

# Non-alloy steel rods for drawing and/or cold rolling —

## Part 4: Specific requirements for rod for special applications

The European Standard EN 10016-4:1994 has the status of a  
British Standard

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee ISE/71, Steel rod for wire drawing, upon which the following bodies were represented:

- British Steel Industry
- British Steel Industry (Wire Section)
- Process Plant Association
- Welding Manufacturers' Association (BEAMA Ltd.)

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# National foreword

This British Standard has been prepared by Technical Committee ISE/71 and is the English language version of EN 10016-4:1994, *Non-alloy steel rod for drawing and/or cold rolling — Part 4: Specific requirements for rod for special applications*, published by the European Committee for Standardization (CEN).

### Cross-references

Publication referred to	Corresponding British Standard
EN 10020:1988	BS EN 10020:1991 <i>Definition and classification of grades of steel</i>

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### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 6, an inside back cover and a back cover.

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

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Descriptors: Iron and steel products, unalloyed steels, wire drawing, cold rolling, wire rod, chemical composition, grades: quality defects, inspection, mechanical properties

English version

## Non-alloy steel rod for drawing and/or cold rolling — Part 4: Specific requirements for rod for special applications

Fil machine en acier non allié destiné au  
tréfilage et/ou au laminage à froid —  
Partie 4: Prescriptions spécifiques au fil  
machine pour applications particulières

Walzdraht aus unlegiertem Stahl zum Ziehen  
und/oder Kaltwalzen —  
Teil 4: Besondere Anforderungen an  
Walzdrahte für Sonderanwendungen

This European Standard was approved by CEN on 1994-11-10. 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.

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# CEN

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

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

Foreword

This European Standard EN 10016 is subdivided as follows:

- *Part 1: General requirements;*
- *Part 2: Specific requirements for general purpose rod;*
- *Part 3: Specific requirements for rimmed and rimmed substitute for low carbon steel rod;*
- *Part 4: Specific requirements for rod for special applications.*

This European Standard has been drawn up by ECISS/TC 15, Wire-rod — Qualities, dimensions, tolerances and specific tests, whose Secretariat is held by UNI/UNSIDER.

Parts 1, 2, 3 and 4 of this European Standard replace:  
EURONORM 16(1987), *Non alloy steel wire rod for cold drawing and/or cold rolling.*

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 June 1995, and conflicting national standards shall be withdrawn at the latest by June 1995.

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

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## 1 Scope

This Part of this European Standard defines rod with improved characteristics intended for drawing and/or cold rolling.

## 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.

EN 10016/1, *Non-alloy steel rod for drawing and/or cold rolling — Part 1: General requirement.*

EN 10020, *Definition and classification of grades of steel.*

EN 10221, *Surface quality classes for hot rolled bars and rods — Technical delivery conditions.*

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

## 3 Requirements

For the general requirements see EN 10016-1.

### 3.1 Chemical composition

For the heat analysis, the values shown in Table 1 apply. The permissible deviations of the product analysis in relation to the actual heat analysis are given in Table 2. When further patenting is envisaged rod can be ordered with restricted analysis for the residual elements.

Table 1 — Chemical analysis (heat analysis) 1) 2)

Steel grades 3)		Heat analysis										
Steel name	Steel number	C %	Si 4) %	Mn 5) %	P % max.	S % max.	Cr 6) % max.	Ni 6) % max.	Mo % max.	Cu 6) 7) 8) % max.	Al 9) % max.	N 10) % max.
C3D2	1.1110	≤ 0,05	≤ 0,30	0,30–0,50	0,020	0,025	0,10	0,10	0,05	0,15	0,01	0,007
C5D2	1.1111	≤ 0,07	≤ 0,30	0,30–0,50	0,020	0,025	0,10	0,10	0,05	0,15	0,01	0,007
C8D2	1.1113	0,06–0,10	≤ 0,30	0,30–0,50	0,020	0,025	0,10	0,10	0,05	0,15	0,01	0,007
C10D2	1.1114	0,08–0,12	≤ 0,30	0,30–0,50	0,020	0,025	0,10	0,10	0,05	0,15	0,01	0,007
C12D2	1.1124	0,10–0,14	≤ 0,30	0,30–0,50	0,020	0,025	0,10	0,10	0,05	0,15	0,01	0,007
C15D2	1.1126	0,13–0,17	≤ 0,30	0,30–0,50	0,020	0,025	0,10	0,10	0,05	0,15	0,01	0,007
C18D2	1.1129	0,16–0,20	≤ 0,30	0,30–0,50	0,020	0,025	0,10	0,10	0,05	0,15	0,01	0,007
C20D2	1.1137	0,18–0,23	≤ 0,30	0,30–0,50	0,020	0,025	0,10	0,10	0,05	0,15	0,01	0,007
C26D2	1.1139	0,24–0,29	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C32D2	1.1143	0,30–0,34	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C36D2	1.1145	0,34–0,38	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C38D2	1.1150	0,36–0,40	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C40D2	1.1153	0,38–0,42	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C42D2	1.1154	0,40–0,44	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C46D2	1.1162	0,44–0,48	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C48D2	1.1164	0,46–0,50	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C50D2	1.1171	0,48–0,52	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C52D2	1.1202	0,50–0,54	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C56D2	1.1220	0,54–0,58	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C58D2	1.1212	0,56–0,60	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C60D2	1.1228	0,58–0,62	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C62D2	1.1222	0,60–0,64	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C66D2	1.1236	0,64–0,68	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C68D2	1.1232	0,66–0,70	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C70D2	1.1251	0,68–0,72	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,03	0,15	0,01	0,007
C72D2	1.1242	0,70–0,74	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,02	0,15	0,01	0,007
C76D2	1.1253	0,74–0,78	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,02	0,15	0,01	0,007
C78D2	1.1252	0,76–0,80	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,02	0,15	0,01	0,007
C80D2	1.1255	0,78–0,82	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,02	0,15	0,01	0,007
C82D2	1.1262	0,80–0,84	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,02	0,15	0,01	0,007
C86D2	1.1265	0,84–0,88	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,02	0,15	0,01	0,007
C88D2	1.1272	0,86–0,90	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,02	0,15	0,01	0,007
C92D2	1.1282	0,90–0,95	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,02	0,15	0,01	0,007
C98D2	1.1283	0,96–1,00	0,10–0,30	0,50–0,70	0,020	0,025	0,10	0,10	0,02	0,15	0,01	0,007

1) Elements not included in this table may not be added intentionally to the steel without the agreement of the purchaser, except those intended for finishing the cast.

2) The addition of microalloying elements can be agreed between the manufacturer and purchaser at the time of ordering.

3) Special non-alloy steel according to EN 10020.

4) For rod intended for galvanization the allowed lower limit of silicon content should be specified at the time of ordering.

5) For the manganese content, a different range from the one indicated in the table can be agreed at the time of ordering with a maximum value not exceeding 1,20 % and with an amplitude of 0,20 %.

6) The sum of the contents Cu + Ni + Cr shall not exceed 0,30 %.

7) Cu + Sn ≤ 0,15 %.

8) For certain applications the Cu content may be restricted to 0,12 % max, by agreement.

9) By agreement at the time of ordering, the value for aluminium can be fixed at 0,02 to 0,06 %. The value for silicon can then be fixed at ≤ 0,10 % on request.

10) If, in accordance with note 9), the Al content is fixed at 0,02 to 0,06 %, the limit value for N shall be agreed at the time of ordering.



**Table 2 — Permissible deviations in the product analysis in relation to the actual heat analysis**

Element	Steel grade	Permissible deviation in product analysis %
C	C3D2 to C20D2	± 0,02
	C26D2 to C82D2	± 0,03
	C86D2 to C98D2	± 0,04
Si	All grades	± 0,04
Mn	All grades	± 0,06
P and S	All grades	± 0,005

### 3.2 Internal soundness and surface quality

The rod shall have no internal and/or surface imperfections such as: shrink holes, segregation, cracks, folds, incrustations, notches, scabs, rolling burrs, damage, which may be prejudicial to its correct use.

### 3.3 Soundness

The rod shall not have any surface discontinuities of depth greater than the values shown in Table 3. These limit values apply for the test chosen according to EN 10016-1 (clauses 9.5.1 and 9.6.2).

**Table 3 — Limit values for the depth of surface discontinuities**

Class according to EN 10221	Nominal diameter $d_N$ mm	Maximum permissible depth <sup>a</sup> of surface discontinuities mm
D	$5 \leq d_N \leq 12$	0,15
	$12 < d_N \leq 30$	0,20

<sup>a</sup> The depth of surface discontinuities is measured from the actual surface of the product in a radial direction.

### 3.4 Depth of decarburization

The specifications given below concerning the depth of decarburization and the inspection procedure relating to it only apply to grades C42D2 to C98D2.

#### 3.4.1 Complete decarburization

The rod shall not display complete decarburization.

#### 3.4.2 Partial decarburization

The rod shall not display partial decarburization of depth greater than the values given in Table 4. The maximum point of decarburization shall not exceed twice the limit of Table 4. These limit values are applicable for the test described in EN 10016-1 (clause 9.5.2).

**Table 4 — Limit of the depth of partial decarburization**

Nominal diameter $d_N$ mm	Limit values mm
$5 < d_N \leq 8$	0,10
$8 < d_N \leq 30$	1,2 % of $d_N$

### 3.5 Inspection of non-metallic inclusions

The method for inspecting non-metallic inclusions and the assessment criteria for it shall be agreed at the time of ordering, as far as possible with reference to the ENV 10247 or to one of the following standards:

- DIN 50 602/1985 *Metallographische Prüfverfahren — Mikroskopische Prüfung von Edeltählen auf nichtmetallische Einschlüsse mit Bildreihen*
- NF A 04-107-/1980 *Produits sidérurgiques — Méthode micrographique de détermination de la teneur en inclusions non-metalliques du fil machine en acier non allié*
- UNI 3244/1980 (with annex) *Esame microscopico dei materiali ferrosi — Valutazione delle inclusioni non metalliche negli acciai mediant immagini tipo*
- ASTM E 45/1987 *Standard practice for determining the inclusion content of steel*

### 3.6 Core segregation

If so agreed at the time of enquiry and order, rod of grade C60D2 or grades with a higher carbon content shall be inspected for carbon segregation. Not more than 10 % of the samples tested shall be of class 4; class 5 is not allowed (see EN 10016/1, Annex A). It is recommended to do the evaluation as part of a quality assurance system.

### 3.7 Mechanical properties

At the request of the purchaser at the time of ordering, the manufacturer shall notify indicative values of tensile strength. The permissible variation on the values agreed at the time of ordering shall not exceed the values reported in Table 5.

**Table 5 — Permissible variation of tensile strength values**

Steel grades	Permissible range <sup>a b</sup> N/mm <sup>2</sup>
C3D2 to C20D2	80
C26D2 to C70D2	100
C72D2 to C98D2	120
<sup>a</sup> These values are applicable to rod with the same nominal diameter, up to 12 mm, of the same heat and rolled under the same conditions. <sup>b</sup> These values are not applicable when the note 5) of Table 1 is used.	

## List of references

See national foreword.

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