

b) The galvanized coating shall be tested by the uniformity test (cupric sulfate test) in accordance with **9.2.2 b)**, and shall not reach the end point after six or less immersions (duration of each immersion : about 60 s) in the cupric sulfate solution.

NOTE The end point refers to the point where the coating layer is lost and the deposit of brilliant adherent metallic copper is observed on the substrate of the pipe (see **B.7**).

c) The property characteristics of the galvanized coating shall be tested in accordance with **9.2.2 c)**, and neither of the two test pieces shall reach the end point after an elapse of 100 min or longer from the start of immersion of the test piece in the test solution.

d) The bend test for evaluation of adhesion of galvanized coating shall be performed in accordance with **9.2.2 d)** for pipes of nominal diameter 50A (2B) or under specified in Table 2, and the galvanized surface at the bent portion shall be free from separation of coating or other abnormalities.

7 Dimensions, dimensional tolerances and unit mass

The dimensions, dimensional tolerances and unit mass shall be as follows.

a) The dimensions, dimensional tolerances and unit mass of the pipes before galvanization shall be as given in Table 2.

Table 2 Dimensions, dimensional tolerances and unit mass

Nominal diameter of pipe [a]		Outside diameter	Tolerance on outside diameter [b]	Wall thickness	Tolerance on wall thickness	Unit mass excluding socket
A	B	mm	mm	mm	mm	kg/m
10	3/8	17.3	±0.5	2.3	+ Not specified.	0.851
15	1/2	21.7	±0.5	2.8	−12.5 %	1.31
20	3/4	27.2	±0.5	2.8		1.68
25	1	34.0	±0.5	3.2		2.43
32	1 1/4	42.7	±0.5	3.5		3.38
40	1 1/2	48.6	±0.5	3.5		3.89
50	2	60.5	±0.5	3.8		5.31
65	2 1/2	76.3	±0.7	4.2		7.47
80	3	89.1	±0.8	4.2		8.79
90	3 1/2	101.6	±0.8	4.2		10.1
100	4	114.3	±0.8	4.5		12.2
125	5	139.8	±0.8	4.5		15.0
150	6	165.2	±0.8	5.0		19.8
200	8	216.3	±1.0	5.8		30.1
250	10	267.4	±1.3	6.6		42.4
300	12	318.5	±1.5	6.9		53.0
350	14	355.6	±2.8 [c]	7.9		67.7
400	16	406.4	±3.3 [c]	7.9		77.6
450	18	457.2	±3.7 [c]	7.9		87.5
500	20	508.0	±4.1 [c]	7.9		97.4

NOTE The unit mass values in the table are calculated using the formula below assuming 1 cm^3 of steel to be 7.85 g in mass, and are rounded off to three significant figures in accordance with Rule A of **JIS Z 8401**.

$$W = 0.024\,66\,t\,(D-t)$$

where, W: unit mass of pipe (kg/m)
t: wall thickness of pipe (mm)
D: outside diameter of pipe (mm)
0.024 66: unit conversion factor for obtaining W

Note [a] The nominal diameter shall be selected between A and B. The nominal diameter designation shall consist of the numeral of the diameter, followed by the letter A or B, whichever is selected.

Note [b] The outside diameter tolerance in this table shall not apply to the local repaired parts, etc., as long as those parts can be verified to satisfy the wall thickness tolerance in this table.

Note [c] For pipes of nominal diameter 350A or over, conformance to the outside diameter tolerance may be verified by measurement of the circumferential length, in which case, the tolerance applied shall be ±0.5 %. The conversion between the outside diameter (D) and the circumferential length (l) is obtained by the following formula :

$$D = l / \pi$$

where, D: outside diameter (mm)
l: circumferential length (mm)
π: 3.141 6

b) The pipe length shall be 3 600 mm or over and according to the specified length. The tolerance on the length shall be zero for the minus side, and not specified for the plus side.

8 Appearance

The appearance shall be as follows.

a) The pipe shall be straight for practical purposes, and furnished with ends that are perpendicular to the pipe axis.

b) The galvanized surfaces of the pipe shall be free from defects detrimental to use.

c) Upon agreement between the purchaser and the manufacturer, the pipe may be given coating (e.g. zinc rich coating, epoxy coating, primer coating, etc.) on the external and/or internal surface.

9 Tests

9.1 General test requirements

General requirements for tests shall be in accordance with Clause 7 of **JIS G 0404**. The sampling of test pieces shall be in accordance with Class A of 7.6 of **JIS G 0404**.

9.2 Tests for galvanized coating

9.2.1 Sampling method and number of test pieces

The sampling method and number of test pieces for tests for galvanized coating shall be as follows.

a) Take one sample pipe from each group of 250 pipes and its fraction of the same dimensions (same outside diameter and wall thickness).

b) For sampling of test pieces for coating mass test, uniformity test and property test, see Annex A, Annex B and Annex C, respectively.

c) For pipes of nominal diameter 50A (2B) or under, take one tubular test piece of a suitable length for bend test from one end of the sample pipe.

9.2.2 Test methods

The test methods for galvanized coating shall be as follows.

a) **Coating mass test**, performed by the indirect method in accordance with Annex A.

b) **Uniformity test**, performed in accordance with Annex B.

c) **Property test**, performed in accordance with Annex C.

d) **Bend test**, for evaluating the adhesion of galvanized coating, performed by bending the test piece at room temperature (5 °C to 35 °C) through 90° around a cylinder of radius 8 × D (D : outside diameter of pipe) and holding for about 10 s.

10 Inspection and reinspection

10.1 Inspection

The inspection shall be as follows.

a) The general requirements of the inspections are specified in **JIS G 0404**.

b) The characteristics of the galvanized coating shall conform to the requirements of Clause **6**.

c) The dimensions shall conform to the requirements of Clause **7**.

d) The appearance shall conform to the requirements of Clause **8**.

10.2 Reinspection

The pipes which have failed the tests for galvanized coating may be further evaluated for acceptance by conducting a retest specified in **9.8** of **JIS G 0404**.

11 Marking

Each of the pipes having passed the inspection shall be marked with the following information. Where the pipe diameter is too small for the individual marking or there is a special request by the purchaser, the marking may be given on each bundle of pipes by an appropriate method. The order of the items in the marking is not specified. When approved by the purchaser, items of the marking not essential for identification of the product may be omitted.

a) Symbol of grade

b) Nominal diameter of pipe

c) Length of pipe

d) Manufacturer's name or identifying brand

12 Information to be supplied by the purchaser

The purchaser shall provide the manufacturer, processor or intermediary at the time of ordering with at least the following information in order to properly specify the requirements given in this Standard.

a) Dimensions (Table 2)

b) Pipe ends (threaded or plain) [**5.3 a**)]

13 Report

Unless otherwise specified, the manufacturer shall submit an inspection document to the purchaser. The report shall be in accordance with Clause **13** of **JIS G 0404**. Unless otherwise specified at the time of ordering, the type of inspection document to be submitted shall be as specified in **5.1** of **JIS G 0415**.

Annex A (normative)
Coating mass test method (indirect method)

A.1 Summary

The galvanized test piece is weighed, immersed in the test solution until the coating layer dissolves, and then weighed again. The coating mass is determined from the difference in mass of the test piece before and after removal of the coating.

A.2 Test piece

One tubular test piece about 60 mm in length shall be taken from any position of the sample pipe excluding 10 mm from both ends. When the test piece taken is too large, it may be cut to a size suitable for measurement.

A.3 Test solution

Dissolve 3.5 g of hexamethylenetetramine specified in **JIS K 8847** in 500 ml of hydrochloric acid not less than 1.18 g/cm^3 in density [35 % (mass fraction) HC1], and dilute this solution with water to 1 L. The test solution may be repeatedly used as long as it is capable of easily removing the coating.

A.4 Cleaning of test piece

As necessary, degrease the test piece with an organic solvent that will not affect the coating then dry.

A.5 Operation

Weigh the test piece prior to dissolution of the coating layer to an accuracy within ±1 % of the presumed coating mass (the prospective coating mass). At least 10 ml of the test solution per 100 mm^2 of the coated surface area of the test piece shall be used. Submerge the test piece completely under the test solution at room temperature and leave until the coating layer is completely removed. The cessation of originally brisk evolution of hydrogen in the test solution indicates the completion of removal of the coating layer. Then, rinse the test piece with water, wipe well with cotton cloth or the like, dry sufficiently and weigh the mass again to the same accuracy as specified for the weighing before removal of the coating. After weighing, determine the coated surface area S (mm^2) of the test piece. The surface area shall be measured to an accuracy within ±1 % and calculated to the nearest 1 mm^2.

For calculation of surface area, the nominal values indicated in the test piece drawing may be used.

A.6 Calculation of coating mass

Calculate the coating mass according to the following formula, and express the result

by rounding up the first decimal place to the nearest whole number according to Rule A of **JIS Z 8401**.

$$M = \frac{W_1 - W_2}{S} \times 10^6$$

where, M: coating mass (g/m^2)

W_1 : mass of test piece before removal of coating layer (g)

W_2 : mass of test piece after removal of coating layer (g)

S : coated surface area of test piece (mm^2)

Annex B (normative)
Uniformity test method (cupric sulfate test)

B.1 Summary

The galvanized test piece is immersed in cupric sulfate solution for about 60 s. After the specified number of repetitions of this immersion, the test piece is visually examined for the presence of copper deposit on the surface.

NOTE In this test, one immersion results in the loss of wall thickness of about 8 μm.

B.2 Test piece

One tubular test piece about 60 mm in length shall be taken from any position of the sample pipe excluding 10 mm from both ends. When the test piece taken is too large, it may be cut to a size suitable for measurement.

B.3 Test solution

Mix 100 ml of water per 36 g of copper sulfate pentahydrate [purity not less than 98.5 % (mass fraction), iron content not more than 0.1 % (mass fraction), water insoluble content not more than 0.5 % (mass fraction)] and dissolve by heating. Add to this an excessive amount of about 10 g of powdered copper (II) hydroxide [$Cu(OH)_2$] (for chemical analysis) [1)] per 10 L of the solution to neutralize free sulfuric acid, mix and leave to stand for 24 h. Then, filter this to obtain a solution 1.186 g/cm^3 to 1.188 g/cm^3 in density (measured with a hydrometer, etc.) at 18 °C.

Note [1)] Addition of an excessive amount can be confirmed by the precipitation observed at the bottom of the vessel.

In place of copper (II) hydroxide, about 8 g of copper (II) oxide [CuO] (for chemical analysis) may be used per 10 L of the solution, in which case the solution shall be left to stand for 48 h, or about 12 g of powdered basic copper carbonate [$CuCO_3 \cdot Cu(OH)_2$] (for chemical analysis) may be used per 10 L of the solution, in which case the solution shall be left to stand for 24 h.

B.4 Amount of test solution

The amount of the test solution shall be not less than 6 ml per 1 cm^2 of the surface area of the test piece and enough to completely immerse the test piece. The same test solution may be used up to 20 times for immersion.

B.5 Cleaning of test piece

As necessary, degrease the test piece with an organic solvent that will not affect the coating then dry.

B.6 Operation

Gently submerge a cleaned test piece at the centre of the test solution kept at 16 °C to 20 °C, and immerse in the test solution for about 60 s without stirring the test solution and with care that the test piece is not in contact with the wall of the vessel. Take out the test piece, immediately rinse with water, and wipe off the copper adhering to the coating surface with a brush or the like. Repeat this operation.

B.7 Judgement of end point

The end point is reached when the deposit of brilliant adherent metallic copper is observed on the surface of the test piece. The end point has not been reached if :

a) the total area with the deposit of brilliant adherent metallic copper is less than 0.05 cm^2;

b) the brilliant adherent metallic copper can be scraped off easily without the use of a sharp knife or the like and the coating layer underneath it can be observed;

NOTE If dropping one or several drops of dilute hydrochloric acid on the surface removed of the adherent metallic copper causes brisk evolution of hydrogen, the coating layer can be judged to have been exposed.

c) the brilliant adherent metallic copper is visually observed not more than 10 mm from the corners or edges of the test piece;

d) the brilliant adherent metallic copper is visually observed on the cuts and scratches generated after application of coating or on the parts adjacent thereto.

Annex C (normative)
Property test method for galvanized coating

C.1 Test piece

Test piece about 30 mm in length shall be taken from any position of the sample pipe excluding 10 mm from both ends. The test piece section shall be in accordance with Table C.1.

For pipes of nominal diameter over 300A (12B), the test piece shall be cut out to a size suitable for testing.

Table C.1 Test piece section

Nominal diameter of pipe		Outside diameter mm	Section
A	B		
10	3/8	17.3	Full circle
15	1/2	21.7	Full circle
20	3/4	27.2	Full circle
25	1	34.0	1/2 circle
32	1 1/4	42.7	1/2 circle
40	1 1/2	48.6	1/2 circle
50	2	60.5	1/4 circle
65	2 1/2	76.3	1/4 circle
80	3	89.1	1/6 circle
90	3 1/2	101.6	1/6 circle
100	4	114.3	1/6 circle
125	5	139.8	1/8 circle
150	6	165.2	1/8 circle
200	8	216.3	1/8 circle
250	10	267.4	1/8 circle
300	12	318.5	1/8 circle

C.2 Test solution

Dissolve 20 g of sodium hydroxide specified in **JIS K 8576** or 28 g of potassium hydroxide specified in **JIS K 8574** in 100 ml of water.

C.3 Cleaning of test piece

As necessary, degrease the test piece with an organic solvent that will not affect the coating then dry.

C.4 Operation

In a beaker or other glass vessel, take an amount of the test solution that is 5 ml or

more per 100 mm^2 of the coated area of the test piece, heat and maintain this solution at 75 °C to 80 °C. Put the test piece in the test solution, and measure the time from the start of immersion to the cessation of generation of bubbles from the test piece (end point). The generation of bubbles progresses as follows according to the dissolution of the coating layer. While the zinc layer on the surface is dissolving, only a small amount of bubbles is generated, but once the alloy layer of zinc and iron is exposed, the generation of hydrogen becomes vigorous, filling the inside of the glass vessel with bubbles. When the coating layer and the alloy layer dissolve and the substrate surface is exposed, the generation of bubbles stops. This point is taken as the end point.

The cross-section of the test piece may be protected with a suitable coating material or the like so that the substrate surface is not directly in contact with the test solution.

Errata for **JIS** (English edition) can be downloaded in PDF format at Webdesk (purchase information page) of our website (https://www.jsa.or.jp/).

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