

Steel rod, bars and wire for cold heading and cold extrusion —

Part 1: General technical delivery conditions

The European Standard EN 10263-1:2001 has the status of a
British Standard

ICS 77.140.60; 77.140.65

National foreword

This British Standard is the official English language version of EN 10263-1:2001, including Corrigendum August 2002. Together with BS EN 10263-2:2001, BS EN 10263-3:2001 and BS EN 10263-4:2001 it supersedes BS 3111-1:1987, which is withdrawn; and together with BS EN 10263-5:2001 it supersedes BS 3111-2:1979, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/71, Steel rods for wire drawing, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 August 2001

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English version

Steel rod, bars and wire for cold heading and cold extrusion — Part 1: General technical delivery conditions

Barres, fil machine et fils en acier pour déformation à froid
et extrusion à froid — Partie 1: Conditions techniques
générales de livraison

Walzdraht, Stäbe und Draht aus Kaltstauch- und
Kaltfließpreßstählen — Teil 1: Allgemeine technische
Lieferbedingungen

This European Standard was approved by CEN on 19 April 2001.

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 Management Centre 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 Management Centre has the same status as the official versions.

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



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Contents

	Page
Foreword	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	6
4 Classification and designation	6
4.1 Classification	6
4.2 Designation	6
5 Information to be supplied by the purchaser	7
5.1 Mandatory information	7
5.2 Non-mandatory information	7
5.3 Example of an order	7
6 Production process	7
7 Requirements	7
7.1 General	7
7.2 Quality management system	8
7.3 Method of delivery	8
7.4 Delivery condition	8
7.5 Chemical composition	8
7.6 Mechanical properties	9
7.7 Hardenability requirements	9
7.8 Microstructure	9
7.9 Internal soundness	10
7.10 Surface quality	10
7.11 Decarburization	11
7.12 Corrosion resistance of stainless steels	12
8 Dimensions and tolerances on dimensions and shape	12
9 Testing	12
9.1 Types and contents of inspection documents	12
9.2 Extension of inspection	12
9.3 Specific inspection and testing	13
10 Test methods	14
10.1 Mechanical tests	14
10.2 Verification of hardenability	15
10.3 Upsetting test	15
10.4 Determination of the depth of decarburization	15
10.5 Retests, sorting and reprocessing	16
11 Marking	16
12 Packaging	16
13 Protection	16
14 Complaints after delivery	17
15 Options	17
Annex A (informative) List of the national standards corresponding to the EURONORMS referred to	21
Annex B (normative) Supplementary or special requirements	22

Annex C (normative) Determining the non-metallic inclusion content.....	25
Annex D (informative) Dimensional standards applicable to products complying with this European Standard.....	27

Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 15, Wire-rod - Qualities, dimensions, tolerances and specific tests, the Secretariat of which is held by UNI.

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 December 2001, and conflicting national standards shall be withdrawn at the latest by December 2001.

This European Standard EN 10263 is subdivided as follows:

- *Part 1: General technical delivery conditions;*
- *Part 2: Technical delivery conditions for steels not intended for heat treatment after cold working;*
- *Part 3: Technical delivery conditions for case hardening steels;*
- *Part 4: Technical delivery conditions for steels for quenching and tempering;*
- *Part 5: Technical delivery conditions for stainless steels.*

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

1 Scope

1.1 This part of EN 10263 specifies the general technical delivery conditions for round rod, round bars and wire for cold heading and cold extrusion made of:

- a) non alloy steels not intended for heat treatment after cold working, as specified in EN 10263-2;
- b) non alloy and alloy steels for case hardening as specified in EN 10263-3;
- c) non alloy and alloy steels for quenching and tempering as specified in EN 10263-4;
- d) stainless steels as specified in EN 10263-5.

1.2 Parts 2, 3 and 4 of this EN 10263 cover products having a diameter up to and including 100 mm.

Part 5 covers products having a diameter up to and including:

- 25 mm for ferritic and austenitic-ferritic steels;
- 50 mm for austenitic steels;
- 100 mm for martensitic steels.

1.3 In special cases supplementary requirements or deviations with respect to this European Standard may be agreed between the purchaser and the supplier at the time of enquiry and order (see annex B).

1.4 The general technical delivery conditions in EN 10021 also apply to products supplied in accordance with this European Standard

2 Normative references

This European Standard incorporates by dated or undated reference, 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 (including amendments).

EN 10002-1	<i>Metallic materials — Tensile testing — Part 1: Method of test (at ambient temperature).</i>
EN 10020	<i>Definitions and classification of grades of steel.</i>
EN 10021	<i>General technical delivery requirements for steel and iron products.</i>
EN 10027-1	<i>Designation system for steels — Part 1: Steel names, principal symbols.</i>
EN 10027-2	<i>Designation system for steels — Part 2: Numerical system.</i>
EN 10052	<i>Vocabulary of heat treatment terms for ferrous products.</i>
EN 10079	<i>Definition of steel products.</i>
EN 10088-1	<i>Stainless steels — Part 1: List of stainless steels.</i>
EN ISO 6508-1	<i>Metallic material — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T).</i>
EN 10204	<i>Metallic products — Types of inspection documents.</i>
EN 10221	<i>Surface quality classes for hot-rolled bars and rods — Technical delivery conditions.</i>
ENV 10247	<i>Micrographic examination of the inclusion content of steels using standard pictures.</i>

EN ISO 377	<i>Steel and steel products — Location and preparation of samples and test pieces for mechanical testing.</i>
EN ISO 642	<i>Steel — Hardenability test by end quenching (Jominy test).</i>
EN ISO 3651-2	<i>Determination of resistance to intergranular corrosion of stainless steel — Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in media containing sulfuric acid.</i>
EN ISO 9002	<i>Quality systems — Model for quality assurance in production, installation and servicing.</i>
CR 10260	<i>Designation systems for steel: Additional symbols.</i>
CR 10261	<i>Iron and steel — Review of available methods of chemical analysis.</i>
prEN 10060 ¹⁾	<i>Hot rolled round steel bars. Dimensions and tolerances on shape and dimensions.</i>
prEN ISO 14284 ¹⁾	<i>Steel and iron — Sampling and preparation of samples for the determination of chemical composition.</i>
prEN 10168 ¹⁾	<i>Iron and steel products — Inspection documents — List of information and description.</i>
EURONORM 103 ²⁾	<i>Micrographic determination of austenitic or ferritic grain size of steel.</i>
EURONORM 104 ²⁾	<i>Determination of depth of decarburization of non alloy and low alloy mechanical steel.</i>

3 Terms and definitions

For the purpose of this standard the definitions in EN 10020, EN 10021, EN 10052, EN 10079, EN ISO 377, and prEN ISO 14284 apply.

4 Classification and designation

4.1 Classification

The classification of the steel grades covered by this European Standard according to EN 10020 is indicated in clause 4.1 of Parts 2, 3, 4 and 5 of this standard for the corresponding steel grades.

4.2 Designation

4.2.1 Steel names

For the steel grades covered by this European Standard, the steel names as given in the relevant tables of Parts 2,3,4 and 5 of this standard are allocated in accordance with EN 10027-1 and CR 10260

4.2.2 Steel numbers

For the steel grades covered by this European Standard, the steel numbers as given in the relevant tables of Parts 2,3,4 and 5 of this standard are allocated in accordance with EN 10027-2.

¹⁾ In preparation, until this document is published as European Standard, the corresponding national standard should be agreed at the time of enquiry and order.

²⁾ Until this EURONORM is transformed into a European Standard, this EURONORM or a corresponding national standard may be applied, depending on the agreement at the time of ordering (see annex A).

5 Information to be supplied by the purchaser

5.1 Mandatory information

The following information shall be supplied by the purchaser at the time of enquiry and order, to enable the supplier to comply satisfactorily with the requirements of this European Standard:

- a) quantity to be delivered;
- b) product denomination (rod or bar or wire);
- c) the relevant European Standard or EURONORM specifying the dimensions (see clause 8);
- d) the nominal diameter of the products;
- e) length for bars and dimensions and mass for the coils;
- f) reference to this European Standard including the number of the relevant part(s);
- g) steel name or steel number (see 4.2);
- h) indication of the delivery condition (see 7.4.1);
- i) surface quality (see 7.10);
- j) where applicable, indication of the symbol for hardenability requirements (see 7.7);
- k) type of inspection and inspection document in accordance with EN 10021 and EN 10204 respectively (see 9.1).

5.2 Non-mandatory information

Supplementary requirements among the following may be specified by the purchaser at the time of enquiry and order. If a supplementary requirement is not specified, all decisions regarding it shall be left to the manufacturer's discretion:

- a) where applicable, indication of any additional requirement, by reference to the corresponding clause number of annex B;
- b) verification of hardenability by calculation (see 7.7);
- c) special surface treatment (see 7.4.3);
- d) packaging (see 12);
- e) protection during transport and handling (see 13).

5.3 Example of an order

100 t bars in accordance with Part 4 of this European Standard, with a diameter of 50 mm and length of 6 000 mm in accordance with prEN 10060, made of steel grade 32CrB4 (1.7076) spheroidized and cold drawn, with a 3.1.B inspection certificate in accordance with EN 10204.

100 t – Bars – prEN 10060 - 50 x 6000 – EN 10263-4 - 32CrB4+AC+C - EN 10204 3.1.B

6 Production process

Unless the production process is agreed at the time of ordering, it is left to the discretion of the manufacturer.

7 Requirements

7.1 General

The manufacturer is responsible, using the means he thinks fit, for controlling his production from the point of view of the various quality criteria specified. In view of the fact that it is difficult to inspect coils of rod or wire apart from at the ends of the coils delivered, it cannot be proved that no value outside the specified limits is to be found in the coil of rod or wire as a whole. The means and procedures adopted by the manufacturer for controlling his production shall be in conformity with his quality assurance scheme (see 7.2).

Statistical evaluation of performances may be agreed between the manufacturer and the purchaser at the time of enquiry and order.

7.2 Quality management system

The manufacturer should have a quality management system corresponding at least to EN ISO 9002.

7.3 Method of delivery

The products covered by Parts 2 to 5 of this European Standard shall be delivered by heat or fraction thereof.

7.4 Delivery condition

7.4.1 Basic delivery condition

Rod, bars and wire shall be supplied in one of the delivery conditions, that has been agreed at the time of ordering, as indicated in Table 1 of EN 10263-2:2001 to EN 10263-5:2001.

7.4.2 Summary of combinations of delivery conditions, product forms and corresponding requirements

A summary of customary delivery conditions and product forms and of the corresponding requirements concerning chemical composition, mechanical properties and, where applicable, hardenability is given in Table 1 of EN 10263-2:2001 to EN 10263-5:2001.

7.4.3 Surface treatment

Any surface treatment that can facilitate subsequent cold heading and cold extrusion or partially delay any formation of rust shall be subject of an agreement at the time of ordering.

The above treatment can include e.g. descaling, treatment with lime and/or phosphate.

7.5 Chemical composition

7.5.1 Heat analysis

7.5.1.1 The chemical composition of steel on heat analysis shall be in conformity with the values specified in Table 2 of EN 10263-2:2001, in Table 2 of EN 10263-3:2001, in Tables 2 and 3 of EN 10263-4:2001 and in Table 2 of EN 10263-5:2001, as appropriate to the steel grade concerned.

7.5.1.2 In cases where steels for case hardening or for quenching and tempering are ordered with designations as quoted in Tables 7 and 8 of EN 10263-3:2001 and in Tables 7 to 9 of EN 10263-4:2001, which involves conformity with hardenability requirements according to the Jominy test, such hardenability requirements shall be considered as the governing criterion so far as acceptance is concerned.

In such cases, a deviation of the heat analysis with respect to the values indicated in Table 2 of EN 10263-3:2001 and in Tables 2 and 3 of EN 10263-4:2001 is admissible, taking into account the prescriptions given in footnote 2 of those tables. In any case however, the deviations in the product analysis in relation to the specified limits of cast analysis shall not exceed the values indicated in Table 3 of EN 10263-3:2001 and in Table 4 of EN 10263-4:2001.

7.5.2 Product analysis

The purchaser can specify at the time of enquiry and order that the chemical composition on product analysis be verified. In this case reference should be made to B.2.

The permissible deviations in the product analysis in relation to the specified limits of cast analysis (see 7.5.1) are indicated in Table 3 of EN 10263-2:2001, in Table 3 of EN 10263-3:2001, in Table 4 of EN 10263-4:2001 and in Table 3 of EN 10263-5:2001.

7.6 Mechanical properties

The mechanical properties of products covered by this European Standard shall meet the prescriptions stated in clause 6.3 of EN 10263-2:2001, EN 10263-3:2001, EN 10263-4:2001 and EN 10263-5:2001.

7.7 Hardenability requirements

7.7.1 General

Products cannot be ordered and supplied according to both end quench test hardenability requirements and core hardening requirements

7.7.2 End quench (Jominy test) hardenability requirements

In cases where a product is ordered with reference to a steel grade the designation of which is quoted in Tables 7 and 8 of EN 10263-3:2001 or in Tables 7 to 9 of EN 10263-4:2001, the product shall meet the hardenability requirements indicated in those tables.

7.7.3 Core hardening requirements

In cases where a product is ordered with reference to a steel grade the designation of which is quoted in Table 10 of EN 10263-4:2001, core hardening properties shall meet the requirements indicated in the relevant tables.

At least 90 % of the structure shall be martensite.

In cases of dispute regarding supplies of products with diameters larger than those quoted in Table 10 of EN 10263-4:2001, samples to be tested shall be brought to the corresponding dimensions indicated in that table by hot working or forging, taking into account the requirements of EN ISO 642.

7.7.4 Hardenability by calculation

A verification of hardenability by calculation may be agreed at the time of ordering. In this case the method of calculation should also be agreed.

7.8 Microstructure

7.8.1 Austenitic grain size

Unless otherwise specified at the time of enquiry and order, the choice of the austenitic grain size is left to the manufacturer's discretion. If a fine grain steel is requested for steels of EN 10263-3:2001 and of EN 10263-4:2001, reference shall be made to B.3.

7.8.2 Carbide spheroidization

For steels covered by Parts 2, 3 and 4 of this European Standard, in cases where carbide spheroidization is requested, reference shall be made to B.4.

7.8.3 Non-metallic inclusions

See B.5.

7.9 Internal soundness

7.9.1 Rod, bars and wire shall be free from internal defects that might be prejudicial to cold heading or to cold extrusion or during proper quench hardening, therefore having an adverse effect on the product.

7.9.2 Requirements concerning internal soundness can be agreed at the time of enquiry and order, e.g. with reference to non-destructive tests (see B.6).

7.10 Surface quality

7.10.1 General

The surface quality requirements for steels of Parts 2, 3 and 4 of this European Standard are as follows. Those for steels of Part 5 are given in that part.

7.10.2 Hot rolled products

7.10.2.1 Rod shall meet surface quality requirements according to EN 10221 class E.

7.10.2.2 Bars shall meet surface quality requirements according to EN 10221 class D. Compliance with surface quality according to EN 10221 class E may be agreed at the time of enquiry and order. When the diameter of the product is greater than the maximum diameter specified in EN 10221, for the surface quality class concerned, the maximum permissible depth of surface defects on the product shall not be greater than that specified for this maximum diameter.

7.10.3 Cold drawn products

Depending on the starting material for cold drawn products the same requirements apply as specified in 7.10.2.1 and 7.10.2.2 respectively.

For diameters less than 5 mm, the permissive depth of surface defects shall be reduced in proportion to the reduction of the diameter during cold drawing.

7.10.4 Upsetting test

The upsetting test is applicable to coiled products and by agreement to bars.

The absence of cracks on the test piece after it has been submitted to the upsetting test shall be considered as evidence that the product concerned is free from surface defects. Marks appearing on the test piece after the test as a result of guide marks shall not be considered as defects.

For the test method see 10.3.

The inspection unit shall be "C+D+T" [see footnote a) to Table 2].

A test piece shall be taken from each sample.

NOTE Normally the upsetting test is not carried out on the stainless steel products covered by Part 5 of this European Standard.

7.10.5 Removal of surface defects and imperfections

Removal of surface defects and imperfections is permitted only after approval from the purchaser.

Until the time of publication of a European Standard on this subject, the admissible depth of removal of defects and imperfections and the corresponding method of removal shall be the subject of an agreement at the time of enquiry and order.

7.11 Decarburization

Independently of their heat treatment condition, rod and bars with as-rolled surface of steels specified in Table 2 of EN 10263-3:2001 and in Tables 2 and 3 of EN 10263-4:2001 and wire shall be free from zones of total decarburization.

For bars annealed in a atmosphere which is not controlled the depth of decarburization shall be agreed at the time of enquiry and order.

Partial decarburization (ferrite-pearlite) is admissible provided that it does not exceed the limits indicated in Figure 1. For diameters ≤ 10 mm the maximum admissible depth of decarburization is 0,07 mm; for diameters greater than 10 mm the diagram corresponds to the following formula:

$$E = 0,007 d \quad \text{mm}$$

where d = diameter.

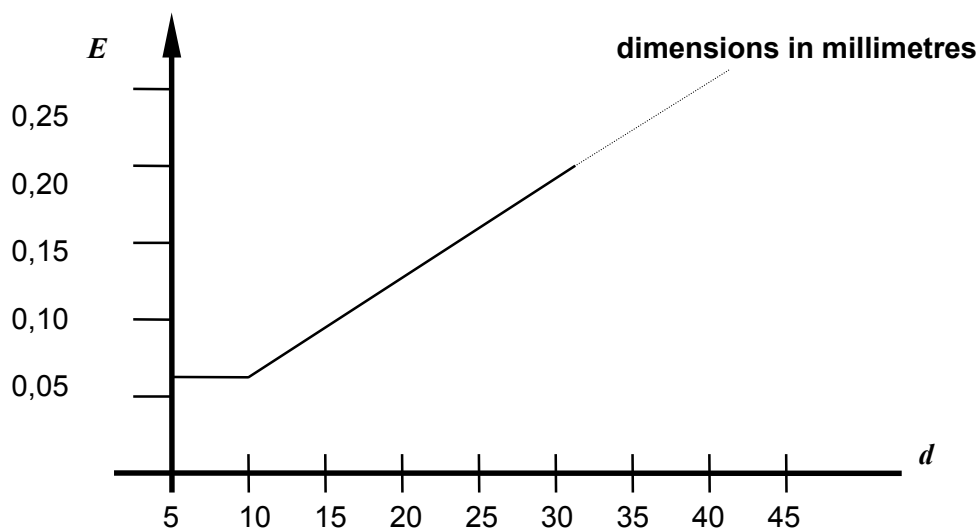


Figure 1 — Admissible limits of depth of Partial decarburization

For cold drawn products with diameters greater than 5 mm, the limits of decarburization shall be the same as those for hot-rolled products.

For cold drawn products with diameter less than 5 mm, the permissible depth of decarburization shall be reduced in function of the reduction of the diameter during the cold drawing.

If in special cases the purchaser requests other values for partial decarburization, those values shall be agreed at the time of enquiry and order with reference to B.7.

7.12 Corrosion resistance of stainless steels

Tests for the determination of corrosion resistance of stainless steels covered by Part 5 of this European Standard may be agreed at the time of enquiry and order. In this case reference should be made to B.8.

8 Dimensions and tolerances on dimensions and shape

The nominal dimensions and tolerances on dimensions and shape for the product shall be agreed at the time of enquiry and order, wherever possible with reference to the dimensional standards applicable (see annex D).

9 Testing

9.1 Types and contents of inspection documents

9.1.1 Products complying with this European Standard shall be ordered and delivered with one of the inspection documents as specified in EN 10204. The type of document shall be agreed upon at the time of enquiry and order.

9.1.2 If in accordance with the agreements made at the time of enquiry and order, an inspection certificate or inspection report is to be issued, the specific tests described in 9.2 shall be carried out and the results shall be recorded in the inspection document.

In addition the inspection document shall contain the following information:

- a) the results of the cast analysis carried out by the manufacturer for the elements specified in the relevant tables of Parts 2,3 ,4 and 5 of this European Standard for the steel grade concerned;
- b) the results of inspection and tests ordered in relation to supplementary requirements (see annex B);
- c) the symbols, letters or numbers relating the inspection documents, test pieces and products to each other.

9.2 Extension of inspection

If a specific test report or an inspection certificate or an inspection report is requested in the order, the inspection shall be carried out in accordance with Table 1.

Table 1 — Extension of inspection

Type of test	Products not intended for heat treatment, see EN 10263-2	Products for case hardening, see EN 10263-3	Products for quenching and tempering, see EN 10263-4	Stainless steel products, see EN 10263-5
Heat analysis	+	+	+	+
Product analysis	o	o	o	o
Mechanical properties	+	o	o	o
End quench hardenability test	—	o	o	—
Core hardening requirements	—	—	o	—
Austenitic grain size	—	o	o	—
Carbide spheroidization	o	o	o	—
Non-metallic inclusions	—	o	o	—
Surface defects	o	o	o	o
Surface decarburization	—	o	o	—
Corrosion resistance	—	—	—	o
+ = is carried out. — = is not carried out. o = is carried out only if it is agreed at the time of the ordering.				

9.3 Specific inspection and testing

9.3.1 Verification of hardenability and mechanical properties

Verification of hardenability or mechanical properties shall only be carried out in cases where the order is accompanied by a request for an inspection certificate or an inspection report, provided that the relevant requirements are applicable according to the indication given in Table 1 of EN 10263-2:2001, EN 10263-3:2001, EN 10263-4:2001 or EN 10263-5:2001.

9.3.1.1 Verification of mechanical properties

Verification of the mechanical properties shall be carried out in the specified delivery condition (see Table 1 of EN 10263-2:2001, EN 10263-3:2001, EN 10263-4:2001 or EN 10263-5:2001).

9.3.1.2 Verification of hardenability by end quench test (Jominy test)

In cases where products are ordered with reference to a steel grade the designation of which includes one of the symbols +H, +HH, +HL, compliance with hardenability test requirements shall be verified by the end quench test (Jominy test) in accordance with the prescriptions given in Tables 7 and 8 of EN 10263-3:2001 and in Tables 7 to 9 of EN 10263-4:2001.

9.3.1.3 Verification of compliance with core hardening requirements

In cases where products are ordered with reference to a steel grade the designation of which includes the symbol +CH, compliance with core hardening requirements shall be verified in accordance with the prescriptions given in Table 10 of EN 10263-4:2001.

9.3.1.4 Number and frequency of tests

The number and frequency of tests, the conditions for sampling and sample preparation and the test methods to be used for the verification of compliance with the various requirements are given in Table 2.

9.3.2 Dimensional inspection

A sufficient number of products shall be inspected to ensure compliance with the relevant specifications.

10 Test methods

10.1 Mechanical tests

10.1.1 Tensile test

The tensile test shall be carried out as described in EN 10002-1. For the location of test pieces for the tensile test see Figure 2.

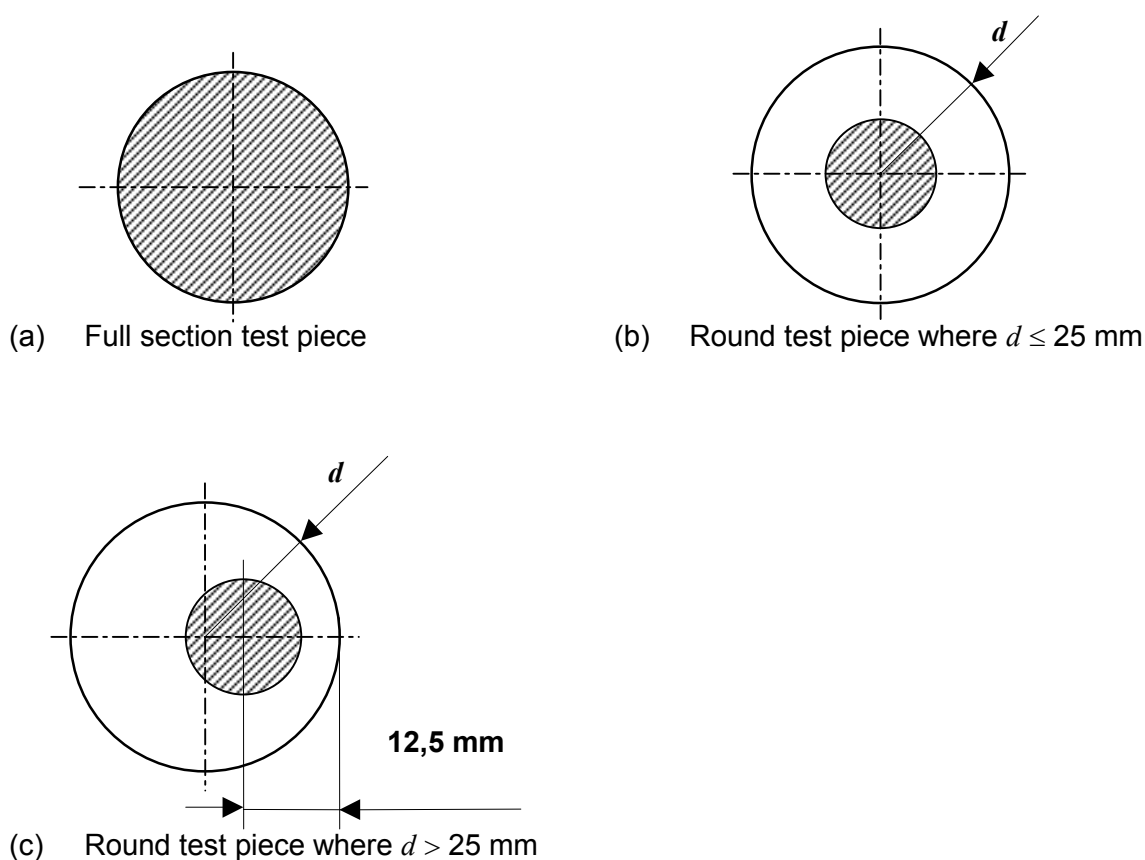


Figure 2 — Location of test piece for the tensile test

10.1.2 Hardness test

The Rockwell hardness test shall be carried out according to EN ISO 6508-1.

10.2 Verification of hardenability

10.2.1 End quench test (Jominy test)

The end quench test shall be carried out according to EN ISO 642 (see also Table 2, columns 6a and 7a).

10.2.2 Core hardening requirements

For the test piece to be used see Table 2, column 6a.

The test piece shall be heated in a furnace with neutral or reducing atmosphere up to the temperatures indicated in Table 10 of EN 10263-4:2001. It shall be maintained at that temperature until complete austenitizing takes place.

It shall then be removed from the furnace and quenched immediately in a quenching oil with high cooling capacity until a full equilibrium of temperature is reached, the temperature of the quenching bath being about 50 °C and the rate of movement of the test piece being about 0,25 m/sec. The test piece shall then be notched at its midpoint in a direction perpendicular to its longitudinal axis and then broken. One of the fracture surfaces shall be polished (care should be taken to prevent excessive local heating).

The Rockwell hardness at the centre of the fracture surface shall then be determined according to EN ISO 6508-1.

10.3 Upsetting test

10.3.1 Non-alloy and alloy steel grades (except stainless steels)

Unless otherwise agreed at the time of ordering, for the upsetting test straight test pieces shall be taken from the relevant samples. The surfaces of the end sections of the above test pieces shall be flat and parallel to each other and their initial length (height) shall be $h = 1,5 d$, where d is the test piece diameter.

During the test the length (height) of the test piece shall be reduced to 1/3 of its initial value.

10.3.2 Stainless steel grades

The requirements given in Part 5 of this European Standard shall apply.

10.4 Determination of the depth of decarburization

Testing for decarburization shall be carried out in accordance with EURONORM 104 with the following exceptions.

Decarburization is inspected by microscope on a transverse metallographic test piece suitably etched, with a magnification of X 200.

The depth of decarburization of the sample is considered as being the average of 8 measurements at the ends of 4 diameters located at 45° to each other, starting from the zone of maximum decarburization and avoid starting from a defective zone. In the calculation of the above average

value, any measuring point of the seven remaining situated in a local surface defect shall not be taken into account in the calculation.

In cases of dispute, the depth of decarburization shall be determined by microhardness measurements (HV 0,3) along 4 diameters located at 45° to each other, on test pieces submitted to quenching in conformity with the indications given in the various tables regarding hardenability test, included in Parts 3 and 4 of this European Standard. The depth of decarburization is considered as being the average of the eight values $e_1, e_2, e_3, \dots$ (see Figure 3) which correspond to the distances between the surface and the nearest point on the hardness curve for which the hardness value is found to be equal to 80 % of the maximum hardness value in the zone adjacent to the decarburized zone (see Figure 3). Any measuring point situated in a local surface defect shall not be taken into consideration.

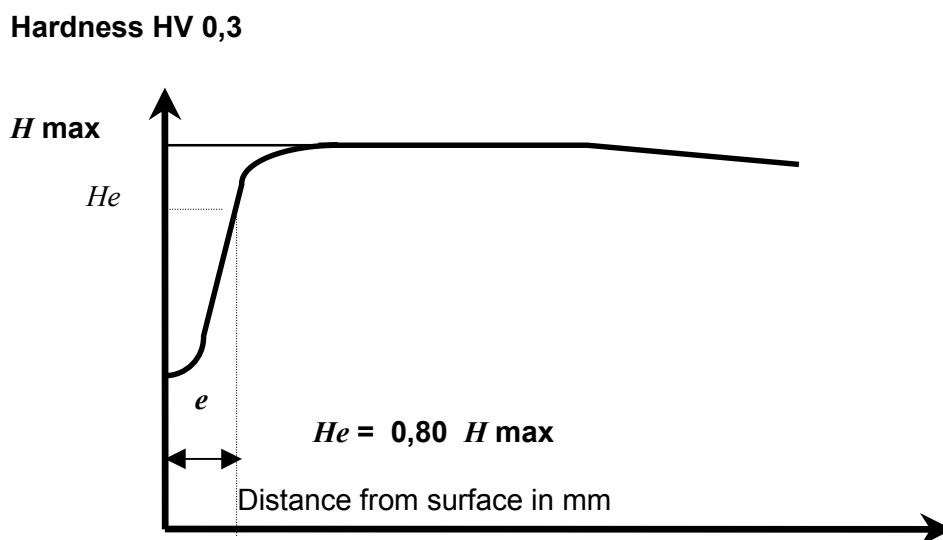


Figure 3 — Determination of the depth of decarburation (see B.7)

10.5 Retests, sorting and reprocessing

EN 10021 shall apply.

11 Marking

The manufacturer shall mark the products or the bundles or coils in a suitable way so that it is possible to identify the manufacturer's name or symbol, the heat, the nominal diameter and the steel grade.

For any special or additional marking see B.9.

12 Packaging

The diameter and the mass of the coil and the method of packaging of the product to be delivered shall be agreed during the ordering.

13 Protection

Any surface protection may be agreed at the time of enquiry and order.

14 Complaints after delivery

With regard to any claims and action arising therefrom, EN 10021 shall apply.

15 Options

See annex B.

Table 2 — Test conditions for the verification of the requirements given in column 2

Type of requirements			Inspection unit ^a	Number and frequency of tests		Sampling and sample preparation	Test procedure and method to be used	Line	Supplement to sampling and test procedure	
	see part	see Table		Number of sample per inspection unit	Number of test piece taken from each sample	(see line T1 and line...in the supplement to this table)			Sampling and sample preparation	Test procedure and method to be used
Chemical composition	2 3 4 5	2 2 2-3 2	C	The cast analysis is given by the manufacturer For the possible product analysis see clause B.2 of annex B				T1	The general conditions and preparation of samples and test piece shall be in accordance with prEN ISO 14284	
Mechanical properties in the delivery condition prescribed	2 3 4 5	4 4-5-6 5-6 4-5-6-7	C + D + T	1 for each 15 t with a maximum of 3 tests	1	T2		T2	-Products with <i>d</i> > 25 mm: The sample for the tensile test shall be taken in conformity with the indication given in Figure 2 The test piece shall be prepared according to the prescriptions of EN 10002-1 -Products with <i>d</i> ≤ 25 mm: The sample for the tensile test shall be submitted to test without preliminary machining	In accordance with EN 10002-1

Table 2 (continued)

Type of requirements			Inspection unit ^a	Number and frequency of tests		Sampling and sample preparation	Test procedure and method to be used	Line	Supplement to sampling and test procedure	
	see part	see Table		Number of sample per inspection unit	Number of test piece taken from each sample	(see line T1 and line...in the supplement to this table)			Sampling and sample preparation	Test procedure and method to be used
End quench hardenability	3 4	7-8 7-8-9	C	1	1	T3		T3	-Jominy test: The test piece shall be obtained by machining from the samples with $d \leq 40$ mm. Depending on the agreements made at the time of ordering the samples shall be taken from the product concerned, or the billet or bloom originating from the same cast. In the absence of such agreements the origin of the sample is left to the manufacturer's discretion. The sample shall be obtained by hot rolling or hot forging.	EN ISO 642

Table 2 (*continued*)

Type of requirements			Inspection unit ^a	Number and frequency of tests		Sampling and sample preparation	Test procedure and method to be used	Line	Supplement to sampling and test procedure	
	see part	see Table		Number of samples per inspection unit	Number of test piece taken from each sample	(see line T1 and line...in the supplement to this table)			Sampling and sample preparation	Test procedure and method to be used
Core hardening	4	10	C	1	1	T4		T4	The diameter of the test piece shall, if possible, be the maximum indicated in Table 10 of EN 10263-4:2001. Sampling and sample preparation is left to the manufacturer's discretion, taking into account the indications concerning the test piece for the End Quench test (Jominy test) (see EN ISO 642). The length of the test piece shall be greater than or equal to four times its diameter.	See 10.2.2

^a The tests shall be carried out separately for each heat (indicated by “C”), for each dimension (indicated by “D”) and for each treatment batch (indicated by “T”). Rod, bars and wire for which the ratio of nominal section does not exceed 3 : 1 may be grouped in a single test unit. In cases where heat treatment is performed as a continuous process the symbol “T” denotes that the tests are to be carried out for each 25 t or fraction thereof.

Annex A
(informative)

List of the national standards corresponding to the EURONORMS referred to

Either the EURONORMS referred to or the corresponding national standards given in Table A.1 may be applied until they are transformed into European Standards.

Table A.1 — EURONORMS and corresponding national standards

EURONORM EN/prEN	Corresponding standard in:					
	GERMANY DIN	FRANCE NF	UNITED KINGDOM BS	SPAIN UNE	ITALY UNI	SWEDEN SIS
103	50601	A 04-303	4490	7279	3150	-
104	50192	A 04-201	6617/1	7317/1	4839	11 70 20

Annex B
(normative)

Supplementary or special requirements

B.1 General

One or more of the following supplementary or special requirements may be agreed upon at the time of enquiry and order. The details of these requirements may be agreed upon between the manufacturer and the purchaser at the time of enquiry and order if necessary.

B.2 Product analysis

One product analysis shall be carried out per heat for the determination of elements for which values are specified for the heat analysis of the steel grade concerned in the corresponding part of this standard.

Sampling shall be carried out as specified in prEN ISO 14284. Further details concerning sampling and sample preparation and the method of analysis to be used may be agreed at the time of enquiry and order. In cases of dispute, the method used shall be agreed if possible with reference to the corresponding European Standards or EURONORMS.

For the EURONORMS or European Standards which are now available in the field of chemical analysis of iron and steel, see CR 10261.

B.3 Fine grain steel

This requirement is applicable to products covered by EN 10263-3:2001 and EN 10263-4:2001.

B.3.1 Case hardening steels (EN 10263-3)

The steel when tested in accordance with one of the methods described in EURONORM 103 shall show an austenitic grain size of 5 or finer. The grain structure shall be considered satisfactory if 70 % of the area is within the specified size limits.

B.3.2 Steels for quenching and tempering (EN 10263-4)

When tested in accordance with EURONORM 103, the steel shall have an austenitic grain size of 5 or finer. If specific testing is ordered, it shall also be agreed whether this grain size requirement is to be verified by determining the aluminium content or micrographically.

In the first case, the aluminium content shall also be agreed.

In the second case, one test piece per cast shall be inspected for the determination of the austenitic grain size.

Sampling and samples preparation shall be as specified in EURONORM 103.

Unless otherwise agreed at the time of enquiry and order, the quenched grain size shall be determined.

Hardening shall be carried out under the following conditions for the purpose of determining the quenched grain size:

- for steel with a minimum carbon content $< 0,35 \%$: $(880 \pm 10) ^\circ\text{C}$, 90 min/water;
- for steels with a minimum carbon content $\geq 0,35 \%$: $(850 \pm 10) ^\circ\text{C}$, 90 min/water.

In cases of dispute, pre-treatment at 1 150 °C for 30 min/air shall be carried out in order to produce a uniform initial condition.

B.4 Carbide spheroidization

This requirement is applicable to products covered by Parts 2, 3 and 4 of this European Standard, when ordered in the heat treatment conditions “+AC”, “+AC+PE”, “+U+AC”, “+U+C+AC”, “+U+C+AC+LC”, “+AC+C”, as defined in Table 1 of the above Parts 2, 3 and 4.

NOTE It should be kept in mind that as the carbon content decreases it becomes more difficult to obtain spheroidized cementite.

The cross-section of each test piece shall be prepared, polished and then etched by means of a suitable solution.

The degree of spheroidization of cementite shall be verified by means of a microscopic examination of the section, normally with a magnification of X 500.

If so agreed at the time of ordering, the degree of spheroidization shall be assessed with reference to an agreed series of standard images.

B.5 Non-metallic inclusion content

This requirement is applicable to products covered by Parts 3 and 4 of this European Standard.

The microscopically determined non-metallic inclusion content shall be within agreed limits when tested according to a procedure to be agreed at the time of enquiry and order (see annex C).

NOTE The requirements for non-metallic inclusion content apply in every case, however, proof requires a special agreement.

B.6 Internal soundness

This testing requirement is applicable only to bar products covered by EN 10263-2:2001, EN 10263-3:2001, EN 10263-4:2001 or EN 10263-5:2001.

The products shall be submitted to non-destructive testing in order to prove their conformity with the internal soundness requirements agreed at the time of enquiry and order.

The inspection unit and the corresponding number of samples and test pieces are to be agreed at the time of enquiry and order.

The products shall be tested in accordance with a method to be agreed upon at the time of enquiry and order and to acceptance criteria also to be agreed upon at the time of enquiry and order.

B.7 Special limits for decarburization

This requirement is applicable to products covered by 10263-3:2001 and EN 10263-4:2001.

Values below those indicated in Figure 3 for partial decarburization are to be agreed at the time of enquiry and order.

The inspection unit and the corresponding number of samples and test pieces are also to be agreed at the time of enquiry and order.

For the method of determination of the depth of decarburization see 10.4.

B.8 Corrosion resistance of stainless steel products

This requirement is applicable to products covered by EN 10263-5:2001.

The resistance to intergranular corrosion shall be tested in accordance with EN ISO 3651-2. The definition of a degree of corrosion resistance for the products concerned shall be agreed at the time of enquiry and order.

The inspection unit and the corresponding number of samples and test pieces are to be agreed at the time of enquiry and order.

B.9 Special or additional marking

The products shall be marked in a way specially agreed at the time of enquiry and order.

Annex C (normative)

Determining the non-metallic inclusion content

C.1 For the microscope determination of the non-metallic inclusions in special steels, agreement may be reached at the time of enquiry and order on a test in accordance with one of the following standards.

ENV 10247 *Micrographic examination of the inclusion content of steels using standard pictures.*

DIN 50602 *Metallographic test method; microscopic examination of special steels using standard diagrams to assess the content of non-metallic inclusions.*

NF A 04-106 *Iron and steel — Methods for the determination of the non-metallic inclusion content of steel Part 2: Microscopic methods with standard series.*

NOTE ISO 4967-1979, *Steel — Determination of non-metallic inclusions — Microscopic method using standard diagrams*, is identical to NF A 04-106.

SS 11 11 16 *Steel — Methods for assessment of the content of non-metallic inclusions — Microscopic methods — Jernkontoret's inclusion chart II for the assessment of non-metallic inclusions.*

C.2 The following requirements are applicable.

C.2.1 If evidence is provided in accordance with DIN 50602, the requirements specified in Table C.1 apply.

C.2.2 If evidence is provided in accordance with NF A 04-106, the requirements specified in Table C.2 apply.

C.2.3 If evidence is provided in accordance with SS 11 11 16, the requirements specified in Table C.3 apply.

C.2.4 In case where ENV 10247 is used for testing the non-metallic inclusion content the method of assessment and the requirements shall be defined at the time of enquiry and order.

Table C.1 — Requirements for microscopic degree of purity when tested in accordance with DIN 50602 (method K) (valid for oxidic non-metallic inclusions)

Bars diameter d mm	Total characteristic value for an individual cast K (oxides)
$70 < d \leq 100$	$K \leq 40$
$35 < d \leq 70$	$K \leq 35$
$17 < d \leq 35$	$K \leq 40$
$8 < d \leq 17$	$K \leq 30$
$d \leq 8$	$K \leq 35$

Table C.2 — Requirements for microscopic degree of purity when tested in accordance with AFNOR NF A 04-106

Inclusion type	Series	Limiting values
Type B	fine	≤ 3
	thick	≤ 2
Type C	fine	≤ 1
	thick	≤ 1
Type D	fine	≤ 2
	thick	≤ 1

Table C 3 — Requirements for microscopic degree of purity when tested in accordance with SS 11 11 16

Inclusion type	Series	Limiting values
Type B	fine	≤ 4
	medium	≤ 3
	thick	≤ 2
Type C	fine	≤ 4
	medium	≤ 3
	thick	≤ 2
Type D	fine	≤ 4
	medium	≤ 2
	thick	≤ 1

Annex D
(informative)

Dimensional standards applicable to products complying with this European Standard

EN 10218-2	<i>Steel wire and wire products — General — Part 2: Wire dimensions and tolerances.</i>
prEN 10060 ¹⁾	<i>Hot rolled round steel bars — Dimensions and tolerances on shape and dimensions.</i>
prEN 10017 ¹⁾	<i>Non alloy steel rod for drawing and/or cold rolling — Dimensions and tolerances.</i>
PrEN 10108	<i>Round steel wire rod for cold formed nuts and bolts — Dimensions and tolerances.</i>

¹⁾ In preparation, until this document is published as European Standard, the corresponding national standard should be agreed at the time of enquiry and order.

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