

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS A 5525 : 2019

(JISF)

Steel pipe piles

ICS 77.140.75;93.020

Reference number : **JIS A 5525 : 2019 (E)**

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Date of Establishment: 1963-10-01

Date of Revision: 2019-03-20

Date of Public Notice in Official Gazette: 2019-03-20

Investigated by: Japanese Industrial Standards Committee
Standards Board for ISO area
Technical Committee on Metal and Inorganic
Materials

JIS A 5525:2019, First English edition published in 2019-07

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

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Printed in Japan

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Contents

	Page
1 Scope	1
2 Normative references	1
3 Constitution of piles	1
4 Class symbols	2
5 Manufacturing process	2
6 Chemical composition	3
7 Mechanical properties	3
8 Shop circumferential welding	3
9 Accessories, additional processing, and painting/coating	4
10 Shapes, dimensions, and mass and their tolerances	4
10.1 End shape	4
10.2 Dimensions and mass	5
10.3 Shape and dimensional tolerances of single pipe	9
11 Appearance.....	11
12 Tests	11
12.1 Chemical analysis	11
12.2 Mechanical tests	11
12.3 Radiographic testing	14
13 Inspection and reinspection	14
13.1 Inspection	14
13.2 Reinspection	14
14 Marking	14
15 Test report	15
Annex A (normative) Quality requirements for ribbed blank pipes	16
Annex B (informative) Examples of accessories	19
Annex C (informative) Examples of additional processing, and coating or plating	24

Foreword

This Japanese Industrial Standard has been 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 Iron and Steel Federation (JISF) 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 A 5525:2014** is replaced with this Standard.

However, **JIS A 5525:2014** may be applied in the **JIS** mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until March 19, 2020.

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Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

Steel pipe piles

1 Scope

This Japanese Industrial Standard specifies requirements for welded steel pipe piles (hereafter referred to as piles) used for foundation of structures mainly in the fields of civil engineering and architecture. The piles for land slide prevention are within the scope of this Standard.

The quality requirements for ribbed blank pipe that can be applied upon agreement between the purchaser and the manufacturer are given in Annex A.

NOTE 1 Steel pipes for landslide prevention are also specified in **JIS G 3444** and **JIS G 5201**.

NOTE 2 This Standard is mainly applicable to piles with an outside diameter of 318.5 mm to 2 000 mm.

2 Normative references

The following standards contain provisions which, 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 G 0320 *Standard test method for heat analysis of steel products*

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

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

JIS G 3193 *Dimensions, mass and permissible variations of hot rolled steel plates, sheets and strips*

JIS Z 2241 *Metallic materials—Tensile testing—Method of test at room temperature*

JIS Z 3104 *Methods of radiographic examination for welded joints in steel*

JIS Z 3121 *Methods of tensile test for butt welded joints*

JIS Z 3211 *Covered electrodes for mild steel, high tensile strength steel and low temperature service steel*

JIS Z 3312 *Solid wires for MAG and MIG welding of mild steel, high strength steel and low temperature service steel*

JIS Z 3313 *Flux cored wires for gas shielded and self-shielded metal arc welding of mild steel, high strength steel and low temperature service steel*

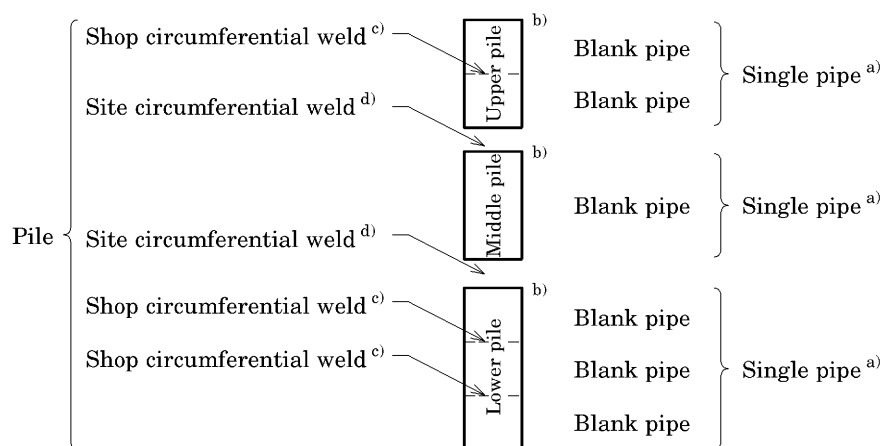
JIS Z 3351 *Solid wires for submerged arc welding of carbon steel and low alloy steel*

JIS Z 3352 *Fluxes for submerged arc welding and electroslag welding*

JIS Z 8401 *Guide to the rounding of numbers*

3 Constitution of piles

Constitution of a pile and designation of each member are shown in Figure 1.



- Notes a) A single pipe is either a blank pipe or a pipe produced by joining blank pipes by shop circumferential welding (hereafter referred to as jointed pipe).
- b) A pile is either a single pipe or a pipe comprised of a series of single pipes joined by welding. When single pipes are joined on site, the piles in the upper, the middle and the lower positions are designated as the upper pile, the middle pile and the lower pile, respectively. If there are two or more middle piles, they are designated in the ascending order so that the lowermost pile is designated as the first middle pile, and the one above it, the second middle pile, and so on.
- c) The shop circumferential welding refers to circumferential welding performed by the manufacturer to join blank pipes to produce single pipes.
- d) The site circumferential welding refers to circumferential welding performed by the constructor to join single pipes to produce piles.

Figure 1 Constitution of pile and designation of each member

4 Class symbols

Piles are classified into two grades as shown in Table 1.

Table 1 Symbol of grade

Symbol
SKK400
SKK490

5 Manufacturing process

The manufacturing process shall be as follows.

- a) Blank pipes are produced by spiral seam arc welding or straight seam arc welding, or electric resistance welding.
- In shop circumferential welding, the seam welds of the blank pipes to be joined shall be staggered by at least 1/8 of the pipe end circumference in the circumferential direction.
- b) The manufacturing process of ribbed blank pipes shall be as given in A.1.
- c) A single pipe is either a blank pipe or a jointed pipe made by joining blank pipes by shop circumferential welding. A jointed pipe may consist of blank pipes of different types or different wall thicknesses.

6 Chemical composition

The blank pipes shall be subjected to the chemical analysis specified in **12.1**, and the heat analysis values shall be as given in Table 2.

Table 2 Chemical composition

Unit: %

Symbol of grade	C	Si	Mn	P	S
SKK400	0.25 max.	—	—	0.040 max.	0.040 max.
SKK490	0.18 max.	0.55 max.	1.65 max.	0.035 max.	0.035 max.
If required, other alloy elements than above may be added.					

7 Mechanical properties

The blank pipes, when subjected to the mechanical tests specified in **12.2**, shall satisfy requirements for the tensile strength, yield point or proof stress, elongation, tensile strength of welds and flattening resistance given in Table 3. In the flattening test, the test piece shall be free from cracks when compressed between two parallel plates until the distance between the plates reaches the value specified in Table 3. The tensile strength of welds shall apply to the blank pipes manufactured by arc welding, and the flattening resistance shall apply to the blank pipes produced by electric resistance welding.

Table 3 Mechanical properties

Symbol of grade	Tensile strength	Yield point or proof strength	Elongation %		Tensile strength of welds	Flattening resistance (Distance between two parallel plates) (<i>H</i>)
			Tensile test piece	Test direction		
	N/mm ²	N/mm ²	Test piece No. 5	Normal to pipe axis ^{a)}	N/mm ²	mm
SKK400	400 min.	235 min.	18 min.		400 min.	$\frac{2}{3}D^{b)}$
SKK490	490 min.	315 min.	18 min.		490 min.	$\frac{7}{8}D^{b)}$
NOTE 1 N/mm ² = 1 MPa						
Notes ^{a)} Parallel or normal to the rolling direction if sample is taken from a steel strip or steel sheet.						
^{b)} <i>D</i> : pipe outside diameter						

8 Shop circumferential welding

The welding material for shop circumferential welding and the quality of welds shall be as follows.

- a) **Welding materials** The welding materials used for the shop circumferential welding of blank pipes to make a steel pipe body shall have a tensile strength equal or superior to the specified tensile strength of the blank pipe material and shall be any one or combination of materials specified in the following standards:

JIS Z 3211, JIS Z 3312, JIS Z 3313, JIS Z 3351, JIS Z 3352

Where blank pipes of different grades are welded by shop circumferential welding, the welding material shall have a tensile strength of 400 N/mm² or greater.

- b) **Quality of welds** When shop circumferential welds are examined by the radiographic testing in **12.3**, the observed flaws shall conform to Class 1 to Class 3 specified in Clause **6** of Annex 4 in **JIS Z 3104** based on the type of flaw defined according to Table 1 of Annex 4 in **JIS Z 3104**.

9 Accessories, additional processing, and painting/coating

The purchaser may request the attachment of accessories¹⁾, additional processing²⁾ and painting/coating on piles. Where such request has been made, the appearance, inspection, and marking requirements shall be as agreed between the purchaser and the manufacturer. Annex B and Annex C respectively provide examples of accessories and examples of additional processing and coating/painting that can be applied on single pipes apart from the specifications in the main body of this Standard.

Notes ¹⁾ Members temporarily required for the installation of piles.

²⁾ Processing to impart to the piles certain desired characteristics, e.g. transfer of load to concrete.

10 Shapes, dimensions, and mass and their tolerances

10.1 End shape

The end shape of the single pipe shall be as shown in Figure 2. Where blank pipes of different wall thicknesses are to be joined, they shall receive the machining as shown in Figure 3 at shop prior to joining. Other end shape, reinforcement or machining, if specially requested, may be applied upon agreement between the purchaser and the manufacturer.

NOTE In Figure 2, head end face refers to the upper end of the pile, and bottom end face, the bottom end of the pile.

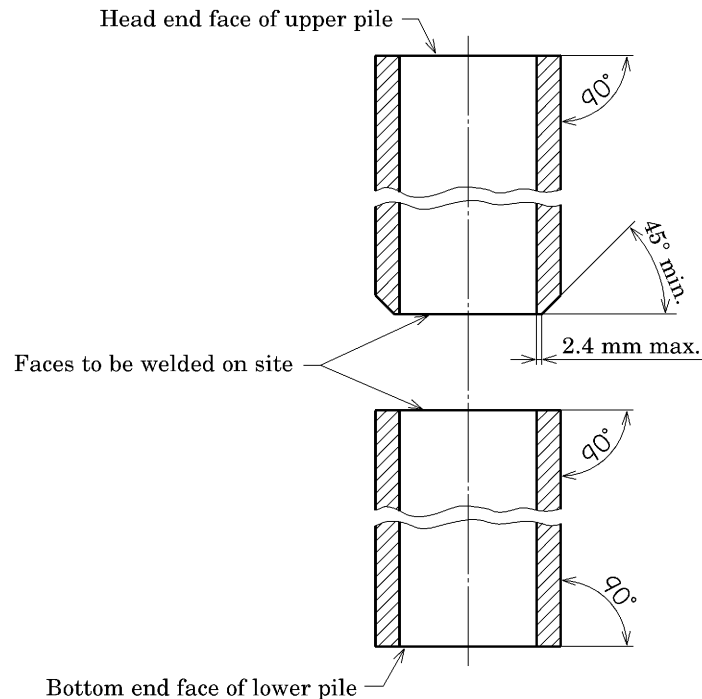
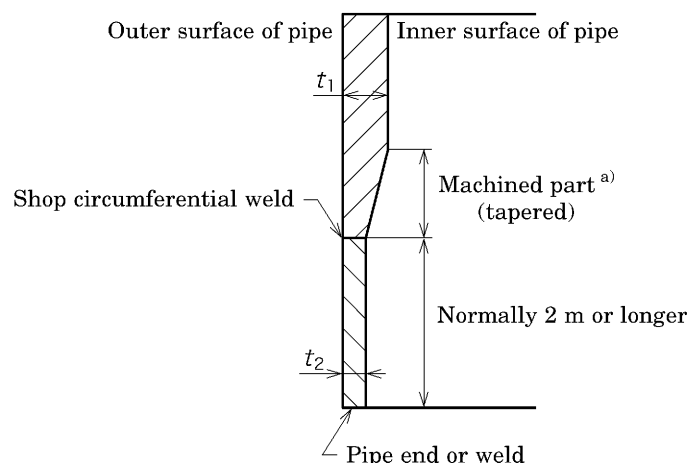


Figure 2 Shape of both ends and site circumferential welds of single pipe



Note ^{a)} The length of the machined taper on the inner wall of the pipe shall be not less than $4(t_1 - t_2)$. This machining is unnecessary for pipes with $(t_1 - t_2)$ of 2 mm or less, regardless of whether they are welded from both inside and outside, or for pipes given shop circumferential welding on both the inner and outer surfaces and with $(t_1 - t_2)$ of 3 mm or less.

Figure 3 Shape of shop circumferential weld of blank pipes of different thicknesses

10.2 Dimensions and mass

The dimensions and mass of blank pipes shall be as follows. The dimensions and unit mass of ribbed blank pipes shall be as given in **A.2.2**.

- a) The outside diameter, wall thickness, sectional area, and unit mass of blank pipes shall be as specified in Table 4. Other dimensions than specified in Table 4 may be used upon agreement between the purchaser and the manufacturer, in which case

the unit mass shall be obtained by the following formula assuming the mass of 1 cm³ of steel to be 7.85 g, and rounding off the result to three significant figures according to Rule A of **JIS Z 8401**. If the calculated value exceeds 1 000 kg/m, it shall be rounded to the four-digit integer.

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

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 coefficient for obtaining W

NOTE The unit mass values given in Table 4 have been obtained according to the calculation above.

Table 4 shows for information the geometric moment of inertia, section modulus, radius of gyration of cross-section and outside surface area.

- b) The length of a blank pipe shall normally be 2 m or greater. The length of a steel pipe body shall normally be 6 m or greater and in 0.5 m increments.

Table 4 Dimensions, sectional area and unit mass of blank pipe

Outside diameter D mm	Wall thickness t mm	Sectional area A cm ²	Unit mass W kg/m	Informative			
				Geometric moment of inertia I cm ⁴	Section modulus Z cm ³	Radius of gyration of cross-section i cm	Outside surface area m ² /m
318.5	6.9	67.5	53.0	820×10	51.5×10	11.0	1.00
	10.3	99.7	78.3	119×10^2	74.4×10	10.9	1.00
355.6	6.4	70.2	55.1	107×10^2	60.2×10	12.4	1.12
	7.9	86.3	67.7	130×10^2	73.4×10	12.3	1.12
	11.1	120.1	94.3	178×10^2	100.3×10	12.2	1.12
400	9	110.6	86.8	211×10^2	105.7×10	13.8	1.26
	12	146.3	115	276×10^2	137.8×10	13.7	1.26
406.4	9	112.4	88.2	222×10^2	109.2×10	14.1	1.28
	12	148.7	117	289×10^2	142.4×10	14.0	1.28
500	9	138.8	109	418×10^2	167×10	17.4	1.57
	12	184.0	144	548×10^2	219×10	17.3	1.57
	14	213.8	168	632×10^2	253×10	17.2	1.57
508.0	9	141.1	111	439×10^2	173×10	17.6	1.60
	12	187.0	147	575×10^2	227×10	17.5	1.60
	14	217.3	171	663×10^2	261×10	17.5	1.60
600	9	167.1	131	730×10^2	243×10	20.9	1.88
	12	221.7	174	958×10^2	319×10	20.8	1.88
	14	257.7	202	111×10^3	369×10	20.7	1.88
	16	293.6	230	125×10^3	417×10	20.7	1.88