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Fifth edition
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Steel sheet, aluminium-silicon alloy-coated by the continuous hot-dip process, of commercial and drawing qualities

Tôles en acier au carbone laminées à froid, revêtues par immersion à chaud en continu d'une couche d'aluminium-silicium, de qualité commerciale et pour emboutissage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

This fifth edition cancels and replaces the fourth edition (ISO 5000:2011), which has been technically revised. The main changes compared to the previous edition are as follows:

— editorial updates throughout for clarity.

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, aluminium-silicon alloy-coated by the continuous hot-dip process, of commercial and drawing qualities

1 Scope

This document is applicable to the minimum requirements for steel sheet, in coils and cut lengths, metallic-coated by the continuous hot-dip process, with aluminium-silicon alloy coating.

The product is intended for heat-resisting applications and also where both corrosion and heat resistance are required.

The steel sheet is produced in a number of quality designations and grades, coating mass, surface treatments and coating finish conditions 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 6353 (all parts), *Reagents for chemical analysis*

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

ISO 7438, *Metallic materials — Bend test*

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 http://www.electropedia.org/

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

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

3.3
deep drawing
base-metal quality intended for 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

3.6
interstitial free steel
IF steel
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.

3.7
differential coating
coating deliberately produced to have a different *coating mass* (3.9) on each surface

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

3.9
coating mass
total amount of coating on both sides of the sheet, expressed in grams per square metre

3.10
normal spangle
coating formed as a result of the unrestricted growth of aluminium-silicon alloy crystals during normal solidification

3.11
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.

3.12
lot
up to a specified quantity of steel sheet of the same designation rolled to the same thickness and coating condition

3.13
smooth finish
smoothness produced by skin-passing the coated material in order to achieve an improved surface condition as compared with the normal as-coated product

4 Dimensions

4.1 Aluminium-silicon alloy-coated steel sheet is produced in thicknesses from 0,40 mm to 3,0 mm inclusive and in widths of 600 mm to 1 500 mm in coils and cut lengths. Aluminium-silicon alloy-coated sheet less than 600 mm wide, slit from wide sheet, is considered as sheet.

4.2 The thickness of aluminium-silicon alloy-coated steel sheets may be specified as a combination of the base metal and metallic coating, or as 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 aluminium-silicon alloy-coated 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 shall be in accordance with Tables 2 and 3.

Table 1 — Chemical composition (heat analysis)

Mass fractions in percent

Base-metal quality		C	Mn	P	S	Ti
Designation	Name	max.	max.	max.	max.	max.
01	Commercial	0,15	0,60	0,05	0,035	—
02	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

[a] Interstitial free steel may be applied (see 5.4.3).

Table 2 — Limits on additional chemical elements

Mass fractions in percent

Element	Cu[a] max.	Ni[a] max.	Cr[ab] max.	Mo[ab] max.	Nb[c] max.	V[c,d] max.	Ti[c] 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 producer 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
	0,15	0,03
Mn	0,60	0,03
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 Ordering conditions

Aluminium-silicon alloy-coated steel sheet of designations 02 and 03 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.

5.4.2 Fabrication qualities

Aluminium-silicon alloy-coated steel sheets are available in several fabrication qualities: commercial, drawing, deep drawing, deep drawing aluminium killed and extra-deep drawing stabilized.

5.4.3 Interstitial free steel

Stabilized interstitial free (IF) steel is applicable to orders for designations 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

Base-metal quality		R_{eL} max.[a]	R_m max.[b]	A min.[c] %		$\bar{r}$ min.[def]	$\bar{n}$ min.[def]
Designation	Name	MPa	MPa	L_0 = 80 mm	L_0 = 50 mm		
01	Commercial	—	—	—	—	—	—
02	Drawing	340	430	30	31	—	—
03	Deep drawing	300	410	34	35	—	—
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 stretchability of the product

1 MPa = 1 N/mm2

NOTE 1 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 may be specified.

NOTE 2 With the exception of footnote 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 tends to decrease as the sheet thickness decreases.

[a] The values apply to 0,2 % proof strength when a definite yield phenomenon is not present, otherwise to the lower yield strength (R_{eL}).

[b] The minimum tensile strength for qualities 02, 03 and 04 would normally be expected to be 270 MPa. For design purposes, the lower limit for R_{eL} may be assumed to be 140 MPa for grades 01, 02, 03, 04, and 120 MPa for grade 05. All tensile strength values are determined to the nearest 10 MPa.

[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] $\bar{r}$ can also be written as *r*-bar and $\bar{n}$ can 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 producer and the purchaser.