INTERNATIONAL STANDARD

ISO 630-2

Second edition
2011-09-15

Structural steels —

Part 2: Technical delivery conditions for structural steels for general purposes

Aciers de construction —

Partie 2: Conditions techniques de livraison pour aciers de construction métallique d'usage général

Reference number
ISO 630-2:2011(E)

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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 630-2 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 3, *Steels for structural purposes*.

This second edition cancels and replaces ISO 630:1995 and ISO 630:1995/Amd 1:2003. The first edition has been replaced by ISO 12633-1 and this edition covers a new subject.

ISO 630 consists of the following parts, under the general title *Structural steels*:

— *Part 1: General technical delivery conditions for hot-rolled products*

— *Part 2: Technical delivery conditions for structural steels for general purposes*

— *Part 3: Technical delivery conditions for fine grain structural steels*

— *Part 4: Technical delivery conditions for high yield strength quenched and tempered structural steel plates*

Technical delivery conditions for structural steels with improved atmospheric corrosion resistance will form the subject of a future Part 5.

Technical delivery conditions for seismic improved structural steels for building will form the subject of a future Part 6.

Structural steels —

Part 2:
Technical delivery conditions for structural steels for general purposes

1 Scope

This part of ISO 630 specifies qualities for steels for general structural use. This part of ISO 630 applies to steel plates rolled on a reversing mill, wide flats, hot-rolled sections and bars, which are used in the as-delivered condition and normally intended for welded or bolted structures.

This part of ISO 630 covers eight steel grades and four qualities. Grades S235, S275, S355, and S450 are covered in Annex A. Grades SG205, SG250, SG285 and SG345 are covered in Annex B. Not all grades are available in all qualities, and some qualities have Charpy V-notch requirements.

This part of ISO 630 does not include the following structural steels, some of which are covered by other International Standards:

— sheet and strip: refer to ISO TC 17/SC 12 “Continuous mill flat rolled products”;

— tubular products: refer to ISO TC 5/SC 1 “Steel tubes”.

NOTE Lists of standards covered by ISO/TC 17/SC 12 and ISO/TC 5/SC 1 are available on the ISO Web site.

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 630-1, *Structural steels — Part 1: General technical delivery conditions for hot-rolled products*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 630-1 and the following apply.

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

3.2
normalized rolled
steel rolled with a process in which the final deformation is carried out in 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 after normalizing

NOTE In international publications for both normalized rolling, as well as thermomechanical rolling, the expression “controlled rolling” may be found.

3.3
normalized
steel produced by heating to a suitable temperature above the transformation range and then cooling in air to a temperature substantially below the transformation range

3.4
thermomechanical processed
steel rolled with a 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 Hot forming or post-weld heat treatment above 580 °C may lower the strength values and should not be performed. Flame straightening can be applied in accordance with relevant technical recommendations.

NOTE 2 Thermomechanical rolling can include processes with an increasing cooling rate with or without tempering, including self-tempering but excluding direct quenching and quenching and tempering.

NOTE 3 In some publications, the wording “Thermomechanical Control Process” is also used.

4 Classification and designation

4.1 Classification

The steel grades specified in this part of ISO 630 shall be classified as non-alloy or alloy quality steels.

4.2 Grades and qualities

This part of ISO 630 specifies eight steel grades. Grades S235, S275, S355, and S450 are specified in Annex A. Grades SG205, SG250, SG295, and SG345 are specified in Annex B. Each grade is available in up to four qualities. These grades and qualities differ in their specified mechanical properties and impact energy requirements.

Quality A: no impact testing.

Quality B: impact testing at 20 °C.

Quality C: impact testing at 0 °C.

Quality D: impact testing at −20 °C.

4.3 Use of normative annexes A and B

The requirements of Annex A or Annex B are to be regarded separately. Each is independent of the other without combining in any way.

5 Information to be supplied by the purchaser

5.1 Mandatory information

The information that shall be supplied by the purchaser at the time of the order is specified in ISO 630-1.

5.2 Options

The options of ISO 630-1 apply (see ISO 630-1). In addition, the following option applies to products according to this part of ISO 630. If the purchaser does not indicate a wish to implement any of these options at the time of ordering, the products shall be supplied in accordance with the basic specification (see 5.1).

a) Required delivery condition.

b) Testing of impact properties in the transverse direction using Charpy V-notch test pieces in accordance with ISO 630-1.

6 Requirements

See ISO 630-1.

6.1 Steel-making process

See ISO 630-1.

If a special steel-making process has been specified, this shall be reported in the inspection document.

6.2 Delivery condition

At the manufacturer's discretion, the products covered by this part of ISO 630 are delivered in the as-rolled condition, normalized rolled, normalized, or thermomechanical processed condition. The delivery condition is indicated in the inspection document.

6.3 Chemical composition

6.3.1 Heat analysis

The chemical composition determined by heat analysis shall comply with the values specified in Table A.1 or Table B.1.

6.3.2 Product analysis tolerances

The product analysis of grades S235, S275, S355 and S450 shall comply with the values given in Table A.2.

The permitted deviations on analysis of grades SG205, SG250, SG285 and SG345, relative to the values for heat analysis, are given in Table B.2.

6.3.3 Carbon-equivalent value

The carbon-equivalent value (CEV) requirements for the grades in Annex A are given in Table A.3.

6.4 Mechanical properties

6.4.1 Tensile properties

The tensile properties at ambient temperature shall comply with the values specified in Tables A.4 and A.5 or Table B.3.

6.4.2 Charpy V-notch impact tests

The impact properties of Charpy V-notch test pieces shall comply with the values specified in Table A.6 or Table B.4. The orientation of the specimens shall be longitudinal unless transverse orientation is agreed between purchaser and manufacturer (see 5.2 and ISO 630-1).

6.5 Surface conditions

See ISO 630-1.

6.6 Internal soundness

See ISO 630-1.

6.7 Dimensions and tolerances on dimensions, shape and mass

See ISO 630-1.

7 Inspection

Type of inspection documents (specific or non-specific) shall be specified. Refer to ISO 630-1:2011, 7.1.

8 Sampling — Frequency of testing

8.1 Verification

The verification of mechanical properties shall be by heat. Verification by lot shall be by agreement between the producer and purchaser.

8.2 Test units

8.2.1 Annex A

The test unit shall contain products of the same form, grade, quality, and delivery condition, and of the same thickness range as specified in Table A.4 for the yield strength, and shall be:

— by heat: 40 tons or part thereof;

— 60 tons or part thereof for heavy sections with a mass > 100 kg/m;

— 80 tons or part thereof for all sections if the mass of the heat exceeds 200 tons.

By agreement at the time of ordering, two tests by heat may be used.

8.2.2 Annex B

The test unit shall contain products of the same form, grade, and quality, delivery condition and the same thickness range as specified in Table B.3 for the yield strength and shall be 50 tons or part thereof.

By agreement at time of ordering, two tests by heat may be used.

9 Test methods

See ISO 630-1.

10 Marking

See ISO 630-1.

Annex A
(normative)

Steel grades S235, S275, S355 and S450: Chemical composition and mechanical properties

Table A.1 — Chemical composition (heat analysis) [a]

Grade	Quality	Method of deoxidation [b]	C in % max. for nominal product thickness in mm			Si % max.	Mn % max.	P % max.[d]	S % max.[de]	N % max.[f]	Cu % max.[g]	Other % max.[h]
			≤ 16	> 16 ≤ 40	> 40 [c]							
S235	B	FN	0,17	0,17	0,20	—	1,40	0,035	0,035	0,012	0,55	—
	C	FN	0,17	0,17	0,17	—	1,40	0,030	0,030	0,012	0,55	—
	D	FF	0,17	0,17	0,17	—	1,40	0,025	0,025	—	0,55	—
S275	B	FN	0,21	0,21	0,22	—	1,50	0,035	0,035	0,012	0,55	—
	C	FN	0,18	0,18	0,18 [i]	—	1,50	0,030	0,030	0,012	0,55	—
	D	FF	0,18	0,18	0,18 [i]	—	1,50	0,025	0,025	—	0,55	—
S355	B	FN	0,24	0,24	0,24	0,55	1,60	0,035	0,035	0,012	0,55	—
	C	FN	0,20	0,20 [j]	0,22	0,55	1,60	0,030	0,030	0,012	0,55	—
	D	FF	0,20	0,20 [j]	0,22	0,55	1,60	0,025	0,025	—	0,55	—
S450 [k]	C	FF	0,20	0,20 [j]	0,22	0,55	1,70	0,030	0,030	0,025	0,55	[l]

[a] See 6.3.1.

[b] FN = rimming steels not permitted; FF = fully killed steel.

[c] For sections with nominal thickness > 100 mm, the C content is by agreement.

[d] For long products, the P and S content may be 0,005 % higher.

[e] For long products, the max. S content may be increased for improved machinability by 0,015 % by agreement if the steel is treated to modify the sulfide morphology, and if the chemical composition shows min. 0,002 0 % Ca.

[f] The maximum value for nitrogen does not apply if the chemical composition shows a minimum total Al content of 0,020 % or, alternatively, minimum 0,015 % acid-soluble Al or if sufficient other N-binding elements are present. In this case, the N-binding elements shall be mentioned in the inspection document.

[g] Cu content above 0,40 % can cause hot shortness during hot forming.

[h] If other elements are added, they shall be mentioned on the inspection document.

[i] For nominal thickness > 150 mm: C = 0,20 % max.

[j] For nominal thickness > 30 mm: C = 0,22 % max.

[k] Applicable for long products only.

[l] The steel may show an Nb content of max. 0,05 %, a V content of max. 0,13 % and a Ti content of max. 0,05 %.

Table A.2 — Chemical composition of product analysis, according to the specification in Table A.1 [a]

Grade	Quality	Method of deoxidation [b]	C in % max. for nominal product thickness in mm			Si	Mn	P	S	N	Cu	Other
			≤ 16	> 16 ≤ 40	> 40 [c]	% max.	% max.	% max.[d]	% max.[de]	% max.[f]	% max.[g]	% max.[h]
S235	B	FN	0,19	0,19	0,23	—	1,50	0,045	0,045	0,014	0,60	—
	C	FN	0,19	0,19	0,19	—	1,50	0,040	0,040	0,014	0,60	—
	D	FF	0,19	0,19	0,19	—	1,50	0,035	0,035	—	0,60	—
S275	B	FN	0,24	0,24	0,25	—	1,60	0,045	0,045	0,014	0,60	—
	C	FN	0,21	0,21	0,21 [i]	—	1,60	0,040	0,040	0,014	0,60	—
	D	FF	0,21	0,21	0,21 [i]	—	1,60	0,035	0,035	—	0,60	—
S355	B	FN	0,27	0,27	0,27	0,60	1,70	0,045	0,045	0,014	0,60	—
	C	FN	0,23	0,23 [j]	0,24	0,60	1,70	0,040	0,040	0,014	0,60	—
	D	FF	0,23	0,23 [j]	0,24	0,60	1,70	0,035	0,035	—	0,60	—
S450 [k]	C	FF	0,23	0,23 [j]	0,24	0,60	1,80	0,040	0,040	0,027	0,60	[l]

[a] See 6.3.2.

[b] FN = rimming steels not permitted; FF = fully killed steel.

[c] For sections with nominal thickness > 100 mm, the C content by agreement.

[d] For sections and bars, the P and S content may be 0,005 % higher.

[e] For sections and bars, the max. S content may be increased for improved machinability by 0,015 % by agreement, if the steel is treated to modify the sulphide morphology and the chemical composition shows min. 0,002 0 % Ca.

[f] The max. value for nitrogen does not apply if the chemical composition shows a minimum total Al content of 0,015 % or alternatively min. 0,013 % acid-soluble Al or if sufficient other N-binding elements are present. In this case, the N-binding elements shall be mentioned in the inspection document.

[g] Cu content above 0,45 % can cause hot shortness during hot forming.

[h] If other elements are added, they shall be mentioned on the inspection document.

[i] For nominal thickness > 150 mm: C = 0,22 % max.

[j] For nominal thickness > 30 mm: C = 0,24 % max.

[k] Applicable for sections and bars only.

[l] The steel may show a Nb content of max. 0,06 %, a V content of max. 0,15 % and a Ti content of max. 0,06 %.

Table A.3 — Maximum carbon equivalent — Based on heat analysis [a]

Grade	Quality	Method of deoxidation [b]	Maximum CEV in % for nominal product thickness in mm				
			≤ 30	> 30 to ≤ 40	> 40 to ≤ 150	> 150 to ≤ 250	> 250 to ≤ 400
S235	B	FN	0,35	0,35	0,38	0,40	—
	C	FN	0,35	0,35	0,38	0,40	—
	D	FF	0,35	0,35	0,38	0,40	0,40
S275	B	FN	0,40	0,40	0,42	0,44	—
	C	FN	0,40	0,40	0,42	0,44	—
	D	FF	0,40	0,40	0,42	0,44	0,44
S355	B	FN	0,45	0,47	0,47	0,49 [c]	—
	C	FN	0,45	0,47	0,47	0,49 [c]	—
	D	FF	0,45	0,47	0,47	0,49 [c]	0,49
S450 [d]	C	FF	0,47	0,49	0,49	—	—

[a] For the optional increase of elements which influence the CEV, the following applies:

1. For all S235, S275, and S355 qualities, the following additional chemical requirement may be agreed at the time of the order: Copper content between 0,25 % and 0,40 % on heat analysis and between 0,20 % and 0,45 % on product analysis. In this case, the maximum carbon-equivalent value of this table shall be increased by 0,02 %.

2. When products of grades S275 and S355 are supplied with a control on Si (e.g. for hot-dip zinc coating) so that there could be a need to increase the content of other elements, such as C and Mn, to achieve the required tensile properties, the maximum carbon equivalent value of this table shall be increased as follows:

— for Si ≤ 0,030 %, increase CEV by 0,02 %;

— for Si ≤ 0,25 %, increase CEV by 0,01 %.

[b] FN = rimming steels not permitted; FF = fully killed steel.

[c] For long products, a maximum CEV of 0,54 applies.

[d] Applicable for long products only.

Table A.4 — Tensile properties

Grade	Quality	Upper yield strength R_{eH} [ae], MPa [b], min.									Tensile strength R_m [a], MPa [b]			
		Nominal thickness, mm									Nominal thickness, mm			
		≤ 16	> 16 to ≤ 40	> 40 to ≤ 63	> 63 to ≤ 80	> 80 to ≤ 100	> 100 to ≤ 150	> 150 to ≤ 200	> 200 to ≤ 250	> 250 to ≤ 400 [c]	≥ 3 to ≤ 100	> 100 to ≤ 150	> 150 to ≤ 250	> 250 to ≤ 400 [c]
S235	B	235	225	215	215	215	195	185	175	—	360-510	350-500	340-490	—
	C	235	225	215	215	215	195	185	175	—	360-510	350-500	340-490	—
	D	235	225	215	215	215	195	185	175	165	360-510	350-500	340-490	330-480
S275	B	275	265	255	245	235	225	215	205	—	410-560	400-540	380-540	—
	C	275	265	255	245	235	225	215	205	—	410-560	400-540	380-540	—
	D	275	265	255	245	235	225	215	205	195	410-560	400-540	380-540	380-540
S355	B	355	345	335	325	315	295	285	275	—	470-630	450-600	450-600	—
	C	355	345	335	325	315	295	285	275	—	470-630	450-600	450-600	—
	D	355	345	335	325	315	295	285	275	265	470-630	450-600	450-600	450-600
S450 [d]	C	450	430	410	390	380	380	—	—	—	550-720	530-700	—	—

[a] For plate and wide flats with widths ≥ 600 mm, the direction transverse (t) to the rolling direction applies. For all other products, the values apply for the direction parallel (l) to the rolling direction.

[b] 1 MPa = 1 N/mm^2.

[c] The values apply to flat products.

[d] Applicable for long products only.

[e] If R_{eH} is not pronounced, refer to ISO 630-1:2011, 9.2.

Table A.5 — Elongation

Grade	Quality	Position of test pieces [a]	Elongation, %, min. $L_0 = 5{,}65\sqrt{S_0}$					
			Nominal thickness, mm					
			≥ 3 to ≤ 40	> 40 to ≤ 63	> 63 to ≤ 100	> 100 to ≤150	> 150 to ≤ 250	> 250 to ≤ 400 [b] only for D quality
S235	B, C, D	l	26	25	24	22	21	21
		t	24	23	22	22	21	21
S275	B, C, D	l	23	22	21	19	18	18
		t	21	20	19	19	18	18
S355	B, C, D	l	22	21	20	18	17	17
		t	20	19	18	18	17	17
S450 [c]	C	l	17	17	17	17	—	—

[a] For plate and wide flats with widths ≥ 600 mm, the direction transverse (t) to the rolling direction applies. For all other products, the values apply for the direction parallel (l) to the rolling direction.

[b] The values apply to flat products.

[c] Applicable for long products only.

Table A.6 — Longitudinal Charpy V-notch properties [a]

Grade	Quality	Temperature °C	Minimum energy, J Nominal thickness, mm		
			≤ 150 [ab]	> 150 to ≤ 250 [b]	> 250 to ≤ 400 [c]
S235	B	20	27	27	—
	C	0	27	27	—
	D	−20	27	27	27
S275	B	20	27	27	—
	C	0	27	27	—
	D	−20	27	27	27
S355	B	20	27	27	—
	C	0	27	27	—
	D	−20	27	27	27
S450 [d]	C	0	27	—	—

[a] For nominal thicknesses ≤ 12 mm, see ISO 630-1.

[b] For sections with a nominal thickness > 100 mm, the values shall be agreed upon.

[c] The values apply to flat products.

[d] Applicable for long products only.

Annex B
(normative)

Steel grades SG205, SG250, SG285 and SG345: Chemical composition and mechanical properties

Table B.1 — Chemical composition (heat analysis)

Grade	Quality	C % max.	Si % max.	Mn % max.	P % max.	S % max.	Cu % max.	Ni % max.	Cr % max.	Mo % max.	V % max.	Nb % max.	V + Nb % max.	Ti % max.
SG205	A	[a]	0,55	[a]	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
	B	0,20	0,55	1,40	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
	C	0,17	0,55	1,40	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
	D	0,17	0,55	1,40	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
SG250	A	[a]	0,55	[a]	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
	B	0,22	0,55	1,50	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
	C	0,20	0,55	1,50	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
	D	0,20	0,55	1,50	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
SG285	A	[a]	0,55	[a]	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
	B	0,24	0,55	1,60	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
	C	0,22	0,55	1,60	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
	D	0,22	0,55	1,60	0,04	0,05	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
SG345	A	[a]	0,55	[a]	0,04	0,05	0,60	0,45	0,35	0,15	0,15	0,05	0,15	0,04
	B	0,24	0,55	1,70	0,04	0,05	0,60	0,45	0,35	0,15	0,15	0,05	0,15	0,04
	C	0,22	0,55	1,70	0,04	0,05	0,60	0,45	0,35	0,15	0,15	0,05	0,15	0,04
	D	0,22	0,55	1,70	0,04	0,05	0,60	0,45	0,35	0,15	0,15	0,05	0,15	0,04

[a] There is no requirement, but the amount of these elements shall be determined for each heat and shall be reported in the inspection document.