



नेपाल गुणस्तर
NEPAL STANDARD

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



Government of Nepal
Ministry of Industry, Commerce and Supplies
Nepal Bureau of Standards and Metrology (NBSM)
Kathmandu, Nepal

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नेपाल गुणस्तर प्रस्तावना

१. नेपाल गुणस्तर (प्रमाण चिन्ह) ऐन २०३७ ले प्रदत्त अधिकार प्रयोग गरी नेपाल गुणस्तर निर्धारण गर्ने यस विभागलाई भएको निर्देशन र नीति अनुसार राष्ट्रियस्तरमा गुणस्तर प्रलेखहरू तयार पार्ने सिलसिलामा आवश्यक तरिका र ढाँचामा यो गुणस्तर प्रलेख तर्जुमा गरी प्रस्तुत गरिएको छ। यसले नेपाल गुणस्तरसँग सम्बन्धित सबै पक्षमा निमित्त आवश्यक निर्देशिकाको कार्य गर्नेछ।
२. प्रलेख तयार पार्दा खास ध्यानमा राखिएका बुँदाहरू:
 - २.१ गुणस्तर प्रलेखको तर्जुमा गर्दा अन्य प्रलेखको कुनै पनि परिच्छेदको उल्लंघन हुन नजाओस भनी यथाशक्य होशियारी राखिएको छ। असावधानीबाट केहि उल्लंघन हुन गएको ज्ञात हुन आएमा यसमा चाहिने संशोधनको लागि यथाशिघ्र कदम उठाइने छ।
 - २.२ देशको ऐन नियम अन्तरगत परेको सबै बुँदालाई यथोचित मान्यता दिई यसको कुनै दफा तथा परिच्छेदको उल्लंघन नहुने गरी यो गुणस्तर प्रलेख तयार पार्ने कोशिस गरिएको छ। कथंकदाचित गुणस्तर प्रलेखको कुनै भागमा उल्लेखित कुराहरू हाल प्रचलनमा भएका तथा भविष्यमा आउने ऐन नियमसँग बाझिन गएमा त्यस्ता (प्रलेखका) कुराहरू स्वतः निष्कृत हुनेछन्।
 - २.३ नापतौल इकाई तथा तिनीहरूको रूपान्तरण गर्दा स्ट्याण्डर्ड नापतौल ऐन अन्तर्गत जे जति नियमहरू छन् सबैलाई यथोचित मान्यता दिई यिनीहरूको प्रयोग गरिएको छ।
 - २.४ यो प्रलेख तयार पार्दा गुणस्तर निर्धारण सम्बन्धी अरु देशहरूले र अन्तर्राष्ट्रिय संगठनहरूले अपनाएका प्रणाली, चलन, तरिका र ढाँचालाई यथोचित ध्यानमा राखिएको छ।
 - २.५ यो गुणस्तर प्रलेखको अंगीकार गर्दा वातावरणीय लगायत स्वास्थ्य सम्बन्धी विविध पक्षहरूमा समेत यथोचित ध्यान पुर्याइएको छ।
 - २.६ यस गुणस्तर प्रलेखमा उल्लेखित विषयवस्तु राष्ट्रिय आवश्यकता अनुरूप छ वा छैन भन्ने निश्चित गर्न नेपाल गुणस्तर परिषद्को निर्णय नै अन्तिम मानिनेछ।

नेपाल गुणस्तर परिषद्

Nepal Council for Standardization (NCS)

NS: XXX: 2083 Hot Dip Aluminium – Zinc Alloy Metallic Coated
Steel Strip and Sheet - Specificationअध्यक्ष:उपाध्यक्ष:आमन्त्रित:

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सदस्य सचिव

**NS: XXX: 2083 Hot Dip Aluminium – Zinc Alloy Metallic Coated
Steel Strip and Sheet - Specification**

विषयक प्राविधिक समितिका सदस्यहरु

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**NS: XXX: 2083 Hot Dip Aluminium – Zinc Alloy Metallic Coated
Steel Strip and Sheet - Specification**

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Foreword

This Standard was adopted by the Nepal Bureau of Standard and Metrology after the draft finalized by Technical Committee had been approved by the Nepal Council for Standardization.

Till recently, there used to be 100 percent import of hot-dip aluminium-zinc alloy metallic coated steel strip and sheet. Now local production has started and number of manufacturers are developing facilities for these products. This standard has been formulated to cover the various technical requirements.

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 NS 17: 2037 “Rules for rounding off numerical values”. 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

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

2 REFERENCES

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

Standard	Title
NS 414	Terminology Used in Iron and Steel
NS/ISO 404	Steel and steel products – General technical delivery requirements
NS ***	Cold reduced carbon steel and strip
ISO 6892-1	Metallic Materials – Tensile testing: Part 1 Method of test at room temperature
NS ***	Metallic coating thickness by X-ray fluorescence technique method - Determination
ISO 16163	Continuously hot-dipped coated steel sheet products – Dimensional and shape tolerances

① *Note: Latest editions of the referenced standards shall apply.*

3 TERMINOLOGY

For the purpose of this standard the following definition given in NS 414 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 (see **Annex A**).

3.3 Coated Thickness

Thickness of coated sheet in cut-length or coil form. This is also termed as TCT (total coated thickness) (see **Annex A**).

3.4 Aluminium-Zinc Alloy Coating

A hot-dip coating with nominal composition of 55 percent aluminium, 1.6 percent silicon, balance zinc and incorporating minor addition of control elements. This type of coating normally has a post treatment for preservation of the brightness.

3.5 Surface Finish

3.5.1 Normal

The un-altered nominally 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: 'AZ 150'

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'; and
- 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 and sheet shall conform to NS/ISO 404.

4.2 The coated steel to this standard maybe supplied in surface finish normal (regular spangle) or skin passed based on mutual agreement between the purchaser and the supplier.

4.3 The coated steel sheets of this standard may also be supplied in profiles. The dimensions and other structural related requirements for supply of profiles shall be as per agreement between the manufacturer and the purchaser. Manufacturer shall comply with the agreed dimensional requirements.

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 NS ***.

5.2 Coating is done by dipping the cold-rolled strip in a bath of molten aluminium, 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

The product designation shall follow the sequence below:

- Number of this Nepal Standard (NS);
- Steel grade;
- Coating class;
- Surface finish; and
- Surface treatment condition (Passivated, other coating, etc.).

Example: NS XXX-YS550 AZ150 NT

7 CHEMICAL COMPOSITION

Requirements for chemical composition of the base steel shall be as per NS ***.

8 TENSILE TEST

8.1 Test Piece

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

The thickness to be used for the calculation of the yield point or yield strength, tensile strength shall be either one of the following:

- Actual measured thickness after removing the coating layer; or
- Results after subtracting the equivalent coating thickness of the actual measured coating mass from the actually measured thickness including the coating layers. The equivalent coating thickness may be as per mutual agreement between both manufacturer and purchaser. Refer to **Annex A** for calculating coating thickness based on coating mass.

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 ISO 6892-1, the tensile properties shall conform to the requirements specified in **Table 1**. Width of the test piece shall be 12.5 mm for $L_0 = 50$ mm and 20 mm for $L_0 = 80$ mm.

Table 1 Mechanical Properties

(Clause 8.3)

S.No.	Grade Designation	Yield Strength	Tensile Strength	Elongation, Percent, Min (see Note 3 and Note 4)	
		Min (see Note 2)	Min	$L_0 = 50$ mm	$L_0 = 80$ mm
		MPa	MPa		
(1)	(2)	(3)	(4)	(5)	(6)

i.	YS 250	250	320	21	19
ii.	YS 300	300	340	20	18
iii.	YS 350	350	420	15	14
iv.	YS 450	450	480	10	9
v.	YS 550	550	550	-	-

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 Applies to test piece equal to or greater than 0.60 mm thick.

5 (—) No requirement but can be mutually agreed based on the application requirement.

9 COATING TEST

9.1 Triple spot test to be done by X-ray fluorescence method (see NS***) or weight loss (Gravimetric) method to comply the requirement of this standard. The weight loss test shall be conducted as per **Annex B**. 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 mm × 50 mm or 50 mm diameter shall be selected at random from one sheet for every lot of 1 000 sheets, or part thereof. In case of material supplied in coil form, one set of three samples each of 50 mm × 50 mm 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 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.

9.5 Triple Spot Coating Mass

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

9.6 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 the purchaser and the supplier but meet the total coating mass requirement of one of the coating classes in **Table 2**.

9.7 Use following relationship to estimate the coating thickness from the coating mass:

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

Table 2 Coating Class and Coating Mass

(Foreword, Clauses 9.1 and 9.6)

S.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.	AZ 200	200	180	80
ii.	AZ 180	180	155	72
iii.	AZ 165	165	150	66
iv.	AZ 150	150	135	60
v.	AZ 120	120	105	48
vi.	AZ 100	100	90	40
vii.	AZ 90	90	75	36
viii.	AZ 70	70	63	28

NOTES

1 As per the mutual agreement between the customer and supplier, the steel strip and sheet with minimum coating mass other than the specified above may be supplied for each coating class. In such cases, the agreed minimum coating mass shall not be less than the minimum coating mass specified for each of the above coating classes.

2 However, in any case, the agreed minimum coating mass shall not be less than that of AZ 70.

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 3**.

Table 3 Coating Adhesion

(Foreword and Clause 10)

S.No.	Grade Designation	Diameter of Mandrel in Terms of Thickness (t) of the Product Coating Class	
		(AZ 70 to AZ 150)	Above AZ 150
(1)	(2)	(3)	(4)
i.	YS 250	0t	1t
ii.	YS 300	1t	1t
iii.	YS 350	1t	1t
iv.	YS 450	2t	2t
v.	YS 550	-	-

NOTES

1 0t indicates that the coated sample is bent flat on itself.

2 (—) No requirement but can be mutually agreed based on the application requirement.

11 FREEDOM FROM DEFECTS

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

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 percent 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.

13.4 Thickness Tolerance

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

13.5 Camber

Minimum camber values for coils and sheets shall be as given in 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)

S.No.	Steepness Ratio, Percentage	
	Class A	Class B
(1)	(2)	(3)
i.	1.2	0.5

NOTES

1 Class A tolerance, where length between the points of contact is less than 1 000 mm, the steepness percentage will be 1.

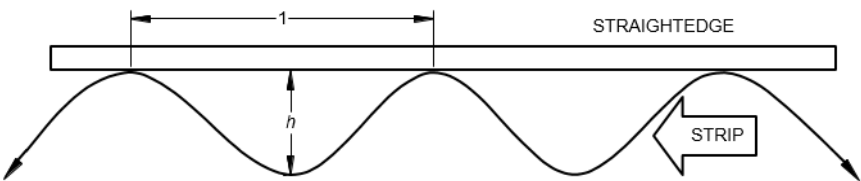


FIG. 1 DEVIATION FROM FLATNESS

2 The steepness ratio expressed as a percentage is calculated by determining the maximum distance between the product surface and the straightedge and the length between two consecutive points of contact (see Fig. 1), then applying the following equation:

Steepness ratio = $(h/l) \times 100$, percentage

where

h = deviation from flatness (wave height), in mm; and

l = distance between two consecutive points of contact, in mm.

13.8 Profiled Sheets

Dimension, shape and tolerances of profiled sheet shall be as agreed upon between purchaser and manufacturer.

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. NS No. of this Standard;
- b. Manufacturer's name or trade-mark;
- c. Material identification/coil number/package number/batch number etc.;
- d. Product dimensions;
- e. Number of sheets or mass;
- f. Steel grade;
- g. Coating class; and
- h. Date of manufacture.

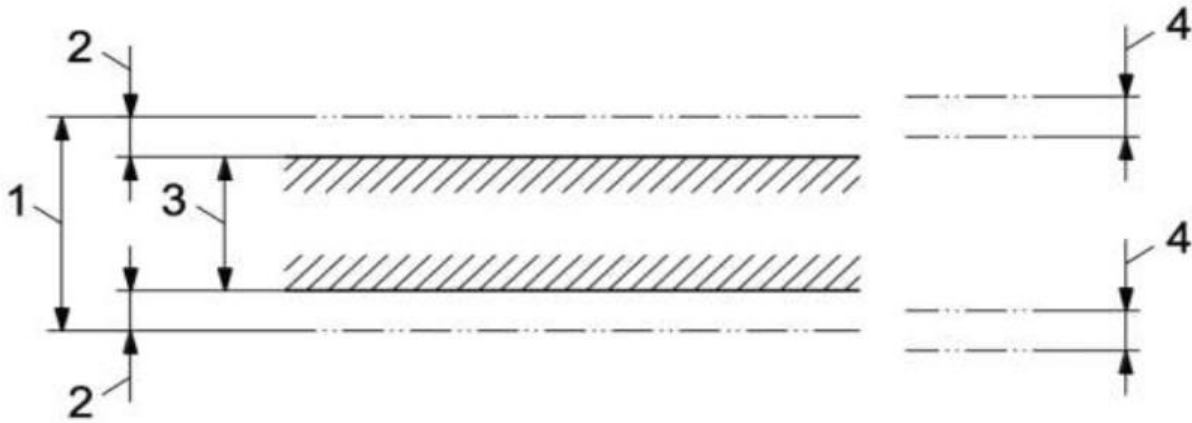
16.2 NS Certifications Marking

The product conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the Nepal Standards (Certification Mark) Act, 2037 and the rules and regulations framed thereunder. The product may be marked with the Standard Mark.

ANNEX A*[Clauses 3.2, 3.3 and 8.1]***ORDERS REQUIRING BASE – METAL THICKNESS****B-1 THE AVERAGE THICKNESS OF THE COATING CALCULATION**

When specified by the purchaser, the ordered thickness shall be the base-metal thickness. In these cases, the product thickness shall be calculated as the base-metal thickness + the equivalent coating thickness for each surface, as indicated in **Fig. 2**.

Thickness tolerance tables apply to the product thickness.

**Key**

1. Product thickness
2. Equivalent coating thickness
3. Base – metal thickness
4. Thickness tolerance

FIG. 2 CALCULATION OF THE PRODUCT THICKNESS

NOTE — Equivalent coating thickness may be calculated using the following:

$$Tc = \frac{M}{3.75}$$

Where,

Tc = equivalent coating thickness (both sides) in μm ; and

M = total coating mass in g/m^2 .

ANNEX B*[Clause 9.1]***METHOD OF COATING WEIGHT DETERMINATION BY WEIGHT LOSS
METHOD****B-1 CHEMICALS AND APPARATUS REQUIRED**

- Hydrochloric Acid (1 + 1) – Mix 500 ml of HCL and (special gravity 1.19) with 500 ml of reagent water;
- Reagent water shall be prepared by distillation ion exchange/continuous electro deionization/reverse osmosis/electro-dialysis or combination thereof;
- Solvent naphtha;
- Alcohol;
- Weighing balance (Least count 0.01 g minimum); and
- Dryer.

B-2 PROCEDURE

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

- Rinse with alcohol, and dry thoroughly;
- Determine the weight (mass) of the specimens individually to the nearest 0.01 g;
- 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 s to 30 s. The same solution may be used repeatedly until the time for required for stripping becomes inconveniently long;
- The temperature of the stripping solution shall at no time exceed the temperature of 38 °C. After stripping, wash the specimens by scrubbing them under running water, dip in hot water, and wipe or blow dry;
- Determine the weight (mass) of the specimens again, to the same precision as in the initial determination; and
- 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 without a stop off on the first side).

$$C = \left[\frac{W_1 - W_2}{A} \right] \times K$$

Where,

C = mass, in g/m², of coating of sheet;
W1 = original mass, in g, of the specimen;
W2 = mass, in g, of stripped specimen;
A = area of one side of the test piece, in mm²; and
K = 1×10⁶.

- ❖ नेपाल गुणस्तर तथा नापतौल विभाग राष्ट्रिय गुणस्तर निर्धारना गर्ने विभाग हो।
- ❖ नेपाल सरकारले यस विभागलाई निम्न जिम्मेवारीहरू सुम्पेको छः
 - नेपाल गुणस्तर कायम गर्नु, संशोधन गर्नु वा रद्ध गर्नु।
 - गुणस्तर प्रमाणचिन्ह प्रयोग गर्न इजाजत दिने वा प्रमाण पत्र दिने प्रयोजनको निम्मित सरकारी प्रयोगशालाहरूलाई मान्यता दिनु वा दिइएको मान्यतालाई निलम्बन वा रद्ध गर्नु।
 - गुणस्तर प्रयोग गर्न वा इजाजत वा प्रमाण पत्र दिनु।
 - परीक्षण उपकरणहरूको मापांकन गर्नुतथा कानूनी नापतौल कार्यान्वयन गराउनु।

नेपाल गुणस्तर तथा नापतौल विभाग

बालाजु, काठमाडौं, नेपाल

फोन नं. ०१-४९५०८१८, ४९५६६७२, ४३५०७२९

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सर्वाधिकार सुरक्षित