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तप्त निमज्जी एल्यूमीनियम- जिंक मिश्रधातु लेपित इस्पात पत्ती एवं चादरें - विशिष्टि

(IS 15961 *का पहला पुनरीक्षण)*

Draft Indian Standard

Hot Dip Aluminium-Zinc Alloy Metallic Coated Steel Strip and Sheet - Specification

(*first revision of* IS 15961)

ICS 7.140.50

Wrought Steel Products	Last date for receipt of comments is
Sectional Committee MTD 4	**18 Aug 2023**

FOREWORD

(*Formal clauses will be added later*)

This standard was first published in 2012. This Indian standard has been developed to cover the various technical requirements. While reviewing this standard in the light of experience gained in its usage Committee felt that the standard should be reviewed to bring it in line with the present national and international practices in the field. In this revision, following significant changes have been made:

a) Amendments number 1, 2 and 3 have been incorporated.
b) Commercial and drawing quality class has been added.
c) Number of Structural steel grades has been enhanced.
d) Tables 1, 2 & 3 have been modified to capture changes in requirements meant for adding new class and grades
e) Clauses 1.2, 8.1, 9.5, 13.4 and 13.1 have been modified.
f) Scope has been modified - done away with restriction on thickness and supply of steel only in form of plain steels
g) Clauses 9.8 and 13.3 have been added.

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.

The composition of the Committee responsible for formulation of this standard is given in Annex B.

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 : 2022 'Rules for rounding off numerical values (*second revision)'. 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

HOT DIP ALUMINIUM-ZINC ALLOY METALLIC COATED STEEL STRIP AND SHEET

(First Revision)

1. SCOPE

This standard covers the requirement of continuously hot-dip aluminium- zinc alloy metallic coated steel strips and sheets.

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*
IS 513 (Part 1) : 2016	Cold reduced carbon steel sheet and strip: Part 1 cold forming and drawing purpose (*sixth revision*)
IS 513 (Part 2) :2016	Cold reduced carbon steel sheet and strip: Part 2 High Tensile and Multi-phase Steel (*sixth revision*)
IS 875 Part 2: 1987	Code of practice for design loads (Other Than Earthquake) for buildings and structures: Part 2 imposed loads (*second revision*)
IS 1608 (Part 1) : 2022 / ISO 6892-1 : 2019	Metallic Materials — Tensile Testing Part 1 Method of Test at Room Temperature (*fifth revision*)
IS 1956 (Part 4) : 2013	Glossary of terms relating to iron and steel: Part 4 flat products (*second revision*)
IS 8910:2022/ ISO 404:2013	Steel and Steel Products — General Technical Delivery Requirements (*second revision*)
IS 12860: 1989	Metallic coatings thickness by X-ray fluorescence technique method -Determination
IS/ISO 16163:2012	Continuously hot - Dipped coated steel sheet products - Dimensional and shape tolerances (*first revision*)

3. TERMINOLOGY

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

3.1 Cold Reduced Sheet or Coil — Cold rolled sheet or coil prior to hot-dip coating process.

3.2 Thickness of Sheet — Thickness of cold reduced sheet in cut-length or coil form without any coating on it. This is also termed as BMT (base metal thickness). In case of coated steel, it is measured after removing the coating. This is the thickness on which structure is designed and should be used while ordering the coated steel.

3.3 Coated Thickness — Thickness of coated sheet in cut-length or coil form. This is also termed as TCT (total coated thickness).

3.4 Aluminium/Zinc Alloy coating — A hot-dip coating composed of 50-60 percent of aluminium, 1-2 percent Si, balance zinc and incorporating minor addition of control elements. This type of coating normally has a post treatment for perseverance.

3.5 Surface Finish:

3.5.1 *Normal*

The un-altered about 55 percent aluminium zinc crystal structure that occurs during solidification of a hot-dip coated steel sheet. It will be denoted by N (Normal).

3.5.2 *Skin Passed*

The material is skin passed for improved surface condition to make it suitable for subsequent painting and it will be denoted by S (Skin Passed).

3.6 Coating Class — The designation of coating class shall include a set of characters as follows:

Aluminium zinc alloy shall be indicated by the prefix 'AZ', followed by a number representing the minimum coating mass, in 'grams per square meter' (g/m^2) of sheets or strips (total for both surfaces determined by triple spot test/on-line X-ray fluorescence method).

Example:

"AZ150"

3.7 Steel Grade: The designation of steel grade shall include a set of characters as follows:

(a) First and second characters: to indicate Yield Strength 'YS'.

(b) Third, fourth and fifth characters: to represent the minimum yield strength in MPa, namely '250', '300', '350', '450' and '550'.

Example:

"YS 550"

3.8 Surface Treatment Condition: Coated steel surface maybe given passivation treatment or other additional coating. This condition will be designated as `T'.

4. SUPPLY OF MATERIAL

4.1 The general requirements relating to supply of aluminium- zinc alloy metallic coated steel strip & sheet shall conform to IS 8910.

The coated steel to this standard may be supplied in surface finish Normal (Regular Spangle) /Skin-passed based on mutual agreement between purchaser and supplier. The coated steel of this standard may also be supplied in profiles based on mutual agreement between the purchaser and the supplier for structural applications subject to fulfillment of required condition for imposed load on roofs as per 4.2 of IS 875 (Part 2).

5. MANUFACTURE

5.1 The base metal of cold rolled low carbon steel strip for aluminium- zinc alloy metallic coated steel strip and sheet shall be as per IS 513 Part 1 and IS 513 Part 2.

5.2 Coating is done by dipping the cold-rolled strip in a bath of molten aluminum, zinc and control elements at a temperature suitable to produce a complete and uniformly adhering aluminium- zinc alloy metallic coating.

5.3 Coated Surface may be given treatment like temper mill pass, surface passivation or other coating for different beneficial reasons.

6. PRODUCT DESIGNATION

6.1 The product designation shall follow the sequence below:

(a) Number of this Indian Standard (IS);
(b) Steel grade;
(c) Coating Class;
(d) Surface finish; and
(e) Surface treatment condition (Passivated, other coating etc.)

Example:
IS 15961 YS550 AZ150 NT

7. CHEMICAL COMPOSITION

7.1 Requirements for Chemical Composition of the base steel shall be as per IS 513 Part 1 and IS 513 Part 2.

8. TENSILE TEST

8.1 Test Piece

The tensile test piece shall be cut transverse to the direction of rolling.

8.2 Testing frequency

Sample shall be collected and tested for each mother cold rolled coil and the part thereof as per agreement between supplier and the purchaser.

8.3 Testing

When tested as per IS 1608 Part 1, the tensile properties shall conform to the requirements specified in Table 1A and Table 1B. Width of the test piece shall be 12.5 mm for L_0 = 50 mm and 20 mm for L_0 =80 mm.

Table 1A Mechanical Properties for Commercial and Drawing Quality grades
(*Clause* 8.3)

Sl. No.	**Grade Designation**	**Designation (Quality)**	**Yield Strength** *Max* (*see* Note 2) MPa	**Tensile Strength** MPa	**Elongation** Percent, *Min* (*see* Notes 3 and 4) L_0-50 mm	L_0-80 mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	CR1	Commercial	-	-	-	-
ii)	CR2	Drawing	300	270 - 430	24	23
iii)	CR3	Deep Drawing	260	270 – 410	26	25
iv)	CR4	Extra Deep Drawing	210	260-390	28	27

NOTES
1 Test specimen to be tested with coating intact, in alignment with international norms the base metal thickness will be used for calculation of strength.
2 The yield strength is the lower yield stress. If well defined yielding is not obvious, then 0.2 percent proof stress should be determined.
3 L_0 stands for original gauge length.
4 Elongation values shall be reduced by 4 units for thickness 0.50 mm and lower and by 2 units for thickness 0.51 - 0.70 mm.

Table 1B Mechanical Properties for Structural Quality
(*Clause* 8.3)

Sl. No.	**Grade Designation**	**Yield Strength** *Min* (*see* Note 2) MPa	**Tensile Strength** *Min* MPa	**Elongation,** Percent, *Min* (*see* Notes 3 and 4) Test Piece Type 3 of IS 1608 Part 1	Test Piece Type 2 of IS 1608 Part 1
(1)	(2)	(3)	(4)	(5)	(6)
i.	YS 220	220	300	22	20
ii.	YS 250	250	320	21	19
iii.	YS 280	280	360	20	18
iv.	YS 300	300	340	20	18
v.	YS 320	320	390	19	17
vi.	YS 350	350	400	15	14
vii.	YS 390	390	430	15	14
viii.	YS 420	420	450	14	13
ix.	YS 450	450	480	10	9
x.	YS 500	500	520	9	8
xi.	YS 550	550	550	---	---
xii.	YS 550E	550	570	3	3

NOTES

1 Test specimen to be tested with coating intact, in alignment with international norms the base metal thickness will be used for calculation of strength.

2 The yield strength is the lower yield stress. If well defined yielding is not obvious, then 0.2 percent proof stress should be determined.

3 L_0 stands for original gauge length.

4 Elongation values shall be reduced by 4 units for thickness 0.50 mm and lower and by 2 units for thickness 0.51 - 0.70 mm.

9. COATING TEST

9.1 Triple spot test to be done by X-ray fluorescence method (*see* IS 12860) or weight loss (Gravimetric) method to comply the requirement of this standard. The weight loss test shall be conducted as per Annex A. The minimum coating weight shall be as per the Table 2 when tested as per **9.2** to **9.7**.

9.2 One set of three samples each at least 50×50 mm square or 50 mm diameter shall be selected at random from one sheet for every lot of 1000 sheets, or part there-of. In case of material supplied in coil form, one set of three samples each of 50×50mm square or 50 mm diameter shall be selected from one end of each coil lot. However, if there is any process interruption or change in coating weight or change in grade, then coating shall be tested each change/interruption.

9.3 This set of three samples in total shall be taken one each from the middle of the width of the sheet, and one from each edge of the sheet. The samples from extremities, diagonal or from the side of the sheet shall not be closer than 25 mm from the edge of the sheet.

9.4 One surface single spot coating mass

The minimum coating mass on any one surface of any of the three specimens used for triple spot test.

9.5 Single Spot Coating Mass

The minimum coating mass on any one of the three specimens used for triple spot test. For products 600 mm in width and narrower, only single spot test is required. Specimens shall be taken at least 10 mm away from strip/sheet edge.

9.6 Triple spot coating mass

The average of three specimens selected from a sample representing the original cross section of the sheet and strip.

9.7 Differential Coating

A coating which has a substantially different coating mass on each side of the steel sheet or strip. This shall be as per the agreement between purchaser and supplier.

9.8 Use following relationship to estimate the coating thickness from the coating mass ,

$$3.75\ g/m^2 \text{ coating mass} = 1.00\ \mu m \text{ coating thickness.}$$

Table 2 Coating Class and Coating Mass
(*Clauses* 1.2 *and* 9.1)

Sl No.	Coating Class	Minimum coating Mass , g/m^2		
		Total both surfaces		One surface
		Triple spot	Single spot	Single spot
(1)	(2)	(3)	(4)	(5)
i)	AZ200	200	180	80
ii)	AZ180	180	155	72
iii)	AZ165	165	150	66
iv)	AZ150	150	135	60
v)	AZ120	120	105	48
vi)	AZ100	100	90	40
vii)	AZ90	90	75	36
viii)	AZ 70	70	63	28

10. COATING ADHESION TEST

One test specimen per coil is to be tested from any part of the sample. Minimum test specimen width shall be 50 mm. Both surfaces of the test specimen shall be capable of being bent 180° around a mandrel with diameter specified in following table without flaking of coating. Failure of coating within 5 mm of the edge of the test specimen shall be disregarded. This will be in accordance with Table 3A and Table 3B.

Table 3A Coating Adhesion test for Commercial and Drawing Quality grades
(*Clause* 10)

Sl No.	Grade Designation	Designation (Quality)	Diameter of Mandrel in Terms of Thickness (*t*) of the Product Coating Class	
			AZ200	Other than AZ200
(1)	(2)	(3)	(4)	(5)
i)	CR1	Commercial	t	t
ii)	CR2	Drawing	t	0
iii)	CR3	Deep Drawing	t	0
iv)	CR4	Extra Deep Drawing	t	0

Table 3B Coating Adhesion test for Structural Quality
(Clause 10*)*

Sl No.	Grade Designation	Diameter of Mandrel in Terms of Thickness (*t*) of the Product Coating Class	
		AZ200	Other than AZ200
(1)	(2)	(3)	(4)
i)	YS 220	t	0
ii)	YS 250	t	0
iii)	YS 280	t	t
iv)	YS 300	t	t
v)	YS 320	t	t
vi)	YS 350	t	t
vii)	YS 390	t	t
viii)	YS 420	2t	2t
ix)	YS 450	2t	2t
x)	YS 500	2t	2t
xi)	YS 550	-	-
xii)	YS 550E	-	-

NOTE - 0 indicates that the coated sample is bent flat on itself.

11 FREEDOM FROM DEFECTS

11.1 Plain Sheets and coils shall be reasonably flat and free from bare spots, holes, tears and other harmful defects.

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

12 MASS

The actual mass of the sheets or coils shall be mentioned in ‘kg’ or ‘*t*’.

13 DIMENSIONS, SHAPE AND TOLERANCES

13.1 Coil Internal Diameter

Unless otherwise agreed, internal diameter of coils shall be 508 mm or 610 mm (±10 mm).

13.2 Length Tolerance

In the case of sheet - No sheet shall be smaller in length than specified. Tolerance on length on plus side shall be 15 mm or 0.5% of length, whichever is greater.

13.3 Width Tolerance

Width of the finished product shall not be smaller than specified. Plus side tolerance on untrimmed width shall be 10 mm. In case of trimmed width it will be plus 3 mm max. The total unilateral width tolerance range may be allowed bilaterally as agreed between purchaser and supplier on mutual agreement basis.

13.4 Thickness Tolerance

The tolerance on thickness of sheet and coil shall be as per IS/ISO 16163.

13.5 Camber

Minimum camber values for coils and sheets shall be as given in IS/ISO 16163.

13.6 Deviation from Squareness (Out-of Square)

The diagonal distance between opposite corners of any sheet shall not differ by more than 10 mm.

13.7 Deviation from Flatness (Steepness) - This will be in accordance with Table 4

Table 4 Flatness Tolerance
(*Clause* 13.7)

Steepness Percentage	
Class A	Class B
(1)	(2)
1.2	0.5

NOTE — Class A tolerance, where length between the points of contact is less than 1000 mm, the steepness percentage will be 1.

14 RE-TESTING

When a part of the test results for physical properties fails to comply with the requirement, a retest (two more sets of test samples shall be taken for specific test requirements from the same lot) on the relevant items may be carried out to determine whether it is acceptable or not. If any of the retest samples fail to meet the test requirements of this standard, the lot represented by the sample shall be deemed as not conforming to this standard.

15 PACKING

Coils/sheets should be suitably packed to avoid any transit/handling/storage damage.

16 MARKING

16.1 The following shall be legibly and indelibly marked on the top of each coil or package of sheets or shown on a tag attached to each coil or packet:

(a) No. of this standard
(b) Manufacturer's name or trade-mark.
(c) Material identification/ coil number/ packet number/ batch number etc.
(d) Product dimensions.
(e) Number of sheets or mass.
(f) Steel grade
(g) Coating Class
(h) Date of manufacture.

16.2 BIS Certification Marking

The Product (s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the Bureau of Indian Standards Act, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

ANNEX A

(*Clause* 9.1)

METHOD OF COATING WEIGHT DETERMINATION BY WEIGHT LOSS METHOD

A-1 CHEMICALS AND APPARATUS REQUIRED

a) Hydrochloric Acid (1+1) — Mix 500ml of HCL and (sp gr. 1.19) with 500 ml of reagent water;
b) Reagent water shall be prepared by distillation ion exchange/ continuous electro deionisation/ reverse osmosis/ electro dialysis or combination thereof;
c) Solvent naphtha;
d) Alcohol;
e) Weighing balance (Least count 0.01g minimum);and
f) Dryer

A-2 PROCEDURE

Clean the accurately prepared specimens by washing with solvent naphtha (or other suitable solvent),

a) Rinse with alcohol, and dry thoroughly.
b) Determine the weight (mass) of the specimens individually to the nearest 0.01 g.
c) Immerse each specimen in the stripping solution and allow remaining there until the violent evolution of the Hydrogen has ceased, and only few bubbles are being evolved. This requires 15 to 30 sec. The same solution may be used repeatedly until the time for required for stripping becomes inconveniently long.
d) The temperature of the stripping solution shall at no time exceed the temperature of 38 deg centigrade. After stripping, wash the specimens by scrubbing them under running water, dip in hot water, and wipe or blow dry.
e) Determine the weight (mass) of the specimens again, to the same precision as in the initial determination.
f) Determine the coating mass as per the following calculation

When determining coating weight (mass) on one side of sheet material, use the above procedure except the use of “stop-off’’). To protect one side from the stripping medium, a

few common examples are acid resistant paints or acid resistant tapes. Apply the 'stop off' to the specimen after weighing initially and remove it before taking weight after the stripping of the coating. There is always a possibility of moisture absorption, so the 'Stop off' should not be there during the weight determination. The coating weight on the other side may be determined subsequently with out a stop off on the first side).

$$C = [(W_1 - W_2)/A] \times K$$

Where

C	=	Weight (mass) of coating, g/m^2 of sheet
W_1	=	original weight (mass) of the specimen, g
W_2	=	Wight of stripped specimen, g
A	=	Area of sheet, square mm
K	=	1×10^6