

# Continuously hot rolled low carbon steel sheet and strip for cold forming — Technical delivery conditions

ICS 77.140.50

# National foreword

This British Standard is the UK implementation of EN 10111:2008. It supersedes BS EN 10111:1998 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/10, Flat rolled steels products.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

## Continuously hot rolled low carbon steel sheet and strip for cold forming - Technical delivery conditions

Tôles et bandes en acier doux laminées à chaud en continu  
pour formage à froid - Conditions techniques de livraison

Kontinuierlich warmgewalztes Band und Blech aus weichen  
Stählen zum Kaltumformen - Technische Lieferbedingungen

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## **Foreword**

This document (EN 10111:2008) has been prepared by Technical Committee ECISS/TC 13 “Flat products for cold working - Qualities, dimensions, tolerances and specific tests”, the secretariat of which is held by NBN.

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of an identical text or by endorsement, at the latest by October 2008, and conflicting national standards shall be withdrawn at the latest by October 2008.

This document supersedes EN 10111:1998.

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## **1 Scope**

This European Standard specifies the grades of continuously hot rolled low carbon steel sheet and strip (in coils) for cold forming.

Depending on its actual width, strip is classified as:

- hot rolled wide strip if its width is greater than or equal to 600 mm;
- hot rolled slit wide strip if its width is less than 600 mm.

For each grade, it specifies the chemical composition and the mechanical properties.

This European Standard is applicable to products of thickness not less than 1,0 mm and not exceeding 11 mm.

This European Standard is not applicable to products covered by other standards, such as:

- hot rolled products of non-alloy structural steels for general use (see EN 10025 all parts);
- steel sheet for pressure purposes (see EN 10028 all parts);
- steel sheet for welded gas cylinders (see EN 10120);
- quenched and tempered steels (see EN 10083-1 and EN 10083-2).

## **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.

EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

EN 10021, *General technical delivery requirements for steel products*

EN 10027-1, *Designation systems for steels - Part 1: Steel names*

EN 10027-2, *Designation systems for steels — Part 2: Numerical system*

EN 10051, *Continuously hot-rolled uncoated plate, sheet and strip of non-alloy and alloy steels - Tolerances on dimensions and shape*

EN 10079, *Definition of steel products*

EN 10204, *Metallic products — Types of inspection documents*

EN ISO 14284, *Steel and iron - Sampling and preparation of samples for the determination of chemical composition (ISO 14284:1996)*

## **3 Terms and definitions**

For the purposes of this European Standard, the terms and definitions of hot rolled flat products are those given in EN 10079.

## 4 Classification and designation

### 4.1 Classification

The choice of steel grade and product type is left to the purchaser. For this choice, the purchaser may be advised by the manufacturer, but without any liability on the part of the latter, unless agreed at the time of enquiry and order.

Hot rolled products are classified into four grades DD11, DD12, DD13 and DD14 defined by chemical composition, mechanical and forming characteristics (see Table 1).

### 4.2 Designation

**4.2.1** The steel names are in compliance with EN 10027-1; the steel numbers, with EN 10027-2.

**4.2.2** Products conforming to this European Standard shall be designated, in order, in the following way:

- a) product designation (e.g. "strip", "sheet" or "slit strip cut longitudinally") in line with EN 10079;
- b) number of this European Standard (EN 10111);
- c) symbolic or numerical designation of the steel (see Table 1).

EXAMPLE Strip EN 10111 – DD13

or

Strip EN 10111 – 1.0335

## 5 Requirements

### 5.1 Steelmaking and manufacturing processes

Unless otherwise agreed at the time of enquiry and order, the steelmaking and manufacturing processes are left to the discretion of the manufacturer.

The purchaser shall be informed of these processes if he specifies it.

### 5.2 Deoxidation

For grade DD11 the method of deoxidation shall be at the manufacturer's discretion. Grades DD12, DD13 and DD14 shall be fully killed.

### 5.3 Chemical composition

Table 1 gives the permissible chemical composition limits in the cast.

### 5.4 Delivery conditions

**5.4.1** The products shall usually be delivered with their surface as rolled. By agreement at the time of enquiry and order, the products may be delivered with descaled surface. When they are delivered as rolled, they are covered with a thin layer of scale of variable coloration.

The products may be supplied with a light skin-pass, either at the manufacturer's discretion or by agreement at the time of enquiry and order.

**5.4.2** The descaled products are usually delivered oiled. In this case, both surfaces are preserved by a layer of neutral non-drying oil, free of impurities, and uniformly spread in such a way that under normal conditions of packaging, transportation, handling and storage the products will show no corrosion for up to three months from the date on which the products are made available. The date of availability shall be notified to the purchaser with reasonable prior notice compatible with the validity of corrosion resistance.

The layer of oil shall be capable of being removed by alkaline solutions or usual solvents.

The choice of protective oils may be subject to special agreement at the time of enquiry and order.

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

If the purchaser does not require the surfaces to be oiled, this shall be clearly indicated at the time of enquiry and order.

**NOTE** If the order is for unoiled products, the manufacturer is not responsible for the risk of corrosion. The purchaser is also advised that there is a greater risk of the appearance of light scratches during handling, transportation and putting into application.

**5.4.3** Descaled products may be supplied with trimmed edges upon agreement at the time of enquiry and order (designation GK following EN 10051).

## **5.5 Mechanical properties**

Table 1 gives the basic mechanical properties valid for the four grades.

They correspond to the increasing formability in the order DD11 to DD14.

The characteristics indicated in Table 1 are valid for the period specified in the same Table 1, from the date on which the products are made available.

The date of availability shall be notified to the purchaser with reasonable prior notice compatible with the validity of the mechanical properties.

Subject to special agreement, the products may be supplied with special suitability for the production of a specific part. In this case, a maximum rejection percentage may be set by mutual agreement and acceptance on the basis of mechanical properties does not apply.

## **5.6 Surface characteristics**

The sheets shall be free of slivers, blow holes, seams, cracks or scratches which would adversely affect their use.

Pores, small pits, small marks, small scratches, kinks from pay-off reels and a slight coloration are permitted.

The defects shall not be of such an extent that they might run the risk of causing failure or damage to tooling or welding difficulties when in use.

The surface quality of the unwound coil is assessed as for sheets. However, the percentage of surface defects is generally greater than when supplied in sheets. The maximum percentage of permissible rejections shall be fixed by special agreement at the time of enquiry and order.

## **5.7 Suitability for surface coating**

The products may be intended for metallic coating by the hot dipping or electrodeposition and/or organic or other coatings. When such a coating is required, it shall be specified at the time of enquiry and order.

## **5.8 Weldability**

The products are suitable for standard welding processes. However, the welding process and possible specific requirements of the resulting welded component should be specified at the time of enquiry and order, e.g. gas welding, structural safety requirements.

For non-descaled products, the welding process shall take into account the presence of a layer of scale.

## **5.9 Tolerances on dimensions and shape**

The tolerances on dimensions and shape are given in EN 10051

**BS EN 10111:2008**  
**EN 10111:2008 (E)**

**Table 1 — Characteristics <sup>a</sup>**

| Steel name | Steel number | Method of deoxidation                 | Ladle analysis chemical composition <sup>b</sup> |                     |                    |                    | Mechanical properties <sup>c</sup> |                                  |       |                                   |                                 |                               |                                                               | Validity |
|------------|--------------|---------------------------------------|--------------------------------------------------|---------------------|--------------------|--------------------|------------------------------------|----------------------------------|-------|-----------------------------------|---------------------------------|-------------------------------|---------------------------------------------------------------|----------|
|            |              |                                       |                                                  |                     |                    |                    | $R_{eL}$ <sup>d</sup>              |                                  | $R_m$ | Minimum elongation after fracture |                                 |                               |                                                               |          |
|            |              |                                       | C<br><br>max.<br>%                               | Mn<br><br>max.<br>% | P<br><br>max.<br>% | S<br><br>max.<br>% | 1,0 mm ≤ e<br>e < 2 mm<br><br>MPa  | 2 mm ≤ e<br>e ≤ 11 mm<br><br>MPa |       | $L_0 = 80$ mm                     |                                 |                               | $L_0 = 5,65 \sqrt{S_0}$<br><br>3 mm ≤ e<br>e ≤ 11 mm<br><br>% |          |
|            |              |                                       |                                                  |                     |                    |                    |                                    |                                  |       | 1,0 mm ≤ e<br>e < 1,5 mm<br><br>% | 1,5 mm ≤ e<br>e < 2 mm<br><br>% | 2 mm ≤ e<br>e < 3 mm<br><br>% |                                                               |          |
| DD11       | 1.0332       | At the discretion of the manufacturer | 0,12                                             | 0,60                | 0,045              | 0,045              | 170 to 360                         | 170 to 340                       | 440   | 22                                | 23                              | 24                            | 28                                                            | –        |
| DD12       | 1.0398       | Fully killed                          | 0,10                                             | 0,45                | 0,035              | 0,035              | 170 to 340                         | 170 to 320                       | 420   | 24                                | 25                              | 26                            | 30                                                            | 6        |
| DD13       | 1.0335       | Fully killed                          | 0,08                                             | 0,40                | 0,030              | 0,030              | 170 to 330                         | 170 to 310                       | 400   | 27                                | 28                              | 29                            | 33                                                            | 6        |
| DD14       | 1.0389       | Fully killed                          | 0,08                                             | 0,35                | 0,025              | 0,025              | 170 to 310                         | 170 to 290                       | 380   | 30                                | 31                              | 32                            | 36                                                            | 6        |

NOTE 1 MPa = 1 N/mm<sup>2</sup>.

- <sup>a</sup> The mechanical characteristics relate only to hot rolled non-descaled or chemically descaled and oiled products, skin-passed or not.
- <sup>b</sup> Unless otherwise agreed at the time of enquiry and order, nitrogen-fixing elements such as titanium and boron may be added at the discretion of the manufacturer.
- <sup>c</sup> As long as the width of the product permits, the test pieces for the tensile tests shall be taken transverse to the direction of rolling.
- <sup>d</sup>  $R_{p0,2}$  shall be used instead of  $R_{eL}$  if the product does not exhibit any yield phenomenon.
- <sup>e</sup> It is recommended that products in grade DD11 should be formed within 6 weeks from the time of their availability.

## 6 Tests

### 6.1 General

**6.1.1** The purchaser shall specify at the time of enquiry and order his requirements for:

- type of inspection in accordance with EN 10021;
- type of inspection document for the products in accordance with EN 10204.

**6.1.2** Specific inspection and testing shall be carried out in accordance with 6.2 to 6.6.

### 6.2 Inspection units

The inspection units for products of the same grade and nominal thickness are given in Table 2.

**Table 2 — Inspection units**

| Steel name | Inspection unit<br>t |
|------------|----------------------|
| DD11       | 150                  |
| DD12       | 100                  |
| DD13       | 60                   |
| DD14       | 40                   |

### 6.3 Number of tests

A series of tests comprises all the tests necessary to verify the specified characteristics:

- tensile test;
- by agreement at the time of enquiry and order, a product chemical analysis.

### 6.4 Sampling

For sheets, the selection of the product(s) for testing is left to the discretion of the inspection representative.

For wide strips and slit wide strips, the samples should preferably be taken from the outer end.

For sheets and wide strips, the samples shall be taken so that the axis of the test pieces is at half distance between the edge and the axis of the products.

The test pieces for the tensile tests shall be taken transverse to the direction of rolling unless otherwise agreed at the time of enquiry and order.

## 6.5 Test methods

### 6.5.1 Mechanical properties

#### 6.5.1.1 General

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

The lower yield point ( $R_{eL}$ ) shall be determined to verify the yield strength values indicated in Table 1.

If there are no yield point phenomena, the 0,2 % proof strength ( $R_{p0,2}$ ) shall be determined and shall satisfy the values in Table 1. In cases of dispute, the 0,2 % proof strength value ( $R_{p0,2}$ ) shall be determined.

#### 6.5.1.2 Product thickness less than 3 mm

The test piece used (initial gauge length  $L_0 = 80$  mm, width  $b = 20$  mm) shall be of type 2 as described in EN 10002-1: the thickness of the test piece is that of the sheet.

#### 6.5.1.3 Product thickness greater than or equal to 3 mm

The test piece used is the proportional test piece with an initial gauge length  $L_0$  given by the following formula:

$$L_0 = 5,65 \sqrt{S_0}$$

where

$S_0$  is the original cross-sectional area of the parallel length of the test piece; the maximum parallel width is 30 mm and the thickness is that of the sheet.

### 6.5.2 Chemical composition

For the determination of the chemical composition, EN ISO 14284 and the corresponding European Standards shall apply.

## 6.6 Retests

The requirements of EN 10021 shall apply. In the case of coils, the retest specimens shall be taken from a distance of at least one lap away, but with a maximum of 20 m from the end of the coil.

## 6.7 Inspection document

Following agreement at the time of enquiry and order, an inspection document as specified in EN 10204 shall be completed.

## 7 Marking

When marking is specified, the following information shall be given:

- grade designation, in accordance with the designation rules given in clause 4 of this standard;
- heat number;
- indication of the name or the mark of the supplier.

If the goods are supplied in coils or sheets in bound bundles, the marking may be on a label attached to the coil or bundle.

## 8 Packing

The packing requirements shall be agreed at the time of enquiry and order.

## 9 Storage and transportation

Moisture, in particular condensation between the sheets, laps of the coil or other adjacent parts made of hot rolled flat products can lead to the formation of corrosion products. As a precaution, the products should be transported and stored dry and protected from moisture.

## 10 Disputes

With regard to any claims and actions arising there from, EN 10021 shall apply.

## 11 Information to be provided by the purchaser at the time of enquiry and order

### 11.1 Mandatory information

In order to allow the manufacturer to supply products conforming to this European Standard, the following information shall be provided by the purchaser at the time of enquiry and order:

- a) full designation as given in subclause 4.2;
- b) nominal dimensions and ordered quantities;
- c) if inspection documents are required and their type;
- d) any special requirements for packing and marking (e.g. bar coding, see EN 606);
- e) limits on the mass and the sizes of the coils and the individual bundles.

### 11.2 Options

The following information is optional:

- a) if the products are to be supplied skin-passed;
- b) if the products are to be supplied descaled;
- c) if the products are to be supplied with sheared edges;
- d) if oiling is not required in descaled products;
- e) if the products are to be supplied as suitable for making a specific part;
- f) if an external inspection is to be carried out at the manufacturer's works;
- g) intended application of the products, including surface coating and welding technique.

## **Bibliography**

- [1] EN 606, *Bar coding – Transport and handling labels for steel products*
- [2] EN 10025 (all parts), *Hot rolled products of non-alloy structural steels*
- [3] EN 10028 (all parts), *Flat products made of steels for pressure purposes*
- [4] EN 10083-1, *Steels for quenching and tempering - Part 1: General technical delivery conditions*
- [5] EN 10083-2, *Steels for quenching and tempering - Part 2: Technical delivery conditions for non alloy steels*
- [6] EN 10120, *Steel sheet and strip for welded gas cylinders*



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