INTERNATIONAL STANDARD

ISO 24314

First edition
2006-10-01

Structural steels — Structural steels for building with improved seismic resistance — Technical delivery conditions

Aciers de construction — Aciers de construction à résistance améliorée aux séismes — Conditions techniques de livraison

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Reference number
ISO 24314:2006(E)

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Published in Switzerland

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Contents

Page

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ISO 24314:2006
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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 24314 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 3, *Steels for structural purposes*.

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Structural steels — Structural steels for building with improved seismic resistance — Technical delivery conditions

1 Scope

This International Standard specifies qualities for seismic-purpose structural steels. This International Standard applies to steel plates with thicknesses of 6 mm or over and up to 125 mm, wide flats and hot-rolled sections, which are used in the as-delivered condition and normally intended for bolted, riveted or welded structures [1)].

It does not include the following steels, certain of which are covered by other International Standards, namely:

— structural steels (ISO 630);

— steels for general engineering purposes (ISO 1052);

— high-yield-strength flat steel products (ISO 4950-1, ISO 4950-2 and ISO 4950-3);

— high-yield-strength steel bars and sections (ISO 4951-1, ISO 4951-2 and ISO 4951-3);

— structural steels with improved atmospheric corrosion resistance (ISO 4952);

— high-yield-strength steel plates and wide flats for cold forming (ISO 6930-1 and ISO 6930-2).

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ISO 24314:2006
https://standards.iteh.ai/catalog/standards/sist/fea05451-aea3-4055-9580-52b745c139d8/iso-24314-2006

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 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

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 657-1, *Hot-rolled steel sections — Part 1: Equal-leg angles — Dimensions*

ISO 657-2, *Hot-rolled steel sections — Part 2: Unequal-leg angles — Dimensions*

ISO 657-5, *Hot-rolled steel sections — Part 5: Equal-leg angles and unequal-leg angles — Tolerances for metric and inch series*

ISO 657-11, *Hot-rolled steel sections — Part 11: Sloping flange channel sections (Metric series) — Dimensions and sectional properties*

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1) For precautions to be taken when welding, see the guide for the welding and weldability of C-Mn and C-Mn micro-alloy steels published by Sub-commission IX-G of the International Welding Institute (document ISS/IIWI 843-87).

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ISO 657-14, *Hot-rolled steel sections — Part 14: Hot-finished structural hollow sections — Dimensions and sectional properties*

ISO 657-15, *Hot-rolled steel sections — Part 15: Sloping flange beam sections (Metric series) — Dimensions and sectional properties*

ISO 657-16, *Hot-rolled steel sections — Part 16: Sloping flange column sections (metric series) — Dimensions and sectional properties*

ISO 657-18, *Hot-rolled steel sections — Part 18: L sections for shipbuilding (metric series) — Dimensions, sectional properties and tolerances*

ISO 657-19, *Hot-rolled steel sections — Part 19: Bulb flats (metric series) — Dimensions, sectional properties and tolerances*

ISO 657-21, *Hot-rolled steel sections — Part 21: T-sections with equal depth and flange width — Dimensions*

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

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

ISO 6929, *Steel products — Definitions and classification*

ISO 7452, *Hot-rolled structural steel plates — Tolerances on dimensions and shape*

ISO 7778:1983, *Steel plate with specified through-thickness characteristics*

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ISO 7788, *Steel — Surface finish of hot-rolled plates and wide flats — Delivery requirements*

ISO 9034, *Hot-rolled structural steel wide flats — Tolerances on dimensions and shape*

ISO 24314:2006
https://standards.iteh.ai/catalog/standards/sist/fea05451-aea3-4055-9580-526745e139d8/iso-24314-2006

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 terms and definitions given in ISO 6929 and the following apply.

3.1
as-rolled
steel without any special rolling and/or heat-treatment condition

3.2
thermomechanical rolling
rolling process in which the final deformation is carried out in a certain temperature range leading to a material condition with certain properties which cannot be achieved or repeated by heat treatment alone

NOTE 1 Subsequent heating above 580 °C may lower the strength values. If temperatures above 580 °C are needed, reference should be made to the supplier.

NOTE 2 Thermomechanical rolling leading to the delivery condition “thermomechanically rolled” can include processes with an increasing cooling rate with or without tempering, including self-tempering but excluding direct quenching or quenching and tempering.

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4 General requirements

4.1 Steel-making process

Unless otherwise agreed at the time of enquiry and order, the steel-making process is left to the discretion of the manufacturer.

4.2 Delivery condition

The products are generally delivered in the as-rolled condition, with the exception of grade S460S which is normally produced using a thermomechanical rolling operation. For all other grades, unless otherwise agreed, all delivery conditions other than thermomechanical rolling are allowed at the manufacturer's discretion. When agreed upon between the purchaser and the manufacturer, thermomechanical rolling can be applied to any grade.

4.3 Surface conditions

The products shall have a smooth surface corresponding to the rolling process used ; they shall not have any defects that are prejudicial to their subsequent processing or appropriate use. By agreement, alternative requirements may be specified, such as ISO 7788 for plates and wide flats, ISO 20723 for sections and ISO 9443 for bars. Other and/or more requirements than those reported in International Standards may be specified as well.

4.4 Shape, dimensions, mass and tolerances

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The shape, dimensions and mass of product and the tolerance thereof shall be in accordance with the following standards. Other size shapes are acceptable, if agreed between the purchaser and the manufacturer.

ISO 657-1, *Hot-rolled steel sections — Part 1: Equal-leg angles — Dimensions*

ISO 24314:2006
https://standards.iteh.ai/catalog/standards/sist/fea05451-aea3-4055-9580-

ISO 657-2, *Hot-rolled steel sections — Part 2: Unequal-leg angles — Dimensions*

ISO 657-5, *Hot-rolled steel sections — Part 5: Equal-leg angles and unequal-leg angles — Tolerances for metric and inch series*

ISO 657-11, *Hot-rolled steel sections — Part 11: Sloping flange channel sections (Metric series) — Dimensions and sectional properties*

ISO 657-14, *Hot-rolled steel sections — Part 14: Hot-finished structural hollow sections — Dimensions and sectional properties*

ISO 657-15, *Hot-rolled steel sections — Part 15: Sloping flange beam sections (Metric series) — Dimensions and sectional properties*

ISO 657-16, *Hot-rolled steel sections — Part 16: Sloping flange column sections (metric series) — Dimensions and sectional properties*

ISO 657-18, *Hot-rolled steel sections — Part 18: L sections for shipbuilding (metric series) — Dimensions, sectional properties and tolerances*

ISO 657-19, *Hot-rolled steel sections — Part 19: Bulb flats (metric series) — Dimensions, sectional properties and tolerances*

ISO 657-21, *Hot-rolled steel sections — Part 21: T-sections with equal depth and flange width — Dimensions*

ISO 7452, *Hot-rolled structural steel plates — Tolerances on dimensions and shape*

ISO 9034, *Hot-rolled structural steel wide flats — Tolerances on dimensions and shape*

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See also Annex B

In this case, unless otherwise agreed between the purchaser and the manufacturer, the following requirements shall also be satisfied.

a) The tolerances on thickness for the steel plates: ISO 7452:2002, Table 2, Class B, shall be applied.

b) The tolerances on thickness for the steel wide flats: ISO 9034:1987, Table 1, Class B, shall be applied.

c) The tolerance on flange thickness for the H-sections: Table 1 or Table 2 of this International Standard, shall be specified at the time of enquiry or order.

The dimensions of the H-section are given in Figure 1.

Table 1 — Tolerances on flange thickness of H-section (Class A)

Dimensions in millimetres

Thickness (t_2)	Tolerance
$6 \leqslant t_2 < 16$	+1,7 −0,3
$16 \leqslant t_2 < 40$	+2,3 −0,7
$40 \leqslant t_2 \leqslant 100$	+2,5 −1,5
$100 < t_2 \leqslant 125$	[a]
[a] Subject to agreement between purchaser and manufacturer.	

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Table 2 — Tolerances on flange thickness for H-section (Class B)

Dimensions in millimetres

Thickness (t_2)	Tolerance
$6 \leqslant t_2 < 10$	+2,0 −1,0
$10 \leqslant t_2 < 20$	+2,5 −1,5
$20 \leqslant t_2 < 30$	+2,5 −2,0
$30 \leqslant t_2 < 40$	+2,5 −2,5
$40 \leqslant t_2 < 60$	+3,0 −3,0
$60 \leqslant t_2$	+4,0 −4,0

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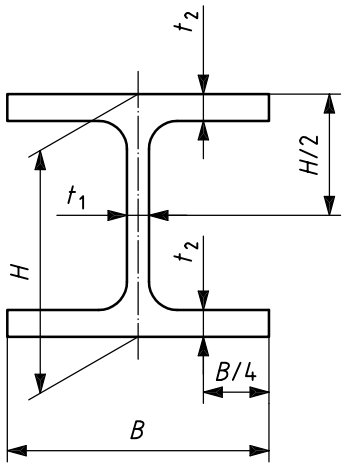

Key

B width
H height
t_1 web thickness
t_2 flange thickness

Figure 1 — Dimensions of H-section

5 Characteristics of types, grades and qualities

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5.1 Chemical composition

5.1.1 Cast (heat) analysis

ISO 24314:2006
https://standards.iteh.ai/catalog/standards/sist/fea05451-aea3-4055-9580-

The maximum values of the composition limits for ladle analysis are given in Table 3.

5.1.2 Product analysis

Table 4 gives the permissible deviations on analysis relative to the values for cast (heat) analysis which are given in Table 3.

Table 3 — Chemical composition

Grade	Thickness e mm	C % max.	Si % max	Mn %	P % max.	S % max.	Cu % max.	Ni % max.	Cr % max.	Mo % max.
S235S	$6 \leqslant e < 50$	0,20	0,35	0,50 to 1,40	0,030	0,045	0,60	0,45	0,35	0,15
	$50 \leqslant e \leqslant 125$	0,22								
S325S	$6 \leqslant e < 50$	0,18	0,55	0,50 to 1,60	0,030	0,045	0,60	0,45	0,35	0,15
	$50 \leqslant e \leqslant 125$	0,20								
S345S	$6 \leqslant e < 50$	0,23	0,55	0,50 to 1,60	0,030	0,045	0,60	0,45	0,35	0,15
	$50 \leqslant e \leqslant 125$									
S460S	$6 \leqslant e < 50$	0,18	0,55	0,50 to 1,60	0,030	0,045	0,60	0,45	0,35	0,15
	$50 \leqslant e \leqslant 125$	0,20								
The sum of niobium, vanadium and titanium shall not exceed 0,15 %.										
NOTE 1 If agreed between the purchaser and the manufacturer, the limitations of alloying elements other than those given in Table 4 can be applied.										
NOTE 2 If agreed between the purchaser and the manufacturer, the lower limit of a maximum sulfur content can be applied.										

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Table 4 — Permissible deviation for the product analysis relative to the specified cast (heat) analysis (refer to 6.4.4.1)

Element	Specified limits %	Permissible deviation %
C	⩽ 0,23	+0,03
Si	⩽ 0,55	+0,05
Mn	⩾ 0,50; ⩽ 1,60	+0,10, −0,10
P	⩽ 0,030	+0,005
S	⩽ 0,045	+0,005
Cu	⩽ 0,60	+0,07
Ni	⩽ 0,45	+0,05
Cr	⩽ 0,35	+0,05
Mo	⩽ 0,15	+0,03
Nb + V + Ti	⩽ 0,05	+0,02

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5.1.3 Carbon equivalent or parameter crack measurement (Pcm)

5.1.3.1 Carbon equivalent

ISO 24314:2006
https://standards.iteh.ai/catalog/standards/sist/fca03451-aea3-4055-9580-52b745c159d8/iso-24314-2006

A maximum value of carbon equivalent (CEV) based on the cast (heat) analysis, shall be as given in Table 5. The carbon-equivalent value, expressed as a percentage, shall be determined using the following formula:

$$\text{CEV} = \text{C} + \frac{\text{Mn}}{6} + \frac{\text{Cr} + \text{Mo} + \text{V}}{5} + \frac{\text{Ni} + \text{Cu}}{15} \qquad (1)$$

In this respect, all the elements designated in the formula shall be used for calculation and reported, regardless of whether those elements are intentionally added or not.

If agreed between the purchaser and the manufacturer, Annex C can be applied as the formula of carbon equivalent and maximum value of carbon equivalent in place of Table 5 and Formula 1.

Table 5 — Maximum value of carbon equivalent

Grade	Maximum value of carbon equivalent %	
	50 mm or under in thickness	over 50 mm, up to and including 125 mm in thickness
S235S	0,35	0,35
S325S	0,46	0,48
S345S	0,45	0,47
S460S	0,47	0,49
The applicable thickness is t_2 in the case of H-sections.		

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5.1.3.2 Parameter crack measurement

A maximum value of parameter crack measurement (Pcm) may be applied, instead of the maximum value of carbon equivalent subjected to the agreement between the purchaser and supplier. In this case, the maximum value of parameter crack measurement shall be as given in Table 6. The value of parameter crack measurement shall be calculated from the following formula by using the cast (heat) analysis values obtained by the procedure in 6.4.4.

$$Pcm = C + \frac{Si}{30} + \frac{Mn}{20} + \frac{Cu}{20} + \frac{Ni}{60} + \frac{Cr}{20} + \frac{Mo}{15} + \frac{V}{10} + 5B \quad (2)$$

In this respect, all the elements designated in the formula shall be used for calculation and reported, regardless of whether those elements are intentionally added or not.

Table 6 — Maximum value of parameter crack measurement

Grade	Maximum value of parameter crack measurement %
S235S	0,26
S325S	0,29
S345S	0,28
S460S	0,30

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ISO 24314:2006
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5.1.4 Carbon equivalent or parameter crack measurement (Pcm) for thermomechanically rolled steel products

The maximum carbon-equivalent value for the thermomechanically rolled steel products by agreement between the purchaser and supplier shall be as given in Table 7.

Table 7 — Maximum value of carbon equivalent when thermomechanically rolled process is used

Grade	Maximum value of carbon equivalent %	
	Up to and including 50 mm in thickness	Over 50 mm to 125 mm inclusive in thickness
S325S	0,37	0,39
S345S	0,39	0,39
S460S	0,44	0,47
The applicable thickness is t_2 in the case of H-sections.		

Furthermore, the maximum value of parameter crack measurement may be applied, instead of the maximum value of carbon equivalent subjected to the agreement between the purchaser and supplier. The maximum value of parameter crack measurement, in this case, shall be as given in Table 8.

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