JIS G3447 Stainless Steel sanitary Pipes

1. Scope

This Japanese Industrial Standard specifies the stainless steel sanitary pipes (Hereafter referred to as "pipes") used for the dairy, food industry, etc.

Remark: Attached Table Cited standards

JIS G 0303 General rules for inspection of steel

JIS G 0321 Product analysis and its tolerance for wrought steel

JIS G 0571 Method of 10 per cent oxalic acid etch test for stainless steels

JIS G 0572 Method of ferric sulfate-sulfuric acid test for stainless steels

JIS G 0573 Method of 65 per cent nitric acid test for stainless steels

JIS G 0574 Method of nitric-hydrofluoric acid test for stainless steels

JIS G 0575 Method of copper sulfate-sulfuric acid test for stainless steels

JIS G 0582 Ultrasonic examination for steel pipes and tubes

JIS G 0583 Eddy current examination for steel pipes and tubes

JIS G 1211 Methods for determination of carbon in iron and steel

JIS G 1212 Methods for determination of silicon in iron and steel

JIS G 1213 Methods for determination of manganese in iron and steel

JIS G 1214 Methods for determination of phosphorus in iron and steel

JIS G 1215 Methods for determination of sulfur in iron and steel

JIS G 1216 Methods for determination of nickel in iron and steel

JIS G 1217 Methods for determination of chromium in iron and steel

JIS G 1218 Methods for determination of molybdenum in iron and steel

JIS G 1253 Methods for photoelectric emission petrochemical analysis of iron and steel

JIS G 1256 Methods for x-ray fluorescent spectrometric analysis of iron and steel

JIS G 1257 Iron and steel - Methods for atomic absorption spectrometric analysis

JIS Z 2201 Test pieces for tensile test for metallic materials

JIS Z 2241 Method of tensile test for metallic materials

1. The purchaser may specify the special quality specified in Annex 1 in addition to items specified in the main text subjected to a previous agreement between the purchaser and the manufacturer. Requirements Z6 corrosion tests.

2. Grade and symbol Pipes shall be classified into four grades, and their symbol shall be as given is Table 1.

3. Annex 2 was based on ISO 2037-1992 which corresponds to this Standard, and may be applied instead of the provisions of the main text in this Standard.

2. Grade and symbol

Pipes shall be classified into four grades, and their symbols shall be as given in Table 1.

Table 1.

Symbol of grade	Chemical composition %							
	C	Si	Mn	P	S	Ni	Cr	Mo
SUS 304TBS	0.08 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	8.00 to 11.00	18.00 to 20.00	-
SUS 304LTBS	0.030 max.					9.00 to 13.00		
SUS 316TBS	0.08 max.					10.00 to 14.00	16.00 to 18.00	2.00 to 3.00
SUS 316LTBS	0.030 max.					12.00 to 16.00		

Remarks: When the product analysis is requested by the purchaser, an for the tolerances for the abovementioned values, Table 4 given in JIS G 0321 shall be applied.

World Standard Comparative Table

Standard	KS	JIS	ASTM
Standard number	D 3585	G-3447	A270
Designation Of Grade	STS 304 TBS	SUS 304TBS	TP304
	STS 304 LTBS	SUS 304LTBS	TP304L
	STS 316 TBS	SUS 316TBS	TP316
	STS 316 LTBS	SUS 316LTBS	TP316L

3. Method of manufacture

The method of manufacturing pipes shall be as follows.

(1) Pipes shall be manufactured by a seamless process, of be manufactured by an automatic arc welding, laser welding of electric resistance welding.

(2) Pipes shall be solution-treated (rapid cooling after heating at 1010^{o}C of higher).

4. Chemical composition

Pipes shall be tested in accordance with10.1, and the resulting cast analysis shall conform to Table 1.

Table 1.

Symbol of grade	Chemical composition %							
	C	Si	Mn	P	S	Ni	Cr	Mo
SUS 304TBS	0.08 max.	1.00	2.00	0.040	0.030	8.00 to 11.00	18.00 to 20.00	-

SUS 304LTBS	0.030 max.	max.	max.	max.	max.	9.00 to 13.00		
SUS 316TBS	0.08 max.					10.00 to 14.00	16.00 to 18.00	2.00 to 3.00
SUS 316LTBS	0.030 max.					12.00 to 16.00		

Remarks: When the product analysis is requested by the purchaser, as for the tolerances for the abovementioned values, Table 4 given in JIS G 0321 shall be applied.

5. Mechanical property

5.1 Tensile strength and elongation

Pipes shall be tested in accordance with 10.2, and the resulting tensile strength and elongation shall conform to table 2. These tests shall be conducted when requested by the purchaser.

Table 2. Mechanical property

Symbol of grade	Tensile strength N/mm^2	Elongation %
SUS 304 TBS	520 min.	35 min.
SUS 304 LTBS	480 min.	
SUS 316 TBS	520 min.	
SUS 316 LTBS	480 min.	

Remarks: When a tensile test piece is sampled from a welded steel pipe, No. 12B test piece shall be sampled from a seamless part.

5.2 Reverse flattening resistance Welded pipes shall be tested in accordance with 10.3, and the weld part shall be free from flaws, cracks, etc.

6. Hydraulic of pneumatic test characteristic, of nondestructive examination characteristic

Pipes shall be tested in accordance with 10.4, and the hydraulic or pneumatic test characteristic, of the nondestructive examination characteristic, of the pipe shall be in accordance with either of the following. Preference shall be left to the designation by the purchaser of the discretion of the manufacturer.

6.1 Hydraulic of pneumatic test characteristic

When subjected to the test of 10.4, pipes shall withstand the applied hydraulic pressure of 2.5 MPa of the applied pneumatic pressure of 0.6 MPa, being free form leakage.

6.2 Nondestructive examination characteristic Seamless steel pipes shall be examined by ultrasonic flaw detection of eddy current flaw detection, and welded steel pipes shall be examined by eddy current flaw detection. Then, there shall be no signal at least equal to that from the artificial defects of the reference test piece of working sensitivity division UD of JIS G 0582 or of working sensitivity division EY of JIS G 0583.

7. Surface finish

Pipes shall be finished, as a rule, by abrasive grain size #400 polishing on both inner and outer faces. However, the purchaser can designate the surface to be finished and the finished conditions.

8. Dimensions and dimensional tolerances

8.1 Dimensions

Dimensions of pipes shall be as given in Table 3.

Table 3. Dimensions

Outside diameter mm	Thickness mm	Length m
25.4	1.2	4 or 6
31.8	1.2	
38.1	1.2	
50.8	1.5	
63.5	2.0	
76.3	2.0	
89.1	2.0	
101.6	2.0	
114.3	3.0	
139.8	3.0	
165.2	3.0	

8.2 Dimensional tolerances Dimensional tolerances of pipes shall be as follows.

(1) Tolerances on the outside diameter and thickness of pipes shall be as given in Table 4.

Table 4. Tolerances on outside diameter and thickness

Unit: mm

Outside diameter	Tolerance on outside diameter	Tolerance on Thickness
25.4	【 0.15	【10%
31.8	【 0.16	
38.1	【 0.19	
50.8	【 0.25	
63.5	【 0.25	

76.3	【 0.25	
89.1	+0.30 -0.40	
101.6	+0.35 -0.40	
114.3	+0.40 -0.60	
139.8	+0.40 -0.80	
165.2	+0.40 -1.20	

Remarks: The method for measurement of the outside diameter shall be based on the measurement of the circumference. In this case, the outside diameter shall be obtained by dividing the circumference by 3.1416. The difference between the value of outside diameter measured on a plane perpendicular to the pipe axis and the calculated outside diameter shall be within 1%.

(2) Tolerances on the length of pipes shall be within $^{+10}_{0}$mm.

9. Appearance

The appearance shall be as follows.

(1) Pipes shall be practically straight, and their both ends shall be at right angles to the pipes axes.

(2) Both the internal and external surfaces of pipes shall be well finished and free from defects detrimental to use.

10. Tests

10.1 Chemical analysis

10.1.1 Chemical analysis

General matters common to chemical analysis and sampling of the analysis sampling shall be in accordance with 3. of JIS G 0303.

10.1.2 Method of analysis The method of an analysis shall be in accordance with any one of the following standards.

JIS G 1211, JIS G 1212, JIS G 1213, JIS G 1214, JIS G1215, JIS G 1216

JIS G 1217, JIS G 1218, JIS G 1253, JIS G 1256, JIS G 1257

10.1.3 Number of product analytical samples

The number of product analytical samples shall be as greed upon between the purchaser and supplier.

10.2 Tensile test

10.2.1 Sampling of test specimen and number of test piece

For sampling of a test specimen and number of test pieces, one test pieces, one test specimen shall be sampled from each group of pipes having the same dimensions processed under the same heat treatment, and one test piece each for tensile test and reverse flattening test shall be sampled from the test specimen.

10.2.2 Test piece

No. 11 or No. 12B test piece of JIS Z 2201 shall be used, which shall be sampled from the pipe.

10.2.3 Test method

The tensile test method shall be in accordance with JIS Z 2241.

10.3 Reverse flattening test

10.3.1 Sampling of test specimen and number of test pieces

The sampling of a test specimen and number of test pieces shall be in accordance with 10.2.1.

10.3.2 Test piece A test piece of 100 mm in length shall be cut off from he end of the pipe.

10.3.3 Test method

Split the opposite side of the welded line of a test piece in the direction of the pipe axis, and examine whether any flaw, track, of other in furious defect is generated on the weld part when it is expanded into a flat plate.

10.4 Hydraulic or pneumatic test, of nondestructive examination

10.4.1 Number of test specimens

Carry out one of the hydraulic of pneumatic test, of nondestructive examination for each pipe.

10.4.2 Hydraulic or pneumatic test, of nondestructive examination

When hydraulic or pneumatic pressure is applied to a pipe and kept at the specified pressure for 5 sec of longer, examine whether it withstands that and whether any leakage is generated of not.

10.4.3 Nondestructive examination

The nondestructive examination shall be in accordance with JIS G 0582 or JIS G 0583.

11. Inspection

11.1 Inspection

The Inspection shall be as follows.

(1) General matters common to the inspection shall be in accordance with JIS G 0303.

(2) The chemical composition shall conform to the requirements specified in 4.

(3) The mechanical properties shall conform to the requirements specified in 5.

(4) The hydraulic or pneumatic test characteristic, of nondestructive examination characteristic shall conform to the requirements specified in 6. However, an appropriate nondestructive examination other than those given in 10.4.3 may be substituted for the hydraulic or pneumatic test as agreed upon between the purchaser and supplier.

(5) The surface finish shall conform to the requirements specified in 7.

(6) The dimensions shall conform to the requirements specified in 8.

(7) The appearance shall conform to the requirements specified in 9.

(8) When special quality requirements specified in Annex 1 are designated under the agreement between the purchaser and supplier, the inspected results shall conform the requirements specified in Z6.

11.2 Reinspection

Retest for pipes may be carried out to determine its final acceptance in accordance with 4.4 JIS G 0303.

12. Making

Pipes having passed the inspection shall be marked with the following items on each package or bundle.

The order of markings are not specified. A part thereof may be omitted as approved by the purchaser.

(1) Symbol of glade

(3) Dimensions (1)

(4) Manufacturer's name or abbreviation

(5) Symbol z indicating the designation of special quality requirements

Note ([1]) The dimensions shall be expressed as follows.

Outside diameter】 thickness

13. Report

The manufacturer shall generally submit to the purchaser a detailed report describing the test results, method of manufacture, ordered dimensions, quantity, working number with which the manufacturing process can be traced, and the like.

JIS Number and Corresponding Foreign Standards

JIS			ASTM			BS			DIN			NF			ISO			Index Number
Standard Number	Grade	Type	Standard Number	Grade	Type	Standard Number	Grade	Type	Standard Number	Grade	Type	Standard Number	Grade	Type	Standard Number	Grade	Type	
G3447	SUS		A270	TP304	SUS	1864	Gr.1	SUS				A49-249	TSZ6CN 18.09	SUS				C015
	304TBS	SUS																
	SUS		A270	TP304L	SUS							A49-249	TSZ2CN 18.10	SUS				
	30004LTBS	SUS																
	SUS		A270	TP316	SUS	1864	Gr.5	SUS				A49-248	TSZ2CND 17.11	SUS				
	316TBS	SUS				"	Gr.6	SUS										

	SUS		A270	TP316L	SUS							A49-249	TSZ2CND 17.12	SUS				
	316LTBS	SUS																

Annex 1. Special quality requirements

These special quality requirements shall be applied when requested by the purchaser and be executed on the designated items by the manufacturer.

Z.6 Corrosion test The corrosion test shall be as follows.

Z6.1 Corrosion resistance

The corrosion resistance of pipes in the intergranular corrosion test shall be as follows, In this case, the kind of the test to be performed shall be determined as agreed upon between the purchaser and supplier.

(1) Evaluation by the etched structures obtained in the 10% oxalic acid etch test shall be made as specified in Annex 1Table 1.

Annex 1 Table 1. Evaluation by 10 % oxalic acid etch test

Symbol of grade	Condition	Structure for ferric sulfate-sulfuric acid test	Structure for 65% nitric acid test	Structure for nitric -hydro- fluoric acid test	Structure for copper sulfate-sulfuric acid test
SUS 304TBS	As delivered (solution treatment)	Ditch structure	Ditch structure End grain pitting II	-	Ditch structure
SUS 316TBS			-	Ditch structure	
SUS 304LTBS	Sensitization		Ditch structure End grain Pitting II	-	
SUS 316LTBS			-	Ditch structure	

(2) Corrosion rate by ferric sulfate-sulfuric acid test shall be as given in Annex 1 Table 2.

Annex 1 Table 2. Corrosion rate by ferric sulfate-sulfuric acid test

Symbol of glade	Condition	Corrosion rate g/m^2h
SUS 304 TBS	As delivered (solution treatment)	As agreed upon between the purchaser and supplier
SUS 316 TBS		
SUS 304 LTBS	Sensitization	
SUS 316 LTBS		

(3) Corrosion rate by 65% nitric acid test shall be as given in Annex 1 Table 3.

Annex 1 Table 3. Corrosion rate by 65 % nitric acid test

Symbol of grade	Condition	Corrosion rate g/m^{2}h
SUS 304 TBS	As delivered (solution treatment)	As agreed upon between the purchaser and supplier
SUS 304 LTBS	Sensitization	

(4) The corrosion rate ratio of SUS316TBS and SUS316LTBS pipes in the nitric-hydrofluoric acid test shall be at most 1.5.

(5) Condition of the bent surface in the copper sulfate-sulfuric acid test shall be as given in Annex 1 Table 4.

Annex 1 Table 4. Conditions of bent surface by copper sulfate-sulfuric acid test

Symbol of grade	Condition	Condition of bent surface
SUS 304 TBS	As delivered (solution treatment)	To be free from cracks due to intergranular corrosion
SUS 316 TBS		
SUS 304 LTBS	Sensitization	
SUS 316 LTBS		

Z6.2 A test piece of a suitable length shall be cut from one end of the pipe.

Z6.3 The test method shall be in accordance with may any one of the following standards.

JIS G 0571, JIS G 0572, JIS G 0573, JIS G 0574, JIS G 0575

Z6.4 The test shall conform to the requirements specified in (1).

Z6.5 Sampling of a test specimen and number of test pieces shall be in accordance with the case of the tensile test specified in 10.2.1 in the main text.

Annex 2. Stainless steel pipes for the food industry

Preface

This Annex2 was based on ISO 2037(Stainless steel tubes for food industry) which corresponds on this Standard G 3447, without remarkable modifications of the technical contents and rules for the drafting and presentation of the standard.

However, Informative references 1 and 2 contained in this Annex 2 are not given in the ISO 2037.

1. Scope

This Annex 2 specifies the dimensions, tolerances, surface roughness, materials and hygienic requirements for seamless of welded stainless steel pipes in straight lengths for the food industry.

2. Cited International

The following standard contain provisions which, through reference in this Annex 2, constitute provisions of this Annex 2, At the time of publication, the editions indicated were

valid. All standards are subject to revision, and parties to agreements based on this International standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ISO 468: 1982 Surface roughness - Parameters, their values and general rules for specifying requirements

ISO 5252: 1991 Steel tubes - Tolerance systems

3. Dimensions

The dimensions given in Annex 2Table 1 have been extracted from the outside diameters of series 1 and 2 in ISO 1127 : 1992 For further information concerning the series, see ISO 4200.

4. Dimensions tolerances

Tolerances on outside diameter and thickness shall be as given in 4.1 and 4.2.

4.1 Tolerance on outside diameter

The tolerance on outside diameters less than of equal to 101.6mm shall be class D4 in accordance with ISO 5252: 1991.

For outside diameters grater than 101.6 mm, this tolerance shall be class D3 in accordance with ISO 5252: 1991.

4.2 Tolerance on thickness

The Tolerance on thickness shall be class T3 in accordance with ISO 5252: 1991

Annex 2 Table 1

Unit: mm

Outside diameter mm	Thickness mm
12	1
12.7	
17.2	
21.3	
25	1.2 : 1.6
33.7	
38	
40	1.2 : 1.6
51	
63.5	1.6

70	1.6
76.1	
88.9	2
101.6	2
114.3	
139.7	
168.3	2.6
219.1	
27.3	
323.9	2.6
355.6	
406.4	3.2

5. Surface roughness

The surface roughness, in accordance with the specifications of ISO 468, shall be as follows.

5.1 Finely finished surface

1) ISO 1127: 1992 stainless steel tube -dimensions, tolerances and conventional masses per unit length.

2) ISO 2604-2: steel products for pressure purposes quality requirements -Part 2 : Wrought seamless tubes

3) ISO 2604-5: 1978 Steel product for pressure purposes Quality requirements- Longitudinally welded austenitic stainless steel tubes

4) ISO 4200: 1991 Plain end steel tubes, welded and seamless- General table of dimensions and masses per unit length