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JAPANESE INDUSTRIAL STANDARD

**Nickel Steel Plates for
Pressure Vessels for
Low Temperature Service**

JIS G 3127—1990

Translated and Published

by

Japanese Standards Association

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

JAPANESE INDUSTRIAL STANDARD

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Nickel Steel Plates for Pressure Vessels for
Low Temperature Service

G 3127-1990

1. Scope

This Japanese Industrial Standard specifies the hot-rolled nickel steel plates (hereinafter, referred to as the "steel plates") to be used for pressure vessels and equipments for low temperature service.

Remark: The units and numerical values given in { } in this Standard are based on the International System of Units (SI) and are appended for informative reference.

Further, the traditional units accompanied by numerical values in this Standard shall be converted to the SI units and numerical values on January 1, 1991.

2. Grades and Symbols

Steel plates shall be classified into seven categories, and their symbols shall be as given in Table 1-1 or Table 1-2.

Table 1-1. Symbols of Grades
(Applicable till the end of 1990)

Grade	Applicable thickness mm	Allowable lowest service temperature °C
SL2N26	6 or over up to and incl. 50	- 70
SL3N26	6 or over up to and incl. 50	-101
SL3N28	6 or over up to and incl. 50	-101
SL3N45	6 or over up to and incl. 50	-110
SL5N60	6 or over up to and incl. 50	-130
SL9N53	6 or over up to and incl. 50	-196
SL9N60	6 or over up to and incl. 50	-196

Applicable Standards: See page 17.

Table 1-2. Symbol of Grades
(Applicable on and after January 1, 1991)

Grade		Applicable thickness mm	Allowable lowest service temperature °C
SI units	(Informative reference) Traditional units		
SL2N255	SL2N26	6 or over up to and incl. 50	- 70
SL3N255	SL3N26	6 or over up to and incl. 50	-101
SL3N275	SL3N28	6 or over up to and incl. 50	-101
SL3N440	SL3N45	6 or over up to and incl. 50	-110
SL5N590	SL5N60	6 or over up to and incl. 50	-130
SL9N520	SL9N53	6 or over up to and incl. 50	-196
SL9N590	SL9N60	6 or over up to and incl. 50	-196

3. Chemical Composition

Steel plates shall be tested in accordance with 8.1 and their cast analysis values shall be as given in Table 2-1 or Table 2-2

Table 2-1. Chemical Composition
(Applicable till the end of 1990)

Unit: %

Grade	C	Si	Mn	P	S	Ni
SL2N26	0.17 max.	0.30 max.	0.70 max.	0.025 max.	0.025 max.	2.10 to 2.50
SL3N26	0.15 max.	0.30 max.	0.70 max.	0.025 max.	0.025 max.	3.25 to 3.75
SL3N28	0.17 max.	0.30 max.	0.70 max.	0.025 max.	0.025 max.	3.25 to 3.75
SL3N45	0.15 max.	0.30 max.	0.70 max.	0.025 max.	0.025 max.	3.25 to 3.75
SL5N60	0.13 max.	0.30 max.	1.50 max.	0.025 max.	0.025 max.	4.75 to 6.00
SL9N53	0.12 max.	0.30 max.	0.90 max.	0.025 max.	0.025 max.	8.50 to 9.50
SL9N60	0.12 max.	0.30 max.	0.90 max.	0.025 max.	0.025 max.	8.50 to 9.50

Remarks 1. Alloy elements other than those given in Table 2-1 may be added if necessary.

2. When the product analysis is carried out on request by the purchaser, the permissible deviation shall be as given in Table 3 of JIS G 0321.

Table 2-2. Chemical Composition
(Applicable on and after January 1, 1991)

Unit: %

Grade	C	Si	Mn	P	S	Ni
SL2N255	0.17 max.	0.30 max.	0.70 max.	0.025 max.	0.025 max.	2.10 to 2.50
SL3N255	0.15 max.	0.30 max.	0.70 max.	0.025 max.	0.025 max.	3.25 to 3.75
SL3N275	0.17 max.	0.30 max.	0.70 max.	0.025 max.	0.025 max.	3.25 to 3.75
SL3N440	0.15 max.	0.30 max.	0.70 max.	0.025 max.	0.025 max.	3.25 to 3.75
SL5N590	0.13 max.	0.30 max.	1.50 max.	0.025 max.	0.025 max.	4.75 to 6.00
SL9N520	0.12 max.	0.30 max.	0.90 max.	0.025 max.	0.025 max.	8.50 to 9.50
SL9N590	0.12 max.	0.30 max.	0.90 max.	0.025 max.	0.025 max.	8.50 to 9.50

Remarks 1. Alloy elements other than those given in Table 2-2 may be added if necessary.

2. When the product analysis is carried out on request by the purchaser, the permissible deviation shall be as given in Table 3 of JIS G 0321.

4. Mechanical Properties

4.1 Yield Point or Proof Stress, Tensile Strength, Elongation, and Bendability Steel plates shall be tested in accordance with 8.2, and their yield point or proof stress, tensile strength, elongation, and bendability shall comply with Table 3-1 or Table 3-2.

In the case of bend test, it shall be bent without crack on the outside of the bent portion.

However, the bend test may be omitted, unless otherwise specified by the purchaser.

Table 3-1. Yield Point or Proof Strength, Tensile Strength, Elongation, and Bendability
(Applicable till the end of 1990)

Grade	Yield point or proof stress kgf/mm ² {N/mm ² }	Tensile strength kgf/mm ² {N/mm ² }	Elongation			Bendability		
			Thickness mm	Test piece	%	Bending angle	Inside radius	Test piece
SL2N26	26 min. {255 min.}	46 to 60 {451 to 588}	6 or over up to and incl. 16 Over 16 Over 20	No. 5 No. 5 No. 4	24 min. 29 min. 24 min.	180°	Thickness x 0.5, for 25 mm max. thickness Thickness x 1.0, for over 25 mm thickness	No. 1, perpendicular to rolling direction
SL3N26	26 min. {255 min.}	46 to 60 {451 to 588}	6 or over up to and incl. 16 Over 16 Over 20	No. 5 No. 5 No. 4	24 min. 29 min. 24 min.	180°	Thickness x 0.5, for 25 mm max. thickness Thickness x 1.0, for over 25 mm thickness	No. 1, perpendicular to rolling direction
SL3N28	28 min. {275 min.}	49 to 63 {481 to 618}	6 or over up to and incl. 16 Over 16 Over 20	No. 5 No. 5 No. 4	22 min. 26 min. 22 min.	180°	Thickness x 1.0, for 25 mm max. thickness Thickness x 1.0, for over 25 mm thickness	No. 1, perpendicular to rolling direction
SL3N45	45 min. {441 min.}	55 to 70 {539 to 686}	6 or over up to and incl. 16 Over 16 Over 20	No. 5 No. 5 No. 4	21 min. 25 min. 21 min.	180°	Thickness x 1.0, for 25 mm max. thickness Thickness x 1.5, for over 25 mm thickness	No. 1, perpendicular to rolling direction
SL5N60	60 min. {588 min.}	70 to 85 {686 to 834}	6 or over up to and incl. 16 Over 16 Over 20	No. 5 No. 5 No. 4	21 min. 25 min. 21 min.	180°	Thickness x 1.0, for 19 mm max. thickness Thickness x 1.5, for over 19 mm thickness	No. 1, perpendicular to rolling direction
SL9N53	53 min. {520 min.}	70 to 85 {686 to 834}	6 or over up to and incl. 16 Over 16 Over 20	No. 5 No. 5 No. 4	21 min. 25 min. 21 min.	180°	Thickness x 1.0, for 19 mm max. thickness Thickness x 1.5, for over 19 mm thickness	No. 1, perpendicular to rolling direction
SL9N60	60 min. {588 min.}	70 to 85 {686 to 834}	6 or over up to and incl. 16 Over 16 Over 20	No. 5 No. 5 No. 4	21 min. 25 min. 21 min.	180°	Thickness x 1.0, for 19 mm max. thickness Thickness x 1.5, for over 19 mm thickness	No. 1, perpendicular to rolling direction

Remark: For the steel plate over 20 mm in thickness, the tensile test piece shall be either No. 5 or No. 4 test piece.

Table 3-2. Yield Point or Proof Stress, Tensile Strength,
Elongation and Bendability
(Applicable on and after January 1, 1991)

Grade	Yield point or proof stress N/mm ²	Tensile strength N/mm ²	Elongation			Bendability		
			Thickness mm	Test piece	%	Bending angle	Inside radius	Test piece
SL2N255	255 min.	450 to 590	6 or over up to and incl. 16	No. 5	24 min.	180°	Thickness x 0.5, for 25 mm max. thickness	No. 1, perpendi- cular to rolling direction
			Over 16	No. 5	29 min.		Thickness x 1.0, for over 25 mm thickness	
			Over 20	No. 4	24 min.			
SL3N255	255 min.	450 to 590	6 or over up to and incl. 16	No. 5	24 min.	180°	Thickness x 0.5, for 25 mm max. thickness	No. 1, perpendi- cular to rolling direction
			Over 16	No. 5	29 min.		Thickness x 1.0, for over 25 mm thickness	
			Over 20	No. 4	24 min.			
SL3N275	275 min.	480 to 620	6 or over up to and incl. 16	No. 5	22 min.	180°	Thickness x 1.0, for 25 mm max. thickness	No. 1, perpendi- cular to rolling direction
			Over 16	No. 5	26 min.		Thickness x 1.0, for over 25 mm thickness	
			Over 20	No. 4	22 min.			
SL3N440	440 min.	540 to 690	6 or over up to and incl. 16	No. 5	21 min.	180°	Thickness x 1.0, for 25 mm max. thickness	No. 1, perpendi- cular to rolling direction
			Over 16	No. 5	25 min.		Thickness x 1.5, for over 25 mm thickness	
			Over 20	No. 4	21 min.			
SL5N590	590 min.	690 to 830	6 or over up to and incl. 16	No. 5	21 min.	180°	Thickness x 1.0, for 19 mm max. thickness	No. 1, perpendi- cular to rolling direction
			Over 16	No. 5	25 min.		Thickness x 1.5, for over 19 mm thickness	
			Over 20	No. 4	21 min.			
SL9N520	520 min.	690 to 830	6 or over up to and incl. 16	No. 5	21 min.	180°	Thickness x 1.0, for 19 mm max. thickness	No. 1, perpendi- cular to rolling direction
			Over 16	No. 5	25 min.		Thickness x 1.5, for over 19 mm thickness	
			Over 20	No. 4	21 min.			
SL9N590	590 min.	690 to 830	6 or over up to and incl. 16	No. 5	21 min.	180°	Thickness x 1.0, for 19 mm max. thickness	No. 1, perpendi- cular to rolling direction
			Over 16	No. 5	25 min.		Thickness x 1.5, for over 19 mm thickness	
			Over 20	No. 4	21 min.			

Remark: For the steel plate over 20 mm in thickness, the tensile test piece shall be either No. 3 or No. 4 test piece.

4.2 Charpy Absorbed Energy Steel plates shall be tested in accordance with 8.2, and their Charpy absorbed energy shall comply with Table 4-1 or Table 4-2.

Table 4-1. Charpy Absorbed Energy
(Applicable till the end of 1990)

Unit: kgf·m{J}

Grade	Thickness mm Thickness x width of test piece mm Test temperature °C	Charpy absorbed energy						Test piece
		Average of tested values of three test pieces			Value on each test piece			
		6 or over to and excl. 8.5	8.5 or over to and excl. 11	11 or over	6 or over to and excl. 8.5	8.5 or over to and excl. 11	11 or over	
		10×5	10×7.5	10×10	10×5	10×7.5	10×10	
SL 2 N 26	−70	1.1 min. {10.8} min.	1.7 min. {16.7} min.	2.1 min. {20.6} min.	1.0 min. {9.8} min.	1.4 min. {13.7} min.	1.7 min. {16.7} min.	No. 4 . In rolling direction
SL 3 N 26	−101	1.1 min. {10.8} min.	1.7 min. {16.7} min.	2.1 min. {20.6} min.	1.0 min. {9.8} min.	1.4 min. {13.7} min.	1.7 min. {16.7} min.	
SL 3 N 28	−101	1.1 min. {10.8} min.	1.7 min. {16.7} min.	2.1 min. {20.6} min.	1.0 min. {9.8} min.	1.4 min. {13.7} min.	1.7 min. {16.7} min.	
SL 3 N 45	−110	1.4 min. {13.7} min.	2.2 min. {21.6} min.	2.8 min. {27.5} min.	1.1 min. {10.8} min.	1.7 min. {16.7} min.	2.1 min. {20.6} min.	
SL 5 N 60	−130	2.1 min. {20.6} min.	3.0 min. {29.4} min.	4.2 min. {41.2} min.	1.8 min. {17.7} min.	2.6 min. {25.5} min.	3.5 min. {34.3} min.	
SL 9 N 53	−196	1.8 min. {17.7} min.	2.6 min. {25.5} min.	3.5 min. {34.3} min.	1.4 min. {13.7} min.	2.2 min. {21.6} min.	2.8 min. {27.5} min.	
SL 9 N 60	−196	2.1 min. {20.6} min.	3.0 min. {29.4} min.	4.2 min. {41.2} min.	1.8 min. {17.7} min.	2.6 min. {25.5} min.	3.5 min. {34.3} min.	

Table 4-2. Charpy Absorbed Energy
(Applicable on and after January 1, 1991)

Unit: J

Grade	Thick- ness mm	Charpy absorbed energy						Test piece
	Thick- ness x width of test piece mm	Average of tested values of three test pieces			Value on each test piece			
		6 or over to and excl. 8.5	8.5 or over to and excl. 11	11 or over	6 or over to and excl. 8.5	8.5 or over to and excl. 11	11 or over	
		10x5	10x7.5	10x10	10x5	10x7.5	10x10	
SL2N255	- 70	11 min.	17 min.	21 min.	10 min.	14 min.	17 min.	No.4 In roll- ing direc- tion
SL3N255	-101	11 min.	17 min.	21 min.	10 min.	14 min.	17 min.	
SL3N275	-101	11 min.	17 min.	21 min.	10 min.	14 min.	17 min.	
SL3N440	-110	14 min.	22 min.	27 min.	11 min.	17 min.	21 min.	
SL5N590	-130	21 min.	29 min.	41 min.	18 min.	25 min.	34 min.	
SL9N520	-196	18 min.	25 min.	34 min.	14 min.	22 min.	27 min.	
SL9N590	-196	21 min.	29 min.	41 min.	18 min.	25 min.	34 min.	

5. Shape, Dimensions, Mass, and Tolerances

The shape, dimensions, mass and their tolerances for steel plates shall comply with JIS G 3193. However, they shall meet the following conditions:

- (1) The tolerances on length for steel plates and on width for cut edges steel plates shall be in accordance with tolerance A of JIS G 3193, unless otherwise specified.
- (2) The tolerances on the thickness for steel plates shall be as given in Table 5.

Table 5. Tolerances on Thickness

Unit: mm

Width Thickness	Under 1600	1600 or over to and excl. 2000	2000 or over to and excl. 2500	2500 or over to and excl. 3150	3150 or over to and excl. 4000	4000 or over to and excl. 5000
6.0 or over to and excl. 10.0	+0.95	+1.05	+1.25	+1.45	+1.65	+1.85
10.0 or over to and excl. 16.0	+0.95	+1.15	+1.35	+1.55	+1.75	+1.95
16.0 or over to and excl. 25.0	+1.15	+1.35	+1.55	+1.75	+2.15	+2.35
25.0 or over to and excl. 40.0	+1.35	+1.55	+1.75	+1.95	+2.35	+2.55
40.0 or over up to and incl. 50.0	+1.55	+1.75	+2.15	+2.35	+2.55	+2.75

Remarks 1. The minus side tolerance shall be 0.25 mm.

2. In the case of 5000 mm or over width, the tolerances on thickness shall be agreed between the purchaser and supplier.

(3) In order to calculate the mass of a steel plate, the sum of the nominal thickness and the numerical value given in Table 6 shall be used instead of the nominal thickness.

Table 6. Values to be Added for Calculation of Mass

Unit: mm

Width \ Thickness	Under 1600	1600 or over to and excl. 2000	2000 or over to and excl. 2500	2500 or over to and excl. 3150	3150 or over to and excl. 4000	4000 or over to and excl. 5000
6.0 or over to and excl. 10.0	0.35	0.40	0.50	0.60	0.70	0.80
10.0 or over to and excl. 16.0	0.35	0.45	0.55	0.65	0.75	0.85
16.0 or over to and excl. 25.0	0.45	0.55	0.65	0.75	0.95	1.05
25.0 or over to and excl. 40.0	0.55	0.65	0.75	0.85	1.05	1.15
40.0 or over up to and incl. 50.0	0.65	0.75	0.95	1.05	1.15	1.25

Remark: The values to be added for 5000 mm or over width shall be agreed between the purchaser and supplier.

6. Appearance

The appearance of steel plates shall comply with the requirements of 6. in JIS G 3193. However, the repair by welding shall be preliminarily agreed between the purchaser and supplier.

7. Heat Treatment and Symbols

7.1 Heat Treatment of Steel Plate The heat treatment of steel plates shall be as given in Table 7-1 or Table 7-2.

Table 7-1. Heat Treatment
(Applicable till the end of 1990)

Grade	Heat treatment	
SL2N26	Normalizing. However, tempering may be applied after normalizing, if necessary. The manufacturer may perform thermo-mechanical control process or suitable heat treatment by agreement between the purchaser and supplier.	However, intermediate heat treatment ⁽¹⁾ may be applied if necessary.
SL3N26		
SL3N28		
SL3N45	Quench hardening and tempering	
SL5N60	Quench hardening and tempering	However, intermediate heat treatment ⁽¹⁾ may be applied if necessary.
SL9N53	Normalizing twice followed by tempering	
SL9N60	Quench hardening and tempering	

Note (1) The intermediate heat treatment is an operation of cooling from a dual phase composed of austenite and ferrite intended for improving toughness which is carried out prior to tempering.

Remark: In the case where the purchaser performs heat treatment by agreement between the purchaser and supplier, the manufacturer may ship as-rolled steel plates applying heat treatment only for their test pieces.

Table 7-2. Heat Treatment
(Applicable on and after January 1, 1991)

Grade	Heat treatment	
SL2N255	Normalizing. However, tempering may be applied after normalizing, if necessary. The manufacturer may perform thermo-mechanical control process or suitable heat treatment by agreement between the purchaser and supplier.	However, intermediate heat treatment ⁽¹⁾ may be applied if necessary.
SL3N255		
SL3N275		
SL3N440	Quench hardening and tempering	
SL5N590	Quench hardening and tempering	
SL9N520	Normalizing twice followed by tempering	However, intermediate heat treatment ⁽¹⁾ may be applied if necessary.
SL9N590	Quench hardening and tempering	

Note (1) The intermediate heat treatment is an operation of cooling from a dual phase composed of austenite and ferrite intended for improving toughness which is carried out prior to tempering.

Remark: In the case where the purchaser performs heat treatment by agreement between the purchaser and supplier, the manufacturer may ship as-rolled steel plates applying heat treatment only for their test pieces.

7.2 Designation on Heat Treatment The designation on heat treatment shall be as follows:

- (1) The purchaser shall clearly specify the category of heat treatment of the steel plate to be applied by the manufacturer on the order sheet, and if necessary shall state the heat treatment conditions of the test piece and the number of times thereof.
- (2) In the case where the purchaser performs heat treatment of the steel plate in accordance with Remark of Table 7-1 or that of Table 7-2 Remark, this matter shall be specified on the order sheet in which clearly states the heat treatment conditions.

7.3 Heat Treatment of Test Piece Heat treatment of the test piece shall be applied to the specimen taken from a steel plate without further processing, and the test piece should be cut down out of the heat treated specimen.

7.3.1 In The Case Where Test Piece Is Taken from Steel Plate Heat Treated by The Manufacturer

- (1) In the case where the purchaser requires the manufacturer to apply such corresponding heat treatment as normalizing of the test piece and post weld heat treatment of the container, the manufacturer shall additionally apply such heat treatment for the specimen taken from the steel plate heat treated by the manufacturer.
- (2) In the case where heat treatment condition is not clearly specified by the purchaser, the manufacturer shall apply heat treatment for the specimen under conditions which is deemed as appropriate by the manufacturer. However, the manufacturer shall clearly state to the purchaser the heat treatment conditions applied for the specimen.

7.3.2 In The Case Where Test Piece Is Taken from As-Rolled Steel Plate Which Will Be Heat Treated by The Purchaser

- (1) In the case where the purchaser requires the manufacturer to apply such corresponding heat treatment as normalizing of the test piece, quench hardening and tempering thereof, and post weld heat treatment of the container, the manufacturer shall apply heat treatment for the specimen taken from the as-rolled steel plate conforming to the heat treatment conditions and number of times specified by the purchaser.
- (2) Whenever the purchaser does not clearly require the manufacturer to apply heat treatment of the test piece, the manufacturer shall take a specimen from the steel plate as rolled, and apply heat treatment for the specimen under conditions which is deemed as appropriate by the manufacturer. However, the manufacturer shall clearly state to the purchaser the heat treatment conditions applied for the specimen.

7.4 Symbols of Heat Treatment Symbols standing for the heat treatment of the steel plate and test piece to be entered in the order sheet shall be as follows:

- | | | |
|-----|---|-----|
| (1) | When normalizing is applied for the steel plate | N |
| (2) | When normalizing followed by tempering is applied for the steel plate | NT |
| (3) | When thermo-mechanical control process is applied for the steel plate | TMC |
| (4) | When normalizing is applied twice followed by tempering for the steel plate | NNT |
| (5) | When quench hardening and tempering are applied for the steel plate | Q |
| (6) | When normalizing is applied only for the test piece | TN |
| (7) | When heat treatment corresponding to post weld heat treatment is applied for the test piece | SR |

Example: 1-1 (Applicable till the end of 1990)

- | | | |
|-------------|---|--|
| SL2N26N | : | When normalizing is applied for the steel plate |
| SL3N28NT | : | When normalizing followed by tempering is applied for the steel plate |
| SL3N26TMC | : | When thermo-mechanical control process is applied for the steel plate |
| SL9N53NNT | : | When normalizing is applied twice followed by tempering for the steel plate |
| SL9N60Q | : | When quench hardening and tempering are applied for the steel plate |
| SL3N26NTNSR | : | When normalizing is applied for the steel plate, and further normalizing and heat treatment corresponding to post weld heat treatment are applied once only for the test piece |
| SL3N28N3SR | : | When normalizing is applied for the steel plate, and further heat treatment corresponding to post weld heat treatment is applied three times for the test piece. |
| SL3N26TNSR | : | When normalizing is not applied for the steel plate, and normalizing and heat treatment corresponding to post weld heat treatment are applied once only for the test piece. |

Example: 1-2 (Applicable on and after January 1, 1991)

- SL2N255N : When normalizing is applied for the steel plate
- SL3N275NT : When normalizing followed by tempering is applied for the steel plate
- SL3N255TMC : When thermo-mechanical control process is applied for the steel plate
- SL9N520NNT : When normalizing is applied twice followed by tempering for the steel plate
- SL9N590Q : When quench hardening and tempering are applied for the steel plate
- SL3N255NTNSR : When normalizing is applied for the steel plate, and further normalizing and heat treatment corresponding to post weld heat treatment are applied once only for the test piece.
- SL3N275N3SR : When normalizing is applied for the steel plate, and further heat treatment corresponding to post weld heat treatment is applied three times for the test piece.
- SL3N255TNSR : When normalizing is not applied for the steel plate, and normalizing and heat treatment corresponding to post weld heat treatment are applied once only for the test piece.

8. Tests

8.1 Chemical Analysis

8.1.1 General Requirements for Chemical Analysis and Sampling Method of Specimen for Analysis The chemical composition of the steel plate shall be determined by cast analysis, and general requirements for chemical analysis and sampling method of specimen for analysis shall be as specified in 3. of JIS G 0303.

8.1.2 Test Method The test method for chemical analysis shall conform to one of the following methods:

- JIS G 1211
- JIS G 1212
- JIS G 1213
- JIS G 1214
- JIS G 1215
- JIS G 1216
- JIS G 1253
- JIS G 1256
- JIS G 1257
- JIS G 1258

8.2 Mechanical Tests

8.2.1 Test in General General requirements for mechanical test shall be in accordance with the specification of 4. in JIS G 0303. With this respect, the sampling method of specimens shall conform to class A, and the number of test pieces and the sampling position shall be as follows:

(1) **Number of Test Pieces for Tensile Test and Bend Test** Each one test piece shall be taken from one of the as-rolled steel plates made from one slab or directly made from one ingot which will be applied the same heat treatment conditions. Each test piece shall be taken transversely to the rolling direction.

(2) **Number of Test Pieces for Impact Test** Each one specimen shall be taken from one of the as-rolled steel plates made from one slab or directly made from one ingot which will be applied the same heat treatment conditions.

Three test pieces shall be taken from each one specimen parallel to the rolling direction unless otherwise specified.

(3) **Sampling Position of Test Pieces for Tensile Test and Bend Test** The center of a test piece shall be at a quarter-width from a side edge, and in the case of No. 4 test piece for tensile test, it shall be at a quarter-width from an edge as well as at a quarter-thickness from a surface. However, when it is infeasible to allow the center of a test piece to be at a quarter-width from a side edge, or at a quarter-thickness, the sampling shall be made as close to the specified position as possible.

(4) **Sampling Position of Test Piece for Impact Test** The center of a test piece shall be at a quarter-thickness from a surface as well as at a quarter-width from a side edge. However, when it is infeasible to secure this position, the sampling shall be made as close to the specified position as possible.

8.2.2 Test Pieces The test pieces for tensile test, bend test, and impact test shall be as follows:

(1) No. 4 or 5 test piece specified in JIS Z 2201

(2) No. 1 test piece specified in JIS Z 2204

(3) No. 4 test piece or subsize test piece (2 mm V notch) specified in JIS Z 2202. However, the longitudinal direction of the base of the notch of a test piece shall be perpendicular to the rolled surface.

8.2.3 Test Methods The test methods for tensile test, bend test, and impact test shall be as follows:

(1) JIS Z 2241

(2) JIS Z 2248

(3) Charpy impact test method specified in JIS Z 2242

9. Inspection

9.1 Inspection The inspection shall be as follows:

- (1) General requirements for the inspection shall conform to JIS G 0303.
- (2) The chemical composition shall conform to the requirements of 3.
- (3) The mechanical properties shall conform to the requirements of 4.
- (4) The shape, dimensions, and mass shall conform to the requirements of 5.
- (5) The appearance shall conform to the requirements of 6.
- (6) The purchaser may designate an ultrasonic examination specifies in JIS G 0801 and the like in addition to the inspections of (1) to (5). In case, the test method, the criteria for acceptance and rejection, etc. shall be preliminarily agreed between the purchaser and supplier.

9.2 Reinspection The reinspection shall be as follows:

- (1) The steel plate having failed to meet the requirements of tensile and bend tests may be subjected to a retest for find acceptance in accordance with 4.4 in JIS G 0303.
- (2) In the case where the average value of the three test results is 85 % or over the specified value as well as two or more individual test results conform to requirements specified in Table 4-1 or Table 4-2, steel plates having failed to meet the requirements of impact test may be subjected to a retest. With this respect, three additional test pieces shall be taken from the vicinity where the original test pieces have been taken for acceptance inspection.

In this case, when the average of tested values of six test pieces and three individual test results of retesting conform to the requirements specified in Table 4-1 or Table 4-2, all as-rolled steel plates made from one slab or directly made from one ingot having been heat treated under the same condition shall be accepted.

- (3) Steel plates having failed to meet the requirements may be subjected to a reappraisal test for final acceptance after carrying out heat treatment or reheat treatment.

10. Marking

Steel plates which have passed the inspection shall be marked on each steel plate with the following details by suitable means. However, a part of them may be omitted by agreement between the purchaser and supplier.

- (1) Symbol of grade (including 7.4 symbols of heat treatment)
- (2) Heat number or inspection number
- (3) Dimensions
- (4) Manufacturer's name or its identifying brand

11. Report

The report shall comply with the requirements of 8. in JIS G 0303.

Further, in the case where Remark 1 of Table 2-1 or Table 2-2 is applied, the contents of additional elements shall be appended to the test results.

Applicable Standards:

- JIS G 0303-General Rules for Inspection of Steel
- JIS G 0321-Product Analysis and its Tolerance for Wrought Steel
- JIS G 0801-Ultrasonic Examination of Steel Plates for Pressure Vessels
- 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 1253-Method for Photoelectric Emission Spectrochemical Analysis of Iron and Steel
- JIS G 1256-Method for X-Ray Fluorescence Spectrometric Analysis of Iron and Steel
- JIS G 1257-Methods for Atomic Absorption Spectrochemical Analysis of Iron and Steel
- JIS G 1258-Methods for Inductively Coupled Plasma Emission Spectrochemical Analysis of Steel
- JIS G 3193-Dimensions, Mass and Permissible Variations of Hot Rolled Steel Plates, Sheets and Strip
- JIS Z 2201-Test Pieces for Tensile Test for Metallic Materials
- JIS Z 2202-Test Pieces for Impact Test for Metallic Materials
- JIS Z 2204-Bend Test Pieces for Metallic Materials
- JIS Z 2241-Method of Tensile Test for Metallic Materials
- JIS Z 2242-Method of Impact Test for Metallic Materials
- JIS Z 2248-Method of Bend Test for Metallic Materials

