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Steel sheet, zinc-aluminium-magnesium alloy-coated by the continuous hot-dip process, of commercial, drawing and structural qualities

Tôles en acier revêtues à chaud en continu d'alliage zinc-aluminium-magnésium de qualité commerciale, pour emboutissage ou destinées à la construction

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Steel sheet, zinc-aluminium-magnesium alloy-coated by the continuous hot-dip process, of commercial, drawing and structural qualities

1 Scope

This document specifies the minimum requirements for steel sheet, in coils and cut lengths, metallic-coated by the continuous hot-dip process, with zinc-aluminium-magnesium alloy coating.

The product is intended for applications requiring high corrosion resistance, formability and paintability.

The steel sheet is produced in a number of quality designations and grades, coating type, coating mass, surface treatments and coating finish conditions designed to be compatible with differing application requirements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1460, *Metallic coatings — Hot dip galvanized coatings on ferrous materials — Gravimetric determination of the mass per unit area*

ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 3497, *Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 7438, *Metallic materials — Bend test*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 14993, *Corrosion of metals and alloys — Accelerated testing involving cyclic exposure to salt mist, dry and wet conditions*

ISO 16163, *Continuously hot-dipped coated steel sheet products — Dimensional and shape tolerances*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
commercial
base-metal quality intended for general fabricating purposes where steel sheet is used in the flat condition, or for bending or moderate forming

3.2
drawing
base-metal quality intended for fabricating parts where drawing or severe forming may be involved

3.3
deep drawing
base-metal quality intended for fabricating parts where severe forming or severe drawing may be involved

3.4
deep drawing aluminium killed
base-metal quality intended for fabricating parts where particularly severe drawing or forming may be involved

3.5
extra-deep drawing stabilized
base-metal quality intended for applications where maximum formability is required by applying *interstitial-free steel* (3.7)

3.6
structural
base-metal quality intended for parts needing guaranteed mechanical properties and where simple forming may be involved

3.7
interstitial-free steel
IF
extra-low-carbon steel in which all interstitial elements are combined with titanium and/or equivalent elements

Note 1 to entry: Interstitial-free steel is sometimes referred to as stabilized steel.

3.8
breakage allowance
agreed upon level of acceptable die breakage not subject to claim

3.9
differential coating
coating which is deliberately produced to have a different *coating mass* (3.13) on each surface

3.10
blackening
phenomenon where surface of the coating appears blackened, especially the coating composition containing magnesium, during storage or in a high temperature and high humidity environments

Note 1 to entry: This phenomenon is related to the formation of magnesium oxide and/or zinc oxide on the surface of the coating.

3.11
smooth finish
smoothness produced by *skin-pass* (3.12) the coated material in order to achieve an improved surface condition as compared with the normal as-coated product

3.12
skin pass
light cold rolling of the product

Note 1 to entry: The purpose of the skin passing is one or more of the following: to minimize the appearance of coil breaks, stretcher strains and fluting; to control the shape; and to obtain the required surface finish.

Note 2 to entry: Some increase in hardness and some loss in ductility will result from skin passing.

3.13
coating mass
total amount of coating on both sides of the steel sheet, expressed in grams per square metre

3.14
lot
specified quantity of steel sheet of the same designation rolled to the same thickness and coating condition

4 Dimensions

4.1 Zinc-aluminium-magnesium alloy-coated steel sheet is produced in thicknesses from 0,20 mm to 9 mm inclusive after coating, and in widths of 600 mm and over in coils and cut lengths. Zinc-aluminium-magnesium alloy-coated steel sheet less than 600 mm wide, slit from wide steel sheet, is considered as steel sheet.

4.2 The thickness of zinc-aluminium-magnesium alloy-coated steel sheet may be specified as a combination of the base-metal and metallic coating, or as the base-metal alone. The purchaser shall indicate on the order which method of specifying thickness is required. In the event that the purchaser does not indicate any preference, the thickness as a combination of the base-metal and coating will be provided. Annex A describes the requirements for specifying the thickness as base-metal alone.

5 Conditions of manufacture

5.1 Steelmaking

Unless otherwise agreed by the interested parties, the processes used in making the steel and in manufacturing zinc-aluminium-magnesium alloy-coated steel sheet are left to the discretion of the manufacturer. On request, the purchaser shall be informed of the steelmaking process being used.

5.2 Chemical composition

The chemical composition (heat analysis) shall conform to the requirements given in Tables 1 and 2.

5.3 Chemical analysis

5.3.1 Heat analysis

An analysis of each heat shall be made by the manufacturer in order to determine conformity with the requirements given in Tables 1 and 2. On request, a report of the heat analysis shall be made available to the purchaser or the purchaser's representative. Each of the elements listed in Tables 1 and 2 shall be included in the report of the heat analysis. When the amount of copper, nickel, chromium or molybdenum present is less than 0,02 %, the analysis may be reported as "<0,02 %".

5.3.2 Product analysis

A product analysis may be made by the purchaser in order to verify the specified analysis of the product and shall take into consideration any normal heterogeneity. The product analysis tolerances shall be in accordance with Table 3.

Table 1 — Chemical composition (heat analysis)

Mass fractions in percent

Base-metal quality		C max.	Mn max.	P max.	S max.	Ti max.
Designation	**Name**					
01	Commercial	0,15	0,60	0,05	0,035	-
02[a]	Drawing	0,10	0,50	0,04	0,035	-
03[a]	Deep drawing	0,08	0,45	0,03	0,03	-
04[a]	Deep drawing aluminium killed	0,06	0,45	0,03	0,03	-
05[a]	Extra-deep drawing stabilized	0,02	0,25	0,02	0,02	0,15
220	Structural	0,25	1,70	0,05 [b]	0,035	-
250[b]						
280[b]						
320						
350[b]						
380						
550						

[a] Interstitial-free steel may be applied.

[b] Grades 250 and 280: phosphorus – 0,10 % max.; Grade 350: phosphorus – 0,20 % max.

Table 2 — Limits on additional chemical elements

Mass fractions in percent

Element	**Cu** [a] max.	**Ni** [a] max.	**Cr** [a,b] max.	**Mo** [a,b] max.	**Nb** [c] max.	**V** [c,d] max.	**T_i** [c,d] max.
Heat analysis	0,20	0,20	0,15	0,06	0,008	0,008	0,008
Product analysis	0,23	0,23	0,19	0,07	0,018	0,018	0,018

[a] The sum of copper, nickel, chromium and molybdenum shall not exceed 0,50 % on heat analysis. When one or more of these elements are specified, the sum does not apply, in which case, only the individual limits on the remaining elements apply.

[b] The sum of chromium and molybdenum shall not exceed 0,16 % on heat analysis. When one or more of these elements are specified, the sum does not apply, in which case, only the individual limits on the remaining elements apply.

[c] For interstitial-free steels only, the value of 0,15 % titanium, and 0,10 % maximum for niobium and vanadium are acceptable to ensure that the carbon and nitrogen are fully stabilized.

[d] Heat analysis greater than 0,008 % may be supplied after agreement between the manufacturer and purchaser.

Table 3 — Product analysis tolerances for Table 1

Mass fractions in percent

Element	Maximum of specified element	Tolerance over maximum specified
C	≤ 0,02	0,01
	> 0,02, ≤ 0,15	0,03
	> 0,15, ≤ 0,25	0,04
Mn	≤ 0,60	0,03
	> 0,60, ≤ 1,70	0,05
P	0,05	0,01
S	0,035	0,01

NOTE The above maximum tolerance is the allowable excess over the requirement of heat analysis shown in Table 1.

5.4 Mechanical properties

5.4.1 Commercial and drawing quality

5.4.1.1 Ordering conditions

Zinc-aluminium-magnesium alloy-coated steel sheet of designations 01, 02, 03, 04 and 05 are supplied under either of the following two ordering conditions.

a) Ordering condition A: steel sheet mechanical properties shall, at the time the steel is made available for shipment, satisfy the applicable requirements of Table 4, when they are determined on test pieces obtained in accordance with the requirements in Clause 7. The values specified in Table 4 are applicable for the periods indicated in Table 5 from the time that the steel is available for shipment.

b) Ordering condition B: steel sheet, ordered to make an identified part, shall be supplied with a commitment for satisfactory manufacturing performance within an established breakage allowance, which shall be previously agreed upon by the interested parties. In the agreement, the part name, the details of fabrication, and special requirements (such as freedom from stretcher strain or fluting) shall be specified.

In the case of ordering condition B, mechanical properties of the steel sheet may also be agreed upon by the interested parties and such properties may not necessarily satisfy the requirements of Table 4.

5.4.1.2 Fabrication qualities

Zinc-aluminium-magnesium alloy-coated steel sheet is available in several fabrication qualities as given in 3.1 to 3.6.

5.4.1.3 Interstitial-free steel

Stabilized interstitial-free steel (IF Steel) is applicable to orders for designations 02 03, 04 and 05; provided that the purchaser is informed of the substitution and that related shipping documents reflect the actual material shipped.

Table 4 — Mechanical properties of commercial and drawing quality grades

Base-metal quality		R_{eL} [a] max. MPa	R_m [b] max. MPa	A [c] min. %			$\bar{r}$ [d,e,f] min.	$\bar{n}$ [d,e,f] min.
Grade	Name			$L_0 = 80$ mm	$L_0 = 50$ mm	$L_0 = 5{,}65\sqrt{S_0}$ [h]		
01	Commercial	—	—	—	—	—	—	—
02	Drawing	340 [g]	430	30	31	22	—	—
03	Deep drawing	300	410	34	35	24	—	—
04	Deep drawing aluminium killed	270	410	36	37	—	—	—
05	Extra-deep drawing stabilized	250	380	38	38	—	1,4	0,17

R_{eL}: lower yield strength
R_m: tensile strength
A: percentage elongation after fracture
L_0: gauge length of original test piece
$\bar{r}$: index of drawability of the product
$\bar{n}$: index of the stretchability of the product
1 MPa = 1 N/mm^2

For products produced according to performance criteria (ordering condition B), the typical mechanical properties presented here are non-mandatory. For products specified according to mechanical properties (ordering condition A), the purchaser may negotiate with the manufacturer if a specific range, or a more restrictive range, is required for the application. When agreed to, such values can be specified.

NOTE With the exception of footnotes c and d; these typical mechanical properties apply to the full range of steel sheet thicknesses. The yield strength tends to increase and some of the formability aspects tend to decrease as the steel sheet thickness decreases.

[a] The yield values apply to 0,2 % proof stress if the yield point is not pronounced, otherwise to the lower yield point (R_{eL}).

[b] The minimum tensile strength for qualities 02, 03, 04 and 05 would normally be expected to be 270 MPa. All tensile strength values are determined to the nearest whole number.

[c] For materials of thickness up to and including 0,6 mm, the elongation percentages in this table shall be reduced by 2.

[d] $\bar{r}$ and $\bar{n}$ values are only applicable to thickness ≥ 0,5 mm. For thickness > 2,0 mm, the $\bar{r}$ value is reduced by 0,2.

[e] $\bar{r}$ may also be written as r-bar and $\bar{n}$ may also be written as n-bar.

[f] $\bar{r}$ and $\bar{n}$ values may be modified or excluded from this specification, by agreement between the manufacturer and the purchaser.

[g] This value applies to skin-passed products only.

[h] This may be used for material over 3 mm in thickness.

Table 5 — Applicable period for values specified in Table 4

Grade	Period
01	Not applicable
02	8 days
03	30 days
04	6 months
05	6 months

5.4.2 Structural quality

The mechanical properties, at the time the steel is made available for shipment, shall satisfy the requirements of Table 6.

Table 6 — Mechanical properties of structural quality grades

Grade	R_{eL} [a] min. MPa	R_m min. MPa	A [b,c] min. %	
			L_0 = 80 mm	L_0 = 50 mm
220	220	310	18	20
250	250	360	16	18
280	280	380	14	16
320	320	430	12	14
350	350	450	10	12
380	380	540	10	12
550[c]	550	570	-	-

R_{eL}: lower yield strength
R_m: tensile strength
A: percentage elongation after fracture
L_0: gauge length of original test piece
1 MPa =1 N/mm^2

[a] The yield values apply to 0,2 % proof stress if the yield point is not pronounced, otherwise to the lower yield point (ReL).

[b] Use either L_0 = 50 mm or L_0 = 80 mm to measure elongation. For material up to and including 0,6 mm in thickness, the elongation values in this table shall be reduced by 2.

[c] If Grade 550 is in the unannealed condition and therefore has limited ductility, when the hardness is 85 HRB or higher, no tension test is required.

5.5 Coating

5.5.1 Coating bath composition

The bath metal used for zinc-aluminium-magnesium alloy–coated steel sheet shall contain 0,5 % to 13 % aluminium, 0,4 % to 4 % magnesium, up to 1 % total additional alloying elements (except iron) and the balance zinc.

5.5.2 Coating type designation and coating bath composition

The coating type designation for the hot-dip zinc-aluminium-magnesium alloy-coated steel sheet shall be as given in Table 7. The coating bath composition for each coating type shall be in accordance with Table 7. Due to differences in coating bath chemistry, the properties provided by each type may differ and the purchaser should specify the type suitable for the application accordingly.

Table 7 — Coating bath composition

Mass fractions in percent

Coating type designation	Al	Mg	Total additional alloying elements	Zn
T1	5 to 9	2 to 4	up to 1	balance
	>9 to 13	2 to 4	up to 1	balance
T2	3 to <5	2 to 4	up to 1	balance
T3	3 to <6	0,4 to < 2	up to 1	balance
T4	0,5 to <3	0,4 to <2,6	up to 1	balance
T5	0,5 to < 3	2,6 to < 4,0	up to 1	balance

5.5.3 Coating mass

The coating mass limits shall conform to the limits for the designations shown in Table 8. The interested parties shall agree upon the coating mass of deferentially coated products. If a maximum coating mass is required, the manufacturer shall be notified at the time of ordering.

Table 8 — Coating mass (total both sides)

Coating mass designation	Minimum check limit	
	Triple-spot test g/m^2 (of steel sheet)	**Single- spot test** [a] g/m^2 (of steel sheet)
ZM60	60	50
ZM70	70	60
ZM80	80	70
ZM90	90	80
ZM100	100	85
ZM120	120	100
ZM140	140	120
ZM150	150	130
ZM180	180	155
ZM200	200	170
ZM220	220	190
ZM250	250	210
ZM275	275	235
ZM300	300	255
ZM350	350	300
ZM450	450	385
ZM500	500	425
ZM600	600	510

NOTE 1 Because of the many variables and changing conditions that are characteristic of continuous zinc-aluminium-magnesium coating, the coating mass is not always evenly divided between the two surfaces of a steel sheet, neither is the coating evenly distributed from edge to edge. However, it can normally be expected that no less than 40 % of the single-spot check limit will be found on either surface.

NOTE 2 Other coating masses than those in this table can be applied by agreement between the manufacturer and the purchaser.

[a] Minimum check limit of single-spot test is approximately 0,85 times that of triple-spot test.

5.5.4 Coating adherence

Zinc-aluminium-magnesium alloy-coated steel sheet shall be capable of being bent in any direction, in accordance with the mandrel diameter requirements of Table 9, without flaking of the coating on the outside of the bend. Flaking of the coating within 7 mm from the edge shall not be a cause for rejection.

Table 9 — Coating adherence — Bend-test mandrel diameter

Grade	Coated metal 180° bend mandrel diameter mm								
	e <1,6			1,6 ≤ e < 3,0			e ≥ 3,0		
	Coating designation								
	up to ZM275	ZM300 ZM350	ZM450	up to ZM275	ZM300 ZM350	ZM450	up to ZM275	ZM300 ZM350	ZM450
01	1a	-	-	1a	-	-	1a	-	-
02, 03, 04 and 05	0	-	-	0	-	-	0	-	-
220	1a	1a	2a	1a	2a	2a	2a	2a	2a
250	1a	1a	2a	1a	1a	2a	2a	2a	2a
280	2a			2a			3a		
320, 350 and 380	3a								
550	-								
a: thickness of bend-test piece, in millimetres. e: thickness of steel sheet, in millimetres.									

5.6 Weldability

The product is normally suitable for welding, such as spot welding, roller-seam welding and fusion welding, if appropriate welding conditions are selected with special attention to the heavier coatings. When the carbon content increases above 0,15 %, spot welding becomes increasingly difficult. Because the heat of welding might have a significant effect on lowering the strength of grade 550, this grade is not recommended for welding.

5.7 Painting

Zinc-aluminium-magnesium alloy-coated steel sheet is a suitable base for paint, but the first treatment may be different from those used on uncoated steel. Pre-treatment primers, chemical conversion coatings (chromate, chromate-free, phosphate or oxide type), and some paints specially formulated for direct application to coated surfaces, are all appropriate first treatments for zinc-aluminium-magnesium alloy-coated steel sheet. In drawing up a painting schedule, consideration shall be given to whether the zinc-aluminium-magnesium alloy-coated steel sheet shall be ordered in the passivated or not passivated state.

NOTE Surfaces with certain passivation treatments (e.g. chromated) are not suitable for phosphating or the application of a pre-treatment (etch) primer.

5.8 Coating finish condition

The coating finish of zinc-aluminium-magnesium alloy-coated steel sheet is either a normal, as-coated surface with unrestricted spangle growth, or a skin passed, surface that has improved smoothness compared to an as-coated surface.

5.9 Surface treatment

5.9.1 Mill passivation

A chemical treatment is normally applied to zinc-aluminium-magnesium alloy-coated steel sheet to minimize the hazard of wet-storage staining (white rust) and blackening during shipment and storage. However, the inhibiting characteristics of the treatment are limited and, if a shipment is received wet, the material shall be used immediately or dried.

NOTE 1 Blackening occurs only on the surface of the coating and does not affect the corrosion resistance of the coating.

NOTE 2 Chromate-free treatment is available for use.

5.9.2 Mill phosphating

When specified, the manufacturer shall apply phosphate treatments to zinc-aluminium-magnesium alloy-coated steel sheet to prepare the surface for painting without further treatment except normal cleaning.

5.9.3 Oiling

When specified, zinc-aluminium-magnesium alloy-coated steel sheet as produced shall be oiled to prevent marring and scratching of the soft surface during handling or shipping and to minimize wet storage stain.

NOTE 1 When zinc-aluminium-magnesium alloy-coated steel sheet has received a passivating treatment, oiling will further minimize the hazard of wet storage stain.

NOTE 2 Protection by oiling is dependent on storage time. The primarily uniform oil film becomes more and more unequal, and bare spots can develop.

5.9.4 Thin organic film (or Sealing)

When specified, zinc-aluminium-magnesium alloy-coated steel sheet as produced shall be coated with a thin organic film coating to offer additional corrosion protection and, depending on its nature, increase the protection against fingerprints. It may improve the sliding characteristics during forming operations and can be used as a priming coat for subsequent painting.

5.10 Coated coil joining

Continuous coil coating lines use various methods to join coil ends. These methods include lap welding, laser wedding, butt welding and stitching. The shipment of coils containing the joined coil ends shall be permitted if agreed upon between the purchaser and manufacturer.

5.11 Dimensional and shape tolerances

5.11.1 Dimensional and shape tolerances applicable to zinc-aluminium-magnesium alloy-coated steel sheets shall be as specified in ISO 16163. The tolerances for thickness apply to products whose thickness is a combination of base-metal and coating thickness.

5.11.2 When the base-metal thickness is specified, the thickness tolerances of ISO 16163 shall apply to the product thickness calculated in accordance with Annex A.

6 Sampling

6.1 Tensile test

When required, one representative transverse sample from each lot of 50 t or less for shipment shall be taken for the tensile test to verify conformance with the requirements of Table 4 and Table 6.

6.2 Coating tests

6.2.1 Coating mass

6.2.1.1 The manufacturer shall develop a testing plan with a frequency sufficient to adequately characterize the lot of material and ensure conformance with specification requirements.

6.2.1.2 The purchaser may conduct verification tests by securing a sample piece approximately 300 mm in length by the as-coated width and cutting three test specimens, one from the mid-width position and one

from each side, not closer than 25 mm to the side edge. The minimum area of each of the three specimens shall be 1 200 mm^2.

6.2.2 Triple-spot test

The triple-spot test result shall be the average coating mass found on three specimens taken in accordance with 6.2.1.

6.2.3 Single-spot test

The single-spot test result shall be the minimum coating mass found on any one of the three specimens used for the triple-spot test. Material, which has been slit from wide coil, shall be subject to a single spot test only.

6.2.4 Coating adherence

One representative sample for the coating adherence bend test shall be taken from each lot of 50 t or less for shipment. The specimens for the coating adherence bend test shall be taken not closer than 25 mm from the side edge. The minimum width of the test specimen shall be 50 mm.

7 Test methods

7.1 Tensile tests

The tests shall be conducted in accordance with the methods specified in ISO 6892-1. Transverse (for structural quality grades: longitudinal) test pieces shall be taken mid-way between the centre and the edge of the as-coated steel sheet. The base-metal thickness shall be used to calculate the cross-sectional area needed for the tensile test; however, for orders specifying thickness "as base-metal only", there are two permissible methods for determining the base-metal thickness.

a) Option A — Determine the actual base-metal thickness through direct measurement of the substrate of a specimen whose coating has been removed.

b) Option B — Calculate the base-metal thickness through subtraction of the equivalent coating thickness for the appropriate coating mass designation included in Annex A, from the actual coated thickness of the test specimen.

7.2 Coating properties

7.2.1 Coating mass

The manufacturer shall conduct tests using methods deemed necessary to ensure that the material complies with the requirements shown in Table 8. Commonly used methods include those specified in ISO 1460, ISO 2178 and ISO 3497. The coating mass is determined by converting coating thickness measurements made with magnetic gauges (see ISO 2178) or by X-ray spectrometry (see ISO 3497). Either the test method in ISO 2178 or ISO 3497 shall be used as a basis for acceptance, but not for rejection. In cases of dispute, ISO 1460 shall be used as the referee method.

7.2.2 Coating adherence

Bend tests shall be conducted in accordance with the methods specified in ISO 7438. The bend tests may also be conducted with the other suitable methods.

7.2.3 Test methods for coating bath composition

Unless otherwise agreed by the interested parties, test methods for coating bath composition are left to the discretion of the manufacturer.

7.2.4 Coating corrosion resistance

If requested and only for quality control purposes of the same coating types, the corrosion resistance of coating shall be tested by using the methods in ISO 9227 or/and ISO 14993.

NOTE The results of these tests are solely for quality control purposes and not to indicate in-service corrosion performance.

8 Designation system

8.1 General

The designation system includes the coating type, coating mass, coating finish condition, surface treatment and base-metal quality.

8.2 Coating type

The coating type designations are T1, T2, T3, T4 and T5.

8.3 Coating mass

8.3.1 The coating mass designations are ZM60, ZM70, ZM80, ZM90, ZM100, ZM120, ZM140, ZM150, ZM180, ZM200, ZM220, ZM250, ZM275, ZM300, ZM350, ZM450, ZM500 and ZM600 as indicated in Table 8. The letter ZM indicates zinc-aluminium-magnesium coating.

8.3.2 The coating mass is expressed as the total mass on both surfaces, in grams per square metre. The coating mass specified shall be compatible with the desired service life, the thickness of the base-metal, and with the forming requirements involved.

NOTE 1 The coating mass designations is shown in the order of top surface and bottom surface. An example designation is 90/90, which equivalent to 180.

NOTE 2 For differential coatings, the coating mass of each surface, which is based on the agreement of the interested parties, is shown in the order of top surface and bottom surface. An example of a complete designation for a differential coating is: ZM15090SCO02T1(see 8.7.3).

8.4 Coating finish condition

The coating finish condition designations are:

— N: as-coated finish, no skin pass.

— S: smooth finish with skin pass.

NOTE 1 The normal spangle is the “as-coated” condition and the smooth finish is achieved with a skin pass.

NOTE 2 End-use applications can require negotiation between the manufacturer and purchaser to establish specific surface requirements.

8.5 Surface treatment

The surface treatment designations are:

— C: mill passivation;

— P: mill phosphating;

— O: oiling;

— CO: mill passivation and oiling;

— MS: mill sealing.

8.6 Base-metal quality

The base-metal quality designations are 01, 02, 03, 04, 05, 220, 250, 280, 320, 350, 380 and 550 as indicated in Table 1.

8.7 Examples

8.7.1 An example of a complete designation for a structural quality product is: ZM275SCO400T1. This designation example is obtained by combining the following components:

— ZM: zinc-aluminium-magnesium alloy coating;

— 275: coating mass;

— S: smooth finish with skin pass;

— CO: mill passivation and oiling;

— 400: structural quality grade;

— T1: coating type 1.

8.7.2 An example of a complete designation is: ZM275SCO02T1. This designation example is obtained by combining the following components:

— ZM: zinc-aluminium-magnesium alloy coating;

— 275: coating mass;

— S: smooth finish with skin pass;

— CO: mill passivation and oiling;

— 02: drawing quality;

— T1: coating type 1.

8.7.3 An example of a complete designation for a differential coating is: ZM15090SCO02T1. The standard designation would give the top surface before the bottom surface. This designation example is obtained by combining the following components:

— ZM: zinc-aluminium-magnesium alloy coating;

— 150: coating mass of top surface;

— 90: coating mass of bottom surface;

— S: smooth finish with skin pass;

— CO: mill passivation and oiling;

— 02: drawing quality;

— T1: coating type 1.

9 Retests

9.1 Machining and flaws

If any tensile test piece shows defective machining or develops flaws, it shall be discarded and another test piece shall be substituted.

9.2 Elongation

On any tensile test, if any part of the fracture is outside the middle half of the gauge length as scribed before the test, the test shall be discarded and a retest carried out.

9.3 Additional tests

If any test does not give the specified results, two additional tests shall be conducted on samples selected at random from the same lot. Both retests shall conform to the requirements of this document; otherwise the lot shall be rejected.

10 Resubmission

10.1 The manufacturer may resubmit, for acceptance, the products that have been rejected during earlier inspection because of unsatisfactory properties, after the rejected products have been subjected to a suitable treatment (e.g. selection, heat treatment), which on request, will be indicated to the purchaser. In this case, tests shall be carried out as if they applied to a new lot.

10.2 The manufacturer may present the rejected products to a new examination for compliance with the requirements for another quality.

11 Workmanship

11.1 The surface condition shall be that normally obtained for a zinc-aluminium-magnesium alloy-coated steel sheet product.

11.2 The steel sheet in cut lengths shall be free from quantities of laminations, surface flaws and other imperfections that are detrimental to the final product or to subsequent appropriate processing.

11.3 Processing for shipment in coils does not afford the manufacturer the opportunity to observe readily or to remove non-conforming portions, as can be carried out on the cut length product. However, this does not relieve the manufacture of responsibility to provide a product that meets the requirement for surface condition that is normally obtained on zinc-aluminium-magnesium alloy-coated steel sheet products.

12 Inspection and acceptance

12.1 Although not usually required for products covered by this document, when the purchaser specifies that inspection and tests for acceptance shall be observed prior to shipment from the manufacturer's works, the manufacturer shall afford the purchaser's inspector all reasonable facilities to determine that the steel is being furnished in accordance with this document.

12.2 Steel that is reported to be non-conforming after arrival at the user's works shall be set aside, properly and correctly identified and adequately protected. The manufacturer shall be notified in order that the reported non-conforming material may be properly investigated.

13 Coil size

When steel sheet in accordance with this document is ordered in coils, a minimum or range of acceptable inside diameter(s) (ID) shall be specified. In addition, the maximum outside diameter (OD) and the maximum acceptable coil mass shall be specified.

14 Marking

Unless otherwise stated, the following minimum requirements for identifying the steel sheet shall be legibly stencilled on the top of each lift or shown on a tag attached to each coil or shipping unit:

a) the manufacturer's name or identifying brand;

b) the number of this document, i.e. ISO 8353:2024;

c) the quality and grade designation;

d) the coating designation:

e) the order number;

f) the product dimensions;

g) the mass;

h) the bundle or coil number.

15 Information to be supplied by the purchaser

To specify requirements adequately in accordance with this document, enquiries and orders shall include the following information:

a) a reference to this document, i.e. ISO 8353:2024;

b) the name and designation of the material, i.e. steel sheet, zinc- aluminium-magnesium alloy-coated, coating type, coating mass, coating finish condition, surface treatment, and base-metal quality (see Clause 8);

c) dimensions: for cut lengths: thickness (combination of base-metal and coating or base-metal alone), width, length and bundle mass, and the total quantity required; for coils: thickness (combination of base-metal and coating or base-metal alone), width, minimum or range of inside diameter, outside diameter, and the maximum acceptable coil mass, and the quantity required;

NOTE 1 When the base-metal alone is specified, see Annex A.

NOTE 2 When the method of specifying thickness is not indicated, the combination of base-metal and coating will be provided.

d) the application (name of part), if available;

NOTE 3 Identification of the application provides the opportunity to assess the compatibility of the end use with the ordered quality and coating designation. Proper identification of the part can include a description of the part, or a visual examination of a submitted part and/or prints, or any combination thereof.

e) ordering condition A or B (see 5.4.1);

f) coating finish condition (see 5.8)

g) whether mill passivated or not (see 5.9.1);

h) whether mill phosphated or not (see 5.9.2);

i) whether oiled or not (see 5.9.3);

j) the report of the heat analysis (see 5.3.1) and mechanical properties, if required;

k) the coil size requirements (see Clause 13);

l) inspection and tests for acceptance prior to shipment from the producer's works, if required (see Clause 12).

EXAMPLE A typical ordering description is as follows:

ISO 8353:2024, steel sheet, zinc-aluminium-magnesium alloy-coated, drawing quality, designation ZM275SCO02T1, 1,0 mm × 1 200 mm × coil, 600 mm ID, 1 500 mm OD, 20 000 kg, exhaust pipe tubing, ordering condition A, mill passivation.