

INTERNATIONAL STANDARD

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Continuously hot-rolled steel sheet of structural quality with improved atmospheric corrosion resistance

*Tôles en acier de construction laminées à chaud en continu à résistance
améliorée à la corrosion atmosphérique*

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Reference number
ISO 5952:1998(E)

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 5952 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

This second edition cancels and replaces the first edition (ISO 5952:1983), which has been technically revised.

Annexes A to C of this International Standard are for information only.

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Continuously hot-rolled steel sheet of structural quality with improved atmospheric corrosion resistance

1 Scope

1.1 This International Standard applies to continuously hot-rolled steel sheet (see 3.2) of structural quality having improved atmospheric corrosion resistance, also known as weather-resistant structural steel. It is produced in the grades and classes listed in tables 1 and 2. The product is intended for applications where requirements are for mechanical properties and increased resistance to atmospheric corrosion. It is generally used in the delivered condition and is intended for bolted, riveted or welded structures.

1.2 This product is commonly produced in the range of thicknesses 1,6 mm and above and widths of 600 mm and over, in coils and cut lengths.

1.3 Hot-rolled sheet less than 600 mm wide may be slit from wide sheet and will be considered as sheet.

NOTE — Hot-rolled sheet up to but not including 3 mm in thickness is commonly known as sheet. Hot-rolled sheet 3 mm and over in thickness is commonly known as either "sheet" or "plate".

1.4 This International Standard does not cover the following steel qualities:

- steels intended for boilers or pressure vessels, or steels designated as commercial quality or drawing qualities (see ISO 3573);
- steels produced on reversing mills and designated as improved atmospheric corrosion resistance (see ISO 4952);
- steels designated as structural quality (see ISO 4995) or high yield strength structural quality (see ISO 4996);
- steels designated as higher yield strength with improved formability (see ISO 5951).

2 Normative references

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

ISO 148:1983, *Steel — Charpy impact test (V-notch)*.

ISO 6892:—¹⁾, *Metallic materials — Tensile testing at ambient temperature*.

IIS/IIW 382-71, *Guide to the welding and weldability of C-Mn steels and C-Mn microalloyed steels*.

¹⁾ To be published. (Revision of ISO 6892:1984)

Table 1 — Chemical composition (heat analysis) (normal standard compositions, see 5.2)

Grade	Class ¹⁾	Method ²⁾	C	Mn	Si	P	S	Cu	Ni	Cr	Mo	Zr
HSA 235W	B	NE	0,13 max.	0,20 to 0,60	0,10 to 0,40	0,040 max.	0,035 max.	0,25 to 0,55	0,65 max.	0,40 to 0,80	—	—
	D	CS										
HSA 245W	B	NE	0,18 max.	1,25 max.	0,15 to 0,65	0,035 max.	0,035 max.	0,30 to 0,50	0,05 to 0,30	0,45 to 0,75	3)	3)
	D	CS										
HSA 355W1	A	NE	0,12 max.	1,00 max.	0,20 to 0,75	0,06 to 0,15	0,035 max.	0,25 to 0,55	0,65 max.	0,30 to 1,25		—
	D	CS										
HSA 355W2	C	NE	0,16 max.	0,50 to 1,50	0,50 max.	0,035 max.	0,035 max.	0,25 to 0,55	0,65 max.	0,40 to 0,80	0,30 max.	0,15 max.
	D	CS										
HSA 365W	B	NE	0,18 max.	1,40 max.	0,15 to 0,65	0,035 max.	0,035 max.	0,30 to 0,50	0,05 to 0,30	0,45 to 0,75	3)	3)
	D	CS										

NOTE — Each grade may contain one or more microalloying elements such as vanadium, titanium, niobium, etc.

- 1) Class A steels satisfy only moderate loading conditions.
 Class B steels are intended for use in welded structures or structural parts, subjected to normal loading conditions.
 Class C steels are to be used in cases where, owing to loading conditions and the general design of the structure, some resistance to brittle fracture is necessary.
 Class D steels are to be used for structures or structural parts where, owing to loading conditions and the general design of the structure, a high resistance to brittle fracture is necessary.
- 2) NE — non-rimming
 CS — aluminium killed (0,020 % minimum total aluminium)
- 3) Total content of Mo, Nb, Ti, V and Zr not to exceed 0,15 %.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 improved atmospheric corrosion resistance: A characteristic achieved by intentional addition of a certain number of alloying elements such as P, Cu, Cr, Ni, Mo, etc., providing a chemical composition which promotes the formation of a protective oxide layer on the product. The degree of corrosion resistance is based on data acceptable to the purchaser.

3.2 hot-rolled steel sheet: A product obtained by rolling heated steel through a continuous-type wide strip mill to the required sheet thickness. The product has a surface covered with oxide or scale resulting from the hot rolling operation.

3.3 hot-rolled descaled steel sheet: Hot-rolled steel sheet from which oxide or scale has been removed by pickling in an acid solution or by mechanical means such as grit blasting. Some change in properties may result from mechanical descaling.

3.4 mill edge: A normal edge without any definite contour, produced in hot rolling. Mill edges may contain some irregularities such as cracked or torn edges or thin (feathered) edges.

3.5 sheared edge: A normal edge obtained by shearing, slitting or trimming a mill edge product. Normal processing does not necessarily provide a definite positioning of the slitting burr.

NOTE — Material is normally supplied as described in 3.4 and 3.5. Other edges may be supplied as agreed upon.

Table 2 — Mechanical properties

Grade	Class	$R_e^{2)}$ min N/mm ²	R_m N/mm ² Nominal thickness		$A^3)$ min %					
					$e < 3$ mm		$3 \leq e < 6$ mm		$6 \leq e$ mm	
			< 3	≥ 3	$L_o = 50$ mm	$L_o = 80$ mm	$L_o = 5,65\sqrt{S_o}$ mm	$L_o = 50$ mm	$L_o = 5,65\sqrt{S_o}$ mm	$L_o = 200$ mm
HSA 235W	B and D	235	360 to 510	340 to 470	20	18	24	22	24	17
HSA 245W	B and D	245	400 to 540		20	18	24	22	24	17
HSA 355W1	A and D	355	510 to 680	490 to 630	15	15	20	19	24	18
HSA 355W2	C and D	355	510 to 680	490 to 630	18	15	20	22	24	18
HSA 365W	B and D	365	490 to 610		15	12	17	19	21	15

NOTE

R_e = yield strength;
 R_m = tensile strength;
A = percentage elongation after fracture;
 L_o = gauge length on test piece;
 e = thickness of steel sheet, in millimetres;
 S_o = original cross-sectional area of gauge length;
1 N/mm² = 1 MPa

1) Class A steels satisfy only moderate loading conditions.
Class B steels are intended for use in welded structures or structural parts, subjected to normal loading conditions.
Class C steels are to be used in cases where, owing to loading conditions and the general design of the structure, some resistance to brittle fracture is necessary.
Class D steels are to be used for structures or structural parts where, owing to loading conditions and the general design of the structure, a high resistance to brittle fracture is necessary.

2) The yield strength can be measured either by 0,5 % total elongation proof stress $R_{t0,5}$ (proof stress under load) or by 0,2 % offset $R_{p0,2}$ when a definite yield phenomenon is not present.

3) For thicknesses up to 3 mm, use either $L_o = 50$ mm or $L_o = 80$ mm. For thicknesses 3 mm to 6 mm, use $L_o = 5,65\sqrt{S_o}$ or $L_o = 50$ mm. For thicknesses 6 mm and over, use $L_o = 5,65\sqrt{S_o}$ or $L_o = 200$ mm. In case of dispute however, only the results obtained on a proportional test piece will be valid for material 3 mm and over in thickness.

4 Surface characteristics

4.1 Surface condition

Oxide or scale in hot-rolled steel sheet is subject to variations in thickness, adherence and colour. Removal of the oxide or scale by pickling or blast cleaning may disclose surface imperfections not readily visible prior to this operation.

4.2 Oiling

As a deterrent to rusting, a coating of oil is usually applied to hot-rolled, descaled steel sheet but sheet may be furnished unoiled, if required. The oil is not intended as a forming lubricant and shall be easily removable with degreasing chemicals.

When requested, the manufacturer shall advise the purchaser which type of oil has been used.

5 Conditions of manufacture

5.1 Steelmaking

Unless otherwise agreed upon, the processes used in making the steel and in manufacturing hot-rolled 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

5.2.1 The chemical composition (heat analysis) shall conform to the values given in table 1, unless otherwise agreed upon between the interested parties.

5.2.2 When selecting the grade or chemical composition to be used, attention should be directed to the appropriate welding procedure to be followed (see 5.4).

5.3 Chemical analysis

5.3.1 Heat analysis

An analysis of each heat of steel shall be made by the manufacturer to determine compliance with the requirements given in table 1. On request, at the time of ordering, this analysis shall be reported to the purchaser or his representative.

5.3.2 Product analysis

A product analysis may be made by the purchaser to verify the specified analysis of the product and shall take into consideration any normal heterogeneity.

For killed steels, the sampling method and deviation limits shall be agreed upon between the interested parties at the time of ordering.

5.4 Weldability

This product is suitable for welding if appropriate welding conditions are selected, such as the recommendations given in IIS/IIW 382-71.

5.5 Application

It is desirable that the specified product be identified for fabrication by name of the part or by intended application. Proper identification of the part may include visual examination, prints or description, or a combination of these.

5.6 Mechanical properties

At the time that the steel is made available for shipment, the mechanical properties shall be as stated in table 2 when they are determined on test pieces obtained according to the requirements of clause 8. Any additional property requirements specified or required shall be subject to agreement before ordering. Such additional requirements may include characterizations or prescribed values for properties such as impact for sheet over 6 mm in thickness (see 8.2).

5.7 Corrosion resistance

The resistance of these steels to atmospheric corrosion is due to the formation of a protective oxide layer. The formation of this protective layer depends not only on chemical composition such as the distinctive differences between the analyses of the various grades, but also on a number of factors such as surrounding atmosphere, design, etc., over which the steel producer has no control. See annexes A and B for information on estimating the corrosion resistance and cautions concerning the use of these steels.

6 Dimensional tolerances

6.1 Dimensional tolerances applicable to hot-rolled steel sheet of structural quality with improved atmospheric corrosion resistance shall be as given in tables 3 to 11. See also figures 1 to 3.

Restricted thickness tolerances are given in table 4.

7 Tensile test sampling

One representative sample for the tensile test required in table 2 shall be taken from each lot of sheet for shipment. A lot consists of 50 t or less of sheet of the same designation rolled to the same thickness and condition.

8 Mechanical property tests

8.1 Tensile test requirements

The tensile test shall be carried out in accordance with ISO 6892. Transverse test pieces shall be taken mid-way between the centre and edge of the sheet as rolled.

Table 3 — Normal thickness tolerances (\pm) for hot-rolled steel sheet (including descaled sheet), coils and cut lengths — Structural quality with improved corrosion resistance (Grades HSA 235W, HSA 245W)

Dimensions and tolerances in millimetres

Specified width	Specified thickness ¹⁾								
	$\leq 2,0$	$> 2,0$ $\leq 2,5$	$> 2,5$ $\leq 3,0$	$> 3,0$ $\leq 4,0$	$> 4,0$ $\leq 5,0$	$> 5,0$ $\leq 6,0$	$> 6,0$ $\leq 8,0$	$> 8,0$ $\leq 10,0$	$> 10,0$ $\leq 12,5$
$> 600 \leq 1\ 200$	0,17	0,18	0,20	0,22	0,24	0,26	0,29	0,32	0,35
$> 1\ 200 \leq 1\ 500$	0,19	0,21	0,22	0,24	0,26	0,28	0,30	0,33	0,36
$> 1\ 500 \leq 1\ 800$	0,21	0,23	0,24	0,26	0,28	0,29	0,31	0,34	0,37
$> 1\ 800$	—	0,25	0,26	0,27	0,29	0,31	0,35	0,40	0,43

NOTES

1 The values specified do not apply to the uncropped ends for a length, l , of a mill edge coil. The length, l , would be calculated using the following formula:

$$\text{length, } l, \text{ in metres} = \frac{90}{\text{thickness in mm}}$$

provided that the result was not greater than 20 m, inclusive of both ends.

2 For Grades HSA 355W1, HSA 355W2 and HSA 365W, the values in this table should be increased by 10 %.

1) Thickness is measured at any point on the sheet not less than 40 mm from a side edge. For measurement on an untrimmed edge sheet nearer to an edge than 40 mm and on a trimmed edge sheet nearer to an edge than 25 mm values of tolerances are subject to negotiation.

Table 4 — Restricted thickness tolerances (±) for hot rolled steel sheet (including descaled sheet), coils and cut lengths-structural quality with improved corrosion resistance (Grades HSA 235W, HSA 245W)

Dimensions and tolerances in millimetres

Specified width	Specified thickness ¹⁾								
	≤ 2,0	> 2,0 ≤ 2,5	> 2,5 ≤ 3,0	> 3,0 ≤ 4,0	> 4,0 ≤ 5,0	> 5,0 ≤ 6,0	> 6,0 ≤ 8,0	> 8,0 ≤ 10,0	>10,0 ≤12,5
> 600 ≤ 1 200	0,13	0,14	0,15	0,17	0,19	0,21	0,23	0,26	0,28
> 1 200 ≤ 1 500	0,14	0,15	0,17	0,18	0,21	0,22	0,24	0,26	0,29
> 1 500 ≤ 1 800	0,14	0,17	0,19	0,21	0,22	0,23	0,25	0,27	0,30
> 1 800		0,20	0,21	0,22	0,23	0,25	0,28	0,32	0,36

NOTES

- The values specified do not apply to the uncropped ends for a length, *l*, of a mill edge coil. The length, *l*, would be calculated using the following formula:

$$\text{length, } l, \text{ in metres} = \frac{90}{\text{thickness in mm}}$$
 provided that the result was not greater than 20 m, inclusive of both ends.
 - For Grades HSA 355W1, HSA 355W2 and HSA 365W, the values in this table should be increased by 10 %.
- 1) Thickness is measured at any point on the sheet not less than 40 mm from a side edge. For measurement on an untrimmed edge sheet nearer to an edge than 40 mm and on a trimmed edge sheet nearer to an edge than 25 mm values of tolerances are subject to negotiation.

Table 5 — Hot-rolled sheet (including descaled sheet), mill edge, coils and cut lengths — Width tolerances, structural quality with improved corrosion resistance

Dimensions and tolerances in millimetres

Specified width	Tolerances ¹⁾ over specified width (no tolerance under)
≤ 1 200	20
> 1 200 ≤ 1 500	20
> 1 500	25

- 1) The values specified do not apply to the uncropped ends for a length, *l*, of a mill edge coil. Length, *l*, would be calculated using the following formula:

$$\text{length, } l, \text{ in metres} = \frac{90}{\text{thickness in mm}}$$
 provided that the result was not greater than 20 m, inclusive of both ends.

Table 6 — Hot-rolled steel sheet (including descaled sheet), sheared edge, not resquared, coils and cut lengths — Width tolerances, structural quality with improved corrosion resistance

Dimensions and tolerances in millimetres

Specified width	Tolerances over specified width ¹⁾ (no tolerance under)
≤ 1 200	3
> 1 200 ≤ 1 500	5
> 1 500	6

- 1) Tolerances for sheared edges apply to products with nominal thickness ≤ 10 mm. For nominal thickness > 10 mm the upper tolerances shall be agreed at the time of enquiry and order.

**Table 7 — Hot-rolled steel sheet (including descaled sheet),
not resquared — Length tolerances, structural quality
with improved corrosion resistance**

Dimensions and tolerances in millimetres

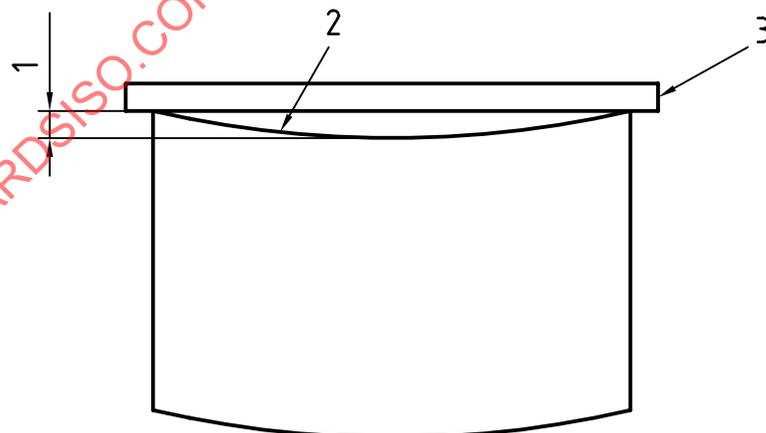
Specified length	Tolerances over specified length (no tolerance under)
$\leq 2\ 000$	10
$> 2\ 000 \leq 8\ 000$	0,5 % of length
$> 8\ 000$	40

**Table 8 — Hot-rolled steel sheet (including descaled sheet),
not resquared — Camber tolerances, structural quality
with improved corrosion resistance**

Form	Maximum tolerance ¹⁾ mm
Coils	25 in any 5 000 length
Cut lengths	0,5 % of length

NOTE — Camber is the greatest deviation of a side edge from a straight line, the measurement being taken on the concave side with a straight edge (see figure 1).

1) The values do not apply to the uncropped ends of mill edge coil within 7 m inclusive of both ends.



Key

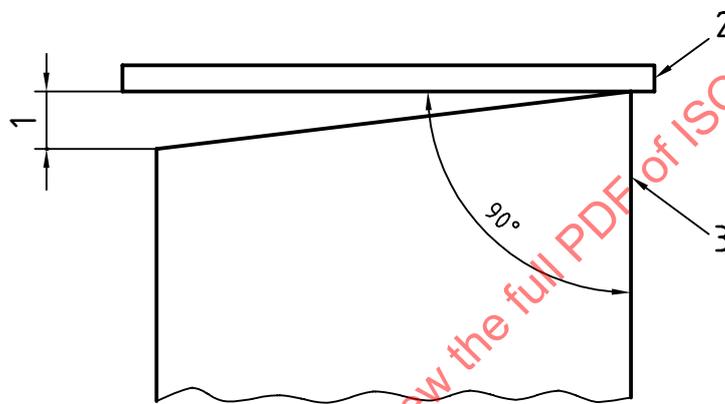
- 1 Edge camber
- 2 Side edge (concave side)
- 3 Straightedge

Figure 1 — Measurement of camber

Table 9 — Hot-rolled steel sheet in cut lengths (including descaled sheet), not resquared — Out-of-square tolerances, structural quality with improved corrosion resistance

Dimensions	Out-of-square tolerance
All thicknesses and all sizes	1 % of width

NOTE — Out-of-square is the greatest deviation of an end edge from a straight line at right angles to a side and touching one corner, the measurement being taken as shown in figure 2. It can also be measured as one-half the difference between the diagonals of the cut length sheet.



Key

- 1 Out-of-square
- 2 Straightedge
- 3 Side edge

Figure 2 — Measurement of out-of-square

Table 10 — Hot-rolled steel sheet (including descaled sheet), resquared — Out-of-square, width and length tolerances, structural quality with improved corrosion resistance

Dimensions and tolerances in millimetres

Specified length	Specified width	Tolerances (≤ 6 in thickness)
≤ 3 000	≤ 1 200	- 0 + 2
	> 1 200	- 0 + 3
> 3 000	All widths	- 0 + 3

NOTES

1 Out-of-square is the greatest deviation of an end edge from a straight line at right angles to a side and touching one corner, the measurement being taken as shown in figure 2. It can also be measured as one-half the difference between the diagonals of the cut length sheet.

2 When measuring material to resquared tolerances, consideration may have to be given to extreme variations in temperature.

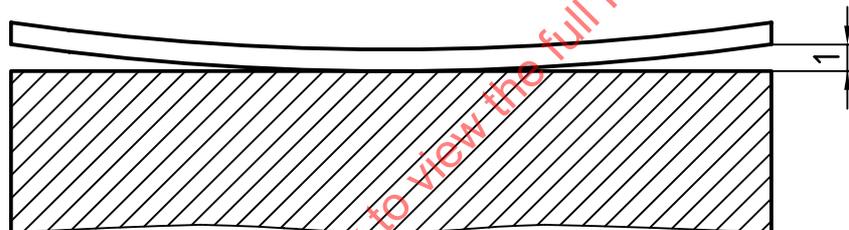
Table 11 — Standard flatness tolerances — Structural quality with improved corrosion resistance, cut lengths

Dimensions and tolerances in millimetres

Thickness	Width	Flatness tolerances ¹⁾
≤ 2	≤ 1 200	21
	> 1 200 ≤ 1 500	25
	> 1 500	30
> 2	≤ 1 200	18
	> 1 200 ≤ 1 500	23
	> 1 500	28

NOTE — These tolerances are only applicable to sheet up to and including 5 000 mm length. Tolerances for sheet having a length exceeding 5 000 mm are subject to agreement. This table also applies to sheet cut to length from coil by the customer when adequate flattening procedures are performed.

1) Maximum deviation from a flat horizontal surface. With the sheet lying under its own mass on a flat surface, the maximum distance between the lower surface of the sheet and the flat horizontal surface is the maximum deviation from flatness (see figure 3).



Key

- 1 Maximum deviation from flatness

Figure 3 — Measurement of flatness

8.2 Impact test requirements

While not usually specified, if so agreed at the time of ordering, impact tests may be specified for material 6 mm and over in thickness. The test pieces shall be in the longitudinal direction and the test shall be carried out in accordance with ISO 148 for the Charpy V-notch test.

9 Retests

9.1 Machining and flaws

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

9.2 Elongation

If the percentage of elongation of any tested piece is less than that specified in table 2 and 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 shall be conducted.

9.3 Additional tests

If a test does not give the specified results, two additional tests shall be taken at random from the same lot. Both retests shall conform to the requirements of this International Standard, otherwise the lot may be rejected

10 Resubmission

The manufacturer may resubmit for acceptance the products that have been rejected during earlier inspection because of unsatisfactory properties, after he has subjected them to a suitable treatment, which, on request, shall be indicated to the purchaser.

In this case, the tests shall be carried out as if they applied to a new batch.

The manufacturer has the right to present the rejected products to a new examination for compliance with the requirements for another grade.

11 Workmanship

The surface condition shall be that normally obtained in a hot-rolled product. The material cut in lengths shall be free from any laminations, surface flaws and other imperfections that are detrimental to the final product or to subsequent appropriate processing.

Processing for shipment in coils does not afford the manufacturer the opportunity of readily observing or removing imperfect portions as would be the case on the cut length product.

12 Inspection and acceptance

12.1 While not usually required for products covered by this International Standard, when the purchaser specifies that inspection and tests for acceptance 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 International Standard.

12.2 Steel that is reported to be defective after arrival at the user's works shall be set aside, properly and correctly identified and adequately protected. The supplier shall be notified in order that he may properly investigate.

13 Coil size

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

14 Marking

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

- a) manufacturer's name or identifying brand;
- b) reference to this International Standard, i.e. ISO 5952:1997;
- c) the grade and class designation;
- d) the order number;
- e) the product dimensions;

- f) the lot number;
- g) the mass.

15 Information to be supplied by the purchaser

To adequately specify requirements under this International Standard, inquiries and orders shall include the following information:

- a) reference to this International Standard, i.e. ISO 5952:1997;
- b) name, quality, grade and class of material (for example, hot-rolled steel sheet of structural quality with improved atmospheric corrosion resistance, grade HSLA 355W1, Class A);
- c) dimensions of product and quantity required;
- d) application (name of part) if possible (see 5.5);
- e) pickling (or descaling by grit or shot blasting), if required (material so specified will be oiled unless ordered unoiled) (see 3.3 and 4.2);
- f) type of edge (see 3.4 and 3.5);
- g) ends cropped, if required;
- h) if required, report of mechanical properties and/or heat analysis (see 5.3.1 and 5.6);
- i) if necessary, additional requirements (see 5.6);
- j) limitations on mass and dimensions of individual coils and bundles, if applicable (see clause 13);
- k) inspection and tests for acceptance prior to shipment from the manufacturer's works, if required (see 12.1);
- l) restricted thickness tolerances, if required.

Examples of ordering descriptions are given below.

International Standard ISO 5952 hot-rolled steel sheet of structural quality with improved atmospheric corrosion resistance, grade HSA 355W1, Class A, 3 mm × 1 200 mm × 2 440 mm restricted thickness tolerance, 40 000 kg, for Part No. 32154, formed channels for outdoor parking garage.

Annex A (informative)

Guidelines for estimating the atmospheric corrosion resistance of low-alloy steels

A.1 Scope

This annex presents a method for estimating the atmospheric corrosion resistance of low-alloy weather-resistant steels from chemical composition data.

A method is presented for estimating the atmospheric corrosion resistance of low-alloy weather-resistant steels. The method utilizes predictive equations based on the steel composition to calculate indices of atmospheric corrosion resistance.

A.2 Terminology

Low-alloy steels means iron-carbon alloys containing greater than 1 % but less than 5 %, by weight, total alloying elements.

NOTE — Most “low-alloy weather-resistant steels” contain additions of both chromium and copper, and may also contain additions of silicon, nickel, phosphorus or other alloying elements which enhance atmospheric corrosion resistance.

A.3 Procedure

A.3.1 Equations for predicting the corrosion penetration of low-alloy steels after 15,5 y of exposure to various atmospheres, based on the chemical composition of the steel, were published by Legault and Leckie^[6]. The equations are based on extensive data published by Larrabee and Coburn^[7].

A.3.2 For use in this guide, the Legault-Leckie equation for an industrial atmosphere was modified to allow calculation of an atmospheric corrosion resistance index based on chemical composition. The modification consisted of deletion of the constant and changing the signs of all the terms in the equation. The modified equation for calculation of the atmospheric corrosion resistance index, I , is given below. The higher the index, the more corrosion resistant is the steel.

$$I = 26,01 (\% \text{ Cu}) + 3,88 (\% \text{ Ni}) + 1,2 (\% \text{ Cr}) + 1,49 (\% \text{ Si}) + 17,28 (\% \text{ P}) - 7,29 (\% \text{ Cu}) (\% \text{ Ni}) \\ - 9,1 (\% \text{ Ni}) (\% \text{ P}) - 33,39 (\% \text{ Cu})^2$$

NOTE – Similar indices can be calculated for the Legault-Leckie equations for marine and semi-rural atmospheres. However, it has been found that the ranking of the indices of various steel compositions is the same for all these equations. Therefore, only one equation is required to rank the relative corrosion resistance of different steels.

A.3.3 The predictive equation should be used only for steel compositions within the range of the original test materials in the Larrabee-Coburn data set. These limits are as follows:

Cu 0,012 to 0,51 %

Ni < 0,05 to 1,1 %

Cr < 0,10 to 1,3 %

Si < 0,10 to 0,64 %

P < 0,01 to 0,12 %

A.3.4 The minimum acceptable atmospheric corrosion index should be a matter of negotiation between the manufacturer/supplier and the purchaser.