IS 277 : 1992
(Reaffirmed 1997)

भारतीय मानक

जस्तीकृत इस्पात की चद्दरें (सादी तथा नालीदार) — विशिष्टि

(पांचवाँ पुनरीक्षण)

Indian Standard

GALVANIZED STEEL SHEETS (PLAIN AND CORRUGATED) — SPECIFICATION

(Fifth Revision)

UDC 669·14-41 : 669·586

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 1992

Price Group 3

FOREWORD

This Indian Standard (Fifth 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 and 1985. In this revision steel sheets of lower thickness from 0·18 mm onwards and higher width of 1200 mm have been included. In the case of corrugated sheets, steel sheets with 13 corrugation have been included.

Galvanized steel sheets covered by this standard are intended to be used for general purposes, such as panelling and roofing. Steel sheets conforming to this standard are not intended to be used for other special applications.

For convenience in ordering galvanized steel sheet, the plain sheets should be ordered on the basis of their length, width and thicknesses. Sheets in coil form should be ordered on the basis of their internal diameter, width, thickness and mass. Whereas the corrugated sheets may be ordered on the basis of their length, thickness and depth and number of corrugations.

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

GALVANIZED STEEL SHEETS (PLAIN AND CORRUGATED) — SPECIFICATION

(Fifth Revision)

1 SCOPE

This standard covers the requirements of plain galvanized steel sheets and coils, and corrugated galvanized sheets.

2 REFERENCES

The following Indian Standards are necessary adjunct to this standard.

IS No.	*Title*
209 : 1979	Specification for zinc (*third revision*)
513 : 1986	Specification for cold rolled low carbon steel sheets and strips (*third revision*)
1079 : 1988	Specification for hot-rolled carbon steel sheets and strip (*fourth revision*)
1956 (Part 4) : 1975	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	Methods for determination of weight of zinc coating on zinc coated iron and steel articles
8910 : 1978	General technical delivery requirements for steel and steel products

3 TERMINOLOGY

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

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

3.3 Cold Rolled Sheet or Coil — Cold rolled sheet or coil prior to continuous galvanizing process.

3.4 Thickness of Sheet — Thickness of hot rolled or cold rolled sheet in cut length or coil form.

4 SUPPLY OF MATERIAL

The general requirements relating to the supply of galvanized sheets and strips shall conform to IS 8910 : 1978.

5 MANUFACTURE

5.1 The base metal (black sheets, cold rolled sheets or coils) for plain galvanized sheets and coils shall conform to grade O and for lock forming quality it shall conform to grade D of IS 1079 : 1988 or IS 513 : 1986 as the case may be. However for corrugated sheets the maximum phosphorus content may be 0·09 percent.

5.2 Galvanizing shall be carried out by first pickling the black sheets or by cleaning the cold-rolled coils in line and then dipping them in a bath of molten zinc at a temperature suitable to produce a comptete and uniformly adhesive zinc coating (*see* IS 2629 : 1985). The zinc ingots used for galvanizing shall conform at least to grade Zn98 of IS 209 : 1979.

6 CLASSIFICATION

Galvanized plain coils and sheets as well as corrugated sheets are classified as per Table 1 which also shows the grade of raw material which is required for the manufacture.

Table 1 Classification of Grades of GP/GC Coils and Sheets

(*Clauses* 6 *and* 9.2)

Type	Designation	Grade Reference of Raw Material IS 1079/IS 513
(1)	(2)	(3)
Ordinary	GP	Grade 'O'
Ordinary-Hard	GPH	Grade 'O'
Lock forming	GPL	Grade 'D'
Deep drawing	GPD	Grade 'DD'
Extra deep drawing	GPED	Grade 'EDD'
Corrugated ordinary	GC	Grade 'O'
Corrugated ordinary Hard	GCH	Grade 'O' Hard

7 ZINC COATING

7.1 The zinc coating shall conform to the requirement of any one of the grades prescribed in Table 2. 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, than those specified in Table 2, may be supplied, if agreed to between the purchaser and the manufacturer.

7.3 The following are recommended grades of zinc coating for the various thickness of sheets:

Thickness	*Grade of Zinc Coating*
0·18 to 0·28 (both inclusive)	200
0·30 to 0·55 (both inclusive)	220
0·63 to 1·0 (both inclusive)	275
above 1·00 mm	350

NOTES

1 The recommended thickness for roofing application is 0·63 mm and corresponding recommended grade of coating shall be minimum 275 gm/m².

2 If agreed to between the manufacturer and purchaser, for thickness 0·18 mm to 0·28 mm (both inclusive), other coating grades 180 and 120 may be used.

8 BEND TEST

8.1 Test Samples

Bend test for the purpose of conformity shall be carried out at the rate of one set of 2 samples for every 1 000 plain sheets or part thereof. However, bend test shall not be carried out on sheets intended for corrugation.

Table 2 Mass of Coating
(Total Both Sides)

(*Clauses* 7.1, 7.2 *and* 9.2)

Grade of Coating	Minimum Average Coating Triple Spot Test g/m²	Minimum Coating Single Spot Test[1] g/m²
(1)	(2)	(3)
600	600	510
450	450	380
350	350	300
275	275	235
220	220	190
200	200	170
180	180	155
120	120	100

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

8.1.1 One bend test shall be conducted for every coil.

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

8.1.3 Specimens for bend tests shall be free from burrs. Filing 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.

8.2 Requirements

Samples of galvanized steel sheets selected as described in **8.1** shall withstand bending through 180° around a mandrel having diameter specified in Table 3 without peeling or flaking of zinc coating. Crack or fracture of base metal, except those indicated in **8.1.3**, shall not be permitted.

9 COATING TEST

9.1 Test Samples

One set of three samples each 50 mm² or 50 mm diameter, shall be selected at random from one sheet for every 1 000 galvanized sheets or part thereof. In the case of the galvanized sheets produced from black sheets, one set of three samples shall be taken, two from each extremities of a diagonal and one from the middle of the sheet, whereas in the case of galvanized sheet produced from cold-rolled coils, one set of three samples shall be taken from the middle of the width of the sheet and one from each side of the sheet. The sample from extremities, diagonal or from the side of the sheet shall not be closer than 75 mm from the edge of the sheet.

9.1.1 In case of galvanized sheet supplied in coils, one set of 3 samples, each 50 mm² or 50 mm diameter shall be selected from one end of each coil across the width.

9.2 Determination of Mass of Zinc Coating

The average masses of zinc coating of samples as selected under **9.1** and determined by the method given in IS 6745 : 1972 shall conform to both the values specified in Table 2.

10 RETESTS

10.1 If any test sample fails to meet test requirements given in **8.2** and **9.2**, two more test samples shall be taken for the specific test requirements from the same lot.

Table 3 Mandrel Diameters for Bend Test

(*Clause* 8.2)

All dimensions in millimetres.

Grade of Coating	Diameter[1] of Mandrel for Thickness of Sheet										
	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)
750	6	8	10	10	11	12	14	15	—	—	—
600	4	6	8	8	9	10	11	12	—	—	—
450	3	4	6	6	7	8	8	8	9	10	11
375	3	4	4	4	5	6	6	7	8	8	9
300	3	4	4	4	5	6	6	6	7	7	8
250	2	3	3	3	4	4	4	4	5	5	5
200	2	2	2	3	3	3	3	3	4	4	4
175	2	2	2	3	3	3	3	3	3	4	4
120	2	2	2	3	3	3	3	3	3	4	4

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

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

11 FREEDOM FROM DEFECTS

11.1 Galvanized plain sheets, corrugated sheets and coils shall be reasonably flat and free from bare spots, holes, tears and other harmful defects.

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

12 MASS

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

12.2 The mass of sheets and coils shall be calculated as given in Table 4 on the bases of nominal dimensions and mass of zinc coating.

13 DIMENSIONS AND TOLERANCES OF PLAIN SHEETS/COILS

13.1 Sizes of Plain Sheets

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

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) — 0·18, 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, 1·25 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.

13.1.1 In case of sheets supplied in coil, the internal diameter of coil shall be 450, 510 or 610 mm and the mass of each coil shall not exceed 12 tonne.

13.1.1.1 Coils weighing more than 12 tonnes may be supplied subject to mutual agreement between the contracting parties.

13.2 Tolerances

13.2.1 *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.

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

13.2.3 *Width*

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

Table 4 Calculation of Mass of Sheets or Coils

(*Clause* 12.2)

Type of Material	Order of Calculation	Method of Calculation	Number of Numerals in Resultant Value
(1)	(2)	(3)	(4)
Sheet	Mass of single sheet	Nominal mass of single sheet plus mass of zinc coating	Rounded off to 4 effective figures
	Total mass	Mass of single sheet (kg) × number of sheets	Rounded off to integral value of kg
Coil	Unit mass of coil	Unit mass of sheet (kg/m^2) × width (mm) × 10^{-3}	Rounded off to 3 effective figures
	Mass of single coil	Unit mass of coil (kg/m) × length (m)	—
	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 (Table 2).

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

13.2.4 *Thickness*

The tolerance on thickness of sheet and coil shall be according to IS 1079 : 1988 or IS 513 : 1986 as applicable.

13.2.5 *Tolerance on Mass*

The tolerance on mass of individual sheets calculated in accordance with **12.2** shall be within ±10 percent and tolerance on mass of each bundle of sheet shall be ±5 percent.

14 DIMENSIONS AND TOLERANCES OF CORRUGATED SHEETS

14.1 Sizes of Corrugated Sheets

14.1.1 *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

14.1.2 *Depth and Pitch of the Corrugations*

The depth and pitch of corrugation shall be as follows (*see* Fig. 1) :

Grade	*Depth of Corrugation*	*Pitch of Corrugation*
	mm	mm
A	17·5	75
B	12·5	75

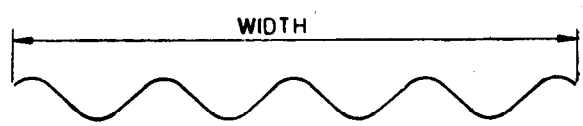
14.1.3 *Number of Corrugations*

The number of corrugations shall be 8, 10, 11 and 13 depending on the width of the sheet. The overall width of the corrugated sheet before and after corrugation shall be as shown in Table 5.

14.1.3.1 Sheets of sizes other than those specified above may be supplied, if agreed to between the contracting parties.

Table 5 Overall Widths and Corrugations of Sheets

(*Clause* 14.1.3)



Number of Corrugations	Grade	Overall Width of Sheet	
		Before Corrugation mm	After Corrugation mm
(1)	(2)	(3)	(4)
8	A	750	660
10	A	900	810
11	A	1 000	910
13	A	1 200	1 110
8	B	750	680
10	B	900	830
11	B	1 000	930
13	B	1 200	1 130

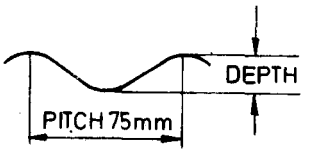


FIG. 1 DEPTH AND PITCH OF CORRUGATIONS

14.2 Tolerances

14.2.1 The tolerances on dimensions of corrugated sheet shall be as given in Table 6.

15 MARKING

15.1 Manufacturer's name or trade-mark, grade of coating, length, width, thickness and number of corrugations, grade in case of corrugated sheets and material identification (grade, quality, etc) shall legibly be marked on top of each sheet or shown on a tag attached to each bundle.

15.2 Standard Marking

The material may also be marked with Standard Mark.

Table 6 Tolerance on Dimension of Corrugated Sheets

(*Clause* 14.2.1)

Dimensions	Tolerance[1)]
(1)	(2)
Depth of corrugation	± 2·5 mm
Pitch of corrugation	± 5 mm
Overall width after corrugation	± 25 mm

1) Average of 4 measurements.

Standard Mark

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 Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence 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

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Amendments Issued Since Publication

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AMENDMENT NO. 1 OCTOBER 1993
TO
IS 277 : 1992 GALVANIZED STEEL SHEETS (PLAIN AND CORRUGATED) — SPECIFICATION

(Fifth Revision)

(*Page* 3, *Table* 3) — Replace the existing table by the following:

Table 3 Mandrel Diameters for Bend Test

(*Clause* 8.2)

All dimensions in millimeters.

Grade of Coating	Diameter* of Mandrel for Thickness of Sheet										
	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)
600	4	6	8	8	9	10	11	12	-	-	-
450	3	4	6	6	7	6	8	8	9	10	11
350	3	4	4	4	5	6	6	7	8	8	9
275	3	4	4	4	5	6	6	6	7	7	8
220	2	3	3	3	4	4	4	4	5	5	5
200	2	2	2	3	3	3	3	3	4	4	4
180	2	2	2	3	3	3	3	3	3	4	4
120	2	2	2	3	3	3	3	3	3	4	4

*Expressed as number of times the thickness of sheet.

(MTD 4)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 DECEMBER 1993
TO
IS 277 : 1992 GALVANIZED STEEL SHEETS (PLAIN AND CORRUGATED) — SPECIFICATION

(Fifth Revision)

(*Foreword, third para*)— Substitute the following for the existing para:

'Galvanized steel sheets covered by this standard are intended to be used for purposes such as panelling, roofing, lock forming, etc.'

(MTD 4)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 DECEMBER 1998
TO
IS 277 : 1992 GALVANIZED STEEL SHEETS (PLAIN AND CORRUGATED) — SPECIFICATION

(Fifth Revision)

(*Page* 1, *clause* 2) — Substitute the following for the existing clause:

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
513 : 1994	Cold-rolled low carbon steel sheets and strips (*fourth revision*)
1079 : 1994	Hot-rolled carbon steel sheet and strip (*fifth revision*)
1956 (Part 4) : 1976	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	Methods for determination of mass of zinc coating on zinc coated iron and steel articles
8910 : 1978	General technical delivery requirements for steel and steel products
13229 : 1991	Zinc for galvanizing

(*Page* 1, *clause* 5.1) — Substitute the following for the existing:

5.1 The base metal of plain glavanized sheets and coils shall conform to grade 0 and for lock forming quality it shall conform to grade D of IS 1079 : 1994 or IS 513 : 1994 as the case may be. The test for base metal shall be verified on samples of galvanized sheet or strip after stripping off the zinc coating. For corrugated sheets, the maximum phosphorous content may be 0.09 percent.'

(*Page* 1, *clause* 5.2) — Substitute the following for the last line of the para:

'Zinc ingots used for galvanizing shall conform to grade Zn 98.50 of IS 13229 : 1991.'

(*Page* 1, *clause* 6) — Substitute the following for the existing clause:

'6 CLASSIFICATION

Base metal of galvanized plain sheets and coils as well as corrugated sheets are classified as per Table 1.'

(*Page* 1, *Table* 1, *column heading* 3, *line* 2) — Substitute '**of Base Metal**' *for* '**of Raw Material**'.

(MTD 4)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 4 MARCH 2002
TO
IS 277 : 1992 GALVANIZED STEEL SHEETS (PLAIN AND CORRUGATED) — SPECIFICATION

(Fifth Revision)

[*Page* 1, *clause* **5.2** (*see also Amendment No.* 3)] — Substitute the following for the last line of the para:

'Zinc ingots used for galvanizing shall conform to any of the grades specified in IS 209 : 1992 or IS 13229 : 1991'.

(MTD 4)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 5 NOVEMBER 2002
TO
IS 277:1992 GALVANIZED STEEL SHEETS (PLAIN AND CORRUGATED) — SPECIFICATION

(Fifth Revision)

(*Foreword*) — Insert the following before last para:

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

(MTD 4)

Reprography Unit, BIS, New Delhi, India