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Prestressing steels - Part 2: Wire

Armatures de précontrainte - Partie 2: Fils

Spannstähle - Teil 2: Draht

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee ECISS/TC 19.

If this draft becomes a European Standard, 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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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

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Foreword

This Part of this European Standard has been prepared by SC2 'Prestressing steels' of the Technical Committee ECISS/TC 19 'Concrete reinforcing and prestressing steels — Properties, dimensions, tolerances and specific tests' of which the Secretariat is held by BSI.

This European Standard has been prepared under mandate M115 given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of the EU Construction Products Directive (89/106/EEC).

For relationship with the EU Construction Products Directive, see informative Annex ZA, which is an integral part of Part 1 of this European Standard and by which it becomes a harmonized European Standard.

EN 10138 is published in four parts, the other parts being :

EN 10138-1, *Prestressing steels — Part 1: General requirements*

EN 10138-3, *Prestressing steels — Part 3: Strand*

EN 10138-4, *Prestressing steels — Part 4: Bars*

All products placed on the market within the European Union and EFTA must be certificated in accordance with Annex ZA of Part 1 of this European Standard.

In accordance with the common rules of CEN/CENELEC the following member countries are obliged to adopt this standard : Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

1 Scope

This Part of this European Standard specifies specific requirements for stress relieved high tensile steel wire, either plain or indented. It is applicable to wire which has been straightened and stress relieved and supplied in the form of coils or in bundles of cut lengths from the same coil.

NOTE General requirements are given in Part 1 of this European Standard.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this European Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this European Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest editions of the normative document referred to applies. Members of CEN/CENELEC maintain registers of currently valid European Standards.

EN 10016-4, *Non alloy steel rod for drawing and/or cold rolling — Part 4: Specific requirements for rod for special applications*

EN 10027-1, *Designation system for steels — Part 1: Steel names; principal symbols*

EN 10027-2, *Designation system for steel grades — Part 2: Steel numbers*

prEN 10138-1, *Prestressing steels — Part 1: General requirements*

CR 10260, *Designation system for steel — Additional symbols*

prEN ISO 15630-3, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 3: Prestressing steels*

3 Terms and definitions

For the purposes of this Part of this European Standard the terms and definitions given in prEN 10138–1 and the following apply.

3.1
indentation spacing, *c*
distance between the centre of two successive indentations measured (or taken) in the direction of the wire axis (see Figure 1)

3.2
unit of product
the product of one rod coil

4 Designation

4.1 For the steel grades covered by this Part of this European Standard the steel names shall be allocated in accordance with EN 10027-1 and CR 10260; the steel numbers shall be allocated in accordance with EN 10027-2.

4.2 The designation shall consist of:

a) the number of this Part of this European standard;

b) the steel name consisting of:

1) the letter Y for prestressing steel;

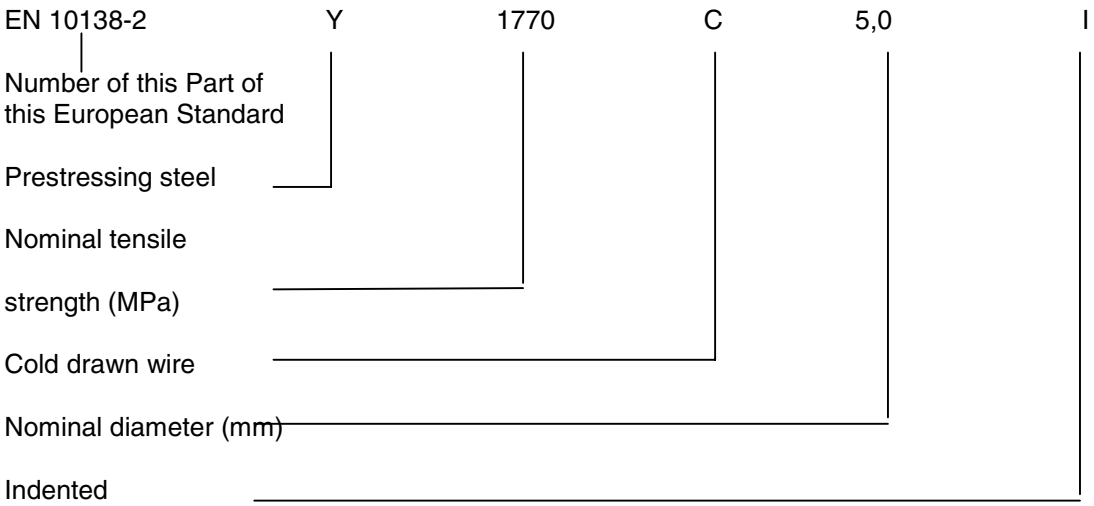
2) the nominal tensile strength in MPa;

3) the letter C for cold drawn wire.

c) the nominal diameter of the wire in mm;

d) where necessary I for indented.

Example



i.e. EN 10138-2-Y1770C-5,0-I.

NOTE The steel number may be used instead of the steel name i.e. EN 10138-2-1.1352-5,0–I

5 Manufacture

5.1 General

The wire shall be manufactured from wire rod in accordance with EN 10016-4, from steel in accordance with prEN 10138-1:2000, 6.1.

5.2 Welds

There shall be no welds in the product as supplied by the manufacturer.

5.3 Type of indentation

For indented wire, the dimensions of the indentations shall be in accordance with Table 1 and Figure 1. One line of indentations shall be at a contrary angle to the others.

Table 1 — Specified indentation dimensions

Dimensions in mm

Nominal wire diameter	**Range of nominal depths of indentation** *a*		**Depth tolerance on chosen nominal depth**	**Length** *l*	**Spacing** *c*
	from	to			
≤ 5	0,06	0,13	± 0,03	3,5 ± 0,5	5,5 ± 0,5
> 5 to 8	0,09	0,13	± 0,04	5,0 ± 0,5	8,0 ± 0,5

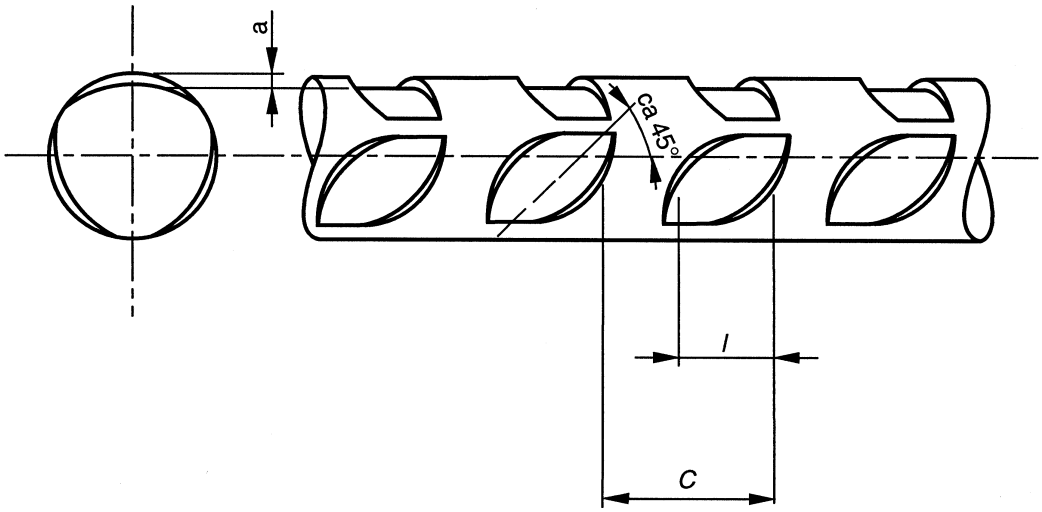


Figure 1 — Indentation

6 Requirements

6.1 General

Nominal and specified properties of wire shall be as specified in Tables 2 and 3.

6.2 Geometrical properties

6.2.1 Plain wire

Where the diameter measurements on the plain round wire show an ovality ≤ 0,03 mm, no checks by weighing shall be necessary.

6.2.2 Indented wire

The nominal diameter of indented wire is the nominal diameter of plain wire having the same cross-sectional area.

6.2.3 Curvature

When a length of wire is lying free on a flat surface, the maximum bow height from a base line 1 m in length, measured from the inside of the curve, shall be not greater than 25 mm for all wire diameters.

Table 2 — Dimensions and properties of wire

Steel designation		Nominal [a]				Specified			
Steel name	**Steel number**	**Diameter** [f]	**Cross sectional area**	**Tensile strength** [b c]	**Mass** [d]	**Permitted deviation on nominal mass**	**Characteristic value of maximum force**	**Maximum value of maximum force**	**Characteristic value of 0,1 % proof force**
		d	S_n	R_m	M		F_m	$F_{m,max}$	$F_{p0,1}$ [e]
		mm	mm^2	MPa	g/m	%	kN	kN	kN
Y1860C	**1.1353**	**3,0**	**7,07**	**1860**	**55,2**	**± 2**	**13,1**	**15,0**	**11,3**
		4,0	**12,57**		**98,1**		**23,4**	**26,7**	**20,1**
		5,0	**19,63**		**153**		**36,5**	**41,8**	**31,4**
Y1770C	1.1352	3,2	8,04	1770	62,5	**± 2**	14,2	16,2	12,2
		5,0	19,63		153		34,8	39,5	29,9
		6,0	**28,27**		**221**		**50,0**	**56,9**	**43,0**
Y1670C	1.1351	6,9	37,39	1670	292	**± 2**	62,4	71,0	53,7
		7,0	**38,48**		**301**		**64,3**	**73,0**	**55,3**
		7,5	44,18		345		73,8	83,8	63,4
		8,0	**50,27**		**393**		**83,9**	**95,4**	**72,2**
Y1570C	1.1350	9,4	69,4	1570	542	**± 2**	109	124	90,4
		9,5	70,88		554		111	126	92,4
		10,0	**78,54**		**613**		**123**	**140**	**102**

[a] The nominal modulus of elasticity may be taken as 205 GPa (kN/mm^2).

[b] 1 MPa = 1 N/mm^2.

[c] The nominal tensile strength is calculated from the cross-sectional area corresponding to the nominal diameter and the specified characteristic maximum force, rounded to the nearest 10 MPa.

[d] The nominal mass is calculated from the nominal cross-section area and a density value of 7,81 kg/dm^3.

[e] For wires larger than 8 mm the specified characteristic $F_{p0,1}$ is approximately 83 % of the specified characteristic maximum force. For wires of 8 mm and smaller the corresponding value is 86 % of the specified characteristic maximum force.

[f] See Annexes A and B for comments on classes of convenience.

Table 3 — Additional requirements for wire

Property		**Specification**	
Minimum elongation at maximum force, $A_{gt,}$ with $L_0 \geq 100$ mm		3,5 %	
Reduction in area at break		Ductile break visible to the unaided eye	
Reverse Bend			
Diameter in mm		Bend radius in mm	
3,0		7,5	
3,2 and 4,0		10	
5,0 and 6,8		15	
6,9 to 9,3		20	
9,4 to 10,0		25	
Minimum number of reverse bends	- for plain wire	4	
	- for indented wire	3	
Maximum relaxation at 1000 h [a] [b]	For initial force corresponding to		
	70 % F_m	2,5 % [a]	
	80 % F_m	4,5 % [b]	
Fatigue stress range F_r with upper limit F_{up} according to 70 % actual max. force	- for plain wire	200 MPa [c]	
	- for indented wire	180 MPa [c]	
Stress corrosion with NH_4SCN		Minimum	Median
		2h	5h

[a] For specific applications the relaxation requirement may be varied by agreement between supplier and purchaser.

[b] The requirement for 70 % F_m is mandatory. Values for 80 % F_m may be agreed between supplier and purchaser.

[c] 1 MPa = 1 N/mm^2.

7 Evaluation of conformity

7.1 Factory production control

7.1.1 General

The requirements in prEN 10138-1: 2000, 7.1.1 shall be met.

7.1.2 Sampling and testing of finished products

7.1.2.1 Frequency of sampling and testing

The test unit shall be composed of units of product (see 3.2) from the same cast, with a maximum mass of 50 t. The manufacturer shall sample and test in accordance with Table 4.

Table 4 — Frequency of sampling and testing for factory production control of cold drawn wire

Maximum force Constriction	Every unit of product
Cross sectional area or diameter 0,1 % proof force Elongation at maximum force Reverse bending	1 in 5 units of product
Indentation depth Straightness	1 in 10 units of product

7.1.2.2 Evaluation of tests results of a test unit

A test unit shall be deemed to comply with the requirements of this Part of this European Standard if all the results are greater than or equal to the specified value for the mechanical properties (except maximum value of maximum force) and within the tolerances for the maximum force and the geometrical properties.

If this condition is not met, the following procedure shall be applied:

1) when results for the maximum force or 0,1 % proof force are lower than the specified value, the mean value of all individual results from the test unit shall be calculated.

The test unit shall be deemed to comply with the requirements of this Part of this European Standard if this mean value is greater than or equal to the specified value.

Otherwise, the test unit shall be rejected and the manufacturer shall immediately take the measures to rectify the fault.

2) when results for properties specified by a minimum and/or a maximum value do not conform to the specifications, two additional samples shall be taken from the unit of product concerned by each failed result and shall be tested for determination of the concerned property.

If the two additional results conform to the specifications, the unit of product shall be deemed to comply with the requirements of this Part of this European Standard and no further check is needed.

If at least one of the two additional results does not conform to the specifications, the concerned unit of product shall be rejected and, except if the deficiency concerns the maximum force, all the units of product from the last good result and until the next good result shall be tested for the defective property(ies).

All units of product with non conforming results shall be rejected and the manufacturer shall immediately take the measures to rectify the fault.

7.1.2.3 Assessment of long term quality level

The requirements in prEN 10138-1:2000, 7.1.2.2 shall be met.

7.2 Initial type testing

The requirements in prEN 10138-1:2000, 7.2 shall be met.

7.3 Continuous surveillance

The requirements in prEN 10138-1:2000, 7.3 shall be met.

8 Test methods

The test methods shall be in accordance with prEN ISO 15630-3. For reverse bend testing the bend radii shall be according to the values in Table 3.

9 Delivery conditions

9.1 Identification

The requirements in prEN 10138-1:2000, 9.1 shall be met.

9.2 Delivery documentation

The requirements in prEN 10138-1: 2000, 9.2 shall be met.

9.3 Dimensions of unit of product

These shall be agreed at the time of purchasing with the manufacturer with the restriction of 9.4 of this Part of this European Standard and prEN 10138-1:2000.

9.4 Packaging and handling

The coil diameter shall be at least 150 times the nominal wire diameter.

Annex A
(informative)

Note on classes of convenience

Table 2 of this Part of this European Standard gives examples of classes of convenience of products manufactured by various countries within the EU. Those in bold type are intended to be preferred sizes for the future. Other sizes not contained in this table may be offered for approval under the CPD provided that manufacture of these sizes already exists within an EU country and the general rules as indicated in notes a to f of Table 2 of this Part of this European Standard are applied. The properties and special properties of these additional classes of convenience should be consistent with the properties required for nominated classes and size ranges in Tables 2 and 3 of this Part of this European Standard.

Annex B
(informative)

Note on new higher tensile wire sizes for future development

It is apparent that new higher tensile ranges are currently under development by a number of manufacturers. It is proposed that these may be included as non aligned parts in this European Standard with the intention of their inclusion as fully integrated parts with full technical approval in future issues of the standard. For formulation of the new product properties the general rules as indicated in notes a) to f) of Table 2 of this Part of this European Standard are applied. The properties and special properties of these additional new classes of convenience shall be consistent with the properties required for existing nominated classes and size ranges in Tables 2 and 3 of this Part of this European Standard.