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**Light gauge stainless steel tubes
for ordinary piping**

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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 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 G 3448 : 1997** is replaced with this Standard.

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Light gauge stainless steel tubes for ordinary piping

Introduction Principal purposes of this revision are deletion of the provision of the highest working pressure conforming to requests of the market, addition of types conforming to latest variation of feed water temperature and use, and amendment of the items and terms based on consideration of the structure of the standard.

1 Scope This Japanese Industrial Standard specifies stainless steel tubes (straight tube and coiled tube, hereafter referred to as “tubes”) used for the piping of water supply, hot water supply, drainage, and others.

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

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

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

JIS G 0583 *Eddy current examination of steel pipes and tubes*

JIS G 4304 *Hot rolled stainless steel plates, sheets and strip*

JIS G 4305 *Cold rolled stainless steel plates, sheets and strip*

JIS S 3200-1 *Equipment for water supply service—Test methods of hydrostatic pressure*

JIS S 3200-7 *Equipment for water supply service—Test methods of effect to water quality*

JIS Z 2201 *Test pieces for tensile test for metallic materials*

JIS Z 2241 *Method of tensile test for metallic materials*

JIS Z 8401 *Guide to the rounding of numbers*

3 Grade and symbol Tubes shall be classified into four grades and their symbols shall be as given in Table 1.

Table 1 Symbol of grade

Symbol of grade	Use (informative)
SUS304TPD	For piping of ordinary water supply, hot water supply, drainage, cold/warm water supply, etc.
SUS315J1TPD	For use requiring corrosion resistance higher than SUS304 because of the water quality, environments, etc. and for use in the hot water piping where stress corrosion cracking resistance higher than SUS316 is required.
SUS315J2TPD	
SUS316TPD	For use requiring corrosion resistance higher than SUS304 to cope with the water quality, environment, etc.

4 Materials and manufacturing method

4.1 Materials For tubes, SUS304, SUS315J1, SUS315J2 and SUS316 which are specified in **JIS G 4304** or **JIS G 4305** shall be used.

Information : Chemical composition of **JIS G 4304** and **JIS G 4305** shall be as given in Informative Table 1.

Informative Table 1 Chemical composition

Unit: %

Symbol of grade	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
SUS304	0.08 max.	1.00 max.	2.00 max.	0.045 max.	0.030 max.	8.00 to 10.50	18.00 to 20.00	—	—
SUS315J1		0.50 to 2.50				8.50 to 11.50	17.00 to 20.50	0.50 to 1.50	0.50 to 3.50
SUS315J2		2.50 to 4.00				11.00 to 14.00	17.00 to 20.50	0.50 to 1.50	0.50 to 3.50
SUS316		1.00 max.				10.00 to 14.00	16.00 to 18.00	2.00 to 3.00	—

4.2 Manufacturing method Tubes shall be manufactured by automatic arc welding, laser welding or electric resistance welding and shall, as a rule, be not heat-treated. The heat treatment, if applied, shall be a solution treatment by acid cleaning or similar treatments. Heat treatments other than the solution treatment shall be as agreed upon between the supplier and the purchaser.

5 Mechanical properties

5.1 Tensile strength and elongation Tubes shall be tested in accordance with 11.2 and the tensile strength and elongation obtained shall conform to Table 2.

Table 2 Mechanical properties

Symbol of grade	Tensile strength N/mm ²	Elongation %	
		No. 11 test piece No. 12 test piece	No. 5 test piece
		Longitudinal direction	Lateral direction
SUS304TPD SUS315J1TPD SUS315J2TPD SUS316TPD	520 min.	35 min.	25 min.

5.2 Flattening property Tubes, when tested in accordance with 11.3, shall be free from flaws, cracks or any other abnormalities on the wall.

5.3 Flaring property Tubes, when tested in accordance with 11.4, shall be free from flaws, cracks or any other abnormalities on the wall. This requirement shall apply to tubes of 80Su or under in designation.

5.4 Bending property Tubes, when subjected to the test in 11.5, shall be free from flaws, cracks, wrinkles or any other abnormalities on the wall. This requirement shall apply to coiled tubes of 20Su or under in designation.

6 Wetting resistance Tubes shall be non-destructively tested in accordance with a pneumatic test or an eddy current test and the obtained characteristics shall be as follows:

- a) **Pneumatic test** Tubes, when tested in accordance with 11.6.1, shall be free from leakage or any other abnormalities.
- b) **Non-destructive inspection** Tubes, when tested in accordance with 11.6.2, shall be free from signals equal to or greater than the signals from artificial flaws of the reference test piece of the sensitivity of flaw detection division EY specified in **JIS G 0583**.

7 Pressure resistance performance Tubes, when subjected to the test of 11.7, shall be free from leakage or any other abnormalities.

8 Leaching performance Tubes, when subjected to the test of 11.8, shall satisfy the requirements in Table 3. However, application of the leaching performance shall be as agreed upon between the manufacturer and the purchaser.

Table 3 Leaching performance

Items		Acceptance standard value
Taste		not abnormal
Odour		not abnormal
Chromaticity	degree	5 max.
Turbidity	degree	2 max.
Sexivalent chromium	mg/L	0.05 max.
Iron	mg/L	0.3 max.

Information : In Water Works Law, a leaching performance test is specified for a tube used as a feed water system.

9 Dimensions, dimensional tolerances and mass

9.1 Outside diameter, thickness, dimensional tolerances and mass The outside diameter, thickness, dimensional tolerances and mass of tubes shall be as given in Table 4.

Table 4 Outside diameter, thickness, dimensional tolerance and mass

Unit: mm

Classification	Designation Su	Outside diameter	Tolerance on outside diameter		Thickness	Tolerance on thickness	Unit mass (kg/m)	
			Outside diameter	Circumference			SUS304TPD	SUS315J1TPD SUS315J2TPD SUS316TPD
Straight tube and coiled tube	8	9.52	0	—	0.7	±0.12	0.154	0.155
	10	12.70	−0.37		0.8		0.237	0.239
	13	15.88			0.8		0.301	0.303
	20	22.22			1.0		0.529	0.532
Straight tube	25	28.58			1.0		0.687	0.691
	30	34.0	±0.34	±0.20	1.2		0.980	0.986
	40	42.7	±0.43		1.2		1.24	1.25
	50	48.6	±0.49	±0.25	1.2		1.42	1.43
	60	60.5	±0.60		1.5	±0.15	2.20	2.21
	75	76.3	±1 %	±0.5 %	1.5		2.79	2.81
	80	89.1			2.0	±0.30	4.34	4.37
	100	114.3			2.0		5.59	5.63
	125	139.8			2.0		6.87	6.91
	150	165.2			3.0	±0.40	12.1	12.2
	200	216.3			3.0		15.9	16.0
	250	267.4			3.0		19.8	19.9
	300	318.5			3.0		23.6	23.8

- Remarks 1 The outside diameter in the tolerance on outside means the tolerance on the measured value of the diameter of the tube.
- 2 The circumference in the tolerance on outside diameter means the tolerance on the value obtained by dividing the measured value of the circumference of the tube by π (3.1416).
- 3 The numerical value of unit mass shall be calculated according to the following formulas and be rounded off to three significant figures in accordance with rule A specified in **JIS Z 8401**.

Symbol of grade	Fundamental mass kg	Equation
SUS304TPD	7.93	$W=0.024\ 91t(D-t)$
SUS315J1TPD SUS315J2TPD SUS316TPD	7.98	$W=0.025\ 07t(D-t)$

where, W : unit mass of tube (kg/m)

t : thickness of tube (mm)

D : outside diameter of tube (mm)

Further, the fundamental mass means the mass of the stainless steel of 1 mm thickness and 1 m² area.

9.2 Length and its tolerance The length of one tube, for straight tube, shall generally be 4 000 mm. The tolerance on length shall be provided on the plus side only. The tolerance on length for coiled tube shall be as given in Table 5.

Table 5 Tolerance on length of coiled tube

Unit: m

Length (designation 20Su or under)	Tolerance
50 max.	+0.5, 0
Over 50	+2 %, 0

10 Appearance The appearance of a tube shall be as follows:

- a) Tubes shall be practically straight and their both ends shall be at right angles to the axes of the tubes.

However, coiled tubes do not apply to this case.

- b) The internal and external surfaces of the tube shall be well finished and free from defects detrimental to use.

11 Test method

11.1 Material under test A sampling method for material under test shall be as given in Table 6.

Table 6 Method for extracting sample

Test item	The number of samples
Tensile test	One piece of material under test is extracted per 250 pieces of straight tubes or per 1 000 m of coil tube of the same dimensions in the same manufacturing lot and their fraction. A length necessary for applying to each test is extracted from the extracted material under test and the number of pieces shall be one piece. Further, for No. 12 test piece or No. 5 test piece, the test piece shall be extracted from the part not containing a joint.
Flattening test	
Flaring test	
Bending test	
Leakage resistance test	Total number. However, the number of material under test may be as agreed upon between the manufacturer and the purchaser.
Pressure resistance test	At definite intervals and every time the quality changes.
Leaching performance test	

11.2 Tensile test For a tensile test, any one of No. 11, No. 12A, No. 12B, No. 12C or No. 5 test piece which are specified in **JIS Z 2201**, shall be made from the tube under test and tensile strength and elongation shall be measured in accordance with **JIS Z 2241**.

11.3 Flattening test For a flattening test, cut out an annular test piece of ≥ 50 mm length from the end of the tube under test, put it between two pieces of flat boards at ordinary temperature as it is and compress until the distance between the flat boards reaches a height of $\frac{2}{3}$ of the outside diameter (D). In this case, place the weld part at a right angle to the compression direction.

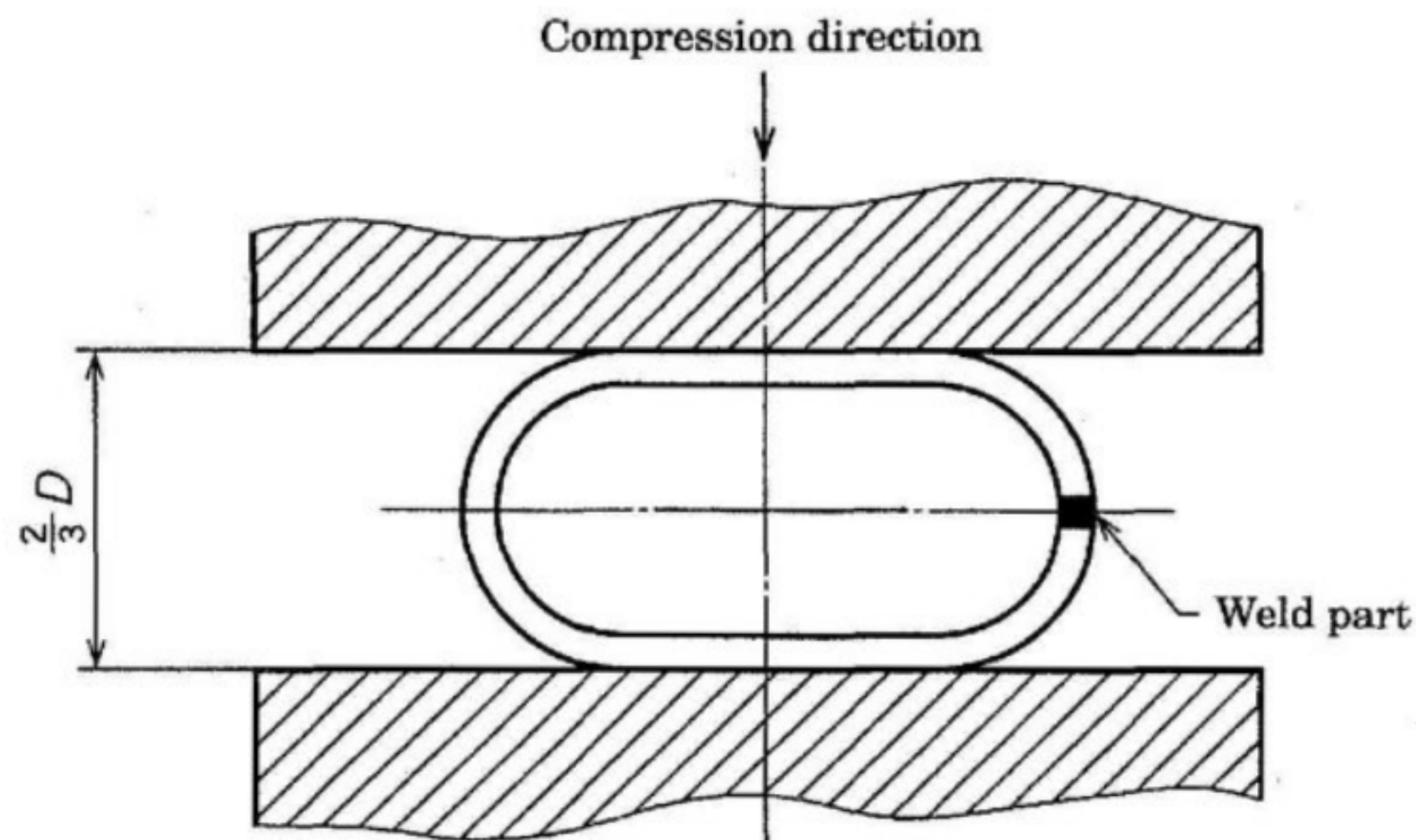
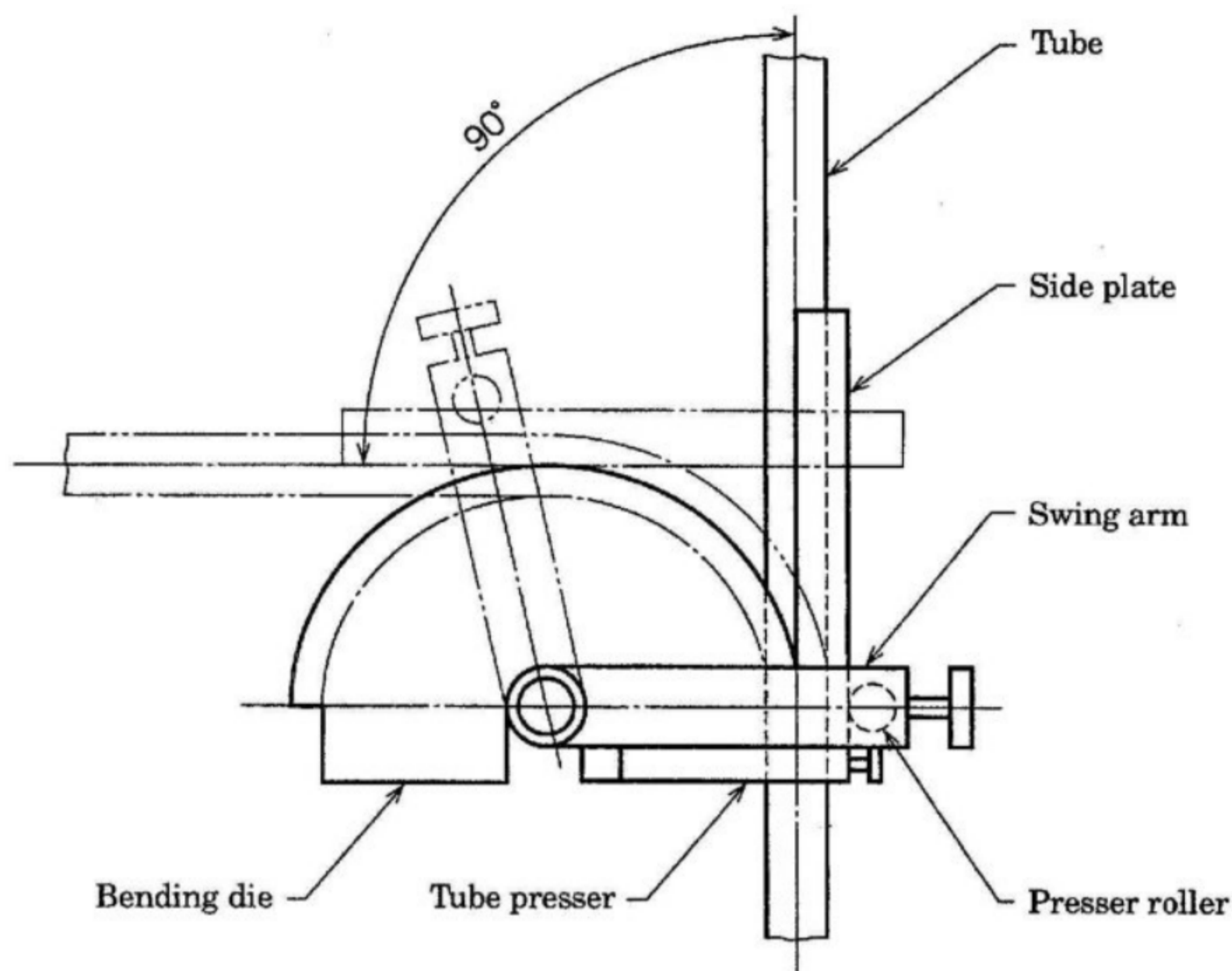


Fig. 1 Flattening test

11.4 Flaring test For a flaring test, cut out a suitable length from the end of a tube under test and flare the end of the tube in a trumpet shape until it becomes a size of 1.2 times the outside diameter with a conical shaped tool of 60° angle at ordinary temperature as it is.

11.5 Bend test For a bend test, cut off an appropriate length of a tube from an end of the tube for test and bend it to 90° with a pipe bender of $4 \times D$ radius (D is outer diameter of the tube) (an example of the pipe bender is given in Informative Fig. 1).



Informative Fig. 1 An example of pipe bender

11.6 Leakage resistance test

11.6.1 Pneumatic pressure test A pneumatic pressure test shall be in accordance with **JIS S 3200-1**. The pneumatic pressure shall be 0.6 MPa and the retention time shall be 5 s.

11.6.2 Eddy current flaw detection test The eddy current flaw detection test shall be as specified in **JIS G 0583**.

11.7 Pressure resistance performance test The pressure resistance performance test shall be as specified in **JIS S 3200-1**. The test water pressure shall be 3.5 MPa and the holding time shall be 1 min.

Further, a test water pressure of 3.5 MPa may be adopted as agreed upon between the manufacturer and the purchaser.

11.8 Leaching performance test The leaching performance test shall be as specified in **JIS S 3200-7**.

12 Inspection

12.1 Inspection The inspection of the tube shall be as follows. When an approval is obtained from the purchaser, a part of the inspection may be omitted.

- General matters of inspection shall be as specified in **JIS G 0404**.
- Mechanical properties shall conform to the requirements specified in clause 5.
- Wetting resistance shall conform to the requirements specified in clause 6.

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- d) Pressure resistance performance⁽¹⁾ shall conform to the requirements specified in clause 7 as a type test.
- e) Leaching performance⁽¹⁾ shall conform to the requirements specified in clause 8 as a type test.
- f) Dimensions shall conform to the requirements specified in clause 9.
- g) Appearance shall conform to the requirements specified in clause 10.

Note ⁽¹⁾ Pressure resistance performance test and leaching performance test shall be carried out as a type test and shall not be carried out for each delivery.

12.2 Retest Tubes not accepted by the tensile test, flattening test, flaring test or bending test may be judged for acceptance by carrying out a retest of 9.8 in **JIS G 0404**.

13 Marking Each tube having passed the inspection shall be marked with the following items. The order of the items is not specified. When approved by the purchaser, the tubes may be bundled and the items may be marked on each bundle by a suitable method.

- a) Symbol of grade
- b) Symbol expressing manufacturing method⁽²⁾ ⁽³⁾
- c) Dimensions⁽⁴⁾
- d) Manufacturer's name or abbreviation
- e) Symbol expressing acceptance for leaching performance M

Notes ⁽²⁾ The symbol expressing the manufacturing method shall be as follows. However, a dash may be replaced by a space.

Automatic arc welded steel tube: —A

Electric resistance welded steel tube: —E

Laser welded steel tube: —L

⁽³⁾ The marking symbol of heat treatment, if conducted, shall be —HT to be suffixed next to A, E or L.

⁽⁴⁾ The size shall be expressed by “designation”.

Example : 30Su

14 Report The report shall be as specified in clause 13 of **JIS G 0404**. When not specially specified in ordering, the grade of an inspection document shall be symbol 2.3 or 3.1.B of Table 1 of **JIS G 0415**.

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