UDC 669.14.018.291-122.4-4 : 620.1

January 1991

Hot rolled unalloyed structural steel products

Technical delivery conditions
English version of EN 10 025

DIN
EN 10 025

Warmgewalzte Erzeugnisse aus unlegierten Baustählen; technische Lieferbedingungen

Supersedes DIN 17 100, January 1980 edition.

European Standard EN 10 025 : 1990 has the status of a DIN Standard.

A comma is used as the decimal marker.

National foreword

This standard has been prepared by ECISS/TC 10.

The responsible German body involved in the preparation of this standard was the *Normenausschuß Eisen und Stahl* (Steel and Iron Standards Committee), Technical Committee 04/2 *Stähle für den Stahlbau.*

The content of this standard was previouly issued for public comment in December 1987 in the form of draft Standard DIN 17 100. Besides the principal amendments made to that draft, as listed on page 3, the following should be noted.

a) The standard no longer deals with hollow sections and forgings. The former are to be covered by a separate European Standard, Part 1 of which will deal with hot rolled sections made of non-alloy and fine-grain structural steel (to be published shortly as prEN 10 210-1). The latter have not been dealt with so far at European level. It is thus recommended that orders for forgings continue to be based on DIN 17 100.

b) At the time of approval of EN 10 025, work on EN 10 027 dealing with designation systems for steel had not been completed. For this reason, column 1 in tables 2 to 8 had to be left void. Once EN 10 027-1 has been published, EN 10 025 will be amended accordingly.

   Since major changes to the material designations for structural steel are to be expected, it is not recommended that the symbols used hitherto be replaced by those specified in EURONORM 25-72 (as given in column 2 of tables 2 to 8) but, pending the publication of the revised version of EN 10 025, the former national material designations or material numbers as given in column 3 of the above tables (and in DIN 17 100) be used for a transitional period.

   It may be assumed that the material numbers (as specified in DIN 17 100) will be adopted in Part 2 of EN 10 027 (and, consequently, in EN 10 025) without alterations so that further changes at a later date will not be necessary.

   For those steel grades not covered in DIN 17 100, new material numbers have been specified on the basis of the German system. This has resulted in major changes for steel grades with special properties, in that those suitable for cold flanging, cold roll forming and bright-drawing are all to designated by the same number (cf. tables 6 to 8).

c) The DIN Standards corresponding to the European Standards referred to in clause 2 of the EN are as follows:

European Standard	DIN Standard
EN 10 002-1	DIN EN 10 002-1
EN 10 020	DIN EN 10 020

See overleaf and table 9 for DIN Standards equivalent to the EURONORMs referred to in clause 2.

Continued on pages 2 and 3.
EN comprises 24 pages.

Standards and other documents referred to
(and not included in **Normative references**)

DIN	1013 Part 1	Hot rolled round steel for general applications; dimensions and tolerances
DIN	1014 Part 1	Hot rolled square steel for general applications; dimensions and tolerances
DIN	1015	Hot rolled steel hexagons for general applications; dimensions and tolerances
DIN	1016	Hot rolled steel sheet and strip; tolerances on size, form and mass
DIN	1017 Part 1	Hot rolled steel flats for general applications; dimensions, tolerances and mass
DIN	1018	Hot rolled steel half-rounds and flattened half-rounds; dimensions, tolerances and mass
DIN	1019	Hot rolled steel bulb flats; dimensions, mass, limit deviations and static values
DIN	1024	Steel bars; hot rolled round-edged T-bars; dimensions, mass, limit deviations and static values
DIN	1025 Part 1	Steel sections; hot rolled narrow flange I-beams (I series); dimensions, mass, limit deviations and static values
DIN	1025 Part 2	Steel sections; hot rolled wide flange I-beams (IPB and IP series); dimensions, mass, limit deviations and static values
DIN	1025 Part 3	Steel sections; hot rolled wide flange I-beams, light duty (IPBl series); dimensions, mass, limit deviations and static values
DIN	1025 Part 4	Steel sections; hot rolled wide flange I-beams, heavy duty (IPBv series); dimensions, mass, limit deviations and static values
DIN	1025 Part 5	Steel sections; hot rolled I-beams of medium flange width (IPE series); dimensions, mass, limit deviations and static values
DIN	1026	Steel bars and sections; hot rolled round-edged U steel; dimensions, mass, limit deviations and static values
DIN	1028	Steel bars; hot rolled round-edged equal angles; dimensions, mass, limit deviations and static values
DIN	1029	Steel sections; hot rolled round-edged unequal angles; dimensions, mass, limit deviations and static values
DIN	17 010	General technical delivery conditions for steel and steel products
DIN	17 014 Part 1	Heat treatment of ferrous materials; terminology
DIN	17 118	Cold rolled steel sections; technical delivery conditions
DIN	50 049	Inspection documents for the delivery of metallic products
DIN	50 601	Determination of grain size of ferrite or austenite in ferrous materials by metallographic methods
DIN	59 130	Hot rolled round steel for bolts, screws and rivets; dimensions and tolerances
DIN	59 200	Hot rolled wide steel flats; dimensions, mass and limit deviations
DIN	59 413	Cold rolled steel sections; tolerances on size, form and mass

Stahl-Eisen-Lieferbedingung (Technical delivery conditions for iron and steel) 071 *Oberflächenbeschaffenheit von warmgewalztem Grob- und Mittelblech sowie Breitflachstahl* (Surface condition of hot rolled steel sheet and plate) *)

Stahl-Eisen-Lieferbedingung 096 *Blech, Band und Breitflachstahl mit verbesserten Eigenschaften für Beanspruchungen senkrecht zur Erzeugnisoberfläche* (Steel strip, sheet and wide flats particularly suitable for being loaded normal to the surface) *)

Stahl-Eisen-Werkstoffblatt (Iron and steel materials sheet) 088 *Schweißgeeignete Feinkornbaustähle; Richtlinien für die Verarbeitung, besonders für das Schmelzschweißen* (Weldable fine grain structural steel; information on welding) *)

Previous editions
DIN 1611: 09.24, 01.28, 04.29, 08.30, 12.35
DIN 1612: 01.32, 03.43x
DIN 1620: 09.24, 03.58
DIN 1621: 09.24
DIN 1622: 12.33
DIN 17 100: 10.57, 09.66, 01.80.

*) Obtainable from *Verlag Stahleisen mbH*, Sohnstraße 65, D-4000 Düsseldorf 1.

Amendments

In comparison with DIN 17 100, January 1980 edition, the following amendments have been made.

a) Square and rectangular hollow sections and forgings are no longer covered.

b) The material designations have been changed throughout and some material numbers for steel grades previously dealt with in DIN 17 100 have been altered.

c) The following changes have been made to the classification of steel grades and to the specifications for the type of deoxidation (cf. table 2):

- for grades Fe 360, Fe 430 and Fe 510, quality C has been introduced (this quality, in terms of impact energy requirement (27 J at 0 °C), is eqivalent to quality C (for condition 3U) as in DIN 17 100, without the type of oxidation RR or FF being specified, as in the DIN Standard);
- quality D (quality 3 as in DIN 17 100) has been subdivided into qualities D1 and D2, the differences lying in their as delivered condition and mechanical properties (cf. subclauses 7.2 and 7.4.1, and table 1);
- grade Fe 510 B has been introduced, with specifications relating to the impact energy at +20 °C (not covered in DIN 17 100);
- grades Fe 510 DD1 and Fe 510 DD2 have been introduced, specifying a minimum impact energy, at a temperature of −20 °C, of 40 J (not covered in DIN 17 100).

d) The specifications for the as delivered condition (cf. subclause 7.2) have been changed (i.e. the detailed specifications regarding the condition as a function of steel grade and quality have been dropped).

e) The values of P and S content have been lowered (cf. tables 2 and 3).

f) The requirements for the mechanical properties now also refer to products up to 250 mm thick.

g) The folding test and the weld bead bend test are no longer specified.

h) The surface finish has been treated in more detail, on the basis of DIN EN 10 163 Parts 1 to 3.

International Patent Classification

B 21 B
C 21 D 7/13
G 01 N 3/00
G 01 N 33/20

Editor's note

This standard reproduces the official text of the English version of EN 10 025 as issued by CEN. In its preparation for publication as DIN EN 10 025 (English version), certain points have been noted which we consider to be in need of correction. These have been marked +). The suggested amendments are given below and will be forwarded to the responsible CEN Secretariat for its consideration.

In presentation, orthography, punctuation and hyphenation, the aim has been to implement the PNE Rules consistently. Obvious errors (e.g. redundancies and omissions) have been rectified without further reference.

Suggested amendments

1 *'plate' should be substituted for 'plates' in cases where reference is made to the semi-finished product (e.g. subclauses 7.6.2 and 8.6.2.1).*

2 *In subclause 7.3.3.1, first item, 'reporting' should be substituted for 'recording' and, for ease of reading, in the 2nd item, 'ladle analysis' and 'product analysis' should preferably be set in brackets.*

3 *To make the sense complete, subclauses 7.4.6 and 11.1, item 8, 'as specified in' is to be substituted for 'of' before 'EURONORM 164'.*

4 *In note 1 to subclause 7.5.1.3, the parameter 'increasing carbon equivalent' is not included in the German text.*

5 *In subclause 8.6.3.2, 'as appropriate' should preferably be deleted.*

6 *To complete the sense, 'total extension' must be inserted before '$R_{t0,5}$'.*

7 *To facilitate comprehension, in subclause 8.8.1, the latter part of the 2nd sentence should read '...of sufficient length, with a maximum of 20 m, to eliminate the coil end effect.'*

8 *To facilitate comprehension, the latter part of footnote 2 in tables 2 to 5, 7 and 8, and of footnote 1 in tables 6 and 10, should preferably read '...and its designations may be subject to changes.'*

9 *Footnote 6 to tables 2 and 3 should preferably read 'For sections with a nominal thickness larger than 100 mm, the C content is to be agreed.*

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 10 025

March 1990

UDC 669.14.018.291-122.4-4 : 620.1

Descriptors: Iron and steel products, structural steels, non-alloy steel, hot rolled products, quality classes, designation, specification, chemical composition, mechanical property, mechanical test, inspection, marking.

English version

Hot rolled products of non-alloy structural steels
Technical delivery conditions

Produits laminés à chaud en aciers de construction non alliés; conditions techniques de livraison

Warmgewalzte Erzeugnisse aus unlegierten Baustählen; technische Lieferbedingungen

This European Standard was approved by CEN on 1990-03-30. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization

Comité Européen de Normalisation

Europäisches Komitee für Normung

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

Ref.No. EN 10 025 : 1990 E

Brief history

This European Standard has been drawn up by ECISS/TC 10 'Structural steel: qualities' whose Secretariat is held by NNI.

This document was originally drawn up as a draft EURONORM under the European Coal and Steel Community. With the formation of ECISS and the establishment of the ECISS work programme, TC 10 was asked to prepare this document for eventual publication as a European Standard.

This European Standard replaces EURONORM 25-72, Structural steels for general application.

It has been submitted to the CEN Formal Vote on 1989-11-08.

It has been adopted and ratified by CEN/BT on 1990-03-30.

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

Contents

1 Scope

1.1 This European Standard specifies requirements for long products and flat products of hot rolled non-alloy, base and quality steels in the grades and qualities given in tables 2 and 3 (chemical composition) and 4 and 5 (mechanical properties) in the usual delivery condition as given in 7.2.

The steels specified in this European Standard are intended for use in welded, bolted and riveted structures, for service at ambient temperatures (subject to the restrictions described in 7.5.1).

They are not intended to be heat-treated, except products delivered in condition N. Stress-relief annealing is permitted. Products delivered in condition N may be normalized and hot formed after delivery (see clause 3).

NOTE 1: Semi-finished products which are to be converted to rolled finished products conforming to this European Standard should be the subject of special agreement at the time of ordering. The chemical composition may also be agreed at the time of ordering, the values should however be within the limits of table 2.

NOTE 2: For certain grades and product forms, suitability for particular applications may be specified at the time of ordering (see 7.5.3, 7.5.4 and table 6).

1.2 This European Standard does not apply to coated products and products for which other EURONORMs exist or European Standards dealing with steels for general structural applications are being prepared, e.g.

- semi-finished products for forging in general purpose structurel steel (see EURONORM 30);
- weldable fine grain structural steel (see EURONORM 113);
- weathering steels for structural purposes (see EURONORM 155);
- plates +) and wide flats of weldable fine-grained structural steels in the quenched and tempered condition (see EURONORM 137);
- flat products in high-yield strength steels for cold forming: wide flats, sheet/plate, wide and narrow strip (see EURONORM 149);
- steels for shipbuilding: normal and high-strength qualities (see EURONORM 156);
- hollow sections (EN 10 210-1, in preparation).

2 Normative references

2.1 General standards

EN 10 020	Definition and classification of grades of steels
EURONORM 21 [1])	General technical delivery requirements for steel and iron and steel products
EURONORM 27 [1])	Designation of steel
EURONORM 52 [1])	Vocabulary of heat treatment terms for ferrous products
EURONORM 79 [1])	Definition and classification of steel products by shape and dimensions
EURONORM 162 [1])	Cold-rolled sections; technical conditions of delivery
EURONORM 163 [1])	Delivery condition for surface finish of hot rolled plates and wide flats
EURONORM 168 [1])	Iron and steel products; contents of inspection documents
Information Circular No. 2 [1])	Weldable fine-grained structural steels; recommendations for processing, in particular for welding

2.2 Standards on dimensions and tolerances

EURONORM 17 [1])	Non-alloy base steel wire rod for cold drawing; dimensions and tolerances
EURONORM 19 [1])	IPE beams: parallel-flanged beams
EURONORM 24 [1])	Standard beams and channel sections; tolerances
EURONORM 29 [1])	Hot-rolled plates 3 mm thick or above; tolerances on dimensions, shape and mass
EURONORM 34 [1])	Hot-rolled wide-flanged beams with parallel faces; tolerances
EURONORM 44 [1])	Hot-rolled IPE beams; tolerances
EURONORM 48 [1])	Specification for hot-rolled narrow steel strip; tolerances on dimensions, shape and mass
EURONORM 51 [1])	Continuously hot-rolled non-coated sheet/plate and strip of non-alloy and alloyed steel with specified minimum yield strength; tolerances on dimensions and shape
EURONORM 53 [1])	Wide-flanged beams with parallel flanges
EURONORM 54 [1])	Small hot-rolled steel channels
EURONORM 55 [1])	Hot-rolled equal flange tees with radiused root and toes in steel
EURONORM 56 [1])	Hot-rolled equal angles (with radiused root and toes)
EURONORM 57 [1])	Hot-rolled unequal angles (with radiused root and toes)
EURONORM 58 [1])	Hot-rolled flats for general purposes
EURONORM 59 [1])	Hot-rolled square bars for general purposes
EURONORM 60 [1])	Hot-rolled round bars for general purposes
EURONORM 61 [1])	Hot-rolled steel hexagons
EURONORM 65 [1])	Hot-rolled round steel bars for screws and rivets
EURONORM 66 [1])	Hot-rolled half-rounds and flattened half-rounds
EURONORM 67 [1])	Hot-rolled bulb flats
EURONORM 91 [1])	Hot-rolled wide flats; tolerances on dimensions, shape and mass

2.3 Standards on testing

EN 10 002-1	Metallic materials; tensile testing. Part 1: Method of test at ambient temperature
EN 10 045-1	Metallic material; Charpy impact test. Part 1: Test method
EURONORM 18 [1])	Selection and preparation of samples and test pieces for steel and iron and steel products
EURONORM 103 [1])	Microscopic determination of the ferritic and austenitic grain size of steel

[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 B to this European Standard.

EURONORM 164 [1]	Steel flat products with specified through thickness properties; technical conditions of delivery
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:

non-alloy base and quality steel: as defined in EN 10 020;

heat treatment terms: as defined in EURONORM 52;

long products, flat products (plate, sheet, narrow strip, wide strip and wide flats) and semi-finished products: as defined in EURONORM 79;

normalizing rolling: 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 designation of this condition of delivery and of the normalized condition is N.

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

a) details of the product form, dimensions and quantity;

b) the grade and quality of steel (see tables 2 and 4);

c) whether products have to be submitted to inspection and testing and, if inspection and testing is required, which type of inspection and which inspection document is required (see 8.1.2);

d) whether specific verification of the mechanical properties for qualities B and 2 has to be carried out by lot or by cast (see 8.3.1).

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

4.2 Options

A number of options are 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

See the EURONORMs listed in 2.2.

5.2 Mass of steel

The calculated mass shall be determined using a volumetric mass of 7,85 kg/dm³.

6 Classification of qualities; designation

6.1 Classification of qualities

This European Standard specifies six qualities: 0, B, C, D, DD and 2.

Products of qualities D and DD are each subdivided into two qualities: D1 and D2, and DD1 and DD2 (see 7.2). Steels of qualities 0, 2 and B are base steels, unless a suitability for cold forming is specified.

Steels of qualities C, D1, D2, DD1 and DD2 are quality steels.

The qualities differ in weldability and specified impact values (see also 7.5.1).

6.2 Designation

6.2.1 The designation of the steels is as specified in EURONORM 27.

NOTE 1: For a list of corresponding former national designations, see annex C, table 10.

NOTE 2: In this European Standard, the old designation from EURONORM 25 based on tensile strength is used. This is done because, at the time of publication of this European Standard, the transformation of EURONORM 27 into a European Standard was not completed.

6.2.2 The designation consists of:

- the number of this European Standard;
- the symbol Fe;
- the indication of the minimum specified tensile strength for thicknesses < 3 mm, expressed in N/mm²;
- the quality designation (see 6.1) with respect to weldability and specified impact values;
- if applicable (for Fe 360 B), a letter combination for the deoxidation method (FU or FN) (see 7.1.3);
- if applicable, the letter combination for the suitability for the particular application (see table 6);
- if applicable, the letter N where the products are to be delivered in condition N (see clause 3) (not necessary for flat products of qualities D1 and DD1).

EXAMPLE:
Steel EN 10 025 – Fe 510 C KQ

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 ordering, the steel manufacturing process shall be reported to the purchaser, with the exception of steel Fe 310-0.

Option 1.

For qualities C, D1, D2, DD1 and DD2, a specific steel manufacturing process may be agreed at the time of ordering.

Option 2.

7.1.2 The method of deoxidation shall be as given in table 2. For steel Fe 360 B, the purchaser may specify the method of deoxidation at the time of ordering.

Option 3.

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

7.1.3 The deoxidation methods are designated as follows:

Optional	Method at the manufacturer's option
FU	Rimming steel
FN	Rimming steel not permitted
FF	Fully killed steel containing nitrogen-binding elements in amounts sufficient to bind the available nitrogen (e.g. min. 0,020 % Al). If other elements are used, they shall be reported in the inspection document.

7.2 Delivery conditions

7.2.1 General

If an inspection document is required (see 8.1.2) and products are ordered and delivered in condition N, this shall be indicated in the document.

7.2.2 Flat products

7.2.2.1 Unless otherwise agreed, flat products of qualities 0, 2, B and C may be supplied in a delivery condition at the manufacturer's discretion (see 7.4.1).

Option 15.

7.2.2.2 Flat products of quality D1 or DD1 may be supplied normalized or in an equivalent condition obtained by normalizing rolling as defined in clause 3.

7.2.2.3 Flat products of quality D2 or DD2 may be supplied in a delivery condition at the manufacturer's discretion.

7.2.3 Long products

7.2.3.1 Unless otherwise agreed, long products of qualities 0, 2, B, D1 and DD1 may be supplied in a delivery condition at the manufacturer's discretion.

Option 20.

7.2.3.2 Long products of quality D2 or DD2 may be supplied in a delivery condition at the manufacturer's discretion.

7.2.4 The delivery conditions are summarized in table 1.

7.3 Chemical composition

7.3.1 The chemical composition determined by ladle analysis shall comply with the values of table 2.

The upper limits applicable for the product analysis are given in table 3.

7.3.2 For the steels Fe 360 B, C, D1 and D2 and Fe 510 C, D1, D2, DD1 and DD2, the following additional chemical requirement may be agreed at the time of ordering:

– copper content between: 0,25 and 0,40 %.

Option 4.

7.3.3 For the steels Fe 510 C, D1, D2, DD1 and DD2, the following additional requirements may be agreed at the time of ordering:

7.3.3.1

– the recording +) in the inspection document of the Cr, Cu, Mo, Nb, Ni, Ti and V contents (ladle analysis);

– a maximum content of 0,18 % C ladle analysis +) or 0,20 % C product analysis +) for thicknesses $\leq$ 30 mm if the products contain more than 0,02 % Nb or 0,02 % Ti or 0,03 % V ladle analysis +) or 0,03 % Nb or 0,04 % Ti or 0,05 % V product analysis +).

Option 5a.

7.3.3.2

– the carbon equivalent value, to be determined using the following formula:

$$CEV = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

When a maximum carbon equivalent value has been agreed, the content of the elements in the carbon equivalent value formula shall be reported in the inspection document.

Option 5b.

7.4 Mechanical properties

7.4.1 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 tables 4 and 5.

For products ordered and supplied in the normalized or normalized rolled condition, the mechanical properties shall comply with tables 4 and 5 in the as delivered condition as well as after normalizing by heat treatment after delivery.

For wire rod, the mechanical properties according to tables 4 and 5 apply to normalized reference test pieces.

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 ordering.

Table 1: Delivery conditions

Delivery condition	Quality 0	2	B	C	D1 DD1	D2 DD2	Indication in the inspection document
Flat products							
Optional	x	x	x	x	–	–	N [1])
Optional	–	–	–	–	–	x	–
Normalized or normalized rolled	–	–	–	–	x	–	–
Long products							
Optional	x	x	x	x	x	–	N [1])
Optional	–	–	–	–	–	x	–

[1]) Only if ordered and delivered in condition N.

7.4.2 For flat products, the nominal thickness applies. For long products of irregular section, the nominal thickness of that part from which the samples are taken applies (see annex A).

7.4.3 For flat products of quality D1 or DD1 supplied as-rolled for normalizing by the purchaser, the samples shall be normalized. The values obtained from the normalized samples shall comply with this European Standard.

NOTE: The results of these tests do not represent the properties of the supplied products but indicate the properties which may be achieved after correct normalizing.

7.4.4 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 8.6.3.3) and the applicable values shall be taken from figure 1.

Impact tests are not required for nominal thicknesses < 6 mm.

For products of qualities D1, D2, DD1 and DD2 with nominal thicknesses < 6 mm, the ferritic grain size shall be ≥ 6, verified by the method described in EURONORM 103, if specified at the time of ordering.

Option 6.

When aluminium is used as the grain-refining element, the grain size requirement shall be deemed to be fulfilled if, on ladle analysis, the aluminium content is not less than 0,020 % total aluminium or, alternatively, 0,015 % acid soluble aluminium. In this case, verification of the grain size is not required.

7.4.5 The impact properties of quality B products are to be verified by testing only when specified at the time of ordering.

Option 7.

7.4.6 If agreed at the time of ordering, products of quality D1, D2, DD1 and DD2 shall comply with the through-thickness properties of +) EURONORM 164.

Option 8.

7.5 Technological properties

7.5.1 Weldability

7.5.1.1 The steels specified in this European Standard do not have unlimited suitability for the various welding processes, since the behaviour of a steel during and after welding depends not only on the material but also on the dimensions and shape and on the manufacturing and service conditions of the components.

7.5.1.2 There is no information concerning the weldability of qualities 0 and 2 available as no requirements are specified concerning the chemical composition.

7.5.1.3 Steels of qualities B, C, D1, D2, DD1 and DD2 are generally suitable for welding by all welding processes.

The weldability increases for each grade from quality B to DD.

For Fe 360 B, killed steels are preferable to rimmed steels particulary if segregation zones could be encountered during welding.

NOTE 1: With increasing product thickness, increasing strength level and increasing carbon equivalent value, the occurrence of cold cracking in the welded zone forms the main risk. 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 Information Circular No. 2 or any relevant national standard, the recommended welding conditions and the various welding ranges of steel grades can be determined depending on the product thickness, the applied welding energy, the design requirements, the electrode efficiency, the welding process and the weld metal properties.

7.5.2 Hot forming

Only products ordered and supplied in the normalized or normalized rolled condition shall comply with the requirements of tables 4 and 5 if hot forming is carried out after delivery (see 7.4.1).

7.5.3 Cold formability

7.5.3.1 Flangeability

If specified at the time of ordering, plate, sheet, strip and wide flats with a nominal thickness ≤ 20 mm shall be suitable for flanging without cracking with the minimum bend radii given in table 7. The grades and qualities to which this applies are given in table 6. Flanging qualities shall be designated by the symbol KQ when ordering (see 6.2.2).

Option 16.

7.5.3.2 Roll forming

If specified at the time of ordering, plate and strip with a nominal thickness ≤ 8 mm shall be suitable for the production of sections through cold rolling (e.g. according to EURONORM 162). The suitability is applicable for bend radii given in table 8. The grades and qualities concerned are given in table 6.

Cold roll forming qualities shall be designated by the symbols KP when ordering (see 6.2.2).

Option 17.

NOTE: All grades and qualities designated as KP are also suitable for the manufacture of cold finished square and rectangular hollow sections.

7.5.3.3 Drawing of bars

If specified at the time of ordering, bars shall be suitable for cold drawing. The grades and qualities to which this applies are given in table 6.

Cold drawing qualities shall be designated by the symbols KZ when ordering (see 6.2.2).

Option 21.

7.5.4 Other requirements

At the time of ordering, the suitability and the relevant product quality requirements for hot-dip zinc coating or enamelling may be agreed.

Option 9.

If agreed at the time of ordering, the material shall be suitable for slitting of heavy sections.

Option 22.

7.6 Surface finish

7.6.1 Strip

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

7.6.2 Plates +), wide flats and long products

EURONORM 163 applies for the permissible surface discontinuities and for the repair of surface defects by grinding and/or welding.

8 Inspection and testing

8.1 General

8.1.1 The products can be supplied after inspection and testing with respect to their compliance with the requirements of this European Standard.

8.1.2 If inspection and testing is required, the purchaser shall specify at the time of ordering:

- the type of inspection and testing (specific or non-specific) (see EURONORM 21);
- the type of inspection document (see 8.10).

See 4.1 c) and option 10.

Products of steel Fe 310-0 shall only be submitted to non-specific inspection and testing.

8.1.3 Specific inspection and testing shall be carried out according to the requirements of 8.2 to 8.9.

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

Option 11.

8.2 Specific inspection and testing

8.2.1 If an inspection document for specific inspection and testing is required, the following shall be carried out:

- for all products, the tensile test;
- for all products of qualities C, D1, D2, DD1 and DD2, the impact test.

8.2.2 At the time of ordering, the following additional tests may be agreed:

a) for all products of quality B, the impact test (see 7.4.5);

b) the product analysis, if the products are delivered per cast (see 8.5.2).

Option 7.

8.3 Batching

8.3.1 Verification of the mechanical properties shall be carried out:

- by lot or by cast as specified at the time of ordering for qualities B and 2;

Option 12.

- by cast for qualities C, D1, D2, DD1 and DD2.

8.3.2 If it is specified at the time of ordering that batching should be by lot, it is permissible for the manufacturer to substitute batching by cast, if the products are delivered by cast.

8.4 Inspection units

8.4.1 The inspection unit shall contain products of the same form and grade and of the same thickness range as specified in table 4 for yield strength and shall be:

- by lot: 20 tonnes or part thereof;
- by cast: 40 tonnes or part thereof or 60 tonnes or part thereof for heavy sections with a mass > 100 kg/m.

8.4.2 If specified at the time of ordering for flat products of qualities D1, D2, DD1 and DD2, the impact test only or the impact test and the tensile test shall be carried out on each parent plate or coil.

Option 18.

8.5 Verification of chemical composition

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

8.5.2 Product analysis shall be carried out if specified at the time of ordering. The purchaser shall specify the number of samples and the elements to be determined.

Option 13.

8.6 Mechanical tests

8.6.1 Number of samples

The following samples shall be taken from each inspection unit:

- one sample for tensile testing (see 8.2.1),
- one sample sufficient for one set of six impact test pieces for qualities C, D1, D2, DD1 and DD2 and, if required, for quality B (see 8.2.1 and 8.2.2 a)).

8.6.2 Position of samples (see annex A)

The samples shall be taken from the thickest product in the inspection unit except for flat products of qualities D1 and DD1, for which the samples are taken from any product of the inspection unit.

8.6.2.1 For plates +), sheet, wide strip and wide flats, the samples shall be taken so that the axes of the test pieces are approximately mid-way between the edge and centre line of the products.

For wide strip and wire rod, 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.

8.6.2.2 For long products, EURONORM 18 shall apply (see annex A).

8.6.2.3 For semi-finished products, when the order specifies the requirement for testing, in addition to chemical composition, samples with a side or diameter ≤ 20 mm are prepared by hot forming from the full product section, and subsequently normalized.

Option 25.

8.6.3 Selection and preparation of test pieces

8.6.3.1 General

The requirements of EURONORM 18 shall apply (see annex A).

8.6.3.2 Tensile test pieces

The requirements of EN 10 002-1 as appropriate +) shall apply.

Test pieces may be non-proportional but in cases of dispute, proportional test pieces having a gauge length, $L_0 = 5{,}65\sqrt{S_0}$ shall be used (see 8.7.2.1).

For flat products with a nominal thickness < 3 mm, the test pieces shall always have a gauge length, $L_0 = 80$ mm and a width of 20 mm (test piece 2 as in EN 10002-1, annex A).

For bars, round test pieces are commonly used but other forms are not prohibited (see EN 10 002-1).

8.6.3.3 Impact test pieces

Impact V-notch test pieces shall be cut parallel to the principal direction of rolling. The test pieces shall be machined and prepared in accordance with EN 10 045-1. In addition, the following requirements apply.

a) For nominal thicknesses > 10 mm, standard 10×10 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 thicknesses $\leq$ 10 mm, when test pieces with reduced widths are used, the minimum width shall be $\geq$ 5 mm.

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

8.7 Test methods

8.7.1 Chemical analysis
For the determination of the chemical composition the corresponding EURONORMs (see footnote 1 of clause 2) shall apply in cases of dispute.

8.7.2 Mechanical tests
Mechanical tests shall be carried out in the temperature range 10 °C to 35 °C, except where a specific temperature is specified for impact tests.

8.7.2.1 Tensile tests
The tensile tests shall be carried out in accordance with EN 10 002-1.

For the specified yield strength in table 4, the upper yield strength (R_{eH}) shall be determined.

If a yield phenomenon is not present, the 0,2% proof strength ($R_{p0,2}$) or the $R_{t0,5}$ shall be determined; 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 $\geq$ 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.

8.7.2.2 Impact tests
The impact test shall be carried out in accordance with EN 10 045-1.

The average value of 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 8.6.1 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.

8.8 Retests

8.8.1 EURONORM 21 shall apply in respect of all retests. In the case of strip and wire rod, 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 +).

8.8.2 If the results of the impact tests (see 8.7.2.2) do not meet the requirements, the product tested shall be rejected and two further samples from the same inspection unit of equal, or if not possible, of the next lowest product thickness, shall be tested.

If one of these retests does not meet the requirements of this European Standard, either the inspection unit is to be rejected or, following consultation with the purchaser, the remainder of the inspection unit shall be retested product by product in accordance with EURONORM 21.

8.8.3 Resubmission for testing
EURONORM 21 shall apply in respect of resubmission for testing.

8.9 Internal defects
EURONORM 21 shall apply for testing for internal defects.

8.10 Inspection documents
8.10.1 For steel Fe 310-0, only certificates of compliance with the order shall be supplied when specified at the time of ordering.

8.10.2 For all other steels, if agreed and specified at the time of ordering, one of the documents specified in EURONORM 21 shall be supplied. In these documents, information groups A, B and Z and code numbers C01 to C03, C10 to C13, C40 to C43 and C71 to C92, according to EURONORM 168, shall be included.

See 4.1 c) and option 10.

9 Marking of flat and long products
Unless otherwise agreed at the time of ordering, products shall be marked by painting, stamping, endurable adhesive label or attached tags with the following:

- the grade, indicated by its abridged designation (e.g. Fe 430 C);
- a number by which the cast can be identified (if inspection is by cast);
- the manufacturer's name or trademark.

Option 14.

Marking shall be at a position close to one end of each product or on the end cut face, at the manufacturer's discretion.

It is permissible for light products to be supplied in securely tied bundles. In this case, the marking shall be on a label attached to the bundle or on the top product of the bundle.

10 Complaints after delivery
EURONORM 21 shall apply in respect of complaints after delivery and their processing.

11 Options (see 4.2)

11.1 All products

1) Whether the steel manufacturing process should be indicated with the exception of steel Fe 310-0 (see 7.1.1).

2) Whether a special steel manufacturing process is required for qualities C, D1, D2, DD1 and DD2 (see 7.1.1).

3) Whether a special method of deoxidation is required for steel Fe 360 B (see 7.1.2).

4) Whether a copper content between 0,25% and 0,40% is required (see 7.3.2).

5a) Whether additional chemical requirements are required (see 7.3.3.1).

5b) Whether a maximum carbon equivalent value is required (see 7.3.3.2).

6) For products of quality D1, D2, DD1 or DD2 with nominal thicknesses < 6 mm, whether the grain size is to be verified (see 7.4.4).

7) Whether the impact properties of quality B are to be verified by testing (see 7.4.5 and table 5).

8) Whether products of quality D1, D2, DD1 or DD2 are to comply with the through-thickness properties of +) EURONORM 164 (see 7.4.6).

9) Whether the material is to be suitable for hot-dip zinc coating or enamelling (see 7.5.4).

10) Whether products have to be submitted for inspection and testing and, if inspection and testing is required, which type and which inspection document is required (see 4.1 c) and 8.1.2).

11) Whether the purchaser wishes to carry out inspection at the manufacturer's works (see 8.1.4).

12) Whether the verification of the mechanical properties for qualities B and 2 is to be carried out by lot or by cast (see 4.1. d) and 8.3.1).

13) Whether product analysis is to be carried out and if so, the number of samples and the elements to be determined (see 8.5.2).

14) Whether specific marking is required (see 9).

11.2 Flat products

15) Whether delivery condition N is required for qualities 0, 2, B and C (see 7.2.2.1).

16) Whether for material, of nominal thicknesses $\leq$ 20 mm a suitability for cold flanging is required (see 7.5.3.1).

17) For plate and strip only: whether suitability for the production of sections by cold rolling of material of nominal thicknesses $\leq$ 8 mm with bend radii given in table 8 is required (see 7.5.3.2).

18) For flat products of qualities D1, D2, DD1 and DD2, for each parent plate or coil: whether the impact test only or the impact test and the tensile test are to be carried out (see 8.4.2).

19) For flat products of nominal thicknesses $>$ 30 mm, a round test piece may be used for the tensile test (see figure A 3).

11.3 Long products

20) Whether for qualities 0, 2, B, C, D1 and DD1 delivery condition N is required (see 7.2.3.1).

21) For bars only: whether the suitability for cold drawing is required (see 7.5.3.3).

22) Whether suitability for slitting of heavy sections is required (see 7.5.4).

23) For sections only: the maximum carbon content for material with nominal thicknesses $>$ 100 mm (see table 2).

24) For sections with a nominal thickness $>$ 100 mm, the minimum impact values (see table 5).

11.4 Semi-finished products

25) Whether semi-finished products are to be tested (see 8.6.2.3).

Table 2: Chemical composition in ladle analysis for flat and long products [1]

Designation				Type of deoxidation	Sub-group [5]	Maximum percentage by mass							
New, according to EN 10 027-1 [2]	According to EU 25-72	Former national (Germany)				C for a product nominal thickness, in mm, of			Mn	Si	P	S	N [3] [4]
						≤ 16	> 16 ≤ 40	> 40 [6]					
	Fe 310-0 [7]	St 33	1.0035	Opt.	BS	–	–	–	–	–	–	–	–
	Fe 360 B [7]	St 37-2	1.0037	Opt.	BS	0,17	0,20	–	–	–	0,045	0,045	0,009
	Fe 360 B [7]	USt 37-2	1.0036	FU	BS	0,17	0,20	–	–	–	0,045	0,045	0,007
	Fe 360 B	RSt 37,2	1.0038	FN	BS	0,17	0,17	0,20	–	–	0,045	0,045	0,009
	Fe 360 C	St 37-3 U	1.0114	FN	QS	0,17	0,17	0,17	–	–	0,040	0,040	0,009
	Fe 360 D1	St 37-3 N	1.0116	FF	QS	0,17	0,17	0,17	–	–	0,035	0,035	–
	Fe 360 D2	–	1.0117	FF	QS	0,17	0,17	0,17	–	–	0,035	0,035	–
	Fe 430 B	St 44-2	1.0044	FN	BS	0,21	0,21	0,22	–	–	0,045	0,045	0,009
	Fe 430 C	St 44-3 U	1.0143	FN	QS	0,18	0,18	0,18 [8]	–	–	0,040	0,040	0,009
	Fe 430 D1	St 44-3 N	1.0144	FF	QS	0,18	0,18	0,18 [8]	–	–	0,035	0,035	–
	Fe 430 D2	–	1.0145	FF	QS	0,18	0,18	0,18 [8]	–	–	0,035	0,035	–
	Fe 510 B	–	1.0045	FN	BS	0,24	0,24	0,24	1,60	0,55	0,045	0,045	0,009
	Fe 510 C [9]	St 52-3 U	1.0553	FN	QS	0,20	0,20 [10]	0,22	1,60	0,55	0,040	0,040	0,009
	Fe 510 D1 [9]	St 52-3 N	1.0570	FF	QS	0,20	0,20 [10]	0,22	1,60	0,55	0,035	0,035	–
	Fe 510 D2 [9]	–	1.0577	FF	QS	0,20	0,20 [10]	0,22	1,60	0,55	0,035	0,035	–
	Fe 510 DD1 [9]	–	1.0595	FF	QS	0,20	0,20 [10]	0,22	1,60	0,55	0,035	0,035	–
	Fe 510 DD2 [9]	–	1.0596	FF	QS	0,20	0,20 [10]	0,22	1,60	0,55	0,035	0,035	–
	Fe 490-2	St 50-2	1.0050	FN	BS	–	–	–	–	–	0,045	0,045	0,009
	Fe 590-2	St 60-2	1.0060	FN	BS	–	–	–	–	–	0,045	0,045	0,009
	Fe 690-2	St 70-2	1.0070	FN	BS	–	–	–	–	–	0,045	0,045	0,009

[1] See 7.3.

[2] At the moment of publication of this European Standard, the transformation of EURONORM 27 into a European Standard (EN 10 027-1) was not complete and may be subject to changes [+].

[3] It is permissible to exceed the specified values provided that for each increase of 0,001 % N, the P maximum content will be reduced by 0,005 %; the N content in the ladle analysis, however, shall not be more than 0,012 %.

[4] The maximum value for nitrogen does not apply if the chemical composition shows a minimum total Al content of 0,020 % or if sufficient other nitrogen binding elements are present. The nitrogen binding elements shall be mentioned in the inspection document.

[5] BS = base steel; QS = quality steel.

[6] For sections with nominal thicknesses > 100 mm, the C content by agreement [+]. Option 23.

[7] Only available in nominal thicknesses ≤ 25 mm.

[8] For nominal thicknesses > 50 mm: C = 0,20 % max.

[9] See 7.3.3.

[10] For nominal thicknesses > 30 mm and for KP (see 7.5.3.2): C = 0,22 % max.

Table 3: Chemical composition in product analysis based on table 2 [1]

Designation				Type of deoxidation	Sub-group [5]	Maximum percentage by mass							
New, according to EN 10 027-1 [2]	According to EU 25-72	Former national (Germany)				C for a product nominal thickness, in mm, of			Mn	Si	P	S	N [3] [4]
						≤ 16	> 16 ≤ 40	> 40 [6]					
	Fe 310-0 [7]	St 33	1.0035	Opt.	BS	–	–	–	–	–	–	–	–
	Fe 360 B [7]	St 37-2	1.0037	Opt.	BS	0,21	0,25	–	–	–	0,055	0,055	0,011
	Fe 360 B [7]	USt 37-2	1.0036	FU	BS	0,21	0,25	–	–	–	0,055	0,055	0,009
	Fe 360 B	RSt 37-2	1.0038	FN	BS	0,19	0,19	0,23	–	–	0,055	0,055	0,011
	Fe 360 C	St 37-3 U	1.0114	FN	QS	0,19	0,19	0,19	–	–	0,050	0,050	0,011
	Fe 360 D1	St 37-3 N	1.0116	FF	QS	0,19	0,19	0,19	–	–	0,045	0,045	–
	Fe 360 D2	–	1.0117	FF	QS	0,19	0,19	0,19	–	–	0,045	0,045	–
	Fe 430 B	St 44-2	1.0044	FN	BS	0,24	0,24	0,25	–	–	0,055	0,055	0,011
	Fe 430 C	St 44-3 U	1.0143	FN	QS	0,21	0,21	0,21 [8]	–	–	0,050	0,050	0,011
	Fe 430 D1	St 44-3 N	1.0144	FF	QS	0,21	0,21	0,21 [8]	–	–	0,045	0,045	–
	Fe 430 D2	–	1.0145	FF	QS	0,21	0,21	0,21 [8]	–	–	0,045	0,045	–
	Fe 510 B	–	1.0045	FN	BS	0,27	0,27	0,27	1,70	0,60	0,055	0,055	0,011
	Fe 510 C [9]	St 52-3 U	1.0553	FN	QS	0,23	0,23 [10]	0,24	1,70	0,60	0,050	0,050	0,011
	Fe 510 D1 [9]	St 52-3 N	1.0570	FF	QS	0,23	0,23 [10]	0,24	1,70	0,60	0,045	0,045	–
	Fe 510 D2 [9]	–	1.0577	FF	QS	0,23	0,23 [10]	0,24	1,70	0,60	0,045	0,045	–
	Fe 510 DD1 [9]	–	1,0595	FF	QS	0,23	0,23 [10]	0,24	1,70	0,60	0,045	0,045	–
	Fe 510 DD2 [9]	–	1.0596	FF	QS	0,23	0,23 [10]	0,24	1,70	0,60	0,045	0,045	–
	Fe 490-2	St 50-2	1.0050	FN	BS	–	–	–	–	–	0,055	0,055	0,011
	Fe 590-2	St 60-2	1.0060	FN	BS	–	–	–	–	–	0,055	0,055	0,011
	Fe 690-2	St 70-2	1.0070	FN	BS	–	–	–	–	–	0,055	0,055	0,011

[1] See 7.3.

[2] At the moment of publication of this European Standard, the transformation of EURONORM 27 into a European Standard (EN 10 027-1) was not complete and may be subject to changes +).

[3] It is permissible to exceed the specific values provided that for each increase of 0,001 % N, the P maximum content will be reduced by 0,005 %; the N content in the product analysis, however, shall not be more than 0,014 %.

[4] The maximum value for nitrogen does not apply if the chemical composition shows a minimum total Al content of 0,020 % or if sufficient other nitrogen binding elements are present. The nitrogen binding elements shall be mentioned in the inspection document.

[5] BS = base steel; QS = quality steel.

[6] For sections with nominal thicknesses > 100 mm, the C content by agreement +). Option 23.

[7] Only available in nominal thicknesses ≤ 25 mm.

[8] For nominal thicknesseses > 150 mm: C = 0,23 % max.

[9] See 7.3.3.

[10] For nominal thicknesses > 30 mm and for KP (see 7.5.3.2): C = 0,24 % max.

Table 4: Mechanical properties of flat and long products

Designation				Type of deoxidation	Sub-group[4]	Minimum yield strength, R_{eH}, in N/mm² [1]								Tensile strength, R_m, in N/mm² [1]			
						Nominal thickness, in mm								Nominal thickness, in mm			
New, according to EN 10 027-1[2]	According to EU 25-72	Former national (Germany)				≤ 16	> 16 ≤ 40	> 40 ≤ 63	> 63 ≤ 80	> 80 ≤ 100	> 100 ≤ 150	> 150 ≤ 200	> 200 ≤ 250	< 3	≥ 3 ≤ 100	> 100 ≤ 150	> 150 ≤ 250
	Fe 310-0[3]	St 33	1.0035	Opt.	BS	185	175							310 to 540	290 to 510	–	–
	Fe 360 B[3]	St 37-2	1.0037	Opt.	BS	235	255	–	–	–	–	–	–	360 to 510	340 to 470	–	–
	Fe 360 B[3]	USt 37-2	1.0036	FU	BS	235	225	–	–	–	–	–	–			340 to 470	320 to 470
	Fe 360 B	RSt 37-2	1.0038	FN	BS	235	225	215	215	215	195	185	175				
	Fe 360 C	St 37-3 U	1.0114	FN	QS	235	225	215	215	215	195	185	175				
	Fe 360 D1	St 37-3 N	1.0116	FF	QS	235	225	215	215	215	195	185	175				
	Fe 360 D2	–	1.0117	FF	QS	235	225	215	215	215	195	185	175				
	Fe 430 B	St 44-2	1.0044	FN	BS	275	265	255	245	235	225	215	205	430 to 580	410 to 560	400 to 540	380 to 540
	Fe 430 C	St 44-3 U	1.0143	FN	QS												
	Fe 430 D1	St 44-3 N	1.0144	FF	QS												
	Fe 430 D2	–	1.0145	FF	QS												
	Fe 510 VB	–	1.0045	FN	BS	355	345	335	325	315	295	285	275	510 to 680	490 to 630	470 to 630	450 to 630
	Fe 510 C	St 52-3 U	1.0553	FN	QS												
	Fe 510 D1	St 52-3 N	1.0570	FF	QS												
	Fe 510 D2	–	1.0577	FF	QS												
	Fe 510 DD1	–	1.0595	FF	QS												
	Fe 510 DD2	–	1.0596	FF	QS												
	Fe 490-2[5]	St 50-2	1.0050	FN	BS	295	285	275	265	255	245	235	225	490 to 660	470 to 610	450 to 610	440 to 610
	Fe 590-2[5]	St 60-2	1.0060	FN	BS	335	325	315	305	295	275	265	255	590 to 770	570 to 710	550 to 710	540 to 710
	Fe 690-2[5]	St 70-2	1.0070	FN	BS	360	355	345	335	325	305	295	285	690 to 900	790 to 830	650 to 830	640 to 830

[1] The values in the table apply to longitudinal test pieces (*l*) for the tensile test. For plate, strip and wide flats with widths ≥600 mm, transverse test pieces (*t*) are applicable.

[2] At the moment of publication of this European Standard, the transformation of EURONORM 27 into a European Standard (EN 10 027-1) was not complete and may be subject to changes [+].

[3] Only available in nominal thicknesses ≤ 25 mm.

[4] BS = base steel; QS = quality steel.

[5] These steels are normally not used for channels, angles and sections.

(continued)

Table 4 (concluded)

Designation				Type of deoxidation	Sub-group [4]	Position of test pieces [1]	Minimum percentage elongation [1]									
New, according to EN 10 027-1 [2]	According to EU 25-72	Former national (Germany)					$L_0 = 80$ mm Nominal thickness, in mm					$L_0 = 5{,}65\sqrt{S_0}$ Nominal thickness, in mm				
							≤ 1	> 1 $\leq 1{,}5$	$> 1{,}5$ ≤ 2	> 2 $\leq 2{,}5$	$> 2{,}5$ < 3	≥ 3 ≤ 40	> 40 ≤ 63	> 63 ≤ 100	> 100 ≤ 150	> 150 ≤ 250
	Fe 310-0 [3]	St 33	1.0035	Opt.	BS	*l*	10	11	12	13	14	18	–	–	–	–
						t	8	9	10	11	12	16	–	–	–	–
	Fe 360 B [3]	St 37-2	1.0037	Opt.	BS											
	Fe 360 B [3]	USt 37-2	1.0036	FU	BS											
	Fe 360 B	RSt 37-2	1.0038	FN	BS	*l*	17	18	19	20	21	26	25	24	22	21
	Fe 360 C	St 37-3 U	1.0114	FN	QS	*t*	15	16	17	18	19	24	23	22	22	21
	Fe 360 D1	St 37-3 N	1.0116	FF	QS											
	Fe 360 D2	–	1.0117	FF	QS											
	Fe 430 B	St 44-2	1.0044	FN	BS											
	Fe 430 C	St 44-3 U	1.0143	FN	QS	*l*	14	15	16	17	18	22	21	20	18	17
	Fe 430 D1	St 44-3 N	1.0144	FF	QS	*t*	12	13	14	15	16	20	19	18	18	17
	Fe 430 D2	–	1.0145	FF	QS											
	Fe 510 B	–	1.0045	FN	BS											
	Fe 510 C	St 52-3 U	1.0553	FN	QS											
	Fe 510 D1	St 32-3 N	1.0570	FF	QS	*l*	14	15	16	17	18	22	21	20	18	17
	Fe 510 D2	–	1.0577	FF	QS	*t*	12	13	14	15	16	20	19	18	18	17
	Fe 510 DD1	–	1.0595	FF	QS											
	Fe 510 DD2	–	1.0596	FF	QS											
	Fe 490-2 [3]	St 50-2	1.0050	FN	BS	*l*	12	13	14	15	16	20	19	18	16	15
						t	10	11	12	13	14	18	17	16	15	14
	Fe 590-2 [5]	St 60-2	1.0060	FN	BS	*l*	8	9	10	11	12	16	15	14	12	11
						t	6	7	8	9	10	14	13	12	11	10
	Fe 690-2 [5]	St 70-2	1.0070	FN	BS	*l*	4	5	6	7	8	11	10	9	8	7
						t	3	4	5	6	7	10	9	8	7	6

[1] The values in the table apply to longitudinal test pieces (*l*) for the tensile test. For plate, strip and wide flats with widths ≥ 600 mm, transverse test pieces (*t*) are applicable.

[2] At the moment of publication of this European Standard the transformation of EURONORM 27 into a European Standard (EN 10 027-1) was not complete and may be subject to changes [4].

[3] Only available in nominal thicknesses ≤ 25 mm.

[4] BS = base steel; QS = quality steel.

[5] These steels are normally not used for channels, angles and sections.

Table 5: Impact strength (KV, longitudinal) for flat and long products [1]

Designation				Type of deoxidation	Sub-group [3]	Temperature, in °C	Min. energy, in J Nominal thickness, in mm	
New, according to EN 10 027-1 [2]	According to EU 25-72	Former national (Germany)					> 10 ≤ 150 [4]	> 150 ≤ 250 [4]
	Fe 310-0 [5]	St 33	1.0035	Opt.	BS	–	–	–
	Fe 360 B [5] [6]	St 37-2	1.0037	Opt.	BS	20	27	–
	Fe 360 B [5] [6]	USt 37-2	1.0036	FU	BS	20	27	–
	Fe 360 B [6]	RSt 37-2	1.0038	FN	BS	20	27	23
	Fe 360 C	St 37-3 U	1.0114	FN	QS	0	27	23
	Fe 360 D1	St 37-3 N	1.0116	FF	QS	−20	27	23
	Fe 360 D2	–	1.0117	FF	QS	−20	27	23
	Fe 430 B [6]	St 44-2	1.0044	FN	BS	20	27	23
	Fe 430 C	St 44-3 U	1.0143	FN	QS	0	27	23
	Fe 430 D1	St 44-3 N	1.0144	FF	QS	−20	27	23
	Fe 430 D2	–	1.0145	FF	QS	−20	27	23
	Fe 510 B [6]	–	1.0045	FN	BS	20	27	23
	Fe 510 C	St 52-3 U	1.0553	FN	QS	0	27	23
	Fe 510 D1	St 52-3 N	1.0570	FF	QS	−20	27	23
	Fe 510 D2	–	1.0577	FF	QS	−20	27	23
	Fe 510 DD1	–	1.0595	FF	QS	−20	40	33
	Fe 510 DD2	–	1.0596	FF	QS	−20	40	33
	Fe 490-2	St 50-2	1.0050	FN	BS	–	–	–
	Fe 590-2	St 60-2	1.0060	FN	BS	–	–	–
	Fe 690-2	St 70-2	1.0070	FN	BS	–	–	–

[1] For sub-size test pieces, figure 1 applies.

[2] At the moment of publication of this European Standard, the transformation of EURONORM 27 into a European Standard (EN 10 0271) was not complete and may be subject to changes +).

[3] BS = base steel; QS = quality steel.

[4] For sections with a nominal thickness > 100 mm, the values shall be agreed. Option 24.

[5] Only available in nominal thicknesses ≥ 25 mm.

[6] The impact properties of quality B products are verified only when specified at the time of ordering. Option 7.

Table 6: Technological properties

Designation		Sub-group [2]	Suitability for				
New, according to EN 10 027-1 [1]	According to EU 25-72		cold flanging	cold roll forming	cold drawing to		
						Former national designation	
			KQ [3] [4]	KP [3] [5]	KZ [3]		
	Fe 360 B	QS	X	X	X	Z St 37-2	1.0120
	Fe 360 BFU	QS	X	X	X	UZ St 37-2	1.0121
	Fe 360 BFN	QS	X	X	X	RZ St 37-2	1.0122
	Fe 360 C	QS	X	X	X	Z St 37-3 U	1.0115
	Fe 360 D1	QS	X	X	X	Z St 37-3 N	1.0118
	Fe 360 D2	QS	X	X	X	–	1.0119
	Fe 430 B	QS	X	X	X	Z St 44-2	1.0128
	Fe 430 C	QS	X	X	X	Z St 44-3 U	1.0140
	Fe 430 D1	QS	X	X	X	Z St 44-3 N	1.0141
	Fe 430 D2	QS	X	X	X	–	1.0142
	Fe 510 B	QS	–	–	X	–	1.0594
	Fe 510 C	QS	X	X	X	Z St 52-3 U	1.0554
	Fe 510 D1	QS	X	X	X	Z St 52-3 N	1.0569
	Fe 510 D2	QS	X	X	X	–	1.0579
	Fe 510 DD1	QS	X	X	X	–	1.0593
	Fe 510 DD2	QS	X	X	X	–	1.0594
	Fe 490-2	QS	–	–	X	Z St 50-2	1.0533
	Fe 590-2	QS	–	–	X	Z St 60-2	1.0543
	Fe 690-2	QS	–	–	X	Z St 70-2	1.0633

[1] At the moment of publication of this European Standard, the transformation of EURONORM 27 (1974) into a European Standard (EN 10 027-1) was not complete and may be subject to changes +).

[2] QS = quality steel in accordance with EN 10 020.

[3] Code letters to be indicated in the designation (see 6.2.2).

[4] Former national designations are given in table 7.

[5] Former national designations are given in table 8.

Table 7: Minimum values of the bend radius for cold flanging of flat products of KQ steels

Designation [1]				Bending direction [3]	Minimum recommended inside bend radius for nominal thicknesses, in mm													
New, according to EN 10 027-1 [2]	According to EU 25-72	Former national (Germany)			> 1 ≤ 1,5	> 1,5 ≤ 2,5	> 2,5 ≤ 3	> 3 ≤ 4	> 4 ≤ 5	> 5 ≤ 6	> 6 ≤ 7	> 7 ≤ 8	> 8 ≤ 10	> 10 ≤ 12	> 12 ≤ 14	> 14 ≤ 16	> 16 ≤ 18	> 18 ≤ 20
	Fe 360 B	–	1.0120															
	Fe 360 BFU	UQSt 37-2	1.0121															
	Fe 360 BFN	RQSt 37-2	1.0122	*t*	1,6	2,5	3	5	6	8	10	12	16	20	25	28	36	40
	Fe 360 C	QSt 37-3 U	1.0115	*l*	1,6	2,5	3	6	8	10	12	16	20	25	28	32	40	45
	Fe 360 D1	QSt 37-3 N	1.0118															
	Fe 360 D2	–	1.0119															
	Fe 430 B	QSt 44-2	1.0128															
	Fe 430 C	QSt 44-3 U	1.0140	*t*	2	3	4	5	8	10	12	16	20	25	28	32	40	45
	Fe 430 D1	QSt 44-3 N	1.0141	*l*	2	3	4	6	10	12	16	20	25	32	36	40	45	50
	Fe 430 D2	–	1.0142															
	Fe 510 C	QSt 52-3 U	1.0554															
	Fe 510 D1	QSt 52-3 N	1.0569															
	Fe 510 D2	–	1.0579	*t*	2,5	4	5	6	8	10	12	16	20	25	32	36	45	50
	Fe 510 DD1	–	1.0593	*l*	2,5	4	5	8	10	12	16	20	25	32	36	40	50	63
	Fe 510 DD2	–	1.0594															

[1] The designation shall be completed, with KQ (see 7.5.3.1).

[2] At the moment of publication of this European Standard, the transformation of EURONORM 27 into a European Standard (EN 10 027-1) was not complete and may be subject to changes +).

[3] *t*: transverse to the rolling section.
l: parallel to the rolling section.

Table 8: Cold roll forming of flat products of KP steels

Designation [1]				Minimum recommended inside bend radii for nominal thicknesses, s, in mm [3]	
New, according to EN 10 027-1 [2]	According to EU 25-72	Former national (Germany)		$s \leq 6$ mm	$6 < s \leq 8$ mm
	Fe 360 B	K St 37-2	1.0120	1 s	1,5 s
	Fe 360 BFU	U K St 37-2	1.0121		
	Fe 360 BFN	R K St 37-2	1.0122		
	Fe 360 C	K St 37-3 U	1.0115		
	Fe 360 D1	K St 37-3 N	1.0118		
	Fe 360 D2	–	1.0119		
	Fe 430 B	K St 44-2	1.0128	1,5 s	2 s
	Fe 430 C	K St 44-3 U	1.0140		
	Fe 430 D1	K St 44-3 N	1.0141		
	Fe 430 D2	–	1.0142		
	Fe 510 C	K St 52-3 U	1.0554	2 s	2,5 s
	Fe 510 D1	K St 52-3 N	1.0569		
	Fe 510 D2	–	1.0579		
	Fe 510 DD1	–	1.0593		
	Fe 510 DD2	–	1.0594		

[1] The designation shall be completed with KP (see 7.5.3.2).

[2] At the moment of publication of this European Standard, the transformation of EURONORM 27 into a European Standard (EN 10 027-1) was not complete and may be subject to changes +).

[3] The values are applicable for bend angles $\leq 90°$.

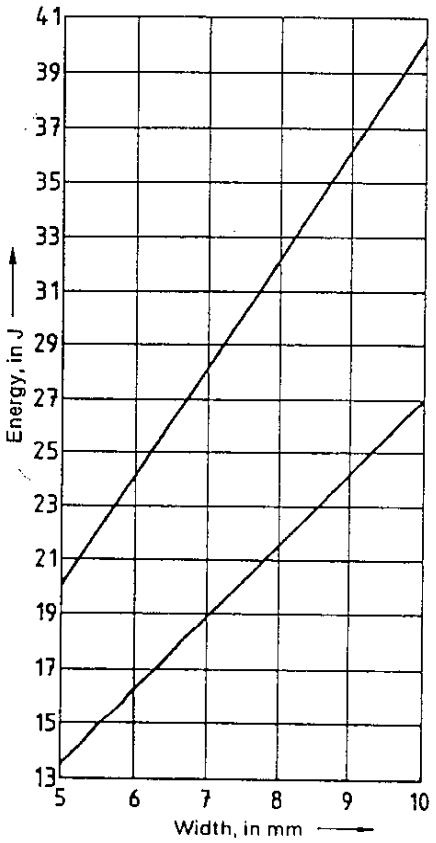


Figure 1: Minimum impact energy values, in J, for impact test pieces with a width between 5 and 10 mm

Annex A

(normative)

Location of samples and test pieces (see EURONORM 18)

This annex gives information on the usual location of samples and test pieces in the absence of requirements in the product quality standard and the order.

The following three categories of products are covered:

- beams, channels, angles, T sections and Z sections (figure A.1);
- bars and wire (including wire rod) (figure A.2);
- flat products (figure A.3).

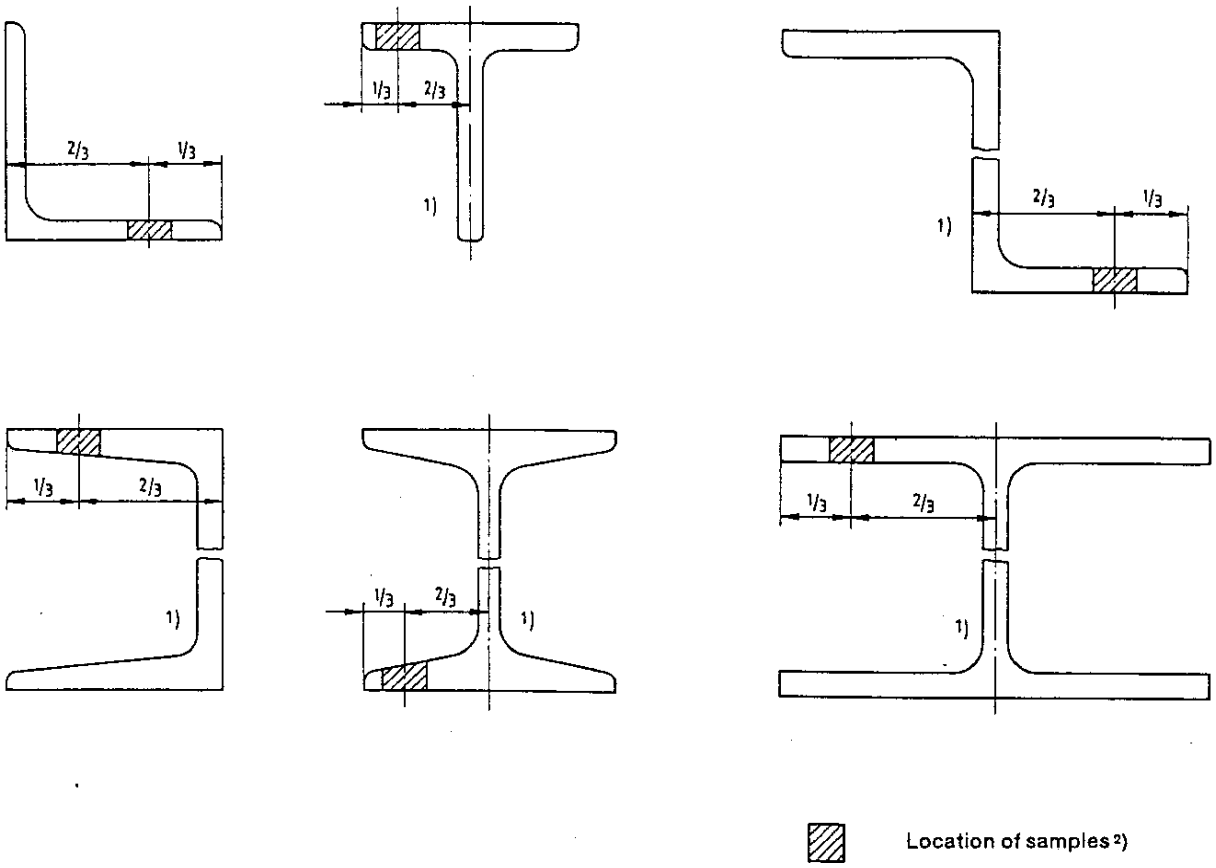
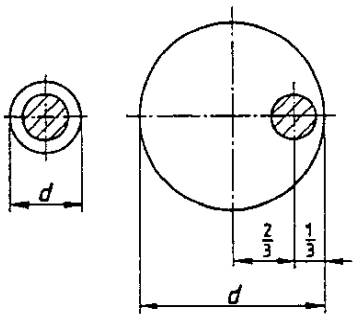
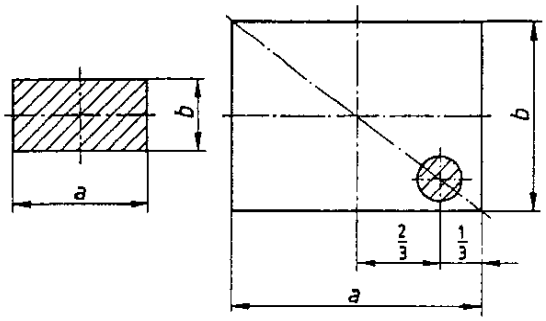
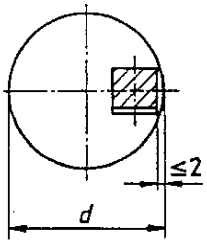
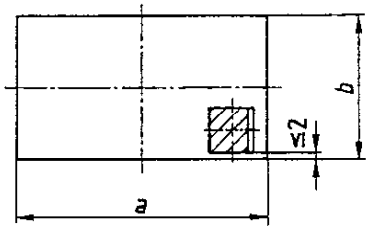


Figure A.1: Beams, channels, angles, T sections and Z sections

[1]) By agreement, the sample may be taken from the web, at a quarter of the total height.

[2]) Test pieces are taken from the sample as indicated in figure A.3. For sections with inclined flanges, machining of the inclined surface is permitted in order to make it parallel to the other surface.

Dimensions in millimetres

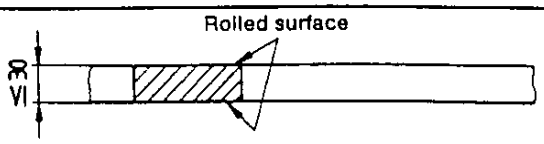
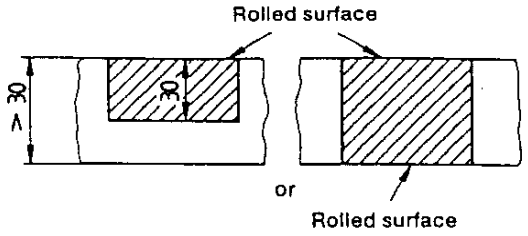
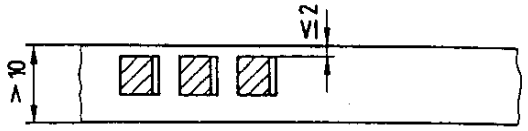
Type of steel	Type of test	Products with round cross section	Products with rectangular cross section
Structural steels	Tensile bending	$d \leq 25$ [1] $d > 25$ [2] 	$b \leq 25$ [1] $b > 25$ [2] 
	Impact [3]	$d \geq 16$ 	$b \geq 12$ 

[1] For products with small dimensions (d or $b \leq 25$ mm), the test piece should, if possible, consist of an unmachined full section of the product.

[2] For products of diameter or thickness ≤ 40 mm, the manufacturer may
- either apply the rules specified for products of diameter or thickness ≤ 25 mm, or
- take the test piece at a location nearer to the centre than indicated in the figure.

[3] For products of round cross section, the axis of the notch is approximately a diagonal; for products with rectangular cross section, the axis of the notch is perpendicular to the greatest rolled surface.

Figure A.2: Bars and wire (including wire rod)

Type of test	Thickness of product in mm	Orientation of the test pieces for widths of		Distance of the test piece from the rolled surface, in mm
		< 600 mm	≥ 600 mm	
Tension [1]	≤ 30	Longitudinal	Transverse	
	> 30			
Impact [2]	> 10	Longitudinal	Longitudinal	

[1] In cases of doubt or dispute, for products of thickness greater than or equal to 3 mm, use proportional test pieces of gauge length $L_0 = 5{,}65\sqrt{S_0}$. For normal testing, for reasons of economy, test pieces of a constant gauge length may be used provided the result obtained for elongation after fracture is converted by a recognized formula (see, for example, ISO 2566).

For products of thickness greater than 30 mm, a round test piece may be used if agreed between the parties.

Option 19.

[2] The axis of the notch shall be perpendicular to the surface of the product.

Figure A.3: Flat products

Annex B

(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 9.

Table 9: EURONORMs with corresponding national standards

EURONORM	Corresponding national standard in				
	Germany	France	United Kingdom	Spain	Italy
18	–	NF A 03-111	BS 4360	UNE 36-300 UNE 36-400	UNI-EU 18
19	DIN 1025 T5	NF A 45-205	–	UNE 36-526	UNI 5398
21	DIN 17 010 DIN 50 049	NF A 03-115	BS 4360	UNE 36-007	UNI-EU 21
24	DIN 1025 T1 DIN 1026	NF A 45-210	BS 4	UNE 36-521 UNE 36-522	UNI 5679 UNI 5680
27	–	NF A 02-005	–	UNE 36-009	UNI-EU 27
29	DIN 1543	NF A 46-503 NF A 46-504	BS 4360	UNE 36-559	UNI-EU 29
34	DIN 1025 T2 DIN 1025 T3 DIN 1025 T4	NF A 45-211	BS 4	UNE 36-527 UNE 36-528 UNE 36-529	UNI 5397
44	DIN 1025 T5	NF A 45-206	BS 4	UNE 36-526	UNI 5398
48	DIN 1016	NF A 46-100	BS 1449	UNE 36-553	UNI 6685
51	DIN 1016	NF A 46-501	BS 1449	UNE 36-560	UNI-EU 51
52	DIN 17 014	NF A 02-010 NF A 02-012	BS 6562	UNE 36-006/1	UNI-EU 52
53	DIN 1025 T2 DIN 1025 T3 DIN 1025 T4	NF A 45-201	BS 4	UNE 36-527 UNE 36-528 UNE 36-529	UNI 5397
54	DIN 1026	NF A 45-007	BS 4	UNE 36-525	UNI-EU 54
55	DIN 1024	NF A 45-008 [1]	BS 4	UNE 36-533	UNI-EU 55
56	DIN 1028	NF A 45-009 [1]	BS 4848	UNE 36-531	UNI-EU 56
57	DIN 1029	NF A 45-010 [1]	BS 4848	UNE 36-532	UNI-EU 57
58	DIN 1017 T1	NF A 45-005 [1]	BS 4360	UNE 36-543	UNI-EU 58
59	DIN 1014 T1	NF A 45-004 [1]	BS 4360	UNE 36-542	UNI-EU 59
60	DIN 1013 T1	MF A 45-003 [1]	BS 4360	UNE 36-541	UNI-EU 60
61	DIN 1015	NF A 45-006 [1]	BS 970	UNE 36-547	UNI 7061
65	DIN 59 130	NF A 45-075 [1]	BS 3111	UNE 36-546	UNI 7356
66	DIN 1018	–	–	–	UNI 6630
67	DIN 1019	NF A 45-011	BS 4848	UNE 36-548	UNI-EU 67
79	–	NF A 40-001	BS 6562	UNE 36-501	UNI 7272
91	DIN 59 200	NF A 46-012	BS 4360	–	UNI-EU 91
103	DIN 50 601	NF A 04-102	BS 4490	UNE 7-280	–
162	DIN 17 118 DIN 59 413	NF A 37-101	BS 2994	UNE 36-570	UNI 7344
164	SEL 096	NF A 36-202	BS 6780	UNE 36-083	UNI-EU 164
168	–	NF A 03-116	BS 4360	UNE 36-800	UNI-EU 168
Circular No. 2	SEW 088	NF A 36-000	BS 5135	–	–

[1] NF A 45-001 and NF A 45-101 shall be added for the tolerances.

(continued)

Table 9 (concluded)

EURONORM	Corresponding national standard in				
	Belgium	Portugal	Sweden	Austria	Norway
18	NBN A 03-001	NP-2451	SS 11 01 20 SS 11 01 05	–	NS 10 005 NS 10 006
19	NBN 533	NP-2116.	SS 21 27 40	M 3262	–
21	NBN A 02-001	NP-2149	SS 11 00 01 SS 21 93 01	M 3101	NS 10 010
24	NBN 633-02	–	SS 21 27 25 SS 21 27 35	M 3261	NS 911
27	NBN 147	NP-1616	MNC 1003 MNC 1005	–	–
29	NBN A 43-101	–	SS 21 11 12	DIN 1543	–
34	NBN 633-02	NP-2117	SS 21 27 50 SS 21 27 51 SS 21 27 52	DIN 1025 T2 DIN 1025 T3 DIN 1025 T4	NS 1907 NS 1908
44	NBN 632-04	–	SS 21 27 40	M 3262	NS 1910
48	–	–	–	DIN 1016	–
51	NBN A 43-103	–	–	M 3216	–
52	–	NP-1697	SS 01 66 01	–	–
53	NBN 633	NP-2117	SS 21 27 50 SS 21 27 51 SS 21 27 52	–	NS 1907 NS 1908
54	NBN A 24-204	NP-338	–	M 3260	–
55	NBN A 24-205	NP-337	SS 21 27 20	–	NS 1905
56	NBN A 24-201	NP-335	SS 21 27 11	M 3246	NS 1903
57	NBN A 24-202	NP-336	SS 21 27 12	M 3247	NS 1904
58	NBN A 34-201	–	SS 21 21 50	M 3230	NS 1902
59	NBN A 34-202	NP-333 NP-334	SS 21 27 25	M 3226	NS 1901
60	NBN A 34-203	NP-331	SS 21 25 02	M 3221	NS 1900
61	NBN A 34-204	–	–	M 3227 M 3228	–
65	NBN A 24-206	–	–	M 3223	–
66	–	–	–	–	–
67	NBN A 24-203	–	SS 21 11 70	–	NS 6034
79	NBN A 01-102	NP-1788	SS 01 66 01	M 3101	–
91	NBN A 43-301	–	SS 21 21 50	M 3231	–
103	NBN A 14-101	NP-1787	–	–	–
162	NBN A 02-002	–	–	M 3316	–
164	–	–	SS 11 21 44	–	–
168	–	–	SS 11 00 12	–	–
Circular No. 2	–	–	SS 06 40 25	–	–

Annex C
(informative)

List of corresponding former national designations

Table 10: List of corresponding former national designations

Designation		Equivalent former designations in					
		Germany		France	United Kingdom	Spain	Italy
New, according to EN 10 027-1 [1])	According to EU 25-72	Werkstoff-nummer	Designation				
	Fe 310-0	1.0035	St 33	A 33		A 310-0	Fe 320
	Fe 360 B	1.0037	St 37-2	E 24-2			Fe 360 B
	Fe 360 BFU	1.0036	USt 37-2			AE 235 B-FU	
	Fe 360 BFN	1.0038	RSt 37-2		40 B	AE 235 B-FN	
	Fe 360 C	–	–	E 24-3	40 C	AE 235 C	Fe 360 C
	Fe 360 D1	1.0116	St 37-3 N	E 24-4	40 D	AE 235 D	Fe 360 D
	Fe 360 D2	–	–				
	Fe 430 B	1.0044	St 44-2	E 28-2	43 B	AE 275 B	Fe 430 B
	Fe 430 C	–	–	E 28-3	43 C	AE 275 E	Fe 430 C
	Fe 430 D1	1.0144	St 44-3 N	E 28-4	43 D	AE 275 D	Fe 430 D
	Fe 430 D2	–	–				
	Fe 510 B	–	–	E 36-2	50 B	AE 355 B	Fe 510 B
	Fe 510 C	–	–	E 36-3	50 C	AE 355 C	Fe 510 C
	Fe 510 D1	1.0570	St 52-3 N		50 D	AE 355 D	Fe 510 D
	Fe 510 D2	–	–				
	Fe 510 DD1	–	–	E 36-4	50 DD		
	Fe 510 DD2	–	–		50 DD		
	Fe 490-2	1.0050	St 50-2	A 50-2		A 490	Fe 480
	Fe 590-2	1.0060	St 60-2	A 60-2		A 590	Fe 580
	Fe 690-2	1.0070	St 70-2	A 70-2		A 690	Fe 650

[1]) At the moment of publication of this European Standard, the transformation of EURONORM 27 into a European Standard (EN 10 027-1) was not complete and may be subject to changes [+]).

(continued)

Table 10 (concluded)

Designation		Equivalent former designations in				
New, according to EN 10 027-1[1])	According to EU 25-72	Belgium	Portugal	Sweden	Austria	Norway
	Fe 310-0	A 320	Fe 310-0	13 00-00	St 320	
	Fe 360 B Fe 360 BFU Fe 360 BFN Fe 360 C	AE 235-B AE 235-C	Fe 360-B Fe 360-C	13 11-00 13 12-00	 USt 360 B RSt 360 B St 360 C St 360 C E	NS 12 120 NS 12 122 NS 12 123 NS 12 124
	Fe 360 D1 Fe 360 D2	AE 235-D	Fe 360-D		St 360 D	NS 12 124
	Fe 430 B Fe 430 C	AE 255-B AE 255-C	Fe 430-B Fe 430-C	14 12-00	St 430 B St 430 C St 430 C E	NS 12 142 NS 12 143
	Fe 430 D1 Fe 430 D2	AE 255-D	Fe 430-D	14 14-00 14 14-01	St 430 D	NS 12 143
	Fe 510 B Fe 510 C Fe 510 D1 Fe 510 D2 Fe 510 DD1 Fe 510 DD2	AE 355-B AE 355-C AE 355-D AE 355-DD	Fe 510-B Fe 510-C Fe 510-D Fe 510-DD		St 510 C St 510 D	NS 12 153 NS 12 153
	Fe 490-2	A 490-2	Fe 490-2	15 50-00 15 50-01	St 490	
	Fe 590-2	A 590-2	Fe 590-2	16 50-00 16 50-01	St 590	
	Fe 690-2	A 690-2	Fe 690-2	16 55-00 16 55-01	St 690	

[1]) At the moment of publication of this European Standard, the transformation of EURONORM 27 into a European Standard (EN 10 027-1) was not complete and may be subject to changes +).