

Specification for

Hot-rolled flat products made of high yield strength steels for cold forming —

**Part 2: Delivery conditions for
thermomechanically rolled steels**

The European Standard EN 10149-2:1996 has the status of a
British Standard

ICS 77.140.50

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee ISE/10, Flat rolled steel products, upon which the following bodies were represented:

- British Railways Board
- British Steel Industry
- Cold Rolled Sections Association
- Society of Motor Manufacturers and Traders Ltd.

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- British Welded Steel Tube Association
- Coated Metals Limited
- Department of the Environment (Property Services Agency)
- International Tin Research Institute
- Metal Roof Deck Association
- National Association of Steel Stockholders
- National Centre of Tribology
- Paintmakers' Association of Great Britain Ltd.
- Zinc Development Association

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National foreword

This British Standard has been prepared under the direction of Technical Committee ISE/10 and is the English language version of EN 10149-2 *Hot-rolled flat products made of high yield strength steels for cold forming — Part 2:1995 Delivery conditions for thermomechanically rolled steels*, published by the European Committee for Standardization (CEN).

This British Standard supersedes BS 1449-1.4:1991 and BS 1449-1.10:1991 which are withdrawn.

Cross references

Publication referred to	Corresponding British Standard
EN 10149:	BS EN 10149 <i>Specification for hot-rolled flat products made of high yield strength steels for cold forming</i>
EN 10149-1:1995	Part 1:1996 <i>General delivery conditions</i>

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 7 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

ICS 77.140.10; 77.140.50

Descriptors: Iron and steel products, hot rolled products, high yield strength steels, cold-working, metal rolling, designation, classifications, grades: quality, chemical composition, delivery condition, mechanical properties, inspection, tests, marking

English version

Hot-rolled flat products made of high yield strength steels for cold forming — Part 2: Delivery conditions for thermomechanically rolled steels

Produits plats laminés à chaud en aciers à
haute limite d'élasticité pour formage à
froid —
Partie 2: Conditions de livraison des aciers
obtenus par laminage thermomécanique

Warmgewalzte Flacherzeugnisse aus Stählen
mit hoher Streckgrenze zum Kaltumformen —
Teil 2: Lieferbedingungen für
thermomechanisch gewalzte Stähle

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard was prepared by the Technical Committee ECISS/TC 10, Structural steels — Qualities, of which the secretariat is held by NNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 1996, and conflicting national standards shall be withdrawn at the latest by March 1996.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

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1 Scope

Part 2 of this European Standard, in addition to Part 1, specifies requirements for flat products made of weldable, hot-rolled, high yield strength steels for cold forming. The grades are given in Table 1 (chemical composition) and Table 2 (mechanical properties) and are supplied in the thermomechanically rolled delivery condition as given in 7.2.

The steels specified in this European Standard are applicable to hot-rolled flat products in the thickness range of 1,5 mm to 20 mm for the steels which have a specified minimum yield strength of 315 N/mm² up to and including 460 N/mm² and 1,5 mm to 16 mm for the steels which have a specified minimum yield strength of 500 N/mm² up to and including 700 N/mm².

2 Normative references

The normative references as given in EN 10149-1 shall apply.

3 Definitions

The definitions given in EN 10149-1 shall apply.

Table 1 — Chemical composition of the ladle analysis for thermomechanically rolled steels

Designation of steel grade		C % max.	Mn % max.	Si % max.	P % max.	S % max. ^b	Al total % min.	Nb % max. ^a	V % max. ^a	Ti % max. ^a	Mo % max.	B % max.
Name	Material number											
S315MC	1.0972	0,12	1,30	0,50	0,025	0,020	0,015	0,09	0,20	0,15	—	—
S355MC	1.0976	0,12	1,50	0,50	0,025	0,020	0,015	0,09	0,20	0,15	—	—
S420MC	1.0980	0,12	1,60	0,50	0,025	0,015	0,015	0,09	0,20	0,15	—	—
S460MC	1.0982	0,12	1,60	0,50	0,025	0,015	0,015	0,09	0,20	0,15	—	—
S500MC	1.0984	0,12	1,70	0,50	0,025	0,015	0,015	0,09	0,20	0,15	—	—
S550MC	1.0986	0,12	1,80	0,50	0,025	0,015	0,015	0,09	0,20	0,15	—	—
S600MC	1.8969	0,12	1,90	0,50	0,025	0,015	0,015	0,09	0,20	0,22	0,50	0,005
S650MC	1.8976	0,12	2,00	0,60	0,025	0,015	0,015	0,09	0,20	0,22	0,50	0,005
S700MC	1.8974	0,12	2,10	0,60	0,025	0,015	0,015	0,09	0,20	0,22	0,50	0,005

^a The sum of Nb, V, and Ti shall be max. 0,22 %.

^b If agreed at the time of the enquiry and order the sulfur content shall be max. 0,010 % (ladle analysis).
See clause 11, option 12.

Table 2 — Mechanical properties for thermomechanically rolled steels

Designation of steel grade		Minimum yield strength R_{eH}	Tensile strength R_m	Minimum percentage elongation at fracture A % ^a Nominal thickness in mm		Bending at 180° minimum mandrel diameter ^b
Name	Material number	N/mm ² _a	N/mm ² _a	< 3 $L_0 = 80 \text{ mm}$	≥ 3 $L_0 = 5,65 \sqrt{S_0}$	
S315MC	1.0972	315	390 – 510	20	24	0t ^c
S355MC	1.0976	355	430 – 550	19	23	0,5t
S420MC	1.0980	420	480 – 620	16	19	0,5t
S460MC	1.0982	460	520 – 670	14	17	1t
S500MC	1.0984	500	550 – 700	12	14	1t
S550MC	1.0986	550	600 – 760	12	14	1,5t
S600MC	1.8969	600	650 – 820	11	13	1,5t
S650MC	1.8976	650 ^d	700 – 880	10	12	2t
S700MC	1.8974	700 ^d	750 – 950	10	12	2t

^a The values for the tensile test apply to longitudinal test pieces.

^b The values for the bend test apply to transverse test pieces.

^c t = thickness in mm of test piece for bend test.

^d For thicknesses > 8 mm the minimum yield strength can be 20 N/mm² lower.

4 Information to be supplied by the purchaser

4.1 General

The information to be supplied by the purchaser shall be in accordance with EN 10149-1.

4.2 Options

The options given in EN 10149-1 and clause 11 shall apply.

5 Dimensions, mass and tolerances

5.1 Dimensions and tolerances

The dimensions and tolerances shall be in accordance with EN 10149-1.

5.2 Mass of steel

The calculated mass of steel shall be determined in accordance with EN 10149-1.

6 Classification and designation

6.1 Classification

6.1.1 Classification

The steel grades S315MC, S355MC, S420MC, S460MC, S500MC and S550MC of this European Standard are alloy quality steels and the steel grades S600MC, S650MC and S700MC of this European Standard are alloy special steels according to EN 10020.

6.1.2 Grades

The subdivision of steel grades shall comply with EN 10149-1.

6.2 Designation

The designation shall comply with EN 10149-1.

NOTE For a list of corresponding former national designations and the former designation from EURONORM 149 (1980) see Annex B, Table B.1.

7 Technical requirements

7.1 Steel manufacturing process

The steel manufacturing process shall be in accordance with EN 10149-1.

See clause 11, option 1.

7.2 Delivery condition

The products shall be supplied in the thermomechanically rolled delivery condition. The delivery condition of descaled surfaces shall be in accordance with EN 10149-1.

See clause 11, option 2.

7.3 Chemical composition

The requirements of EN 10149-1 shall apply.

The chemical composition determined by ladle analysis shall comply with the specified values of Table 1.

See clause 11, option 3.

7.4 Mechanical properties

7.4.1 General

Under the inspection and testing conditions as specified in clause 8 and in the delivery condition as specified in 7.2 the mechanical properties shall comply with the values given in Table 2.

7.4.2 Impact energy

If agreed at the time of the enquiry and order the verification of the impact energy value shall be carried out in accordance with EN 10149-1.

See clause 11, option 5.

7.5 Technological properties

7.5.1 Weldability

Weldability shall be in accordance with EN 10149-1.

7.5.2 Formability

NOTE Recommendations regarding hot and cold forming are laid down in ECSC IC 2.

7.5.2.1 Cold forming

Annex C contains indicative values for the inside bend radii for cold forming.

7.5.2.1.1 Flangeability

The products are suitable for flanging without cracking.

7.5.2.1.2 Roll forming

The suitability for roll forming shall be in accordance with EN 10149-1.

See clause 11, option 6.

7.5.3 Other requirements

If agreed at the time of enquiry and order the grades S315MC, S355MC and S420MC of this European Standard shall be suitable for hot-dip zinc-coating and shall comply with the relevant product quality requirements.

See clause 11, option 7.

7.6 Surface finish

The surface finish shall be in accordance with EN 10149-1.

See clause 11, option 8.

7.7 Internal soundness

The internal soundness shall be in accordance with EN 10149-1.

See clause 11, option 9.

8 Inspection and testing

8.1 General

The products shall be supplied in accordance with 8.1 of EN 10149-1.

See clause 11, option 10.

8.2 Sampling

Sampling shall be in accordance with EN 10149-1.

8.3 Test units

The test unit shall be in accordance with EN 10149-1.

8.4 Verification of chemical composition

The verification of the chemical composition shall be in accordance with EN 10149-1.

See clause 11, option 4.

8.5 Preparation of samples and test pieces

The preparation of samples and test pieces shall be in accordance with EN 10149-1.

8.5.1 *Preparation of samples*

The following samples shall be taken from one sample product of each test unit:

- one sample in the longitudinal direction for tensile testing;
- one sample in the transverse direction for the bend test;
- one sample sufficient for one set of six impact test pieces (if an impact test is agreed at the time of the enquiry and order, see 7.4.2).

See clause 11, option 5.

(See Annex A).

8.6 Test methods

The test methods shall be in accordance with EN 10149-1.

8.7 Retests and resubmission for testing

The retests and resubmission for testing shall be in accordance with EN 10149-1.

8.8 Inspection documents

The inspection documents shall comply with EN 10149-1.

9 Marking

The marking shall comply with EN 10149-1.

See clause 11, option 11.

10 Disputes

In case of disputes EN 10149-1 applies.

11 Options

See options 1 to 11 of EN 10149-1.

- 12) The sulfur content shall be max. 0,010 % (ladle analysis) (see Table 1).

Annex A (normative)

Location of test pieces

This annex gives the location of test pieces.

Dimensions in mm

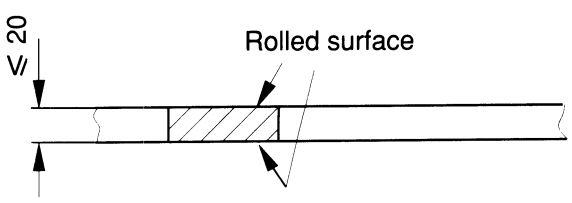
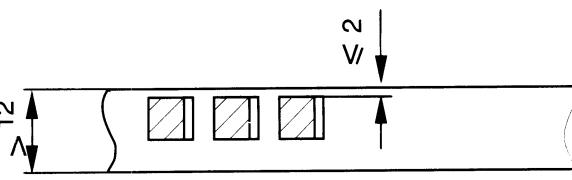
Type of test	Thickness of product	Orientation of the test pieces for widths of		Distance of the test piece from the rolled surface
		< 600	≥ 600	
<i>Tension</i>	≤ 20	longitudinal	longitudinal	
<i>Bend</i>	≤ 20	transverse	transverse	
<i>Impact</i>	> 12	longitudinal	longitudinal	

Figure A.1 — Location of test pieces

Annex B (informative)

List of corresponding former designations

Table B.1 — List of corresponding former designations

Designation of steel grade ^b		Equivalent former designations in ^a						
Name	Material number	EU 149-2 (1980) ^c	Germany SEW 092 ^c		France		United Kingdom	Sweden
			Name	Material number	NFA 36-231 (1992) ^b	NFA 36-203 (1979) ^c		
S315MC	1.0972	Fe E 275-TM	QStE 260 TM	1.0970	E 315 D	E 275 D	40F30	26 42-00 26 52-00 26 62-00
S355MC	1.0976	Fe E 355-TM	QStE 300 TM	1.0972		E 335 D	43F35	
S420MC	1.0980	Fe E 420-TM	QStE 360 TM	1.0976	E 355 D	(E 390 D)	46F40	
S460MC	1.0982	Fe E 420-TM	QStE 420 TM	1.0980	E 420 D	E 445 D	(50F45)	
		Fe E 490-TM	QStE 460 TM	1.0982	E 490 D	E 490 D		
S500MC	1.0984	(Fe E 560-TM)	QStE 500 TM	1.0984	(E 560 D)			
S550MC	1.0986		QStE 550 TM	1.0986			60F55	
S600MC	1.8969		QStE 600 TM	1.0988	E 620 D	68F62		
S650MC	1.8976		QStE 650 TM	1.0989				
S700MC	1.8974		QStE 690 TM	1.0966	(E 690 D)	75F70		

^a The steel grades between brackets () are not exactly equivalent. Their yield strength can be 10 N/mm² lower.

^b The values for the tensile test of these steel grades apply to longitudinal test pieces.

^c The values for the tensile test of these steel grades apply to transverse test pieces.

^a The steel grades between brackets () are not exactly equivalent. Their yield strength can be 10 N/mm² lower.

^b The values for the tensile test of these steel grades apply to longitudinal test pieces.

^c The values for the tensile test of these steel grades apply to transverse test pieces.

Annex C (informative)**Minimum inside bend radii for cold forming****Table C.1 — Minimum inside bend radii for cold forming**

Designation of steel grade		Minimum recommended inside bend radii for nominal thicknesses (t) in mm ^a		
Name	Material number	$t \leq 3$	$3 < t \leq 6$	$t > 6$
S315MC	1.0972	$0,25t$	$0,5t$	$1,0t$
S355MC	1.0976	$0,25t$	$0,5t$	$1,0t$
S420MC	1.0980	$0,5t$	$1,0t$	$1,5t$
S460MC	1.0982	$0,5t$	$1,0t$	$1,5t$
S500MC	1.0984	$1,0t$	$1,5t$	$2,0t$
S550MC	1.0986	$1,0t$	$1,5t$	$2,0t$
S600MC	1.8969	$1,0t$	$1,5t$	$2,0t$
S650MC	1.8976	$1,5t$	$2,0t$	$2,5t$
S700MC	1.8974	$1,5t$	$2,0t$	$2,5t$

^a The values are applicable for bend angles $\leq 90^\circ$.

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