For Comments Only

Draft *Standard*

SPECIFICATION FOR COLD-REDUCED TINPLATE AND COLD-REDUCED BLACKPLATE –ORDINARY QUALITY

ICS 77.140.50

Last date for receipt of comments is

FOREWORD
(Formal clauses will be added later)

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.

1 SCOPE

1.1 This standard covers the requirements for the following to be supplied in sheets of thickness 0.17 to 0.49 mm:

i) Cold-reduced black sheet, and
ii) Single reduced- ordinary quality tinplate

1.2 Single reduced- ordinary grade tinplate is specified in nominal thicknesses that are multiples of 0.005 mm from 0.17 mm up to and including 0.49 mm. Double reduced tinplate is specified in nominal thicknesses that are multiples of 0.005 mm, from 0.14 mm up to and including 0.29 mm.

2 REFERENCES

The standards listed below 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 subject 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*
1586:2000	Method for rockwell hardness test for metallic material (scale A-B-C-D-E-F-G-H-K 15N, 30, 45N, 15T and 45T *(third revision)*
1993:2006	Cold -reduced electrolytic tinplate *(fourth revision)*
2385:1977	Specification for hot-rolled mild steel sheet and strip in CC form for cold reduced tinplate and cold reduced blackplate *(first revision)*
8910:1978	General technical delivery requirements for steel and steel products
10340:1982	Glossary of terms for cold-reduced tinplate and cold-reduced blackplate

3 TERMINOLOGY

3.0 For the purpose of this standard the following definitions and those given in IS 10340 shall apply.

3.1 Cold-reduced Black plate – Low carbon mild steel strip/sheet produced by continuous or semi continuous cold-reduction of hot-rolled steel strip/sheet.

3.2 Cold-Reduced Hot-Dipped Tinplate – Cold-reduced low carbon mild steel sheet which has been tinned by the hot-dip tinning process.

3.3 Cold-reduced Electrolytic Tinplate-Low carbon mild steel cold-reduced strip, which has been tinned by the electrolytic process.

3.4 Ordinary grade tinplate: Material in sheet form which is the product of line inspection. It is suitable, under normal conditions of storage, for established lacquering and printing the defective area is not more than 15 percent of the total surface.

3.5 Defective / deficient tinplate: Material which represents the sheets rejected from the ordinary grade whose suitability for established lacquering and printing over the entire surface of the sheet is not assured.

4 SUPPLY OF MATERIAL

General requirements for the supply of cold-reduced tinplate and cold-reduced blackplate shall conform to IS 8910.

5 MANUFACTURE

5.1 The method of manufacture of tinplate and blackplate shall be at the discretion of the manufacturer.

5.2 The hot-rolled strip for the manufacture of cold-reduced blackplate shall conform to IS 2385. However, for special applications the chemical composition of the steel shall be as agreed to between the purchaser and the manufacturer.

5.3 The used in hot-dip tinning process and for making anodes for electrolytic process shall be of purity not less than 99.75 percent.

5.4 While ordering tinplate or blackplate, it is recommended that the usage for which tinplate or blackplate is intended, should be stated, and when so desired, the purchaser should indicate to the manufacturer the direction of rolling (grain direction) required, by underlining the rolling width dimension on his order.

It is also recommended that the purchaser should be informed of any alternations in the method of manufacture which might significantly affect the properties of the purchased product. Similarly, purchaser should inform the manufacturer of modification in their fabrication methods which might significantly affect the way in which the purchased product is to be used.

6 GRADES

Tinplate and blackplate shall be supplied in the following grades.

Ordinary grade tinplate (TPO)

Defective / deficient tinplate(TPD)

Tin Mill Black Plate (TMBP)

7 MASS OF TIN COATING

7.1 The mass of tin coating shall be expressed in g/m2 in terms of the quantity of tin present on the two surfaces of the sheets. The figure being prefixed by initial `H' in the case of ho-dipped tinplate and E and D in case of equally and differentially coated electrolytic tinplate respectively.

7.2 The tin coating masses normally available in the case of hot-dipped tinplate and electrolytic tinplate are given in Table 1.

7.2.1 Other coating masses may be supplied as agreed to between the purchaser and manufacturer.

Table 1 Tolerances on Tin Coating Masses
(*Clause* 8)

Ranges of Mass (*m*) per surface g / m²	**Permissible deviation for sample average from nominal coating mass g / m²**
1.0 ≤ *m* < 1.5	- 0.30
1.5 ≤ *m* < 2.8	- 0.35
2.8 ≤ *m* < 4.1	- 0. 35
4.1 ≤ *m* < 7.6	- 0. 55
7.6 ≤ *m* < 10.1	- 0. 70
10. 1 ≤ *m*	- 0. 95

8 MECHANIAL PREPERTIES

8.1 Tinplate shall be supplied in any one of the tempers specified in Table 2. The Rockwell superficial hardness of 30 T scale for different tempers using a diamond anvil when determined n accordance with IS 1586 shall be as given in Table 2.

8.1.1 For a given temper classification, the corresponding HR 30 T values for blackplate may be as much as 4 units lower depending on the age of the plate and the conditions of storage.

8.1.2 The Rockwell hardness test is sensitive to the anvil effect and hence is effected by the thickness of test specimen. The values of Table 2 are typical for plates in the thickness range 0.25 to 0.31 mm only. Tinplates in the range of 0.22 to 0.24 mm shall have a value of 1 HR 30 T unit higher and tinplates thicker than 0.31 mm shall have a value of maximum 1 unit lower than specified.

8.1.3 For the purpose of this Standard , single reduced tinplate is classified into temper grades based on Rockwell HR30Tm hardness values and double-reduced tinplate classification is based on the 0,2% proof stress properties.

8.1.4 Other mechanical properties will significantly influence the performance of tinplate in processing, and the subsequent intended end use will vary depending on the steel type and the methods of casting, annealing and temper rolling employed.

NOTE: By agreement , the type of annealing for tinplate i.e. BA or CA , may be specified when ordering.

8.1.5 The hardness values of single- reduced tinplate shall be as given in table 2 when tested as described in D.3 of IS 1993.

8.1.6 The proof stress shall be as given in table 3, when tested as described in 14.3 of IS 1993.

Table 2 - Hardness values (HR30Tm) for single-reduced tinplate
(*Clause* 8.1.5)

Steel grade (previous designation)	***e* ≤ 0.21**		**0.21 < *e* ≤ 0.28**		***e* > 0.28**	
	Nominal	**Range for sample average**	**Nominal**	**Range for sample average**	**Nominal**	**Range for sample average**
TH 50 + SE (T50)	53 max.		52 max.		51 max.	

TH 52 + SE (T52)	53	± 4	52	± 4	51	± 4
TH 55 + SE (T55)	56	± 4	55	± 4	54	± 4
TH 57 + SE (T57)	58	± 4	57	± 4	56	± 4
TH 61 + SE (T61)	62	± 4	61	± 4	60	± 4
TH 65 + SE (T65)	65	± 4	65	± 4	64	± 4

NOTES
1 It is important to distinguish between HR 30Tm from HR30T , the former denoting that depressions on the under surface of the test piece are permitted(cf.ISO 1024)
2 *e* is the thickness, in millimeters

Table 2 - Proof stress values of double-reduced tinplate
(*Clause* 8.1.6)

Steel grade (previous designation)	**Average 0.2 % proof stress**	
	Nominal N/ mm^2	Permitted range N/ mm^2
T 550 + SE (DR 550)	550	± 70
T 580 + SE (DR 580)	580	± 70
T 620 + SE (DR 620)	620	± 70
T 660 + SE (DR 660)	660	± 70
T 690 + SE (DR 690)	690	± 70

8.1.7 On plate of thickness 0.22 mm and below the hardness test may be made using HR 15 T scale. The value thus obtained shall be converted to HR 30 T scale by using Table 3.

8.1.8 The hardness figures applicable for a given consignment shall be the arithmetic mean of the results of the tests.

Table 3 Conversation from HR 15 T To HR 30 T Values
(*Clause* 8.1.7)

HR 15 T value	**Equivalent HR 30 T value**
88.0	73.0
87.5	72.0
87.0	71.0
86.5	70.0
86.0	69.0
85.5	68.0
85.0	67.0
84.5	66.0
84.0	65.0
83.5	63.5
83.0	62.5
82.5	61.5
82.0	60.5
81.5	59.5
81.0	58.5
80.5	57.0

80.0	56.0
79.5	55.0
79.0	54.0
78.5	53.0
78.0	51.5
77.5	51.0
77.0	49.5

9 Tolerances on dimensions and shape

9.1 General

Tolerances on dimensions (i.e thickness and linear dimensions) and shape (i.e. edge camber, out-of-squareness, lateral weave) are specified in **9.2.1** to **9.3.4**, with cross references to IS 1993 for appropriate methods of measurement.

> NOTE - Other geometrical features may be present, such as burr , edge wave , center buckle, longitudinal bow and transverse bow. This standard does not specify methods of measurement and does not specify limits for these geometrical features, certain of which are subject to equipment employed by the purchaser. The producer should endeavor to keep the occurrence and magnitude of burr, edge wave, center buckle and transverse bow to a minimum. He should also endeavor to minimize the variation of the longitudinal bow.

9.2 Coils

9.2.1 Length

The difference between the actual length and the producer's indicated length, measured on any single coil, shall not exceed ± 5 %.

The accumulated difference between the actual lengths and producer's indicated lengths, measured on at least 100 coils, shall not exceed 0.25%.

> NOTE -The purchaser normally verifies the length of strip in a coil by multiplying the average length of the sheets sheared from the coil by the number of sheets obtained and adding the accumulated lengths of any other portions of the coil as received. The average length of the sheets sheared from the coil I s normally determined by measuring the lengths of at least ten sheets, taken at random, to an accuracy of 0.2 mm. coil lengths may be measured by other methods, provided that the method adopted is acceptable to both the producer and purchaser.

9.2.2 Width

The width of each sample sheet, selected in accordance with clause 12, shall be measured to the nearest 0.5 mm. The width shall be measured across the centre of the sheet, at right angles to the direction of rolling, with the sheet lying on a flat surface. The measured width shall be not less than the ordered width and shall not exceed the ordered width by more than 3 mm.

9.2.3 Thickness

9.2.3.1 General

The transverse thickness profile shall be measured using the micrometer method described in **14.1.2** of IS 1993. All other thicknesses shall be determined by the weighing method (see **14.1.1** of IS 1993 or by direct measurement using the micrometer method. However in cases

of dispute and for al retests, except for the transverse thickness profile, the weighing method shall be used.

9.2.3.2 Individual sheets

When shearing a coil, sheets shall be eliminated if they deviate from the nominal thickness by more than + 8.5%.

9.2.3.3 Average thickness of a consignment

The average thickness of a consignment, determined by the weighing method described in **14.1.1** of IS 1993, on the sample sheets selected shall not deviate from the ordered nominal thickness by more than

a) ± 3.5 % for a consignment of more than 20 000 sheets; or

b) ± 5 % for a consignment of 20 000 sheets or less

9.2.3.4 Thickness variation across the width

The thickness of each of the two individual test pieces, determined in accordance with **14.1.1** of IS 1993, shall not deviate from the actual average thickness of the whole sheet by more than 5%.

9.2.3.5 Feather edge (transverse thickness profile)

The minimum thickness, when measured by the micrometer method described in **14.1.2** of IS 1993, shall not differ from the actual centre thickness of the sheet by more than 8%.

9.2.4 Edge camber of coils

Edge camber is the maximum deviation (in the plane of the sheet) of an edge from a straight line forming a chord to its extremities (see figure 1).

The edge camber expressed as a percentage of the chord length, is calculated using the following formula :

$$\text{Edge camber} = \frac{\text{Deviation (D)}}{\text{Length of chord (6 m)}} \times 100$$

The edge camber, measured over a distance (chord length) of 6 m, shall not exceed 0.1% (i.e. 6 mm).

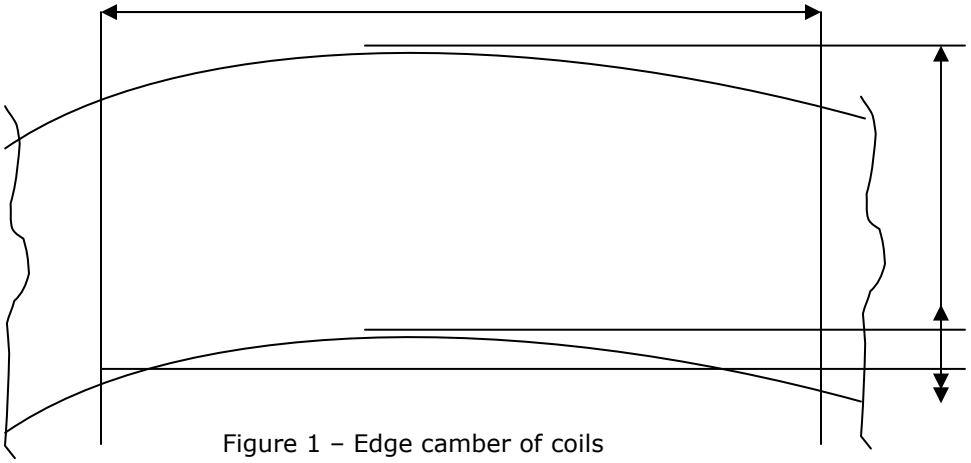

Figure 1 – Edge camber of coils

9.2.5 Lateral weave (short pitch camber) of coils

Lateral weave is the deviation of a mill-trimmed edge from a straight line lying in the same plane and forming a chord to it over a relatively short distance.

The lateral weave, measured over a chord length of 1 m, shall not exceed 1.0 mm, when measured prior to shearing.

> NOTE - If the coil is used for scroll shearing, the permissible values should be agreed upon between the manufacturer and purchaser.

9.3 Sheets

9.3.1 Linear dimensions of sheets

Each sample sheet shall be such that a rectangle of the ordered dimensions can fit into it. To determine the linear dimensions , lay each sample sheet , selected in accordance with **13.2.2** of IS 1993, on a flat surface and measure the length and width to the nearest 0.5 mm across the center of the sheet.

The dimensions of each sample sheet shall be not less than the ordered dimensions and the length shall not exceed the ordered dimension by more than 5 mm and width shall not exceed the ordered dimension by more than 3 mm.

9.3.2 Thickness of sheets

9.3.2.1 General

The transverse thickness profile shall be measured using the micrometer method described in **14.1.2** of IS 1993. All other thicknesses shall be determined by the weighing method (see **14.1.1** of IS 1993 or by direct measurement using the micrometer method. However in cases of dispute and for al retests, except for the transverse thickness profile, the weighing method shall be used.

9.3.2.2 Individual sheets

The thickness of the individual sample sheets, selected from a consignment in accordance with **13.2.2** of IS 1993, shall not deviate from the ordered measured thickness at center by more than ± 5 % and shall not deviate from the ordered nominal thickness by more than ± 8 % (whichever is more).

9.3.2.3 Average thickness of a consignment

The average thickness of a consignment, determined by the weighing method described in **14.1.1** of IS 1993 on the sample sheets selected in accordance with **13.2.2** of IS 1993 shall not deviate from the ordered nominal thickness by more than

a) ± 3.5 % for a consignment of more than 20 000 sheets; or

b) ± 5 % for a consignment of 20 000 sheets or less

9.3.2.4 Tolerances on local thickness within a sheet (crown)

The thickness of each of the two individual test pieces, determined by the weighing method described in **14.1.1** of IS 1993, shall not deviate from the actual average thickness of the whole sheet by more than 5 %.

9.3.2.5 Feather edge (transverse thickness profile)

The minimum thickness, when measured by the micrometer method described in **14.1.2** of IS 1993, shall not differ from the actual center thickness of the sheet by more than 8 %.

9.3.3 Edge camber of sheets

For each sample sheet , the edge camber as in **10.3.3.**of IS 1993, shall not exceed 0.20 %

9.3.4 Out of Squareness

For each sheet in the sample , the out of sqaureness as in **10.3.4** of IS 1993, shall not exceed 0.40 %.

10 Marking of differentially coated cold-reduced tinplate

Refer clause **12** of IS 1993.

11 Sampling

For sampling of sheets refer clause **13.2** of IS 1993.

12 Test methods

Standard test methods for tinplate have been described in clause **14** of IS 1993.

13 Retests

In cases of disputes and retests refer clause 15 of the International Standard IS 1993.

14 Dispatch and packaging

For sheets to be supplied in bulk packages refer clause **16** of IS 1993.

NOTE : Refer to the following in IS 1993 as standard procedures

a) Annex A for Volumetric method for the determination of the tin coating mass
b) Annex B for springback test for routine determination of proof stress for double-reduced material
c) Annex C for alternative marking system for differentially coated tinplate
d) Annex D for recommended Rockwell hardness values for double-reduced tinplate
e) A list of common defects in black plate and tin plate is given in annexure-E. However, these defects if present, shall be in the thickness tolerance.

Lot Size	**Tolerance**
Less than 20,000 Sheets	± 3.5 %
More than 20,000Sheets	± 5%

Out of Squareness Value : Max. Limit shall be 0.4 %

Camber : The max. shall be 0.2 %

ANNEX E
List of Common Defects in Blackplate and Tinplate

E.1 BLACKPLATE

E-1.1 The most common surface defects encountered in blackplate are given below. The degree of acceptance shall be subject to agreement between the purchaser and the manufacturer keeping in view the ultimate use of blackplate:

a) Roll marks and visible scratches;
B) Rust spots;
c) Bran, dirt and excessive oil;
e) Lamination and sand spots;
f) Indentation;
g) Transit rub marks; and
h) Pinhole.

E-2 HOT-DIPPED TINPLAE

E-2.1 The most common surface defects encountered in hot-dipped tinplate are given below. The degree of acceptance shall be subject to agreement between the purchaser and the manufacturer keeping in view the ultimate use of tinplate:

a) Mill grease;
b) Scruff beads;
c) Rust;
d) Roll marks;
e) Visible scratches;
f) Bran, dirt and excessive oil;
g) Small bent corners;
h) Streaks;
j) Excessive list edge;
k) Tin blisters;
m) Fold edge;
n) Lamination, sand spots;
p) Indentation;
q) Transit rub marks;
r) Slight edge corrugation;
s) Pinhole;
t) Dent;
u) Seam;
v) Tin blob; and
w) Lapper.

E-3 ELECTROLYTIC TINPLATE

E-3.1 The most common surface defects encountered in electrolytic tinplate are given below. The degree of acceptance shall be subject to agreement between the purchaser and the manufacturer keeping in view the ultimate use of tinplate:

a) Pinhole;
b) Indentation;
c) Scratches;
d) Transit rub marks;
e) Oil patches;
f) Roll marks;
g) Bent corners;
h) Staining;
j) Orange peel effect;
k) Rust spots;
m) Woodgrain finish;
n) Tin blisters;
p) Matt patches, and
q) White patches (untinned patches).
r) Dull finish.

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Sl.No.	Clause / Subclause / Para No. commented	Comments / Suggestions
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