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**High yield strength steel plates and wide flats for cold forming —**

Part 2:

**Delivery condition for normalized, normalized rolled and as-rolled steels**

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*Tôles et larges-plats en acier à haute limite d'élasticité pour formage à froid —*

*Partie 2: Conditions de livraison des aciers dans les états normalisé, de laminage normalisant et brut de laminage*

ISO 6930-2:2004

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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 6930-2 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 3, *Steels for structural purposes*.

This first edition, together with ISO 6930-1:2001, cancels and replaces ISO 6930:1983 all clauses of which have been technically revised.

ISO 6930 consists of the following parts, under the general title *High yield strength steel plates and wide flats for cold forming*:

- *Part 1: Delivery conditions for thermomechanically-rolled steels*
- *Part 2: Delivery condition for normalized, normalized rolled and as-rolled steels*

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# High yield strength steel plates and wide flats for cold forming —

## Part 2: Delivery condition for normalized, normalized rolled and as-rolled steels

### 1 Scope

1.1 This part of ISO 6930 specifies the requirements for weldable high yield strength steels for cold forming.

This part of ISO 6930 applies to plates and wide-flats, hot-rolled on reversing mills, both having a thickness between 4 mm and 50 mm (inclusive) and supplied in the normalized, normalized rolled and as-rolled delivery condition.

1.2 This part of ISO 6930 does not apply to weldable structural steels, whether or not of special quality, which are covered by other International Standards, namely:

- high yield strength steel products for cold forming delivered in thermomechanically rolled condition (ISO 6930-1); [ISO 6930-2:2004](https://standards.iteh.ai/catalog/standards/sist/f41260be-7e55-42d8-ad09-40b3838a49e9/iso-6930-2-2004)
- structural steels (ISO 630); <https://standards.iteh.ai/catalog/standards/sist/f41260be-7e55-42d8-ad09-40b3838a49e9/iso-6930-2-2004>
- high yield strength flat steel products (ISO 4950-1, ISO 4950-2 and ISO 4950-3);
- hot-rolled steel sheet of higher yield strength with improved formability (ISO 5951).

### 2 Normative references

The following referenced documents are indispensable for the application 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 148, *Steel — Charpy impact test (V-notch)*

ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 404:1992, *Steel and steel products — General technical delivery requirements*

ISO 2566-1:1984, *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels*

ISO 6892, *Metallic materials — Tensile testing at ambient temperature*

ISO 7438, *Metallic materials — Bend test*

ISO/TR 9769, *Steel and iron — Review of available methods of analysis*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

### 3 Terms and definitions

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

- 3.1 as-rolled steel (AR)**  
steel without any special rolling and/or heat treatment condition
- 3.2 normalized steel (N)**  
steel obtained by a normalizing treatment, i.e. heat treatment consisting of austenitizing followed by cooling in air
- 3.3 normalized rolled steel (N)**  
steel obtained by normalizing rolling
- 3.4 normalizing rolling (N)**  
rolling process in which the final deformation is carried out within a certain temperature range leading to a material condition equivalent to that obtained after normalizing so that the specified values of the mechanical properties are retained even after normalizing
- 3.5 wide flat**  
finished flat product of width greater than 150 mm and a thickness generally over 4 mm, always supplied in lengths, i.e. not coiled and whose edges are sharp

NOTE The wide flat is hot-rolled on the four sides (or in box passes) or produced by shearing or flame-cutting wider flat products. Wide flats rolled on all four sides are sometimes termed universal plates.

[ISO 6929:1987]

### 4 General requirements

#### 4.1 Steelmaking process

Unless otherwise specified at the time of the enquiry and the order, the steelmaking process is left to the discretion of the manufacturer; it shall, however, be possible to disclose it to the purchaser, if he so requests, at the time of the delivery.

#### 4.2 Method of deoxidation

The steels shall be fully killed and made to a fine grain practice.

#### 4.3 Production process

Unless otherwise specified at the time of the enquiry and the order, the production process is left to the discretion of the manufacturer.

#### 4.4 Delivery condition

Plates and wide flats are supplied in the normalized, normalized rolled or as-rolled delivery condition.

Unless specially agreed at the time of enquiry and order, the products are generally supplied with their surface as-rolled. On request, they may be delivered with descaled surfaces. However, it is necessary to take into account the fact that certain descaling processes are liable to modify the cold forming properties.

By agreement with the purchaser, descaled products may be delivered with their surfaces protected.

The type of protection shall be agreed upon at the time of the enquiry or order.

### 5 Technical requirements

#### 5.1 Chemical composition

##### 5.1.1 Ladle analysis

The composition limits for the ladle analysis are given in Table 1.

**Table 1 — Chemical composition of normalized, normalized rolled and as-rolled steels (ladle analysis, mass fraction)**

Grades	C	Mn	Si	P	S	Al <sub>total</sub>	Nd	V	Ti
	% max.	% max.	% max.	% max.	% max. <sup>a</sup>	% min. <sup>b</sup>	% max. <sup>c</sup>	% max. <sup>c</sup>	% max. <sup>c</sup>
FeE 260	0,16	1,20	0,50	0,025	0,020	0,015	0,09	0,10	0,15
FeE 315	0,16	1,40	0,50	0,025	0,020	0,015	0,09	0,10	0,15
FeE 355	0,18	1,65	0,55	0,025	0,015	0,015	0,09	0,10	0,15
FeE 420	0,20	1,65	0,55	0,025	0,015	0,015	0,09	0,10	0,15
FeE 490	0,20	1,65	0,55	0,025	0,015	0,015	0,09	0,10	0,15
FeE 550	0,20	1,65	0,55	0,025	0,015	0,015	0,09	0,10	0,15

<sup>a</sup> If agreed upon at the time of enquiry and order, the sulfur content (mass fraction) shall be decreased to a maximum value of 0,010 % (ladle analysis).

<sup>b</sup> If agreed upon at the time of enquiry and order, the minimum content of total aluminium (mass fraction) does not apply when other grain-refining elements are present in sufficient quantity.

<sup>c</sup> The sum of niobium, vanadium, titanium contents (mass fractions) shall be a maximum of 0,22 %.

##### 5.1.2 Product analysis

If requested by the purchaser at the time of enquiry and order, a product analysis shall be carried out.

Table 2 gives the permissible deviations of the product analysis from the specified limits of the ladle analysis given in Table 1.

**Table 2 — Permissible deviations for the product analysis in relation to the specified ladle analysis**

Element	Specified limits %	Permissible deviation <sup>a</sup>
C	≤ 0,20	+ 0,02
Mn	≤ 1,65	+ 0,10
Si	≤ 0,55	+ 0,05
P	≤ 0,025	+ 0,005
S	≤ 0,020	+ 0,002
Al <sub>total</sub>	≥ 0,015	- 0,005
Nb	≤ 0,09	+ 0,01
V	≤ 0,10	+ 0,02
Ti	≤ 0,15	+ 0,01

<sup>a</sup> The deviations apply either above or below the specified limits of the range, but not simultaneously. When maxima only are specified, the deviations are positive only.

**5.2 Mechanical properties**

**5.2.1** The mechanical properties given in Table 3 apply to plates and wide flats supplied in the delivery condition given in 4.4 and are determined on test pieces in accordance with Clause 6.

The mechanical properties for products having a thickness greater than 20 mm shall be the subject of agreement at the time of enquiry or order.

**5.2.2** If agreed upon at the time of the enquiry and order, the impact energy value shall be verified at - 20 °C and shall meet a minimum average value of 40 J based on full size (10 mm × 10 mm) test piece (see 7.2). If the thickness is not sufficient for the preparation of full size impact test pieces, test pieces of smaller width shall be taken and the applicable values shall be decreased proportionally.

**Table 3 — Mechanical properties for thicknesses up to 20 mm**

Grade	Minimum yield strength <i>R<sub>eH</sub></i> N/mm <sup>2</sup>	Tensile strength <i>R<sub>m</sub></i> N/mm <sup>2</sup>	Minimum percentage elongation at fracture <i>A</i> %, with	
			<i>L<sub>0</sub></i> = 5,65 √ <i>S<sub>0</sub></i>	<i>L<sub>0</sub></i> = 200 mm
FeE 260 N	260	370 to 490	30	
FeE 315 N FeE 315 AR	315	430 to 550 ≥ 390	27	20
FeE 355 N FeE 355 AR	355	470 to 610 ≥ 430	25	18
FeE 420 N FeE 420 AR	420	530 to 670 ≥ 490	23	15
FeE 490 AR	490	≥ 550	18	12
FeE 550 AR	550	≥ 620	15	10



## 5.3 Technical properties

### 5.3.1 Weldability

The steels are weldable by all the appropriate processes when following the rules of technology.

A maximum value of the carbon equivalent (CEV) based on the ladle analysis can be agreed upon at the time of enquiry and order. The carbon equivalent value shall be determined using the following formula:

$$\text{CEV} = \text{C} + \frac{\text{Mn}}{6} + \frac{\text{Cr} + \text{Mo} + \text{V}}{5} + \frac{\text{Ni} + \text{Cu}}{15}$$

### 5.3.2 Bending and cold-edging ability

Information about bending and cold-edging ability is given in Annex A.

## 6 Inspection and testing

### 6.1 General

The product covered by this part of ISO 6930 shall be the subject of specific inspection and testing in accordance with the conditions specified in Clause 8 of ISO 404:1992 relating to the chemical composition and mechanical properties of the product.

### 6.2 Test unit

#### 6.2.1 General

The verification of product analysis and mechanical properties shall be per cast (heat).

#### 6.2.2 Tensile properties

A test unit shall contain products of the same form, grade and delivery condition and be from the same thickness range.

For a test unit not exceeding 50 t, one tensile test shall be carried out. For a test unit exceeding 50 t, two tensile tests shall be carried out.

#### 6.2.3 Impact tests

A test unit shall contain products of same form, grade and delivery condition.

For a test unit not exceeding 50 t, one set of impact tests shall be carried out. For a test unit exceeding 50 t, two sets of impact tests shall be carried out.

Tests shall be carried out at – 20 °C using sub-surface specimens from the thickest product. (See 5.2.2 for impact energy values).

### 6.3 Position and orientation of sample

#### 6.3.1 General

Sampling shall be carried out in such a way that the axis of the test piece is approximately equidistant from the centre line and the edge of the rolled product. See ISO 377.