CEN EN*10149-1 95 ■ 3404589 0124074 452 ■

BRITISH STANDARD

BS EN
10149-1 : 1996

Specification for

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

Part 1. General delivery conditions

The European Standard EN 10149-1 : 1995 has the status of a British Standard

ICS 77.140.10; 77.140.50

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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

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on
15 April 1996

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The following BSI references relate to the work on this standard:
Committee reference ISE/10
Draft for comment
93/307662 DC

ISBN 0 580 25432 1

Amendments issued since publication

Amd. No.	Date	Text affected

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National foreword

This British Standard has been prepared by Technical Committee ISE/10 and is the English language version of EN 10149-1 : 1995, *Hot-rolled flat products made of high yield strength steels for cold forming — Part 1 : 1995 General delivery conditions*, published by the European Committee for Standardization (CEN).

This British Standard supersedes BS 1449 : Section 1.4 : 1991 and BS 1449 : Section 1.10 : 1991 which are withdrawn.

Cross-references

Publication referred to	Corresponding British Standard
EN 10029 : 1991	BS EN 10029 : 1991 *Specification for tolerances on dimensions, shape and mass for hot rolled steel plates 3 mm thick or above*
EN 10045 : EN 10045-1 : 1990	*Charpy impact test on metallic materials* BS EN 10045-1 : 1990 *Test method (V- and U- notches)*
EN 10051 : 1991	BS EN 10051 : 1992 *Specification for continuously hot-rolled uncoated plate, sheet and strip of non-alloy and alloy steels. Tolerances on dimensions and shape*
EN 10020 : 1988	BS EN 10020 : 1991 *Definition and classification of grades of steels*
EN 10021 : 1993	BS EN 10021 : 1993 *General technical delivery requirements for steel and iron products*
EN 10027 : EN 10027-1 : 1992 EN 10027-2 : 1991	BS EN 10027 *Designation systems for steel* Part 1 : 1992 *Steel names, principal symbols* Part 2 : 1992 *Steel numbers*
EN 10002-1 : 1990	BS EN 10002 : *Tensile testing of metallic materials* BS EN 10002-1 : 1990 *Method of test at ambient temperature*
EN 10002-2 : 1992	BS EN 10002-2 : 1992 *Verification of the force measuring system of the tensile testing machine*
EN 10052 : 1993	BS EN 10052 : 1994 *Vocabulary of heat treatment terms for ferrous products*
EN 10079 : 1992	BS EN 10079 : 1993 *Definition of steel products*
EN 10163 : EN 10163-1 : 1991 EN 10163-2 : 1991	BS EN 10163 : *Specification for delivery requirements for surface conditions of hot rolled steel plates, wide flats and sections* Part 1 : 1991 *General requirements* Part 2 : 1991 *Plates and wide flats*
EN 10164 : 1993	BS EN 10164 : 1993 *Steel products with improved deformation properties perpendicular to the surface of the products. Technical delivery conditions*
EN 10204 : 1991	BS EN 10204 : 1991 *Metallic products. Types of inspection documents*
EURONORM 12 : 1955	BS 1639 : 1964 *Methods for bend testing of metals*

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 10149-1

September 1995

ICS 77.140.10; 77.140.50

Descriptors: Iron and steel products, hot rolled products, alloy steels, 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 1: General delivery conditions

Produits plats laminés à chaud en aciers à haute limite d'élasticité pour formage à froid —
Partie 1 : Conditions générales de livraison

Warmgewalzte Flacherzeugnisse aus Stählen mit hoher Streckgrenze zum Kaltumformen —
Teil 1 : Allgemeine Lieferbedingungen

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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

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Ref. No. EN 10149-1 : 1995 E

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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

1.1 This European Standard specifies requirements for flat products made of weldable, hot-rolled, high yield strength alloy quality and special steels for cold forming.

Part 1 of this European Standard specifies the general delivery conditions.

Part 2 of this European Standard specifies the delivery conditions for thermomechanically rolled steels in the grades given in table 1 (chemical composition) and table 2 (mechanical properties) of Part 2.

Part 3 of this European Standard specifies the delivery conditions for normalized or normalized rolled steels in the grades given in table 1 (chemical composition) and table 2 (mechanical properties) of Part 3.

The steels specified in Part 2 and 3 of this European Standard are applicable to hot-rolled flat products in the thickness range of 1,5 mm to 20 mm for the steels with $R_{eH} \leq 460$ N/mm^2 and 1,5 mm to 16 mm for the steels with higher minimum yield strength.

1.2 This European Standard does not apply to products for pressure vessels and products for which other EURONORMS exist or European Standards dealing with steels for general structural applications are being prepared:

- Hot-rolled products of non-alloy structural steels — (see EN 10025);
- Semi-finished products for forging in general purpose structural steel — (see EURONORM 30);
- Weldable fine grain structural steels — (see EN 10113 Parts 1 - 3);
- Plates and wide flats made of high yield strength structural steels in the quenched and tempered or precipitation hardened condition — (see EN 10137 Parts 1 - 3);
- Structural steels with improved atmospheric corrosion resistance — (see EN 10155);
- Steels for shipbuilding — normal and high strength qualities — (see EURONORM 156);
- Hot finished structural hollow sections (see EN 10210-1).

2 Normative references

This European Standard incorporates by dated or undated references, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

2.1 General standards

EN 10020	*Definition and classification of grades of steels*
EN 10021	*General technical delivery requirements for steel and iron products*
EN 10027-1	*Designation systems for steel* — Part 1: *Steel names principal symbols*
EN 10027-2	*Designation systems for steel* — Part 2: *Numerical system*
EN 10052	*Vocabulary of heat treatment terms for ferrous products*
EN 10079	*Definitions of steel products*
EN 10163	*Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections* Part 1: *General requirements* Part 2: *Plates and wide flats*
EN 10164	*Steel products with improved deformation properties perpendicular to the surface of the product — Technical delivery conditions*
EN 10204	*Metallic products — Types of inspection documents*
EURONORM 162 (1981)[1)]	*Cold-rolled sections — Technical conditions of delivery*
EURONORM 168 (1986)[1)]	*Iron and steel products — Inspection documents — Contents*
ECSC IC 2 (1983)[1)]	*Weldable fine-grained structural steels — Recommendations for processing, in particular for welding*
ECISS IC 10	*Designation systems for steel — Additional symbols for steel names*

[1)] Until these EURONORMS are transformed into European Standards, they can either be implemented or reference made to the corresponding national standards, the list of which is given in annex A to this European Standard

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2.2 Standards on dimensions and tolerances

EN 10029	*Hot-rolled plates 3 mm thick or above — Tolerances on dimensions, shape and mass*
EN 10048	*Hot-rolled narrow steel strip — Tolerances on dimensions and shape*
EN 10051	*Continuously hot-rolled non-coated sheet and strip of non-alloy and alloy steels — Tolerances on dimensions and shape*
EURONORM 91 (1981)[1)]	*Hot-rolled wide flats — Tolerances on dimensions, shape and mass*

2.3 Standards on testing

EN 10002-1	*Metallic materials — Tensile testing* — Part 1: *Method of test (at ambient temperature)*
EN 10045-1	*Metallic materials — Charpy impact test* — Part 1: *Test method*
EURONORM 6 (1955)[1)]	*Bend test on steel*
EURONORM 12 (1955)[1)]	*Bend test on steel sheet and strip with a thickness less than 3 mm*
EURONORM 18 (1979)[1)]	*Selection and preparation of samples and test pieces for steel and iron and steel products*
EURONORM 103 (1971)[1)]	*Microscopic determination of the ferritic and austenitic grain size of steel*
EURONORM 160 (1985)[1)]	*Manual ultrasonic testing of plate in thickness ≥ 6 mm (reflection method)*
ISO 2566-1 (1984)	*Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels*

3 Definitions

For the purposes of this European Standard the following definitions apply.

3.1 Alloy quality and special steel as defined in EN 10020.

3.2 Flat products (plate, sheet, narrow strip, wide strip and wide flats) as defined in EN 10079.

3.3 Heat treatment terms as defined in EN 10052.

3.4 Fine grained steels

Steels with fine grain structure with an equivalent index of ferritic grain size ≥ 6 determined in accordance with EURONORM 103.

3.5 Thermomechanical rolling

A 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.

The abbreviated form of this delivery condition is M.

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

NOTE 2. Thermomechanical rolling leading to the delivery condition M can include processes with an increased cooling rate with or without tempering including self-tempering but excluding direct quenching and quenching and tempering.

3.6 Normalizing rolling

A rolling 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 even after normalizing. The abbreviated form of this delivery condition is N.

NOTE. In international publications for both the normalizing rolling, as well as the thermomechanical rolling, the expression controlled rolling may be found. However in view of the different applicability of the products a distinction of the terms is necessary.

4 Information to be supplied by the purchaser

4.1 General

The following information shall be supplied by the purchaser at the time of the enquiry and order:

a) details of the product form and quantity;

b) reference to this European Standard;

c) nominal dimensions and tolerances (see **5.1**);

d) the grade and delivery condition of the steel (see Parts 2 and 3 of this European Standard);

[1)] Until these EURONORMS are transformed into European Standards, they can either be implemented or reference made to the corresponding national standards, the list of which is given in annex A to this European Standard

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e) type of inspection document (see **8.8**).

Where no specific choice is made by the purchaser concerning a), b), c), d) and e) the supplier shall refer back to the purchaser.

4.2 Options

A number of options is specified in clause **11**. In the event that the purchaser does not indicate his wish to implement any of these options, the supplier shall supply in accordance with the basic specification.

5 Dimensions, mass and tolerances

5.1 Dimensions and tolerances

Dimensions and tolerances shall be in accordance with the relevant European Standards and EURONORMS (see **2.2**).

5.2 Mass of steel

The calculated mass shall be determined using a volumetric mass of 7,85 kg/dm^3.

6 Classification and designation

6.1 Classification

6.1.1 *Classification*

Classification shall be in accordance with Parts 2 and 3 of this European Standard which specify steel grades that are alloy quality steels or alloy special steels according to EN 10020.

6.1.2 *Grades*

The steels for flat products specified in Parts 2 and 3 of this European Standard are subdivided into grades on the basis of the minimum specified yield strength at ambient temperature.

6.2 Designation

6.2.1 For the steel grades covered by this European Standard the steel names are allocated in accordance with EN 10027-1 and ECISS IC 10; the steel numbers are allocated in accordance with EN 10027-2.

6.2.2 The designation shall consist of the number of this European Standard (EN 10149-2 or EN 10149-3) followed either by the steel number or:

- the symbol S;
- the indication of the minimum specified yield strength expressed in N/mm^2;
- the symbol for the delivery condition (M or N) (see Parts 2 and 3 of this European Standard);
- the capital letter C indicating the steel is suitable for cold forming (see Parts 2 and 3 of this European Standard).

Example 1: Thermomechanically rolled (M) structural steels (S) with a specified minimum yield strength at ambient temperature of 420 N/mm^2 (420) suitable for cold forming (C):

Steel EN 10149-2 — 1.0980

or

Steel EN 10149-2 — S420MC

Example 2: Structural steels (S) with a specified minimum yield strength at ambient temperature of 420 N/mm^2 (420) in the normalized or normalized rolled condition (N) suitable for cold forming (C):

Steel EN 10149-3 — 1.0981

or

Steel EN 10149-3 — S420NC

7 Technical requirements

7.1 Steel manufacturing process

7.1.1 The steel manufacturing process shall be at the manufacturer's option. If specified at the time of the enquiry and order the steel manufacturing process shall be reported to the purchaser.

See clause **11**, option 1.

7.1.2 The steels specified in this European Standard shall be fully killed. The steels shall have a fine grain structure containing nitrogen binding elements in amounts sufficient to bind the available nitrogen.

7.2 Delivery condition

7.2.1 *Thermomechanically rolled steel*

The products described in Part 2 of this European Standard are obtained by thermomechanical rolling.

7.2.2 *Normalized or normalized rolled steel*

The products described in Part 3 of this European Standard are delivered in the normalized or normalized rolled condition.

7.2.3 *Surface protection*

Unless otherwise agreed at the time of the enquiry and order the products are generally supplied with their surfaces as rolled. If agreed at the time of the enquiry and order the products 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.

See clause **11**, option 2.

The descaled products are normally supplied oiled. In this case their two faces shall be coated with a uniform layer of neutral, non-drying oil, free from foreign matters, so that under dry conditions of packaging, transportation, handling and storing, the products can be protected from corrosion for at least three months.

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When descaled products are supplied oiled, the oil coating shall be removable using alkaline solutions or any other usual solvent.

The type of oil shall be left to the discretion of the manufacturer, unless otherwise agreed.

If transportation or storage conditions are such that special corrosion protection is required, the purchaser shall inform the manufacturer at the time of the enquiry and order.

If the purchaser does not require surface oiling, he shall clearly state so at the time of the enquiry and order.

NOTE. When products are ordered in the unoiled condition there is no manufacturers liability for rust hazards. In addition the purchaser shall be made aware of the higher risk of scratches during handling, transportation and application.

7.3 Chemical composition

7.3.1 The chemical composition determined by ladle analysis shall comply with the values in Parts 2 and 3 of this European Standard.

7.3.2 The values for the chemical composition as specified in Parts 2 and 3 of this European Standard are the permitted limits or ranges, between which the various steel grades are delivered.

If agreed at the time of the enquiry and order the manufacturer shall inform the purchaser which of the alloying elements appropriate to the steel grade required will be deliberately added to the material to be delivered.

See clause **11**, option 3.

7.3.3 As the form of sulfide inclusions has an influence on the cold formability of the products, the manufacturer may at his option influence the form of inclusions by adding certain elements (e.g. Ce, Ca) or select a very low sulfur content.

7.3.4 The product analysis shall be carried out when specified at the time of the enquiry and order.

See clause **11**, option 4.

The permissible deviations of the product analysis from the specified limits of the ladle analysis shall be as given in table 1.

7.4 Mechanical properties

7.4.1 *General*

7.4.1.1 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 relevant requirements of Parts 2 and 3 of this European Standard.

NOTE. Stress relief annealing at more than 580 °C or for over 1 hour may lead to a deterioration of the mechanical properties. If the purchaser intends to stress relief anneal the products at higher temperatures or for longer times the minimum values of the mechanical properties after such a treatment should be agreed at the time of the enquiry and order.

7.4.1.2 For the products specified in Parts 2 and 3 of this European Standard the nominal thickness shall apply.

7.4.2 *Impact energy*

7.4.2.1 If agreed at the time of the enquiry and order the impact energy shall be verified for products with nominal thickness $\geq$ 6 mm.

See clause **11**, option 5.

7.4.2.2 If the nominal product thickness is not sufficient for the preparation of full size impact test pieces, test pieces of smaller width shall be taken (see **8.5.2.3**) and the applicable values shall be decreased proportionally.

7.5 Technological properties

7.5.1 *Weldability*

The steels specified in this European Standard shall be suitable for welding processes in current use.

NOTE 1. With increasing product thickness and increasing strength level cold cracking can occur. Cold cracking is caused by the following factors in combination:

- the amount of diffusible hydrogen in the weld metal;
- a brittle structure of the heat affected zone;
- significant tensile stress concentrations in the welded joint.

NOTE 2. When using recommendations as laid down, for example in ECSC IC 2[2)] or any relevant national standard, the recommended welding conditions and the various welding ranges of the steel grades can be determined depending on the product thickness, the applied welding energy, the design requirements, the welding process and the weld metal properties.

7.5.2 *Formability*

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

7.5.2.1 *Cold forming*

7.5.2.1.1 *Flangeability*

The products are suitable for flanging without cracking as given in Parts 2 and 3 of this European Standard.

7.5.2.1.2 *Roll forming*

If specified at the time of the enquiry and order, plate and strip shall be suitable for the production of sections through cold-rolling (for example according to EURONORM 162).

See clause **11**, option 6.

NOTE. The products suitable for roll forming are also suitable for the manufacture of cold-finished square and rectangular hollow sections.

[2)] Will be replaced by EN 1011 'Recommendations for arc welding of ferritic steels'

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7.5.3 ***Other requirements***

If agreed at the time of enquiry and order the grades S315MC, S355MC and S420MC of Part 2 and all grades of Part 3 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

7.6.1 ***Strip***

The surface condition shall not impair an application appropriate to the steel grade if adequate processing of the strip is applied.

7.6.2 ***Plates and wide flats***

EN 10163 Parts 1 and 2 apply for the permissible surface discontinuities and for the repair of surface defects by grinding and/or welding.

Unless otherwise agreed previously with the purchaser repair by welding is not allowed.

See clause **11**, option 8.

7.7 Internal soundness

The products shall be free from internal defects which would exclude them from being used for the usual purpose. Ultrasonic testing may be agreed at the time of the enquiry and order (see **8.6.3**).

See clause **11**, option 9.

8 Inspection and testing

8.1 General

8.1.1 The products shall be supplied with specific inspection and testing with respect to their compliance with this European Standard.

8.1.2 The purchaser shall specify the type of the inspection document at the time of the enquiry and order (see **4.1** and **8.8**).

8.1.3 The specific inspection and testing shall be carried out in accordance with **8.2** to **8.7**.

8.1.4 Unless otherwise agreed at the time of the enquiry and order inspection of surface condition and dimensions shall be carried out by the manufacturer.

See clause **11**, option 10.

8.2 Sampling

The verification of the mechanical properties shall be by cast.

8.3 Test units

For verifying the mechanical properties the following test unit shall apply:

- 40 t or part thereof.

The test unit shall contain products of the same grade, form and thickness.

8.4 Verification of chemical composition

8.4.1 For ladle analysis determined for each cast, the values reported by the manufacturer shall apply.

8.4.2 Product analysis shall be carried out if agreed at the time of the enquiry and order. The purchaser shall specify the number of samples and the elements to be determined.

See clause **11**, option 4.

8.5 Preparation of samples and test pieces

8.5.1 ***Preparation of samples***

8.5.1.1 The samples shall be taken as given in Parts 2 or 3 of this European Standard.

8.5.1.2 The sample product can be any product within the test unit.

8.5.1.3 For plates, sheet, wide strip and wide flats the samples shall be taken approximately midway between the edge and centre line of the products.

For wide strip the sample shall be taken at an adequate distance from the end of the coil.

For narrow strip (< 600 mm wide) the sample shall be at an adequate distance from the end and at one third of the width.

8.5.2 ***Preparation of test pieces***

8.5.2.1 *General*

In addition to the requirements of EURONORM 18 annex A of Parts 2 or 3 of this European Standard shall apply.

8.5.2.2 *Tensile test pieces*

The requirements of EN 10002-1 shall apply.

Test pieces may be non-proportional but in cases of dispute proportional test pieces having a gauge length $L_o = 5{,}65\sqrt{S_o}$ shall be used (see **8.6.2.1**).

For flat products with a nominal thickness < 3 mm the test pieces shall always have a gauge length $L_o = 80$ mm and a width of 20 mm (test piece 2 EN 10002-1).

Both rolled surfaces shall remain on the tensile test pieces.

8.5.2.3 *Impact test pieces*

The test pieces shall be machined and prepared in accordance with EN 10045-1. In addition the following shall apply:

a) for nominal thickness > 12 mm, standard 10 mm $\times$ 10 mm test pieces shall be machined in such a way that one side is not further away than 2 mm from a rolled surface;

b) for nominal thickness ≤ 12 mm, when test pieces with reduced widths are used, the minimum width shall be ≥ 5 mm (see **7.4.2.2**).

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8.5.2.4 *Chemical analysis samples*

The preparation of samples for product analysis shall be in accordance with EURONORM 18.

8.6 Test methods

8.6.1 ***Chemical analysis***

For the determination of the chemical composition the corresponding European Standards or EURONORMS shall apply in cases of dispute.

8.6.2 ***Mechanical tests***

Mechanical tests shall be carried out in the temperature range 10 °C – 35 °C, except where a specific temperature is specified for impact tests (see **7.4.2.1**).

8.6.2.1 *Tensile test*

The tensile test shall be carried out in accordance with EN 10002-1.

For the specified yield strength in table 2 of Parts 2 and 3 of this European Standard the upper yield strength (R_{eH}) shall be determined. If a yield phenomenon is not present and in cases of dispute the 0,2 % proof strength ($R_{p0,2}$) shall be determined.

If a non-proportional test piece is used for products with a thickness ≥ 3 mm the percentage elongation value obtained shall be converted to the value for a gauge length $L_o = 5,65 \sqrt{S_o}$ using the conversion tables given in ISO 2566-1.

8.6.2.2 *Impact test*

If specified at the time of enquiry and order (see **7.4.2.1**), the impact test shall be carried out in accordance with EN 10045-1.

The average value of the three test results shall meet the specified requirement. One individual value may be below the minimum average value specified, provided that it is not less than 70 % of that value. Three additional test pieces shall be taken from the same sample in accordance with **8.5.1** and tested in any one of the following cases:

- if the average of three impact values is lower than the minimum average value specified;
- if the average value meets the specified requirement, but two individual values are lower than the minimum average value specified;
- if any one value is lower than 70 % of the minimum average value specified.

The average value of the six tests shall be not less than the minimum average value specified. Not more than two of the individual values may be lower than the minimum average value specified and not more than one may be lower than 70 % of this value.

8.6.2.3 *Bend test*

The bend test shall be carried out in accordance with EURONORMS 6 and 12. Both rolled surfaces shall remain on the test piece.

8.6.3 ***Ultrasonic testing***

If specified at the time of the enquiry and order (see **7.7**), ultrasonic testing shall be carried out for plate with nominal thickness ≥ 6 mm in accordance with EURONORM 160.

See clause **11**, option 9.

8.7 Retests and resubmission for testing

EN 10021 shall apply in respect of all retests and resubmission for testing.

In the case of strip retests on a rejected coil shall be carried out after the cutting of an additional longitudinal section of sufficient length to remove the coil end effect with a maximum of 20 m.

8.8 Inspection documents

One of the inspection documents mentioned in EN 10204 for specific testing shall be supplied. In these documents the information groups A, B and Z and the code numbers C01-C03, C10-C13, C40-C43 and C71-C92 according to EURONORM 168 shall be included. Code number Z02 applies only for inspection certificates type 3.1.A, 3.1.C and inspection report **3.2** (see **4.1.e**).

9 Marking

9.1 The products shall be marked by a suitable durable method such as painting, stamping, durable adhesive labels or attached tags with the following:

- the grade and delivery condition indicated by its designation (e.g. S420MC or 1.0980);
- a number by which the cast and the sample can be identified;
- the manufacturer's name or trademark;
- the mark of the external inspection body (where applicable).

9.2 Marking shall be at a position close to one end of each product or on the end cut face at the manufacturers discretion.

9.3 If specified at the time of the enquiry and order, stamping of the steel shall either be avoided or confined to positions indicated by the purchaser.

See clause **11**, option 11.

9.4 If light products are to be supplied in securely tied bundles, the marking shall be on a label attached to the bundle or on the top product of the bundle.

10 Disputes

EN 10021 shall apply in respect of disputes.

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11 Options

(see **4.2**)

1) The steel manufacturing process shall be indicated (see **7.1.1**).

2) The products shall be delivered with descaled surfaces (see **7.2.3**).

3) The manufacturer shall inform the purchaser at the time of the enquiry and order which of the alloying elements appropriate to the steel grade required will be deliberately added to the material to be delivered (see **7.3.2**);

4) Product analysis shall be carried out and if so the number of samples and the elements to be determined (see **7.3.4** and **8.4.2**).

5) The impact test shall be carried out with longitudinal test pieces at − 20 °C and the minimum impact energy value will be 40 J (see **7.4.2.1**).

6) Products shall be suitable for roll forming (see **7.5.2.1.2**).

7) Material of the grades S315MC, S355MC and S420MC of Part 2 and all grades of Part 3 of this European Standard shall be suitable for hot-dip zinc-coating (see **7.5.3**).

8) Repair by welding is allowed (see **7.6.2**).

9) Internal defects shall be tested in accordance with EURONORM 160 for plate with nominal thickness ≥ 6 mm (see **7.7** and **8.6.3**).

10) Inspection of surface condition and dimensions shall be carried out by the purchaser or his authorized representative at the manufacturer's works (see **8.1.4**).

11) Stamping of steel is either not allowed or allowed in the position indicated by the purchaser (see **9.3**).

Table 1. Permissible deviations of the product analysis from the specified limits of the ladle analysis

Element	**Specified limit in the ladle analysis** % (m/m)	**Permissible deviation of the product analysis from specified limits for the ladle analysis** % (m/m)
C	≤ 0,20	+ 0,02
Mn	≤ 2,10	+ 0,10
Si	≤ 0,60	+ 0,05
P	≤ 0,025	+ 0,005
S	≤ 0,020	+ 0,002
Al_{total}	≥ 0,015	− 0,005
Nb	≤ 0,09	+ 0,01
V	≤ 0,20	+ 0,02
Ti	≤ 0,22	+ 0,01
Mo	≤ 0,50	+ 0,05
B	≤ 0,005	+ 0,001

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Annex A (informative)

List of national standards which correspond to EURONORMS referenced

Until the following EURONORMS are transformed into European Standards, they may be either implemented or reference made to the corresponding national standards as listed in table A.1.

Table A.1. EURONORMS with corresponding national standards

EURO-NORM	Corresponding national standard in									
	Germany	France	United Kingdom	Spain	Italy	Belgium	Portugal	Sweden	Austria	Norway
6	DIN 50 111	NF A 03-157	BS 1639	UNE 07-292	UNI 564	NBN 117-02	—	—	—	—
12	DIN 50 111	NF A 03-158	BS 1639	UNE 07-292	UNI 5548	NBN 117-22	—	—	—	—
18	—	NF A 03 111	—	UNE 36-300 UNE 36-400	UNI-EU 18	NBN A 03-001	NP-2451	SS 11 01 20 SS 11 01 05	—	NS 10 005 NS 10 006
91	DIN 59 200	NF A 46 012	—	—	UNI-EU 91	NBN A 43-301	—	SS 21 21 50	M 3231	—
103	DIN 50 601	NF A 04 102	BS 4490	UNE 7-280	—	NBN A 14-101	NP-1787	—	—	—
160	—	NF A 04 305	BS 5996	—	UNI-EU 160	—	—	SS 11 42 01	—	—
162	DIN 17 118 DIN 59 413	NF A 37 101	BS 2994	UNE 36-570	UNI 7344	NBN A 02-002	—	—	M 3316	—
168	—	NF A 03 116	—	UNE 36-800	UNI-EU 168	—	—	SS 11 00 12	—	—
ECSC IC 2	SEW 088	NF A 36 000	BS 5135	—	—	—	—	SS 06 40 25	—	—

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