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Indian Standard

IS 277 : 2018

जस्तीकृत इस्पात की पत्तियाँ और चद्दरें (सादी एवं नालीदार) — विशिष्टि

(सातवाँ पुनरीक्षण)

Galvanized Steel Strips and Sheets (Plain and Corrugated) — Specification

(Seventh Revision)

ICS 77.140.50

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली-110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.org.in www.standardsbis.in

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Price Group 4

Wrought Steel Products Sectional Committee, MTD 4

FOREWORD

This Indian Standard (Seventh Revision) was adopted by the Bureau of Indian Standards. after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1951 and subsequently revised in 1962, 1969, 1977, 1985, 1992 and 2003. While reviewing this standard in the light of experiences gained during these years, the Committee decided to revise the standard. In this revision, following changes have been made:

a) Amendments number 1, 2, 3 and 4 have been incorporated.
b) Tables 1, 2, 3 and 5 have been modified.
c) Clauses **1**, **3**, **5**, **6**, **7**, **8**, **9**, **10**, **14** and **15** have been modified.
d) Eight new grades of structural steel have been included.
e) Scope has been modified.
f) Clause **16** has been added.

This standard specifies structural grades and corrugated sheets.

For all tests specified in this standard (chemical/physical/others), the method as specified in relevant ISO Standard may also be followed as an alternate method.

While revising this standard, assistance has been derived from ISO 3575:2011 ‘Continuous hot-dip zinc-coated carbon steel sheet of commercial and drawing qualities’.

For the purpose of deciding whether 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

GALVANIZED STEEL STRIPS AND SHEETS (PLAIN AND CORRUGATED) — SPECIFICATION

(Seventh Revision)

1 SCOPE

1.1 This standard covers the requirements of plain galvanized steel sheets and strips (coils) and corrugated galvanized sheets.

1.2 Galvanized steel sheets covered by this standard are intended to be used for purposes such as paneling, roofing, applications requiring lock forming, etc.

1.3 Requirements of galvannealed and electrogalvanized steels are not covered in this standard.

1.4 The requirements of zinc and zinc alloy coated steel sheets for automotive and engineering applications are being covered in a separate standard which is under development.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subjected to revision and parties to agreement, based on this standard, are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
209 : 1992	Zinc ingot — Specification (*fourth revision*)
228	Methods of chemical analysis of steels (in various parts)
513 : 2008	Cold-reduced low carbon steel sheets and strips (*fifth revision*)
875 (Part 2) : 1987	Code of Practice for design loads (Other than earthquake) for buildings and structures: Part 2 Imposed loads
1079 : 2009	Hot-rolled carbon steel sheet and strip (*sixth revision*)
1608 : 2005	Metallic materials — Tensile testing at ambient temperature (*third revision*)
1956 (Part 4) : 2013	Glossary of terms relating to iron and steel: Part 4 Steel sheet and strip (*first revision*)
2629 : 1985	Recommended practice for hot dip galvanizing on iron and steel (*first revision*)
6745 : 1972	Method for determination of mass of zinc coating on zinc coated iron and steel articles
8910 : 2010	General technical delivery requirements for steel and steel products (*first revision*)
13229 : 1991	Zinc for galvanizing
IS/ISO16163 : 2005	Continuously hot dipped coated steel products — Dimensional and shape tolerances

3 TERMINOLOGY

For the purpose of this standard, the definition given in IS 1956 (Part 4) and the following shall apply.

3.1 Black Sheet — Hot rolled steel sheet prior to pickling operation.

3.2 Cold Rolled Sheet or Coil — Cold-rolled sheet or coil prior to galvanizing process.

3.3 Thickness of Sheet — Thickness of hot-rolled or cold-rolled sheet (Uncoated thickness) in cut length or coil form.

3.4 Normal Spangle (N) — This finish is obtained when zinc coating is left to solidify normally. Zinc crystals of different sizes and brightness appear depending on the galvanizing conditions. The performance of the coating is not affected by this.

3.5 Minimized Spangle (M) — This finish is obtained by influencing the solidification process in a specific way. The surface will have reduced spangles, in some cases, not visible to the unaided eye. This finish may be ordered if the normal spangle does not satisfy the surface appearance requirements.

4 SUPPLY OF MATERIAL

The general requirements relating to the supply of galvanized sheets and strips shall conform to IS 8910.

5 MANUFACTURE

5.1 The base steel chemistry of galvanized sheets and coils shall be as per Table 1. The Product analysis of steel, when carried out either by the methods specified in relevant parts of IS 228 or any other established instrumental/chemical method, shall be as given in

Table 1 Chemical Analysis
(*Clause* 5.1)

Sl No.	Designation	Grade	C *Max*	Mn *Max*	S *Max*	P *Max*	Ti *Max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	GP	Ordinary	0.25	1.70	0.045	0.050	—
ii)	GPH	Ordinary-Hard	0.15	0.60	0.040	0.050	—
iii)	GC	Corrugated ordinary	0.15	0.60	0.040	0.050	—
iv)	GPL	Drawing (Lock forming)	0.12	0.50	0.035	0.040	—
v)	GPD	Deep drawing	0.10	0.45	0.030	0.025	—
vi)	GPED	Extra deep drawing	0.08	0.40	0.030	0.020	—
vii)	GPIF	Interstitial free (Stabilized)	0.06	0.25	0.020	0.020	0.15
viii)	GP230	Structural steel grade 230	0.20	1.35	0.040	0.040	—
ix)	GP250	Structural steel grade 250	0.20	1.35	0.040	0.050	—
x)	GP275	Structural steel grade 275	0.25	1.35	0.040	0.050	—
xi)	GP300	Structural steel grade 300	0.25	1.35	0.040	0.050	—
xii)	GP350 Class-1	Structural steel grade 350 Class-1	0.25	1.35	0.040	0.050	—
xiii)	GP350 Class-2	Structural steel grade 350 Class-2	0.25	1.35	0.040	0.050	—
xiv)	GP450	Structural steel grade 450	0.25	1.60	0.040	0.050	—
xv)	GP550	Structural steel grade 550	0.25	1.70	0.040	0.050	—

NOTES

1 Restricted chemistry may be mutually agreed to between the purchaser and the supplier.

2 When steel is killed by aluminium alone the total aluminium content should be 0.020 percent, *Min*. When steel is silicon killed, the silicon content shall not be less than 0.10 percent. When the steel is Al-Si killed then silicon content shall not be less than 0.030 percent and total aluminium content shall not be less than 0.01 percent.

3 The Nitrogen content of the steel shall not be more than 0.007 percent for Sl.No. v), vi) and vii). However, for rest of the grades the Nitrogen content shall not exceed 0.012 percent. This shall be ensured by the manufacturer by occasional check analysis.

4 The material may be supplied in the copper bearing quality in which case the copper shall be between 0.20 and 0.35 percent on Ladle analysis. In case of product analysis, the copper content shall be permissible in between 0.17 and 0.38 percent.

5 The steel can be made with micro alloying element like niobium, vanadium, titanium and boron either individually or in combination, on mutual agreement in which case the total micro-alloying element should not exceed 0.2 percent. However, in case of boron the limit shall be 0.008 percent *Max*.

6 The titanium may be replaced totally or partially by niobium or vanadium and may be completely stabilized.

7 For rephosphorised steel the maximum percent P shall be 0.20.

Table 1. In case of any dispute, the procedure given in relevant parts of IS 228 shall be the referee method.

5.1.1 When it is not possible to test the base metal before galvanizing, the base metal may be tested after stripping off the zinc coating.

5.2 Galvanizing shall be carried out by first pickling and/or by cleaning the base steel and then dipping in a bath of molten zinc at a temperature suitable to produce a complete and uniformly adhesive zinc coating (*see* IS 2629). The zinc ingots used for galvanizing shall conform to any of the grades specified in IS 209 or IS 13229.

5.3 Passivation and/or oiling shall be carried out on the surface. However, untreated surface, without any passivation and / or oiling can be supplied as agreed to between the purchaser and manufacturer. In case of non-treated products, the manufacturer is not responsible for the risk of corrosion. The purchaser is also advised that there is a greater risk of the appearance of scratches during handling and application.

5.4 Class of coating**,** spangle type (N or M), Coating finish type (*see* **7.6**) and surface treatment (*see* **7.7**) may be as agreed at the time of placing the order.

6 MECHANICAL PROPERTIES

The mechanical properties of base steel, after galvanizing shall be as per Table 2.

7 ZINC COATING

7.1 The zinc coating shall confirm to the requirement of any of the class prescribed in Table 3. The mass of coating referred to in this standard shall represent the total mass of zinc, both sides inclusive.

7.2 Any other mass of coating, not less than 80 g/m^2, may be supplied, if agreed to between the purchaser and the manufacturer.

Table 2 Mechanical Properties
(*Clauses* 6 *and* 8.1.2)

Sl. No.	Quality		Yield Stress, R_e MPa	Tensile Strength, R_m MPa	Elongation, Percent A *Min*	
	Designation	Name			L_o=80 mm	L_o=50 mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	GP	Ordinary	—	—	—	—
ii)	GPH	Ordinary-Hard	400 *Min*	—	—	—
iii)	GC	Corrugated ordinary	—	—	—	—
iv)	GPL	Drawing (Lock forming)	350 *Max*	450 *Max*	24	25
v)	GPD	Deep drawing	280 *Max*	430 *Max*	26	27
vi)	GPED	Extra deep drawing	260 *Max*	430 *Max*	28	31
vii)	GPIF	Interstitial free (Stabilized)	240 *Max*	370 *Max*	34	36
viii)	GP230	Structural Steel Grade 230	230 *Min*	310 *Min*	18	20
ix)	GP250	Structural Steel Grade 250	250 *Min*	360 *Min*	18	20
x)	GP275	Structural Steel Grade 275	275 *Min*	380 *Min*	18	20
xi)	GP300	Structural Steel Grade 300	300 *Min*	400 *Min*	18	20
xii)	GP350 Class-1	Structural Steel Grade 350Class-1	350 *Min*	420*Min*	12	13
xiii)	GP350 Class-2	Structural Steel Grade 350 Class-2	350 *Min*	—	12	13
xiv)	GP450	Structural Steel Grade 450	450 *Min*	480 *Min*	8	9
xv)	GP550	Structural Steel Grade 550	550 *Min*	570 *Min*	—	—

NOTE — Elongation values shall be reduced by 4 units for thickness 0.5 mm and lower and by 2 units for thickness 0.5 mm to 0.7 mm.

7.3 In addition X-ray fluorescence method (on line/ off line) can also be used for the same.

Table 3 Mass of Coating (Total Both Sides)
(*Clauses* 7.1 *and* 10.2)

Sl No.	Class of Coating	Minimum Average Coating Triple Spot Test g/m^2	Minimum Coating Single Spot Test[1)] g/m^2
(1)	(2)	(3)	(4)
i)	600	600	510
ii)	550	550	470
iii)	450	450	380
iv)	350	350	300
v)	275	275	235
vi)	220	220	190
vii)	200	200	170
viii)	180	180	155
ix)	120	120	100

[1)] Minimum individual value obtained in triple spot test.

NOTE — The recommended base steel thickness for roofing application is 0.63 mm and corresponding recommended class of coating shall be minimum 275 g/m^2.

7.4 If agreed to between the purchaser and the manufacturer, the class of coating 100, 90 and 80 may be used for non-critical applications other than roofing such as interior steel doors, furniture, trunks, electrical boxes, trays, etc. The mass of coating in such cases shall be as given in Table 4.

Table 4 Mass of Coating
(*Clause* 7.4)

Sl No.	Class of Coating	Minimum Average Coating Triple Spot Test g/m^2	Minimum Coating Single Spot Test [1)] g/m^2
(1)	(2)	(3)	(4)
i)	100	100	90
ii)	90	90	80
iii)	80	80	75

[1)] Minimum individual value obtained in triple spot test.

NOTES

1 For the above class of coating, the mandrel diameter for bend test for adhesion of zinc coating shall be subject to mutual agreement between the purchaser and the manufacturer.

2 By agreement between the purchaser and the manufacturer sheets of other profile, depth and pitch of corrugation may be supplied for non-roofing application.

7.5 For product 600 mm in width and narrower, only one single spot test is required. Specimens shall be taken at least 10 mm away from strip/sheet edge.

7.6 Coating Finish Type

The conditions of the coating designations are as

follows:

a) N : Normal coating, as coated;
b) S : Normal coating with skin pass;
c) M : Minimized spangle, as produced; and
d) E : Minimized spangle with skin pass.

The 'M' and 'E' coating conditions are normally furnished in thicknesses of 0.40 mm to 3 mm inclusive.

7.6.1 *As Coated Surface (A)*

Imperfections such as pimples, marks, scratches, pits, variation in surface appearance, dark spots, strip marks, and slight passivation marks are permissible. Stretch levelling marks may appear.

7.6.2 *Improved Surface (B)*

With this surface quality, small imperfections such as stretch levelling marks, skin pass marks, run-off marks, slight passivation stains are permissible.

7.6.3 *Best Quality Surface (C)*

Surface quality *C* is obtained by skin passing. The controlled surface shall make it possible to apply a uniform high class paint finish. The other surface shall at least have the characteristics of surface quality *B*.

NOTE — Galvanized material will be guaranteed for only one surface that is the top surface or the outer surface with respect to surface aspect and defects.

7.7 Surface Treatment (Surface Protection)

Hot dip galvanized steel shall be supplied with one of the following surface treatments. The period of protection afforded is limited and depends on the atmospheric and storage conditions.

Chemical passivation	:	C
Oiling	:	O
Chemical passivation and oiling	:	CO
Thin organic coating	:	TOC
Without oiling and passivation	:	WCO

7.7.1 *Chemical Passivation (C)*

Chemical passivation protects the surface against humidity and reduces the risk of formation of corrosion product (white rust) during storage and transportation. Local colour variation as a result of this treatment is permissible and does not impair the quality.

7.7.2 *Oiling (O)*

This treatment also reduces the risk of formation of corrosion products. It shall be possible to remove the oil layer with suitable degreasing solvent which does not adversely affect the coating.

7.7.3 *Chemical Passivation and Oiling (CO)*

Agreement may be reached to this combination of treatment in accordance with **7.7.1** and **7.7.2**, if increased protection against the formation of corrosion products is required.

7.7.4 *Thin Organic Coating (TOC)*

This treatment also reduces the risk of formation of corrosion products.

8 MECHANICAL TESTING

8.1 Tensile Test

8.1.1 Tensile test shall be carried out only, if specified by the purchaser.

8.1.2 When specified, the tensile test shall be carried out in accordance with IS 1608 as applicable, and the values of tensile strength, yield stress and percentage elongation shall conform to the requirements specified in Table 2.

8.1.3 Tensile test values apply to transverse specimen in case of sheet/strips. Transverse test piece shall be taken midway between the centre and the edge of the sheet/strip as-rolled.

8.1.4 The yield strength values apply to the 0.2 percent proof stress, if the yield strength is not clearly distinctive, the values apply to lower yield strength.

8.2 Bend Test

8.2.1 Bend test for the purpose of conformity shall be carriedout. However, bend test shall not be applicable to GPH, GC and GP550 grades.

8.2.1.1 One bend test shall be conducted for every coilor at the rate of one set of 2 samples for every 1 000 plain sheets or part thereof.

8.2.1.2 For bend test, the test piece shall be 230 mm long and 75 mm to 100 mm wide cut across the directionof rolling.

8.2.1.3 Specimens for bend tests shall be free from burrs. Filling or machining to remove burrs is permitted. Cracks of the base metal developing at the edge of the specimen or coarse grain developing at the line of the bend shall be disregarded.

8.3 Requirements

Samples of galvanized steel sheets selected as described in **8.2.1.1** shall with stand bending through 180° around amandrel having diameter specified in Table 5 or bent manually with a vice at 180° in the longitudinal direction of the test piece without peeling or flaking of zinc coating. Crack or fracture of base metal, except those indicated in **8.2.1.3**, shall not be permitted.

Table 5 Mandrel Diameter for Bend Test

(*Clause* 8.3)

All dimensions in millimetres.

Sl No.	Class of Coating	Diameter of Mandrel for Thickness of Sheet[1)]										
		Over 3	Over 2.3 Up to 3	Over 1.6 Up to 2.3	Over 1.25 Up to 1.6	Over 1.0 Up to 1.25	Over 0.8 Up to 1.0	Over 0.5 Up to 0.8	Over 0.4 Up to 0.5	Over 0.3 Up to 0.4	Over 0.22 Up to 0.3	Over 0.16 Up to 0.22
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	600	4	6	8	8	9	10	11	12	—	—	—
ii)	550	4	5	7	7	8	9	9	10	—	—	—
iii)	450	3	4	6	6	7	8	8	8	9	10	11
iv)	350	3	4	4	4	5	6	6	7	8	8	9
v)	275	3	4	4	4	5	6	6	6	7	7	8
vi)	220	2	3	3	3	4	4	4	4	5	5	5
vii)	200	2	2	2	3	3	3	3	3	4	4	4
viii)	180	2	2	2	3	3	3	3	3	3	4	4
ix)	120	2	2	2	3	3	3	3	3	3	4	4

[1)] Expressed as number of times the thickness of strip/sheet.

9 COATING SURFACE FINISH CLASSES AND DESIGNATION

Surface Finish Class	*Surface Finish Designation*	*Surface Roughness*
Dull finish	D	$0.50 \leq R_a \leq 2.0$
	C	$0.50 \leq R_a \leq 1.5$

NOTES

1 The unit is in micrometer.

2 Surface roughness is specified by "mean surface roughness-R_a".

3 For the surface roughness designation *D*, surface roughness specification is not provided. Instead a commonly used roughness control range is given as an informative value.

4 Surface roughness designation *C* may be specified when a controlled surface roughness is required to ensure in the coated film distinctness of image of appearance, gloss and image clarity.

10 COATING TEST

10.1 Test Samples

One set of three samples each 50 mm × 50 mm or 50 mm diameter, shall be selected at random from one sheet for every 1 000 galvanized sheets or part thereof. For single spot and triple spot tests, the test method given in IS 6745 shall be followed.

10.1.1 In case of supply in coil form, one set of 3 samples, 50 mm × 50 mm or 50 mm diameter, shall be selected from one end of each coil across the width.

10.2 Determination of Mass of Zinc Coating

The average masses of zinc coating of samples as selected under **10.1** and determined by the method given in IS 6745 or by any other established instrument or chemical method shall conform to both the values specified in Table 3/Table 4.

11 RETESTS

11.1 If any test sample fails to meet test requirements given in **8** and **10.2**, two more set of test samples shall be taken for the specific test requirements from the same lot.

11.2 If any of the retest sample fails to meet the requirements of this standard, the entire batch represented by the sample shall be deemed as not conforming to the standard.

12 FREEDOM FROM DEFECTS

12.1 Galvanized plain sheets, corrugated sheets and coils shall be reasonably flat and free from bare spots, pin holes, tears and other harmful defects. However, imperfections such as rough/non-uniform coating, minor dents, water/passivation marks, etc., may be present at certain portions which are not harmful for intended use.

12.2 Coils, however, may contain some abnormal imperfections which render a portion of the coil unusable since the imperfections in the coil cannot be removed unlike in the case of cut length.

13 MASS

13.1 Mass of sheets and coils shall be given in kg of actual or calculated mass.

13.2 The mass of sheets and coils shall be calculated as given in Table 6 on the basis of nominal dimensions and mass of zinc coating.

Table 6 Calculation of Mass of Sheets or Coils
(*Clause* 13.2)

Sl No.	Type of Material	Order of Calculation	Methods of Calculations	Number of Numerals in Resultant Value
(1)	(2)	(3)	(4)	(5)
i)	Sheet	a) Mass of single sheet	Nominal mass of single sheet plus mass of zinc coating	Round off to 4 effective figures
		b) Total mass	Mass of single sheet (kg) × Number of sheets	Rounded off to integral value of kg
ii)	Coil	a) Unit mass of Coil	Unit mass of sheet (kg/m^2) × width (mm) × 10^4	Rounded off to 3 effective figures
		b) Mass of single Coil	Unit mass of coil (kg/m) × Length (m)	—
		c) Total mass (kg)	Total mass of each coil	Integral number of kg

NOTES

1 Nominal mass of single sheet shall be calculated by calculating the volume of the sheet and multiplying the same with density of sheet (density 7.85 g/cm^3) and rounding the same to 4 effective figures.

2 Mass of the coating shall be calculated by multiplying the surface area of the single sheet with indicated nominal coating mass (g/m^2) as shown for triple spot test (*see* Table 3).

3 For calculation of corrugated sheet mass, the width before corrugation considered while calculating the area.

14 DIMENSIONS AND TOLERANCES OF PLAIN SHEETS/COILS

14.1 Sizes of Plain Sheets

The plain sheets shall be supplied in any combination of the following lengths, widths and thickness:

a) *Length* — 1 800, 2 200, 2 500, 2 800 and 3 000 mm

b) *Width* — 750, 900, 1 000 and 1 200 mm

c) *Thickness* (*Uncoated sheets*) — 0.10, 0.12, 0.14, 0.16, 0.18, 0.22, 0.25, 0.28, 0.32, 0.40, 0.45, 0.50, 0.55, 0.63, 0.70, 0.80, 0.90, 1.00, and 1.60 mm

NOTE — Sheets for other sizes (length, width and thickness) may also be supplied subject to the mutual agreement between the purchaser and the manufacturer.

14.2 Tolerance

14.2.1 *Length*

No sheet shall be smaller in length than that specified. Tolerances on length on plus side shall be 15 mm or 0.5 percent of length, whichever is greater.

14.2.2 The diagonal distance between opposite corners of any sheet shall not differ by more than 20 mm.

14.2.3 *Width*

No plain sheet shall be smaller in width than that specified. The positive tolerances on width shall be 10 mm.

14.2.4 *Thickness*

The tolerance on thickness of sheet and coil shall be according to IS 513, IS 1079, IS/ISO 16163 or as applicable.

14.2.5 *Tolerance on Mass*

The tolerance on mass of individual sheets calculated in accordance with 13 shall be within $\pm$ 10 percent and tolerance on mass of each bundle of sheet shall be $\pm$5 percent.

15 DIMENSIONS AND TOLERANCES OF CORRUGATED SHEETS

15.1 Sizes of Corrugated Sheets

15.1.1 *Length*

The length of the corrugated sheets shall be as follows:

1 800, 2 200, 2 500, 2 800, 3 000 and 3 050 mm.

NOTE — Sheets of other lengths may also be supplied subject to the mutual agreement between the purchaser and the manufacturer.

15.1.2 *Depth and Pitch of the Corrugations*

The depth and pitch of the corrugation shall be as per Table 7.

Table 7 Depth and Pitch of Corrugations
(*Clause* 15.1.2)

Sl No.	Type	Depth of Corrugation mm	Pitch of Corrugation mm
(1)	(2)	(3)	(4)
i)	A	17.5	75
ii)	B	12.5	75
iii)	C	19.0	70
iv)	D	17.5	70

NOTE — On agreement between the purchaser and the manufacturer sheets of other profile, depth and pitch of corrugation may also be supplied subject to fulfillment of required condition for imposed load on roofs as per **4.2** of IS 875 (Part 2).

15.1.3 *Number of Corrugations*

The number of corrugations shall be as per the Table 8, depending on the width of the sheet The overall width of the corrugated sheets before and after corrugation shall be as shown in Table 8.

15.1.3.1 Sheets of sizes and corrugation patterns other than those specified in Table 8 may be supplied, if agreed to between the purchaser and the manufacturer.

Table 8 Overall Width and Corrugation of Sheets
(*Clause* 15.1.3.1)

Sl No.	No. of Corrugation	Type	Overall Width of Sheet	
			Before Corrugation mm	After Corrugation mm
(1)	(2)	(3)	(4)	(5)
i)	8	A	750	660
ii)	10	A	900	810
iii)	11	A	1 000	910
iv)	13	A	1 200	1 110
v)	14	A	1 220	1 125
vi)	15	A	1 335	1 220
vii)	16	A	1 350	1 220
viii)	18	A	1 500	1 370
ix)	20	A	1 650	1 520
x)	8	B	750	680
xi)	10	B	900	830
xii)	11	B	1 000	930
xiii)	13	B	1 200	1 130
xiv)	16	B	1 350	1 240
xv)	18	B	1 500	1 390
xvi)	20	B	1 650	1 540
xvii)	10	C	840	720
xviii)	12	D	1 000	875

15.2 Tolerances

15.2.1 The tolerances on dimensions of corrugated sheet shall be as given in Table 9.

16 STORAGE AND TRANSPORTATION

Moisture, in particular condensation between the sheets, laps of the coil or other adjacent parts made of hot-dip coated flat products, can lead to the formation of corrosion products. The possible types of temporary surface protection are given in **7.7**. As a precaution, the products should be transported and stored dry and protected from moisture.

Table 9 Tolerance on Dimension of Corrugated Sheets
(*Clause* 15.2.1)

Sl No.	Dimensions	Tolerance[1)] mm
(1)	(2)	(3)
i)	Depth of corrugation	± 2.5
ii)	Pitch of corrugation	± 5
iii)	Overall width after corrugation	± 25

[1)] Average of 4 measurements

During transportation, dark spots may appear on the hot-dip coated surfaces as a result of friction. Generally, they only impair the appearance. Friction is reduced by oiling/acrylic film on the products. Additionally, secure packing, transporting the coils laid flatand avoiding local pressure points, reduce the risk of dark spots.

17 MARKING

17.1 Manufacturer's name or trade-mark, class of coating, length, width, thickness and number of corrugations, type (mention O if not as per the standard type as mentioned under **15.1.3.1**) in case of corrugated sheets and material identification (steel grade, surface quality, etc) shall be marked legibly on each sheet or shown on a tag attached to each bundle.

17.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

17.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

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Review of Indian Standards

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.org.in

Regional Offices: *Telephones*

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002 — 2323 7617, 2323 3841

Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi, KOLKATA 700054 — 2337 8499, 2337 8561, 2337 8626, 2337 9120

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