

# Steel wire and wire products — Hose reinforcement wire

The European Standard EN 10324:2004 has the status of a British Standard

ICS 77.140.65

# National foreword

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The UK participation in its preparation was entrusted to Technical Committee ISE/26, Steel wire, which has the responsibility to:

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## Summary of pages

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## Steel wire and wire products - Hose reinforcement wire

Fils et produits tréfilés en acier - Fil d'armature pour  
flexibles

Stahldraht und Drahterzeugnisse -  
Schlaucharmierungsdraht

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## Foreword

This document (EN 10324:2004) has been prepared by Technical Committee ECISS/TC 30 "Steel wire", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by March 2005, and conflicting national standards shall be withdrawn at the latest by March 2005.

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## 1 Scope

This document specifies the composition, dimensions and mechanical properties of high carbon steel wire for reinforcing high pressure hoses. It is applicable to wire used as a multiple parallel wire braided or spirally wrapped reinforcement in a rubber or synthetic hose which is made to withstand relatively high bursting pressure.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

EN 10016-2, *Non-alloy steel rod for drawing and/or cold rolling — Part 2: Specific requirements for general purposes rod*

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

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

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

EN 10218-1:1994, *Steel wire and wire products — General — Part 1: Test methods*

EN 10218-2, *Steel wire and wire products — General — Part 2: Wire dimensions and tolerances*

EN 10244-1, *Steel wire and wire products – Non-ferrous metallic coatings on steel wire – Part 1: General principles*

EN 10244-6, *Steel wire and wire products – Non-ferrous metallic coatings on steel wire – Part 6: Copper, bronze or brass coatings*

CR 10261, *ECISS Information Circular 11 – Iron and steel – Review of available methods of chemical analysis*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### **nominal diameter: $d$**

value of the diameter, expressed in millimetres, by which the wire is designated and specified by the purchaser

NOTE This is the basis on which the values of all relevant characteristics are determined for the acceptance of the wire

### 3.2

#### **actual diameter**

arithmetic mean of two measurements of the diameter at right angles determined at any cross-section

**3.3****out of roundness**

arithmetic difference between the maximum and minimum diameter measured in a transverse cross-section perpendicular to the wire axis

**4 Classification**

Hose wire is classified according to tensile strength. It is supplied in three classes of tensile strength:

- NT: Normal tensile strength;
- HT: High tensile strength;
- ST: Super tensile strength.

**5 Designation and ordering****5.1 Designation**

For hose wire supplied in accordance with this document, the designation shall state in the following order:

- the term: hose wire;
- the coating: see **6.1.4**;
- the number of this document;
- the tensile strength class (see **4**) and the nominal tensile strength;
- the nominal diameter.

EXAMPLE Brass coated hose wire 0,30 mm high tensile strength 2750 MPa to 3050 MPa in accordance with EN 10324 shall be designated:

Hose wire brass coated EN 10324 HT 2750 MPa to 3050 MPa 0,30.

**5.2 Information to be supplied by the purchaser and items to be agreed**

The purchaser shall clearly state in his enquiry or order the product and following information:

- the required nominal diameter;
- the desired quantity;
- the unit and type of package (for recommended types of spools see **A.1**);
- if a coating other than brass is required (see **6.1.4**);
- the type of inspection document.

The following shall be agreed between the purchaser and the supplier at enquiry or order:

- specification of the coating if a coating other than brass is required (see **6.1.4**);

- value of the circular cast if it is required to be less than 100 mm or more than 250 mm (see **6.5.3**);
- additional information to be included on the spool and unit package labels (see **8**).

EXAMPLE 20 t hose wire brass coated EN 10324 HT 2750 MPa to 3050 MPa 0,30 on spools of 30 kg doc EN 10204"3.1.B."

## 6 Requirements

### 6.1 Material

#### 6.1.1 Steel

The wire shall be manufactured from steel rod conforming to EN 10016-1 and EN 10016-2 for tensile strength NT and conforming to EN 10016-4 for tensile strengths HT and ST.

#### 6.1.2 Chemical composition

The chemical composition according to the heat analysis shall conform to the limit values given in Table 1. The permissible deviation of the product analysis from the heat analysis shall be in accordance with EN 10016-2 and EN 10016-4.

**Table 1 — Chemical composition (% by mass)**

Type	C	Si	Mn	P max.	S max.
NT	0,60 to 0,80	0,15 to 0,30	0,40 to 0,70	0,035	0,035
HT and ST	0,75 to 0,90	0,15 to 0,30	0,40 to 0,60	0,020	0,025

Unless otherwise agreed at the time of enquiry and order, the choice of a suitable physical or chemical method of analysis for the determination of the product analysis shall be at the discretion of the supplier.

In cases of dispute, the analysis shall be carried out by a laboratory approved by the two parties. The method of analysis to be applied shall be agreed upon, if possible, in accordance with CR 10261.

#### 6.1.3 Wire

The wire shall be patented and cold drawn in order to provide the required mechanical properties.

#### 6.1.4 Coating material

If not otherwise stipulated by the purchaser at the time of enquiry or order (see **5.2**), the coating material shall be brass with a chemical composition of Cu:  $(67 \pm 5) \%$  and the remainder zinc.

In the case of other coatings, the specification shall be agreed between the purchaser and supplier at the time of enquiry or order (see **5.2**).



## **6.2 Mechanical properties**

### **6.2.1 Tensile strength and elongation**

When tested in accordance with **7.2.1** before and after the braiding operation the wire shall conform to the tensile strength values and have an elongation at rupture as specified in Table 2.

### **6.2.2 Reverse bend test**

When tested in accordance with **7.2.2** the wire shall withstand the minimum number of bends specified in Table 2 without rupture.

### **6.2.3 Torsion test**

When tested in accordance with **7.2.2** the wire shall withstand the minimum number of torsions specified in Table 2 without fracture.

Table 2 — Mechanical properties

Diameter $d^a$ (mm)	Tensile strength (MPa) <sup>b</sup>	Elongation at rupture (At) % min.	Reverse bends (Nb) on $r$ : 2,5 mm min.	Torsion (Nt) ( $l = 100 d$ ) min.
Normal tensile (NT)				
0,25	2450 to 2750	1,6	125	41
0,28	2450 to 2750	1,6	110	40
0,30	2450 to 2750	1,6	95	39
0,34	2450 to 2750	1,6	80	36
0,38	2450 to 2750	1,6	65	35
0,40	2450 to 2750	1,6	60	34
0,45	2450 to 2750	1,8	50	32
0,50	2450 to 2750	1,9	35	31
0,56	2450 to 2750	2,0	30	29
0,60	2450 to 2750	2,0	28	28
0,65	2450 to 2750	2,2	27	27
0,71	2450 to 2750	2,2	25	25
0,80	2150 to 2450	2,2	22	24
High Tensile (HT)				
0,20	2750 to 3050	1,3	160	41
0,25	2750 to 3050	1,6	120	40
0,28	2750 to 3050	1,6	100	39
0,30	2750 to 3050	1,6	85	38
0,34	2750 to 3050	1,6	70	35
0,35	2750 to 3050	1,6	70	32
0,38	2750 to 3050	1,6	60	32
0,40	2750 to 3050	1,6	50	30
0,45	2750 to 3050	1,8	40	27
0,50	2750 to 3050	1,9	25	25
0,56	2750 to 3050	2,0	25	24
0,60	2750 to 3050	2,0	20	23
Super Tensile (ST)				
0,20	3050 to 3350	1,3	110	33
0,25	3050 to 3350	1,6	80	32
0,30	3050 to 3350	1,6	60	32
0,38	3050 to 3350	1,6	40	26
<sup>a</sup> For intermediate sizes the requirements shall be those given for the next higher size of the same tensile strength class. <sup>b</sup> 1MPa = 1N/mm <sup>2</sup> .				

## 6.3 Surface quality

### 6.3.1 General

The surface of the wire shall be smooth and free from grease and other contaminants. The surface of the wire shall provide good adhesion between the wire surface and the rubber.

### 6.3.2 Coating mass

When measured in accordance with 7.3 the mass of coating on the wire shall be in accordance with the values listed in Table 3.

Table 3 — Coating mass

Diameter $d$ (mm)	Coating mass (kgm)
$d \leq 0,34$	$5 \pm 2$
$0,34 < d$	$4 \pm 2$

## 6.4 Dimensions and tolerances

### 6.4.1 Tolerance on diameter

When the wire is measured in accordance with 7.2.3. The tolerance on the nominal wire diameter shall be  $\pm 0,01$  mm.

### 6.4.2 Out of roundness

The out of roundness shall be  $\leq 0,01$  mm.

## 6.5 Delivery conditions

### 6.5.1 Unit package

The wire shall be supplied in units of one single length of wire, the unit package being spools.

NOTE The recommended types of spool are given in A.1. The recommended length of wire per spool is given in A.2.

### 6.5.2 Welds

Welds at final size are permitted provided the weld is properly cleaned and smooth so as to permit proper processing.

The weld and heat affected zone shall have a minimum breaking force of 40 % of the minimum specified in Table 2.

### 6.5.3 Cast of wire

The circular cast as defined in EN 10218-1 shall be measured in accordance with EN 10218-1. Unless otherwise agreed between the purchaser and the supplier at the time of enquiry or order (see 5.2) the circular cast shall be not be less than 100 mm and not more than 250 mm.

The wap of helix cast measured in accordance with EN 10218-1:1994, 14.3.1 shall be not more than 50 mm.

## 7 Testing and inspection

### 7.1 Tests and inspection documents

Products conforming to this document shall be delivered with specific testing (see EN 10021) and the relevant inspection document in accordance with EN 10204 specified by the purchaser at the time of enquiry or order (see 5.2).

### 7.2 Test procedures

#### 7.2.1 Tensile test

Tensile testing shall be carried out in accordance with EN 10218-1 and EN 10002-1 on samples comprising the full cross-section of the wire. The minimum breaking force and the elongation ( $A_t$ ) at the moment of rupture shall be recorded.

#### 7.2.2 Reverse bend test and torsion test

The test length for the torsion test shall be 100  $d$ .

The test samples shall be subjected to a thermal ageing treatment at 150 °C for 1 h. The reverse bend tests shall be performed in accordance with EN 10218-1.

#### 7.2.3 Diameter and out of roundness

The diameter shall be measured in accordance with EN 10218-2 using a micrometer with a precision of  $\pm 0,001$  mm.

### 7.3 Coating mass

The coating mass shall be determined in accordance with EN 10244-1 and EN 10244-6.

### 7.4 Retests

Retests shall be performed in accordance with EN 10021.

## 8 Marking, labelling and packaging

Each spool and each unit package shall be marked with the information needed to permit traceability and reference to inspection documents.

Each spool and each unit package shall have a label attached to it bearing at least the information specified in Table 4.

Other information on the label shall be as agreed between the purchaser and the supplier.

Wire shipments shall be suitably protected against mechanical damage and/or contamination during transport.

**Table 4 — Labelling information**

Information	Spool	Package
Designation	+	+
Manufacturer	+	+
Identification number	+	
Heat number	(+)	
Destination		+
Order number		+
Mass (Nominal and Gross) in kilograms		+
Origin		(+)
Customer reference		+
NOTE    + = mandatory; (+) = optional.		

Annex A  
(informative)

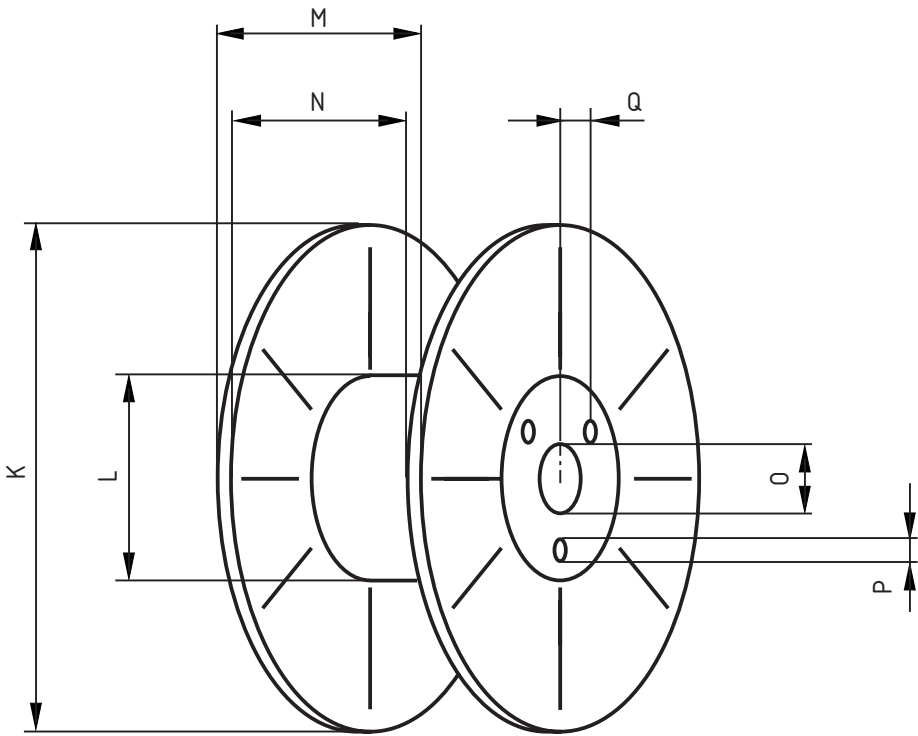
Packaging of hose reinforcement wire

A.1 Recommended types of spool

Hose reinforcement wire is supplied wound on metal or plastic spools. See Figure A.1.

NOTE The arrow on the flange indicates the rotation direction for unwinding the spool.

Recommended types of spool are given in Table A.1.



- Key
- K Diameter of flange
  - L Diameter of barrel
  - M Overall width
  - N Traverse
  - O Bore
  - P Number x diameter of drivehole/bore
  - Q Distance of drivehole/bore

Figure A.1 — Spool for packing hose reinforcement wire

**Table A.1 — Recommended types of spool**

Dimensions in millimetres

	Spool type	
	BS60	BP60
Diameter of flange (K)	255	254
Diameter of barrel (L)	117	102
Overall width (M)	167	184
Tranerse (N)	153	153
Bore (O)	33	33
Number x diameter of drivehole	3 x 12,7	3 x 6
Distance drivehole/bore (Q)	43	30
Mass (kg)	1,90	1,2
Approximate wire capacity (kg)	28	28

## A.2 Recommended length of wire per spool

The recommended length of hose reinforcement wire per spool is given in Table A.2.

**Table A.2 — Recommended length of wire per spool**

Diameter (mm)	Tensile strength range (MPa) <sup>a</sup>	Length per BS 60 spool (m)
0,56	2450 to 2750	15 000
0,60	2150 to 2450	14 000
0,60	2450 to 2750	14 000
0,65	2150 to 2450	11 000
0,65	2450 to 2750	11 000
0,71	2150 to 2450	9 500
0,71	2450 to 2750	9 500
0,80	2150 to 2450	7 000
<sup>a</sup> 1MPa = 1N/mm <sup>2</sup> .		

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