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मानक

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IS 6911 (1992): Stainless steel plate, sheet and strip [MTD  
16: Alloy Steels and Forgings]



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स्टेनलैस इस्पात की प्लेट, चद्दरें तथा पत्तियाँ — विशिष्टि  
( पहला पुनरीक्षण )

*Indian Standard*  
STAINLESS STEEL PLATE, SHEET AND STRIP —  
SPECIFICATION  
( *First Revision* )

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( Incorporating Amendment No. 1 )

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**BUREAU OF INDIAN STANDARDS**  
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NEW DELHI 110002

## FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Alloy Steels and Special Steels Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1972. The main modifications made in this revision are as follows:

- a) Hardness values have been added in Rockwell scale along with Brinell scale;
- b) For tensile strength requirements minimum values have been specified;
- c) Only one set of percentage elongation values have been given by different ranges of thicknesses;
- d) Erichsen cupping values have been given separately for ferritic and austenitic stainless steels;
- e) Surface finish has been included; and
- f) Steel designation based on numerical symbol in line with AISI have been given.

This standard keeps in view the manufacturing and trade practices followed in the country in this field. Assistance has also been derived from the following in the formulation of this standard:

ISO/683/13 : 1986 Heat treatable steels, alloy steels and free-cutting steels — Part 13 Wrought stainless steels. International Organization for Standardization.

BS 1449 : Part 2 : 1983 Steel plate, sheet and strip, Part 4 Stainless and heat-resisting plate, sheet and strip. British Standards Institution.

AISI Steel Products Manual. Stainless and heat-resisting steels. American Iron and Steel Institute.

This standard contains clauses which call for an agreement between the purchaser and the supplier. Such clauses are 4.2, 5.2, 5.3, 6.1, 8.1, 8.2, 9.0, 9.1.2, 10.3, 11.1, 13.1, 14.1, 14.3, 16.1, 18.1 and 20.1.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## *Indian Standard*

# STAINLESS STEEL PLATE, SHEET AND STRIP — SPECIFICATION

*( First Revision )*

### 1 SCOPE

**1.1** This standard covers the requirements for stainless and commonly used heat-resisting steel plate, sheet and strip.

**1.2** The requirements of stainless steel sheets and strips, for the manufacture of utensils have been covered in IS 5522 (*under revision*).

### 2 REFERENCES

**2.1** The Indian Standards listed in Annex A are necessary adjuncts to this standard.

### 3 TERMINOLOGY

**3.1** For the purpose of this standard, the definitions given in IS 1956 ( Part 4 ) : 1975 shall apply.

### 4 SUPPLY OF MATERIAL

**4.1** General requirements relating to the supply of material shall be in accordance with IS 8910 : 1978.

**4.2** Steels covered by the standard shall be ordered and delivered on the basis of the following:

- a) Chemical composition;
- b) Chemical composition, and hardness and/or bend test in the annealed condition;
- c) Chemical composition, hardness, tensile and bend test ( when applicable ) in the annealed condition; and
- d) Chemical composition and mechanical properties in any other condition as agreed to between the purchaser and the supplier.

#### 4.3 Information to be Given by the Purchaser

##### 4.3.1 Basis for Order

While placing an order for the purchase of material covered by this standard, the purchaser should specify the following:

- a) Designation of steel;
- b) Form ( plate, sheet or strip );
- c) Quantity ( mass or number );
- d) Nominal dimensions — thickness, width and length ( for cut lengths );
- e) Condition ( hot rolled, cold rolled, annealed or any other treatment );

- f) Finish ( in case of ground/polished or any other special finish to specify whether finish is required on one or both surfaces);
- g) Method of manufacture, if any specified;
- h) Edge condition;
- j) Test and test reports;
- k) Any other special requirements including end use; and
- m) Specific marking and packing requirements, if any.

### 5 MANUFACTURE

**5.1** Unless otherwise agreed in order, the processes used in making the steel and the product are left to the discretion of the manufacturer. When so desired, the purchaser shall be informed of the steel making process.

**5.2** Unless otherwise agreed to between the purchaser and the supplier and stated in the order, material shall be supplied with trimmed edges. Material with mill edge may be accepted with mutual agreement between the purchaser and the supplier.

### 6 FREEDOM FROM DEFECTS

**6.1** The material shall be of uniform quality consistent with the good manufacturing and inspection practices. The steel shall not have defects of a nature or degree that will be detrimental to the intended end use.

Material may be supplied in ground condition ( ground to remove surface defects ) on mutual agreement between the purchaser and the supplier provided that the thickness at any point does not reduce below allowable thickness tolerances for the ordered thickness.

### 7 CHEMICAL COMPOSITION

#### 7.1 Ladle Analysis

The chemical composition of the steel as determined on the ladle sample for each cast shall conform to the requirements of Table 1 (*see also* Note).

The analysis of the steel shall be carried out according to IS 228 and its relevant parts or any other established instrumental/chemical method. In case of dispute the procedure given in IS 228 and its relevant parts shall be referee method.

Table 1 Chemical Composition  
(Clauses 7.1 and 7.2)

Grade Designation	C	Si Max	Mn	Ni	Cr	Mo	S Max	P Max	Others	
										(1)
<b>Ferritic Steels</b>										
X 04Cr12	0.08 Max	1.0	1.0 Max	—	11.5-13.5	—	0.030	0.040	Al 0.10-0.30	
X 07Cr17	0.12 Max	1.0	1.0 Max	0.50 Max	16.0-18.0	—	0.030	0.040		
<b>Martensite Steel</b>										
X 12Cr12	0.08-0.15	1.0	1.0 Max	1.0 Max	11.5-13.5	—	0.030	0.040		
X 20Cr13	0.16-0.25	1.0	1.0 Max	1.0 Max	12.0-14.0	—	0.030	0.040		
X 30Cr13	0.26-0.35	1.0	1.0 Max	1.0 Max	12.0-14.0	—	0.030	0.040		
X 40Cr13	0.35-0.45	1.0	1.0 Max	1.0 Max	12.0-14.0	—	0.030	0.040		
X 15Cr16Ni2	0.10-0.20	1.0	1.0 Max	1.25-2.50	15.0-17.0	—	0.030	0.045		
X 108Cr17Mo	0.95-1.20	1.0	1.0 Max	0.50 Max	16.0-18.0	0.75 Max	0.030	0.045		
<b>Austenitic Steels</b>										
X 10Cr17Mn6Ni4N20	0.20 Max	1.0	4.0-8.0	3.5-5.5	16.0-18.0	—	0.030	0.045	N 0.05-0.20	
X 07Cr17Mn12Ni4	0.12 Max	1.0	10.0-14.0	3.5-5.5	16.0-18.0	—	0.030	0.045		
X 10Cr18Mn9Ni5	0.15 Max	1.0	8.0-10.0	4.0-6.0	17.0-19.0	—	0.030	0.045		
X 10Cr17Ni7	0.15 Max	1.0	2.0 Max	6.0-8.0	16.0-18.0	—	0.030	0.045		
X 07Cr18Ni9	0.15 Max	1.0	2.0 Max	8.0-10.0	17.0-19.0	—	0.030	0.045		
X 04Cr19Ni9	0.08 Max	1.0	2.0 Max	8.0-10.0	17.5-20.0	—	0.03	0.045		

X 02Cr19Ni10	304 S2	0.03 Max	1.0	2.0 Max	8.0-12.0	17.5-20.0	—	0.030	0.045
X 15Cr24Ni13	309	0.20 Max	1.5	2.0 Max	11.0-15.0	22.0-25.0	—	0.030	0.045
X 20Cr25Ni20	310	0.25 Max	2.5	2.0 Max	18.0-21.0	24.0-26.0	—	0.030	0.045
X 04Cr17Ni12Mo2	316	0.03 Max	1.0	2.0 Max	10.0-14.0	16.0-18.0	2.0-3.0	0.030	0.045
X 02Cr17Ni12Mo2	316 L	0.08 Max	1.0	2.0 Max	10.0-14.0	16.0-18.0	2.0-3.0	0.030	0.045
X 04Cr17Ni12Mo2Ti	316 Ti	0.08 Max	1.0	2.0 Max	10.0-14.0	16.0-18.0	2.0-3.0	0.030	0.045
									Ti Min-5 (C + N) Ti Max-0.80
X 04Cr18Ni10Ti	321	0.08 Max	1.0	2.0 Max	9.0-12.0	17.0-19.0	—	0.030	0.045
									Ti Min-5 (C + N) Ti Max-0.8
X 04Cr18Ni10Nb	347	0.08 Max	1.0	2.0 Max	9.0-12.0	17.0-19.0	—	0.030	0.045
									Nb Min-10C Nb Max-1.0

NOTE — Elements not specified in Table 1 shall not be added to the steel except when added to other than for the purpose of finishing the heat and shall not exceed the following limits:

Constituent	Limits, Percent, Max		
	Ferric and Martensitic Steels	Austenitic Steels	
		Without specified molybdenum	With specified molybdenum
Titanium	—	0.10	0.10
Niobium	—	0.20	0.20
Molybdenum	0.30	0.70	—
Copper	0.30	0.50	0.70



## 7.2 Product Analysis

In case of product analysis, the permissible variation from the limits specified in Table 1 shall be as given in Table 2.

## 8 HEAT TREATMENT

8.1 Unless otherwise mutually agreed to between the purchaser and the supplier, the austenitic stainless steels shall be supplied in solution annealed and descaled condition.

8.2 The ferritic and martensitic stainless steels shall be supplied in annealed and descaled condition unless otherwise agreed between the purchaser and the supplier.

Martensitic stainless steels can subsequently be heat treated for use in hardened and tempered condition.

8.3 The recommended heat treatment for steels covered in this standard are given in Table 3.

## 9 SAMPLING

9.0 Unless otherwise agreed between the purchaser and the supplier, the sampling shall be as follows.

### 9.1 Chemical Analysis

9.1.1 Ladle analysis shall be supplied by the supplier.

9.1.2 If the product analysis is required by the purchaser, the sampling procedure for the product analysis shall be agreed to between the purchaser and the supplier.

### 9.2 Sampling for Mechanical Tests

In case of material annealed in coil form through continuous annealing lines, at least one sample shall be taken from each end of the coil for carrying out tests. Hardness test is to be carried out on samples collected from both ends. At least one tensile test and one bend test (when required) shall be carried out for each coil. In case, there is a difference in hardness by more than 5 HRB between samples collected at both ends, tensile properties shall be determined on both the samples.

In case of material annealed in pieces, one tensile test, one bend test (when required) and one or more hardness tests shall be carried out on each 100 or less number of pieces of the same cast and same nominal thickness annealed as a lot or annealed continuously.

## 10 MECHANICAL PROPERTIES

### 10.1 Tensile Test

The tensile test shall be carried out in accordance with IS 1663 : 1972 and IS 1608 : 1972.

**Table 2 Permissible Variation Between Specified Analysis and Product Analysis**

( Clause 7.2 )

Element	Limits of Ladle Analysis as Shown in Table 1, Percent		Permissible Deviation* Percent
	Over	Up to and Including	
C	—	0.030	+ 0.005
	0.030	0.20	± 0.01
	0.20	0.60	± 0.02
	0.60	1.20	± 0.03
Si	—	1.0	+ 0.05
	—	1.0-2.5	± 0.10
Mn	—	1.0	+ 0.03
	1.0	3.0	± 0.04
	3.0	6.0	± 0.05
	6.0	10.0	± 0.06
	10.0	14.0	± 0.10
Al	—	0.30	± 0.05
Cr	10.0	15	± 0.15
	15.0	20	± 0.20
	20.0	30	± 0.25
	—	0.60	+ 0.03
Mo	0.60	1.75	± 0.05
	1.75	3.0	± 0.10
	—	1.0	+ 0.03
	1.0	5.0	± 0.07
Ni	5.0	10.0	± 0.10
	10.0	20.0	± 0.15
	20.0	30.0	± 0.20
	—	0.25	+ 0.02
	0.15	1.0	± 0.05
Ti	—	1.2	± 0.05
Nb	—	0.040	+ 0.005
	0.04	0.20	+ 0.01
	0.20	0.50	+ 0.02
P	—	0.040	+ 0.005
	0.040	0.060	+ 0.010

\*The use of '+' means that in one cast the deviation may occur over the upper value or under the lower value of the specified range in the table but not both at the same time.

### 10.2 Hardness Test

The hardness test shall be carried out in accordance with IS 1500 : 1983, IS 1501 ( Part 1 ) : 1984, IS 1586 : 1988 or IS 5072 : 1988.

10.3 Bend test, if required, shall be carried out in accordance with IS 1599 : 1985.

10.3.1 Bend test piece shall be cut so that the axis of the bend is parallel to the direction of rolling, that is, the longer axis of the test piece shall be at 90 deg to the direction of rolling.

The test piece shall be bent cold through 180 deg around a mandrel with diameter  $D_{ma}$  as given in Table 4. The test piece shall be deemed to have passed the test, if the outer convex surface is free from cracks.

10.4 The material supplied in annealed condition and tested as per 10.1 shall conform to the requirements of Table 4.

Indicative hardness values for martensitic stainless steels (cutlery steels) after suitable heat

treatments are given in Table 5.

10.5 If agreed between the purchaser and the supplier material can be supplied in cold rolled (work hardened) condition with higher strength and hardness characteristics.

Mechanical properties for certain work hardened austenitic grades of stainless steels shall be in accordance with Table 6 or any other value mutually agreed between the purchaser and the supplier.

Table 3 Recommended Heat Treatment for Stainless Steels  
( Clause 8.3 )

Grade Designation		Symbols*	Annealing or Softening Temperature °C	Quenching Media† for Annealing or Softening	Symbols*	Hardening Temperature	Quenching Media† for Quenching	Tempering Temperature °C
Letter Symbol [ see IS 1762 ( Part 1 ) ]	Numerical Symbol ISS							
<i>Ferritic Steels</i>								
X 04Cr12	405	A	750 to 800	f, a	—	—	—	—
X 07Cr17	430	A	750 to 850	a, w	—	—	—	—
<i>Martensitic Steels</i>								
X 12Cr12	410	A1	700 to 780	a	Q + T‡	950 to 1 000	o, a	700 to 750
		A2	770 to 870	f	—	—	—	—
X 20Cr13	420 S1	A	770 to 870	f	Q + T	980 to 1 030	o, a	650 to 770
X 30Cr13	420 S2	A	770 to 870	f	Q + T§	980 to 1 030	o, a	630 to 700
					Q + T§	980 to 1 030	o, a	100 to 250
X 40Cr13	420 S3	A	770 to 870	f	Q + T	1 000 to 1 050	o, a	100 to 250
X 15Cr16Ni2	431	A	750 to 800	a	Q + T	980 to 1 030	o, a	630 to 700
			620 to 670	a				
X 108Cr17Mo	440		780 to 880	f	Q + T	1 000 to 1 030	—	100 to 250
<i>Austenitic Steels</i>								
X 10Cr17Mn6Ni4N20	201	S	1 000 to 1 120	w, o, a	—	—	—	—
X 10Cr17Ni7	301	S	1 000 to 1 120	w, o, a	—	—	—	—
X 07Cr18Ni9	302	S	1 000 to 1 120	w, o, a	—	—	—	—
X 04Cr19Ni9	304 S1	S	1 000 to 1 120	w, o, a	—	—	—	—
X 02Cr19Ni10	304 S2	S	1 000 to 1 120	w, o, a	—	—	—	—
X 04Cr17Ni12Mo2	316	S	1 000 to 1 120	w, o, a	—	—	—	—
X 02Cr17Ni12Mo2	316 L	S	1 000 to 1 120	w, o, a	—	—	—	—
X 04Cr17Ni12Mo2Ti	316 T2	S	1 000 to 1 120	w, o, a	—	—	—	—
X 04Cr18Ni10Ti	321	S	1 000 to 1 120	w, o, a	—	—	—	—
X 04Cr18Ni10Nb	347	S	1 000 to 1 120	w, o, a	—	—	—	—

\* A = annealing, Q = quenching, T = tempering, and S = softening.

† f = furnace, a = air, o = oil, and w = water.

‡ Applicable for the properties given in Table 4.

§ Applicable for the properties given in Table 5.

**Table 4 Mechanical Properties in Annealed Condition**  
( Clauses 10.3.1 and 10.4 )

Grade Designation		Hardness <i>Max</i>		Yield Strength <i>Min</i> MPa 0.2% Proof Stress	Tensile Strength <i>Min</i> , MPa	Elongation % <i>Min</i> in 50 mm	Bend Test Dma
Letter Symbol [ see IS 1762 ( Part 1 ) ]	Numerical Symbol ISS	Brinell HBS	Rockwell HRB				
X 04Cr12	405	187	88	250	440	20	2 a*
X 07Cr17	430	192	88	250	440	18	2 a*
X 12Cr12	410	212	95	410	590	16	—
X 20Cr13	420 S1	229	—	490	690	14	—
X 30Cr13	420 S2	235	—	590	780	11	—
X 15Cr16Ni2	431	262	—	640	830	10	—
X 10Cr17Mn6Ni4N20	201	217	95	300	640	40	Not required
X 07Cr17Mn12Ni4	201 A	217	95	260	540	40	Not required
X 10Cr18Mn9Ni5	202	217	95	310	620	40	Not required
X 10Cr17Ni7	301	212	—	220	590	40	Not required
X 07Cr18Ni9	302	192	92	210	400	40	Not required
X 04Cr19Ni9	304 S1	192	92	200	400	40	Not required
X 02Cr19Ni10	304 S2	192	88	180	440	40	Not required
X 15Cr24Ni13	309	217	95	210	490	40	Not required
X 20Cr25Ni20	310	217	95	210	490	40	Not required
X 04Cr17Ni12Mo2	316	192	95	210	490	40	Not required
X 02Cr17Ni12Mo2	316 L	192	95	200	440	40	Not required
X 04Cr17Ni12Mo2Ti	316 T2	192	95	220	490	35	Not required
X 04Cr10Ni10Ti	321	192	95	210	490	35	Not required
X 04Cr18Ni10Nb	347	192	92	210	490	35	Not required

\*a = thickness of the test piece.

**Table 5 Hardness Values for Cutlery Steels**  
( Clause 10.4 )

Grade Designation		Annealed HBS, <i>Max</i>	Quenched and Tem- pered Hardness, <i>Min</i>	
Letter Symbol [ see IS 1762 ( Part 1 ) ]	Numerical Symbol ISS		HV	HRC
X 30Cr13	420 S2	241	500	49
X 40Cr13	420 S3	255	515	50
X 108Cr 17Mo	440	285	660	58

### 11 ERICHSEN CUPPING TEST

11.1 Subject to agreement between the purchaser and the supplier, one Erichsen cupping test shall be carried out for annealed material in accordance with IS 10175 : 1982 from each annealing lot of 5 tonnes of material or part thereof from each cast in one thickness/or one coil of one thickness.

11.2 Where sheets of more than one thickness are rolled from the same cast and heat treated in one lot, one additional cupping test shall be made for each thickness of sheet.

11.3 Cupping test shall be applicable for material to be used for deep drawing and extra deep

drawing applications up to a thickness of 1.6 mm.

The minimum Erichsen values shall be as given in Table 7.

### 12 CORROSION RESISTANCE

12.1 If required by the purchaser, the material shall be tested for corrosion resistance as specified in IS 10461 ( Part 1 ) : 1983 and IS 10461 ( Part 2 ) : 1985.

### 13 OTHER TESTS

13.1 Any test, other than those specified in this specification, may be conducted subject to mutual agreement between the purchaser and the supplier.

### 14 RETESTS

#### 14.1 Retests for Chemical Analysis

If the results of the chemical analysis do not conform to the requirements given in Tables 1 and 2; unless otherwise agreed between the purchaser and the supplier, two new samples shall be taken on different pieces from the same cast. Should the two analysis satisfy the requirements, the lot represented shall be accepted. If either of the samples fail, the material shall be taken as not complying with this standard.

**Table 6 Mechanical Properties of Austenitic Steels in Work Hardened Condition**

( Clause 10.5 )

Grade Designation		0.2% Proof Stress, Min	Tensile Strength MPa, Min	Elongation on GL 5.65/S <sub>0</sub> Min Percent	Applicable to Maximum Thickness mm
Letter Symbol [ see IS 1762 ( Part 1 ) ]	Numerical Symbol ISS				
X 04Cr19Ni9	304 S1	490	830	12	2.8
		740	1 030	8	2.4
		910	1 180	7	1.8
		960	1 270	3	1.4
X 07Cr18Ni9	302	490	830	12	2.8
		740	1 030	9	2.4
X 10Cr17Ni7	301	490	830	25	3.3
		740	1 030	10	2.9
		910	1 180	5	2.4
		960	1 270	4	2.3
X 10Cr17Mn 6Ni4N20	201	490	830	20	3.3
		740	1 030	10	2.9
		910	1 180	7	2.4
		980	1 270	4	2.3

**Table 7 Cupping Test Results — Erichsen Values**  
( Clause 11.3 )

Thickness, mm	Depth of Cup, Min mm	
	Austenitic	Ferritic
Up to 0.80	10.0	7.00
Over 0.80 and up to 1.60	11.0	8.00

#### 14.2 Retest for Mechanical Properties

Should any of the original test pieces fail to satisfy the requirements of the mechanical tests specified in Table 3, two more samples shall be selected from the same lot for testing in respect of each failure. Should the test pieces from both the additional samples pass, the material represented by the test samples shall be deemed to comply with the requirements of the particular test. Should either of the retests fail to meet the specified requirements, the material shall be taken as not complying with this standard except that the manufacturer may reheat-treat ( not more than twice ) the material represented and resubmit samples for testing.

14.3 Any other retest may be carried out as per mutual agreement between the purchaser and the supplier.

#### 15 SURFACE FINISH

15.1 The material shall be supplied in one of the standard finishes on both surfaces for mill finishes and one of both for polished/ground finishes. The different surface finishes are

indicated in Table 8. Finish No. 0.1, CR, 2D, 2B and BA are classified as mill finishes. Finish No. 3, 4, 6, 7 and 8 are produced by mechanical polishing and are classified as polished finishes. Some of these standard finishes may not be available on certain rolled products.

15.2 Finish No. 8 is not applicable to austenitic steel stabilized with titanium or niobium.

#### 16 INSPECTION

16.1 Unless otherwise agreed, inspection of material shall be carried out by the manufacturer/supplier to ensure conformity to purchaser specification. Inspection of the material by the purchaser's representative at the manufacturing unit shall be allowed if agreed between the purchaser and the manufacturer/supplier as part of the purchase order.

#### 17 DIMENSIONS AND TOLERANCES

17.1 Dimensions for stainless steel plates, sheets and strips shall be mutually agreed between the purchaser and the manufacturer.

17.2 The dimensional tolerances for stainless steel plates, sheets and strips shall be as laid down in Tables 9 to 19.

#### 18 PACKING

18.1 Material with suitable packing shall be provided by the manufacturer/supplier to prevent damages and deterioration in quality during storage, handling and transport. The exact method of packing and weight of each packet shall be mutually agreed to between the purchaser and the supplier.

**Table 8 Surface Finish**  
( Clause 15.1 )

Type of Finish/ Number	Description	Remarks	Type of Finish/ Number	Description	Remarks
<i>Mill Finishes</i>			<i>Polished Finishes</i>		
0	Hot rolled, annealed without descaling (pickling)	Suitable only for certain heat resisting applications where surface is not important, presence of scale impairs resistance to corrosion. Surface inspection is not practicable and fool proof	No. 3	Coarse grit polished surface finish	A uniform polished surface finish obtained with coarse abrasives of 100-120 grit on one or both surfaces. Suitable for use as a finish polished surface such as for panelling or any other application requiring such surface finish
No. 1	Hot rolled, annealed and descaled (pickled)	Plates and sheets generally used for industrial application where heat and corrosion resistance is more important and smoothness and uniformity of finish are not important. Repair grinding marks may be present in local areas	No. 4	Standard polished surface finish	A standard uniform polished surface finish produced with abrasives of 120-150 grit size and the finish is finer than No. 3 finish. Suitable for general purpose polished finish used for panelling, appliances, equipment and architectural applications
CR	Cold rolled finish	This finish is obtained by cold rolling of annealed and descaled or bright annealed product to get higher strength and hardness. The appearance and strength characteristics depend on amount of cold reduction. Suitable for applications involving higher strength characteristics and where formability is not important	No. 6	Dull satin surface finish	A dull satin surface finish, produced by tampico brush polishing. Suitable for architectural and ornamental applications where high lustre is not desirable
2D	Cold rolled, annealed and descaled (pickled)	A dull, smooth and uniform surface finish most suited for deep drawing applications	No. 7	Polished reflective surface finish	A polished surface finish with high degree of reflectivity produced by buffing finely ground surface without ensuring complete removal of grit marks. Suitable for architectural and ornamental applications
2B	Cold rolled, annealed and descaled (pickled) and skinpassed	A smoother and brighter surface finish (as compared to 2D) most suitable for general applications	No. 8	Mirror finish	A bright, highly reflective surface finish with a high degree of image clarity produced by polishing with successive finer grit polish followed by buffing with very fine polishing compounds. This finish is used for applications requiring highly reflective surfaces like in press plates, mirrors, reflectors, etc
BA	Cold rolled, bright annealed in protective atmosphere	A cold rolled reflective surface finish. Suitable for applications demanding bright and lustrous surface			

**19 MARKING**

**19.1** Every package shall be legibly marked with paint or any other marking system showing the name or trade-mark of manufacturer, weight, thickness, size, steel designation and the cast number or identification marks by which the material may be traced to the cast or casts from which they are made.

**19.2** The material may also be marked with

the BIS Certification Mark. The details are available with the Bureau of Indian Standards.

**20 MATERIAL TEST REPORT AND CERTIFICATION**

**20.1** A report of the results of all the tests required by the purchase specification shall be supplied by the manufacturer/supplier to the purchaser, if mutually agreed. The test report shall include manufacturer's certification for conformity to the purchase specification.

**Table 9 Permissible Variations in Thickness of Hot Rolled Sheet and Plate**  
( Clause 17.2 )

Thickness	Tolerance on Thickness for Width			
	< 1 000	1 000 to < 1 250	1 250 to < 1 600	1 600 to < 2 000
From 1'00 to less than 1'50	± 0'15	± 0'15	± 0'20	—
From 1'50 to less than 2'00	± 0'20	± 0'20	± 0'25	—
From 2'00 to less than 2'50	± 0'20	± 0'25	± 0'30	—
From 2'50 to less than 3'00	± 0'25	± 0'30	± 0'30	—
From 3'00 to less than 4'00	± 0'30	± 0'30	± 0'35	—
From 4'00 to less than 5'00	± 0'40	± 0'40	± 0'45	—
From 5'00 to less than 6'00	± 0'50	± 0'50	± 0'55	± 0'70
From 6'00 to less than 8'00	± 0'60	± 0'60	± 0'60	± 0'75
From 8'00 to less than 10'00	± 0'65	± 0'65	± 0'65	± 0'80
From 10'00 to less than 16'00	± 0'70	± 0'70	± 0'70	± 0'85
From 16'00 to less than 25'00	± 0'80	± 0'80	± 0'80	± 0'95
From 25'00 to less than 40'00	± 0'90	± 0'90	± 0'90	± 1'10
From 40'00 to less than 50'00	± 1'00	± 1'00	± 1'00	± 1'20

**Table 10 Permissible Variation in Thickness for Cold Rolled Sheets**  
( Clause 17.2 )

Thickness	Tolerance on Thickness for Width		
	< 1 000	1 000 to < 1 250	1 250 to < 1 600
From 0'20 to less than 0'30	± 0'04	± 0'04	—
From 0'30 to less than 0'40	± 0'05	± 0'05	—
From 0'40 to less than 0'60	± 0'08	± 0'08	—
From 0'60 to less than 0'80	± 0'10	± 0'10	—
From 0'80 to less than 1'25	± 0'12	± 0'15	± 0'15
From 1'25 to less than 1'50	± 0'13	± 0'15	± 0'20
From 1'50 to less than 2'00	± 0'15	± 0'20	± 0'20
From 2'00 to less than 2'50	± 0'20	± 0'20	± 0'25
From 2'50 to less than 3'00	± 0'25	± 0'25	± 0'30
From 3'00 to less than 4'00	± 0'30	± 0'30	± 0'35
From 4'00 to less than 5'00	± 0'35	± 0'35	± 0'40

**Table 11 Permissible Variation in Width and Length of Hot Rolled or Cold Rolled Sheet and Plate Produced by Machine Cutting**  
( Clause 17.2 )

All dimensions in millimetres.		
Thickness	Tolerance on Width	Tolerance on Length
Less than 10	+ 5 - 0	+ 10 - 0
From 10 up to and including 25	+ 10 - 0	+ 15 - 0

**Table 12 Permissible Variation in Width and Length of Hot Rolled Plate Produced by Arc Cutting**  
( Clause 17.2 )

All dimensions in millimetres.		
Thickness	Tolerance on Width	Tolerance on Length
Up to and including 50	+ 30 - 0	+ 30 - 0

**Table 13 Permissible Variation in Flatness\* for Hot Rolled or Cold Rolled Sheet and Plate**  
( Clause 17.2 )

All dimensions in millimetres.			
Width	Length	Maximum Value of Flatness	
		Unstretched Condition	Stretched Condition
Up to and excluding 1 000	Up to and including 2 000	15	3
	Over 2 000	20	6
1 000 and above	Up to and including 2 000	20	6
	Over 2 000	20	6

\*Maximum deviation from a horizontal flat surface.

**Table 14 Permissible Variations in Thickness for Hot Rolled Strip**  
( Clause 17.2 )

Thickness	All dimensions in millimetres.			
	Tolerance on Thickness for Width			
	< 250	250 to < 500	500 to < 1 000	1 000 to < 1 250
From 1'00 to less than 1'50	± 0'12	± 0'12	± 0'15	± 0'15
From 1'50 to less than 2'00	± 0'15	± 0'18	± 0'20	± 0'20
From 2'00 to less than 2'50	± 0'16	± 0'18	± 0'20	± 0'25
From 2'50 to less than 3'00	± 0'18	± 0'20	± 0'25	± 0'30
From 3'00 to less than 4'00	± 0'20	± 0'25	± 0'30	± 0'30
From 4'00 to less than 5'00	± 0'25	± 0'30	± 0'40	± 0'40
From 5'00 to less than 6'00	± 0'30	± 0'40	± 0'50	± 0'50
From 6'00 to less than 8'00	± 0'40	± 0'50	± 0'60	± 0'60
From 8'00 to 10'0	± 0'50	± 0'60	± 0'65	± 0'65

**Table 15 Permissible Variations in Thickness for Cold Rolled Strip in Coils and Cut Lengths\***  
( Clause 17.2 )

Thickness	All dimensions in millimetres.			
	Tolerance on Thickness for Width			
	< 250	250 to < 500	500 to < 1,000	1 000 to < 1 250
Less than 0'15	± 0'02	—	—	—
From 0'15 to less than 0'25	± 0'03	± 0'03	—	—
From 0'25 to less than 0'40	± 0'03	± 0'04	± 0'04	—
From 0'40 to less than 0'60	± 0'04	± 0'04	± 0'05	± 0'05
From 0'60 to less than 0'80	± 0'05	± 0'06	± 0'07	± 0'07
From 0'80 to less than 1'00	± 0'06	± 0'07	± 0'08	± 0'08
From 1'00 to less than 1'25	± 0'07	± 0'08	± 0'08	± 0'09
From 1'25 to less than 1'50	± 0'08	± 0'09	± 0'10	± 0'10
From 1'50 to less than 2'00	± 0'09	± 0'11	± 0'12	± 0'12
From 2'00 to less than 2'50	± 0'10	± 0'12	± 0'15	± 0'15
From 2'50 to less than 3'00	± 0'12	± 0'15	± 0'20	± 0'20
From 3'00 to less than 4'00	± 0'15	± 0'17	± 0'20	± 0'25
From 4'00 to less than 5'00	± 0'20	± 0'22	± 0'25	± 0'30

\*For thicknesses of 5 mm and above, tolerances shall be as agreed between the purchaser and the manufacturer/seller.

**Table 16 Permissible Variation in Width of Hot Rolled Strip of Thickness up to and Including 5 mm**

( Clause 17.2 )

All dimensions in millimetres.				
Width	Tolerance on Width			
	Mill Edge		Cut Edge	
	Plus	Minus	Plus	Minus
Less than 250	5	0	5	0
From 250 to less than 500	10	0	5	0
From 500 to less than 1 000	20	0	10	0
From 1 000 to 1 250	30	0	10	0

**Table 17 Permissible Variation in Width of Cold Rolled Strip in Coils and Cut Lengths\***

( Clause 17.2 )

All dimensions in millimetres.					
Thickness	Tolerance on Width				
	< 250	250 to < 500	600 to < 1 000	1 000 to < 1 250	
Less than 0.6	± 0.20	± 0.30	± 0.50	± 1.00	
From 0.6 to less than 1.00	± 0.25	± 0.30	± 0.50	± 1.00	
From 1.00 to less than 1.50	± 0.30	± 0.40	± 0.60	± 1.20	
From 1.50 to less than 2.50	± 0.40	± 0.50	± 0.70	± 1.40	
From 2.50 to less than 4.00	± 0.40	± 0.50	± 0.80	± 1.60	
From 4.00 to 5.00	± 0.50	± 0.70	± 1.00	± 2.00	

\*For thicknesses of 5 mm and above, tolerances shall be as agreed between the purchaser and the manufacturer/seller.

**Table 18 Permissible Values of Camber for Hot Rolled Strip**

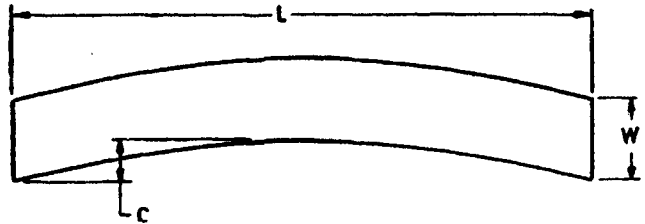
( Clause 17.2 )

All dimensions in millimetres.	
Width	Maximum Value of Camber for Any 2 000 mm Length
Less than 250	10
From 250 to less than 500	8
From 500 to less than 1 000	5
From 1 000 to 1 250	5

**Table 19 Permissible Values of Camber for Cold Rolled Strip**

( Clause 17.2 )

All dimensions in millimetres.	
Width	Maximum Value of Camber for Any 2 000 mm Length
Greater than 50	10
Less than 250	5
From 250 to less than 500	4
From 500 and over	2





## ANNEX A

( Clause 2.1 )

## LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
228 ( in parts )	Methods for chemical analysis of steels	5072 : 1988	Methods for Rockwell superficial hardness test ( scales 15N, 30N, 45N, 15T, 30T and 45T ) ( <i>first revision</i> )
1500 : 1983	Brinell hardness test for metallic materials ( <i>second revision</i> )	5522 : 1992	Stainless steel sheets and strips for utensils ( <i>second revision</i> )
1501 ( Part 1 ) : 1984	Vickers hardness test for metallic materials : Part 1 HV 5 to HV 100 ( <i>second revision</i> )	8910 : 1978	General technical delivery requirements for steel and steel products
1586 : 1988	Rockwell hardness test for metallic materials ( scales A-B-C-D-E-F-G-H-K ) ( <i>second revision</i> )	10175 : 1982	Modified erichsen cupping test for metallic sheet and strip
1599 : 1985	Method for bend test ( <i>second revision</i> )	10461 ( Part 1 ) : 1983	Method for determination of resistance to intergranular corrosion of austenitic stainless steel : Part 1 Corrosion tests in nitric acid medium by measurement of loss in mass ( Huey test )
1608 : 1972	Tensile testing of steel products ( <i>first revision</i> )	10461 ( Part 2 ) : 1985	Method for determination of resistance to intergranular corrosion of austenitic stainless steel : Part 2 Copper sulphate sulphuric acid test ( Monypenny straus test )
1663 : 1972	Tensile testing of steel sheet and strip of thickness 0.5 mm to 3 mm ( <i>first revision</i> )		
1956 ( Part 4 ) : 1975	Glossary of terms relating to iron and steel : Part 4 Steel sheet and strip		

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#### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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