Unofficial Translation

In the event of any doubt or misunderstanding arising from this translation, the standard in Thai will be held to be authoritative

TIS 2011-2543(2000)
Thai Industrial Standard
for
Hot-Rolled Atmospheric Corrosion Resisting Steel Coil, Strip, Plate And Sheet

1. Scope

1.1 This standard prescribes categories, types of edge, grades, basic mass, dimensions and tolerances, chemical composition, requirements, marking and labelling, sampling and criteria for conformity and testing for hot-rolled atmospheric corrosion resisting steel coil, strip, plate and sheet.

1.2 This standard covers hot-rolled atmospheric corrosion resisting steel coil, strip, plate and sheet e.g. container, other structures which are subject to withstand the corrosion in the atmosphere.

1.3 This standard does not cover:

1.3.1 hot-rolled atmospheric corrosion resisting steel coil, strip, plate and sheet for other purposes which have already specified.

1.3.2 hot-rolled atmospheric corrosion resisting steel coil, strip, plate and sheet are followed by cold rolling.

2. Definitions

For the purpose of this standard, the following definitions apply:

2.1 HOT-ROLLED ATMOSPHERIC CORROSION RESISTING STEEL COIL, STRIP, PLATE AND SHEET: hereinafter referred to as “STEEL SHEET”: Steel which having chemical composition as given in Table 8 or 9 and their mechanical properties shall be as given in Table 10 and 13 and obtained by hot rolling.

2.2 HOT-ROLLED ATMOSPHERIC CORROSION RESISTING STEEL COIL, STRIP, PLATE AND SHEET which is followed by cold rolling: Hot-rolled atmospheric corrosion resisting steel coil, strip, plate and sheet which are followed by cold rolling without temperature rise and such operation does not cover to skin pass or temper rolling.

2.3 SKIN PASS: Cold rolling of hot-rolled steel sheet, the purposes of skin passing is one or more of the following: to control shape, hardness, flatness, surface finish and to temporarily minimize the appearance of stretcher strains or coil breaks.

2.4 MILL EDGE: Normal side edge without any definite contour produced in hot-rolling possibly containing some irregularities such as cracked or torn edges or thin edges.

2.5 CUT EDGE: Normal side edge obtained by cutting after hot rolling.

2.6 NORMAL CUT EDGE: Normal edge obtained by cutting in first time to the required sheet width and thickness.

2.7 RESHEARED OR FINE CUT EDGE: Normal side edge obtained by reshearing.

2.8 SLITTED EDGE: Normal edge obtained by slitting to the required sizes as agreed upon.

3. Categories, Types of edge, Grade and symbols

3.1 Steel sheet classifies into 4 categories i.e.

3.1.1 Steel coil: Steel in coil form produced in width of 600 mm and wider and in thickness of not exceed 16.00 mm and thicker.

3.1.2 Steel strip: Steel in long strip and produced in coils form and in width of not less than 600 mm and wider and in thickness of not exceed 16.00 mm in thicker.

3.1.3 Steel plate: Steel produced in the range of thickness 3.15 mm to 16.00 mm, and their width are subject to agreement between the manufacturer and purchaser at the time of ordering.

3.1.4 Steel sheet: Steel produced in thickness less than 3.15 mm and their width are subject to agreement between the manufacturer and purchaser at the time of ordering.

3.2 Steel sheet classifies by type of edges into 2 types i.e.

3.2.1 Mill edge

3.2.2 Cut edge

3.3 Steel sheet in this standard are of one grade denoted by the symbol SPA-H.

4. Basic mass, sizes and tolerances

4.1 Basic mass of steel sheet shall be 7.85 kg per mm thickness per m² area and given for the recommendation.

4.2 Dimensions and tolerances

4.2.1 Dimensions
shall be in accordance with Table 1

4.2.2 Tolerances

4.2.2.1 Thickness shall be as given in Table 2

4.2.2.2 Width shall be as given in Table 3

4.2.2.3 Length shall be as given in Table 4

Compliance is checked by the test of clause 9.1.

4.3 Camber tolerances

4.2.1 Cut edge steel coil and steel strip
shall not exceed the values given in Table 5.

4.2.2 Cut edge steel plate and sheet
shall not exceed the values given in Table 6.

Compliance is checked by the test of clause 9.2.

4.4 Out-of-square for cut edge steel plate and sheet
When tested ad directed in clause 9.3, out-of -square tolerances shall not exceed 1% of width.

4.5 Flatness for cut edge steel plate and sheet
With the sheet lying under its own weight on the flat surface, the flatness tolerances shall not exceed the values given in Table 7.
Compliance is checked by the test of clause 9.4.

Table 1 Dimensions for steel sheet
(clause 4.2.1)

Units in millimetres

Dimension	Steel coil	Steel strip	Steel plate	Steel sheet
Thickness	Not exceed 6.00	Not exceed 6.00	3.15 to 16.00	Less than 3.15
Width	600 or over	Less than 600	shall be agreed between the manufacturer and purchaser	shall be agreed between the manufacturer and purchaser
Length	Not stated	Not stated	shall be agreed between the manufacturer and purchaser	shall be agreed between the manufacturer and purchaser

Note. Inside and outside diameter of roll for steel coil and strip are subjected to agreement between the manufacturer and purchaser.

Table 2 Thickness tolerances for steel sheet
(clause 4.2.2.1)

Units in millimetres

Thickness	Thickness tolerances				
	Less than 1600 in width	1600 to less than 2000 in width	2000 to less than 2500 in width	2500 to less than 3150 in width	3150 to 4000 in width
Less than 1.25	+ 0.16	-	-	-	-
1.25 to less than 1.60	+ 0.18	-	-	-	-
1.60 to less than 2.00	+ 0.19	+ 0.23	-	-	-
2.0 to less than 2.50	+ 0.20	+ 0.25	-	-	-
2.50 to less than 3.15	+ 0.22	+ 0.29	+ 0.29	-	-
3.15 to less than 4.00	+ 0.24	+ 0.34	+ 0.34	-	-
4.00 to less than 5.00	+ 0.45	+ 0.55	+ 0.55	+ 0.65	-
5.00 to less than 6.30	+ 0.50	+ 0.60	+ 0.60	+ 0.75	+ 0.75
6.30 to 16.00	+ 0.55	+ 0.65	+ 0.65	+ 0.80	+ 0.80

Table 3 Width tolerances
(clause 4.2.2.2)

Units in millimetres

Width	Thickness	Tolerances				
		Mill edge		Cut edge		
		Steel plate and sheet	Steel coil and steel sheet manufactured therefrom	Normal cut	Resheared	Slitted
Less than 160	Less than 3.15	-	-	+ 5 0	+ 2 0	± 0.3
	3.15 to less than 6.00			+ 5 0	+ 3 0	± 0.5
	6.00 to 16.00			+ 10 0	+ 4 0	-
160 to less than 250	Less than 3.15	-	-	+ 5 0	+ 2 0	± 0.4
	3.15 to less than 6.00			+ 5 0	+ 3 0	± 0.5
	6.00 to 16.00			+ 10 0	+ 4 0	-
250 to less than 400	Less than 3.15	+ Not stated 0	-	+ 5 0	+ 2 0	± 0.5
	3.15 to less than 6.00			+ 5 0	+ 3 0	± 0.5
	6.00 to 16.00			+ 10 0	+ 4 0	-
400 to less than 630	Less than 3.15	+ Not stated 0	+ 20 0	+ 10 0	+ 3 0	± 0.5
	3.15 to less than 6.00			+ 10 0	+ 3 0	± 0.5
	6.00 to 16.00			+ 10 0	+ 5 0	-
630 to less than 1000	Less than 3.15	+ Not stated 0	+ 25 0	+ 10 0	+ 4 0	-
	3.15 to less than 6.00			+ 10 0	+ 4 0	
	6.00 to 16.00			+ 10 0	+ 4 0	
1000 to less than 1250	Less than 3.15	+ Not stated 0	+ 30 0	+ 10 0	+ 4 0	-
	3.15 to less than 6.00			+ 10 0	+ 4 0	
	6.00 to 16.00			+ 15 0	+ 6 0	

Table 3 Width tolerances (Continued)

Width	Thickness	Tolerances				
		Mill edge		Cut edge		
		Steel plate and sheet	Steel coil and steel sheet manufactured therefrom	Normal cut	Resheared	Slitted
1250 to less than 1600	Less than 3.15	+ Not stated 0	+ 35 0	+ 10 0	+ 4 0	-
	3.15 to less than 6.00			+ 10 0	+ 4 0	
	6.00 to 16.00			+ 15 0	+ 4 0	
1600 or Over	Less than 3.15	+ Not stated 0	+ 40 0	+ 10 0	+ 4 0	-
	3.15 to less than 6.00			+ 10 0	+ 4 0	
	6.00 to 16.00			+ 1.2% 0	+ 6 0	

Table 4 Length tolerances
(clause 4.2.2.3)

Units in millimetres

Length	Thickness	Normal cutting	Reshearing or fine cutting
Less than 6300	Less than 6.00	+ 25 0	+ 5 0
	6.00 to 16.00	+ 25 0	+ 10 0
6300 or Over	Less than 6.00	+ 0.5% 0	+ 10 0
	6.00 to 16.00	+ 0.5% 0	+ 15 0

Note: Reshearing tolerances does not apply to that of 20 mm or over in width.

Table 5 Camber tolerances for cut edge steel coil and steel strip
(clause 4.3.1)

Units in millimetres

Width	Camber tolerances in any 2000 length
Less than 250	8
250 or Over	5

Table 6 Camber tolerances for cut edge steel plate and sheet
(clause 4.3.2)

Units in millimetres

Length	Camber tolerances		
	250 to less than 630 in width	630 to less than 1000 in width	1000 or Over in width
Less than 2500	5	4	3
2500 to less than 4000	8	6	5
4000 to less than 6300	12	10	8
6300 to less than 10000	20	16	12
10000 or Over	20 in any 10000 length	16 in any 10000 length	12 in any 10000 length

Note: For cut edge steel plate and sheet having less than 250 mm in width, the camber tolerances given in Table 5 shall be applied.

Table 7 Flatness tolerances for cut edge steel plate and sheet
(clause 4.5)

Units in millimetres

Thickness	Flatness tolerances				
	Less than 1250 in width	1250 to less than 1600 in width	1600 to less than 2000 in width	2000 to less than 3000 in width	3000 or Over in width
Less than 1.60	18	20	-	-	-
1.60 to less than 3.15	1	18	20	-	-
3.15 to less than 4.00	16	16	16	-	-
4.00 to less than 6.00	14	14	14	24	25
6.00 to less than 10.00	13	13	13	21	22
10.00 to 16.00	12	12	12	16	17

Note : These tolerances are only applicable to sheet up to and including 2000 mm in length. As for the cut edge steel plate and sheet less than 2000 mm in length, the full length shall be used.

5. Chemical composition

5.1 Chemical composition

The chemical composition (cast analysis) shall not exceed the values given in Table 8. Chemical composition (product analysis) shall be in accordance with Table 9, the value which is higher than the maximum or lower than minimum value in Table 8 shall take into the consideration.

Testing shall be made by general chemical analysis or other equivalent method.

Table 8 Chemical composition (Cast analysis)
(clause 5.1)

Grade	Chemical composition %							
	C Max.	Si	Mn	P	S Max.	Cu	Cr	Ni max.
SPA-H	0.12	0.25 to 0.75	0.20 to 0.50	0.070 to 0.150	0.040	0.25 to 0.60	0.30 to 1.25	0.65

Table 9 Chemical composition tolerances (Product analysis)
(clause 5.1)

Composition	Tolerances Min	Tolerances Max
Carbon	-	+ 0.03
Silicon	- 0.02	+ 0.05
Manganese	-0.03	+ 0.03
Phosphorous	- 0.005	+ 0.005
Sulphur	-	+ 0.005
Copper	- 0.03	+ 0.03
Chromium	- 0.03	+ 0.05
Nickel	-	+ 0.03

6. Requirements

6.1 General requirements

6.1.1 The surface of steel sheet shall be flat, smooth and shall be free from such defects as oxide rolled in scale and any lamination that are detrimental to practical use.

Compliance is checked by visual inspection or other equivalent method.

6.2 Mechanical properties

6.2.1 Tensile strength and elongation

shall be as given in Table 10.

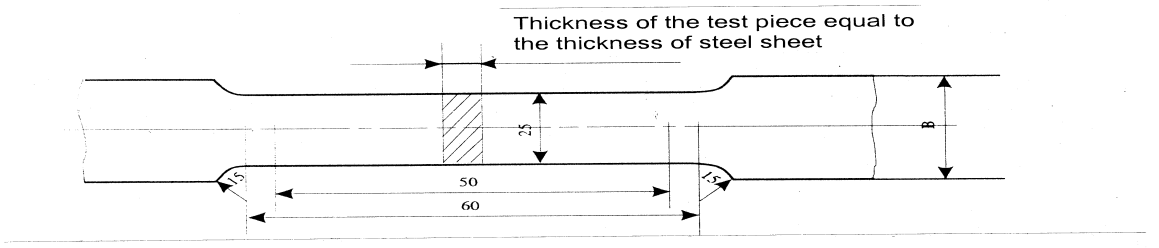
The test method shall be carried out in accordance with JIS Z 2241. As to a test piece specified in JIS 2201 shall be applied. (See Figure 1 and 2)

6.2.2 Bending

When tested as directed in clause 9.5, the test piece shall withstand and being bent without cracking on the outside surface of the bent portion.

Table 10 Tensile strength and elongation
(clause 6.2.1)

Grade	Thickness mm	Yield strength Min Mpa	Tensile strength Min Mpa	Test piece No.	Elongation Min %
SPA - H	Not more than 6.00	345	480	5	22
	More than 6.00	355	490	1A	15



Note: In case of test piece exceed 3 mm thick, the transition curves with a radius shall be equal to 20-30 mm, and the width of the parallel length shall be equal to 30 mm or over.

Figure 1 : Test piece for tensile strength and elongation, No.5 Test piece
(clause 6.2.1)

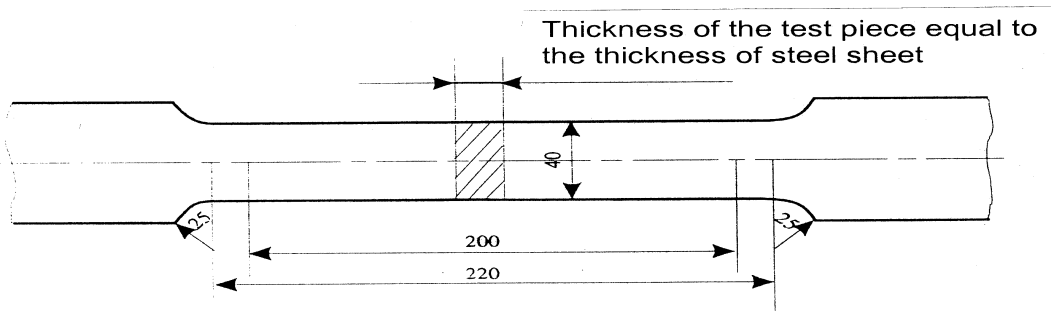


Figure 2 : Test piece for tensile strength and elongation, No.1A Test piece
(clause 6.2.1)

7. Marking and labelling

7.1 Each coil of steel coil and strip and each bundle of steel sheet shall bear at least number, letter or mark indicating legibly and clearly the following information:
(1) Types, the types of edge and grade;
(2) Thickness x width x length expressed in mm x mm x mm (in case of steel coil or strip the length shall not be required)
(3) Mass expressed in kg;
(4) Melting number or the lot number;
(5) Name of a manufacturer, factory or a registered trade-mark ;
(6) Country of manufacture
In case foreign language is used, the meaning shall correspond to that in Thai specified above.

8. Sampling and criteria for conformity

8.1 Lot : Steel sheet of the same type, types of edge, grade and dimension made by the same process which are manufactured, delivered or purchased at the same time.
8.2 Sampling and acceptance shall comply with the sampling plan below or other technically equivalent plan.
8.2.1 Sampling and acceptance for testing on dimension, camber tolerances and general requirements for steel coil and strip
8.2.1.1 Samples shall be taken at random from the same lot as specified in Table 11.
8.2.1.2 Provided that all samples failing to comply with each of the requirements of clauses 4.2, 4.3 and 6.1 does not exceed the acceptance number specified in Table 11, that lot shall be deemed as conforming to the requirements.

Table 11 Sampling plan for testing on dimension, camber tolerances and general requirements for steel coil and strip
(clause 8.2.1)

Lot size coil	Sample size coil	Acceptance number
Not exceed 50	3	0
51 or Over	13	1

Note: Sample of 2 m in length shall each cut from either end of a coil, and shall be approximately 500 mm long.

8.2.2 Sampling and acceptance for testing on dimension, camber tolerances, out-of-square, flatness and general requirements for steel plate and sheet.
8.2.2.1 Samples shall be taken at random from the same lot as specified in Table 12.
8.2.2.2 Provided that all samples failing to comply with each of the requirements of clauses 4.2, 4.3, 4.4, 4.5 and 6.1 does not exceed the acceptance number specified in Table 12, that lot shall be deemed as conforming to the requirements.

Table 12 Sampling plan for testing on dimension, camber tolerances, out-of-square , flatness and general requirements for steel plate and sheet
(clause 8.2.2)

Lot size coil	Sample size coil	Acceptance number
Not exceed 100 101 or Over	3 13	0 1

8.2.3 Sampling and acceptance for testing on chemical composition

8.2.3.1 Three samples complying with clause 8.2.1.2 or 8.2.2.2 shall be taken at random.

8.2.3.2 Provided that all samples meet the requirements of clause 5.1, that lot of steel sheet shall be deemed as conforming to the requirements.

8.2.4 Sampling and acceptance for testing on mechanical properties

8.2.4.1 Three samples shall be taken at random from the same lot with a mass not exceed 1000 t. When the mass of steel sheet exceed 1000 t, take two sets of samples from the lot, and shall each be of adequate size for making the test piece, for testing on tensile strength, elongation and bending.

8.2.4.2 Provided that all samples meet the requirements of clause 6.2, that lot of steel sheet shall be deemed as conforming to the requirements.

8.3 Criteria for conformity

Provided that the samples of steel sheet meet the requirements of clause 8.2.1.2, 8.2.2.2, 8.2.3.2 and 8.2.4.2, that lot shall be deemed to comply with this standard.

9. Testing

9.1 Dimensions

9.1.1 Thickness

9.1.1.1 Apparatus

A measuring device with accuracy to 0.005 mm.

9.1.1.2 Measurement

(1) Steel coil and strip

In case of mill edge, the thickness shall be measured not less than 25 mm at least three points from the both side edges.

As for cut edge steel coil and strip 30 mm or over in width, measurements shall be made at least three points of each edge not less than 15 mm from the both side edges, and on the centre line at least three points for those less than 30 mm in width.

(2) Steel plate and sheet

In case of mill edge, the thickness shall be measured not less than 25 mm at least three points from all side edges.

In case of cut edge, the thickness shall be measured not less than 15 mm at least three points from all side edges.

9.1.1.3 Report

The average value shall be reported.

9.1.2 Width

9.1.2.1 Measurement of the width of steel plate and sheet shall be made by means of a measuring device having an accuracy of 0.5 mm, at the position approximately 100 mm from the both ends, and 1000 mm for steel coil and strip.

The average width value shall be reported.

9.1.2.2 Measurement of the width of slitted edge steel sheet shall be made by means of a measuring device having an accuracy of 0.5 mm.

9.1.3 Length of steel plate and sheet

Length shall be measured at any point on steel plate and sheet approximately 100 mm from the both side edges.

9.2 Camber tolerances

9.2.1 Cut edge steel coil and steel strip

Place the sample on a flat surface, maximum deviation of camber (a) shall be made by means of a measuring device having an accuracy of 0.5 mm, by having the cord length 2000 mm, the measurement being taken as shown in Figure 3.

9.2.2 Cut edge steel plate and sheet

The test shall be carried out same as clause 9.2.1, by having the cord length equal to 10000 mm.

For the tolerances on camber of the cut edge steel plate and sheet less than 10000 mm in length, the full length shall be used.

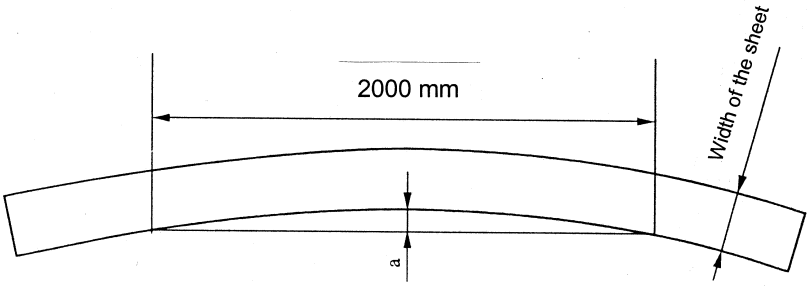


Figure 3 Measurement of camber tolerances
(clause 9.2.1)

9.3 Out-of-square of cut edge steel plate and sheet

The greatest deviation (A) of an end edge shall be measured from a straight line at right angle to a side and touching one corner, the measurement being taken as shown in Figure 4.

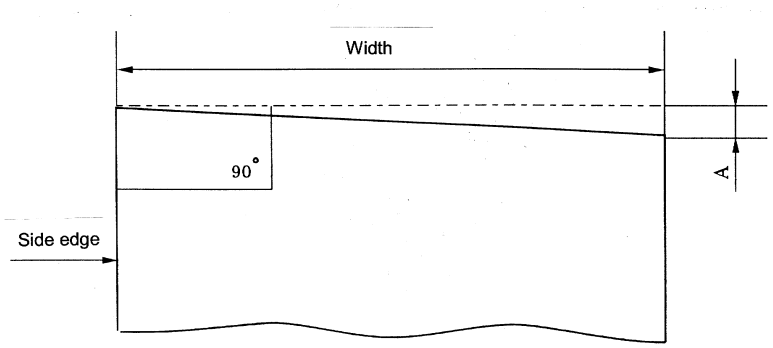


Figure 4 Measurement of out-of-square
(clause 9.3)

9.4 Flatness tolerances

Place the sample under the its own mass on the flat surface, the maximum distance between the lower surface of the sheet and the flat horizontal surface is the maximum deviation from flatness which shall be measured at the any positions, by means of a measuring device having an accuracy of 0.5 mm, the maximum deviation are read accuracy to 0.5 mm.

9.5 Bending

Test piece No.1 shall be prepared as shown in Figure 5. The axes of two legs of the test piece remain in a plane perpendicular to the axis of bending. Its shall withstand being bent through 180°, and the legs of test piece are parallel to each other, the diameter of mandrel as given in Table 13.

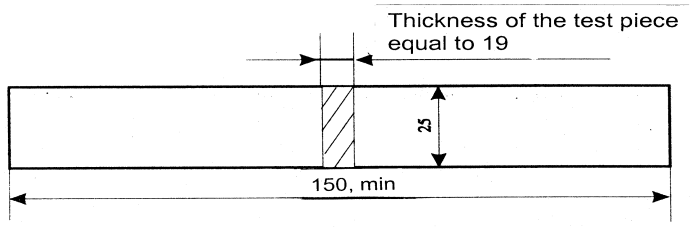


Figure 5 Test piece for bend test
(clause 9.2)

Table 13 Bend test
(clause 9.5)

Units in millimetres

Grade	Thickness	Diameter of mandrel
SPA - H	Not exceed 6.00	Thickness of test piece
	Exceed 6.00	Three times of thickness of the test piece