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Round non-alloy steel wires for general purpose wire ropes, large diameter wire ropes and mine hoisting wire ropes — Specifications

Fils ronds en acier non allié pour câbles à usage général, câbles de grand diamètre et câbles d'extraction minière — Spécifications

ICS: 77.140.65

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html. (standards.iteh.ai)

This document was prepared by Technical Committee ISO/TC 105, *Steel wire ropes*.

This third edition cancels and replaces the second edition (ISO 2232:1990), which has been technically revised.

The main changes compared to the previous edition are as follows:

- Addition of tensile grades 2260 N/mm² and 2360 N/mm²
- Inclusion of wire for mine hoisting ropes previously covered by ISO 6984

Introduction

This International Standard was developed in response to a worldwide demand for a specification giving minimum requirements for non-alloy steel wires for general purpose, large diameter and mine hoisting wire ropes.

As in previous editions, this edition of ISO 2232 specifies metric sizes and grades of wire for the more common diameter and grades of wire.

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Round non-alloy steel wires for general purpose wire ropes, large diameter wire ropes and mine hoisting wire ropes — Specifications

1 Scope

This document specifies round non-alloy steel wires to be used in the manufacture of general purpose, large diameter and mine hoisting wire ropes.

It specifies

- the dimensional tolerances;
- the mechanical characteristics;
- the conditions with which coatings, if any, shall comply;
- the conditions of sampling, control and terms of acceptance.

It applies to round, bright, Zinc (Zn) or Zinc/Aluminum (Zn/Al) alloy coated wires of Quality A or Quality B and of nominal diameters from 0,2 mm to 7,0 mm.

It does not apply to steel wire taken from manufactured ropes.

It does not apply to wire for steel wire ropes for special applications, such as

- ropes for aircraft controls;
- ropes for aerial ropeways;
- ropes for lifts.
- ropes for prestressed concrete.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 1460, *Metallic coatings — Hot dip galvanized coatings on ferrous materials — Gravimetric determination of the mass per unit area*

ISO 2408, *Steel wire ropes — Requirements*

ISO 3154, *Stranded wire ropes for mine hoisting — Technical delivery requirements*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature.*

ISO 7800, *Metallic materials — Wire — Simple torsion test.*

ISO 7801, *Metallic materials — Wire — Reverse bend test.*

ISO 7802, *Metallic materials — Wire — Wrapping test.*

ISO 16120-1, *Non-alloy steel wire rod for conversion to wire — Part 1: General requirements*

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ISO 16120-2, *Non-alloy steel wire rod for conversion to wire — Part 2: Specific requirements for general purpose wire rod*

ISO 16120-4, *Non-alloy steel wire rod for conversion to wire — Part 4: Specific requirements for wire rod for special applications*

ISO 10425, *Steel wire ropes for the petroleum and natural gas industries — Minimum requirements and terms of acceptance*

ISO 17893, *Steel wire ropes — Vocabulary, designation and classification*

ISO 28590, *Sampling procedures for inspection by attributes — Introduction to the ISO 2859 series of standards for sampling for inspection by attributes*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

4 Wire Characteristics

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4.1 General conditions of manufacture

Wire shall be made by the basic open hearth, electric furnace or basic oxygen process or by equivalent methods.

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The nominal diameter of the wire, in millimeters, is that by which the wire is designated. It shall be the basis on which the values of all characteristics are determined for the acceptance of the wire.

The finished wires shall not show superficial or internal defects detrimental to their use.

When specified, the wires shall be supplied with a zinc coating or Zn/Al alloy coating, as required, applied by the hot dip or the electrolytic process.

4.2 Diameter

4.2.1 Nominal diameter, d

The nominal diameter of the wire in millimeters is that by which the wire is designated. It shall be the basis on which the values of all characteristics are determined for acceptance of the wire.

4.2.2 Actual diameter

The actual diameter of the wire is the arithmetic mean of the two measurements carried out in accordance with 5.1. It shall be within the limits of tolerance specified in Table 1.

4.3 Ovality of the wire

The arithmetic difference between the two measurements of the diameter shall not be more than half the tolerance specified in Table 1.

Table 1 — Tolerances on diameter

Values in millimeters

Nominal diameter of wire d	Tolerance on diameter	Tolerance on diameter
mm	Bright wires and Zn or Zn/Al alloy coated wires Quality B	Zn or Zn/Al alloy coated wires Quality A
$0,2 \leq d < 0,5$	+/- 0,01	+/- 0,03
$0,5 \leq d < 0,8$	+/- 0,015	+/- 0,03
$0,8 < d < 1$	+/- 0,015	+/- 0,03
$1 \leq d < 1,6$	+/- 0,02	+/- 0,04
$1,6 \leq d < 2,4$	+/- 0,025	+/- 0,05
$2,4 \leq d < 3,7$	+/- 0,03	+/- 0,06
$3,7 \leq d < 5,2$	+/- 0,03	+/- 0,07
$5,2 \leq d \leq 7,0$	+/- 0,04	+/- 0,08

4.4 Type

This specification provides details on two types of wires,

3.4.1 Standard Duty - wire is specified for general purpose and large diameter ropes

3.4.2 High Duty- wire is specified for demanding applications such as mine hoisting ropes

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5 Tensile grades

- 1570 MPa for wires of all classes, Quality A and B
- 1770 MPa for wires of all classes, Quality A and B
- 1960 MPa for wires of all classes, Quality A and B
- 2160 MPa for bright wires and zinc or Zn/Al alloy coated wires, Quality B
- 2260 MPa for bright wires and zinc or Zn/Al alloy coated wires, Quality B
- 2360 MPa for bright wires and zinc or Zn/Al alloy coated wires, Quality B

These nominal values are the lower limits of strength. The upper limits are equal to the lower limits plus the tolerances specified in [table 2](#).

The test shall be performed in accordance with [5.2](#).

NOTE Other tensile grades may be used by agreement between the manufacturer and the supplier.

Table 2 — Tolerances on tensile grade

Nominal diameter of wire, <i>d</i> mm	Tolerance on tensile grade MPa
0,2≤ <i>d</i> <0,5	390
0,5≤ <i>d</i> <1	350
1≤ <i>d</i> <1,5	320
1,5≤ <i>d</i> <2	290
2≤ <i>d</i> <3,5	260
3,5≤ <i>d</i> <7	250

5.1 Reverse bend strength

The wire shall withstand, without breaking, the minimum number of reverse bends specified in [table 3A](#) or [3B](#) for the appropriate type, diameter, tensile grade and finish. The radius of curvature of the supports for the various wire diameters is also specified.

The test shall be in accordance with [5.3](#).

If the tensile grade of a wire lies between two tensile grades given in table 3, then the number of reverse bends for the next upper tensile grade shall be chosen.

Table 3A — Minimum number of reverse bends for Standard Duty wire for general purpose and large diameter ropes

Nominal Wire Diameter	Radius of Curvature of Supports	Bright and Zn or Zn/Al alloy coated wire Quality B						Zn or Zn/Al alloy coated wire Quality A		
		Tensile strength grade - MPa						Tensile strength grade - MPa		
<i>d</i> (mm)	mm	1570	1770	1960	2160	2260	2360	1570	1770	1960
0,2≤ <i>d</i> <0,25										
0,25≤ <i>d</i> <0,3										
0,3≤ <i>d</i> <0,4										
0,4≤ <i>d</i> <0,5										
0,5≤ <i>d</i> <0,55	1,75	15	14	13	12	11	10			
0,55≤ <i>d</i> <0,6		14	13	12	11	10	9			
0,6≤ <i>d</i> <0,65		12	11	10	9	8	7			
0,65≤ <i>d</i> <0,7		11	10	9	8	7	6			
0,7≤ <i>d</i> <0,75	2,5	17	16	15	14	13	12	13	12	11
0,75≤ <i>d</i> <0,8		16	15	14	13	12	11	12	11	10
0,8≤ <i>d</i> <0,85		14	13	12	11	10	9	11	10	9
0,85≤ <i>d</i> <0,9		13	12	11	10	9	8	10	9	8
0,9≤ <i>d</i> <0,95		12	11	10	9	8	7	9	8	7
0,95≤ <i>d</i> <1		11	10	9	8	7	6	8	7	6
1≤ <i>d</i> <1,1	3,75	18	17	16	14	13	12	15	14	12
1,1≤ <i>d</i> <1,2		17	16	15	13	12	11	14	13	11
1,2≤ <i>d</i> <1,3		16	15	14	12	11	10	12	11	9
1,3≤ <i>d</i> <1,4		14	13	12	10	9	8	10	8	7
1,4≤ <i>d</i> <1,5		12	11	10	9	8	7	8	7	6
1,5≤ <i>d</i> <1,6	5	15	14	13	12	11	10	11	10	9
1,6≤ <i>d</i> <1,7		14	13	12	11	10	9	10	9	8
1,7≤ <i>d</i> <1,8		12	11	11	10	9	8	9	8	7

Table 3A (continued)

1,8≤d<1,9		11	10	10	8	7	6	8	7	6
1,9≤d<2		10	9	9	7	6	5	7	6	5
2≤d<2,1	7,5	16	15	14	12	11	10	13	12	11
2,1≤d<2,2		15	14	13	11	10	9	12	11	10
2,2≤d<2,4		14	13	12	10	9	8	11	10	9
2,4≤d<2,5		13	12	11	9	8	7	10	9	8
2,5≤d<2,6		12	11	10	8	7	6	9	8	7
2,6≤d<2,7		11	10	9	7	6	5	8	7	6
2,7≤d<2,9		10	9	8	6	5		7	6	5
2,9≤d<3		9	8	7	6	5		6	5	4
Nominal Wire Diameter <i>d</i> (mm)	Radius of Curvature of Supports mm	Bright and Zn or Zn/Al alloy coated wire Quality B						Zn or Zn/Al alloy coated wire Quality A		
		Tensile strength grade - MPa						Tensile strength grade - MPa		
		1570	1770	1960	2160	2260	2360	1570	1770	1960
3≤d<3,1	10	14	13	12	10	9		10	9	8
3,1≤d<3,2		13	12	11	9	8		9	8	7
3,2≤d<3,3		12	11	10	8	7		8	7	6
3,3≤d<3,4		11	10	9	7	6		8	7	6
3,4≤d<3,5		10	9	8	6			7	6	5
3,5≤d<3,6		9	8	7	5			6	5	4
3,6≤d<3,7		8	7	6	5			5	4	3
3,7≤d<3,8		7	6	5	4			4	3	3
3,8≤d<3,9		7	6	5	4			4	3	3
3,9≤d<4		6	5	4	3			4	3	3
4≤d<4,2	15	11	10	9	8			7	6	5
4,2≤d<4,4		10	9	8				6	5	4
4,4≤d<4,6		9	8	7				5	5	
4,6≤d<4,8		8	8	6				5	4	
4,8≤d<5		7	7	5				4	4	
5≤d<5,2		6	6	4				3	3	
5,2≤d<5,4		5	5					3	3	
5,4≤d<5,6		4	4					2	2	
5,6≤d<5,8		4	4					2	2	
5,8≤d<6		3	3					2	2	
6≤d<6,25	20	8	6					4	3	
6,25≤d<6,5		6						3		
6,5≤d<6,75		5						2		
6,75≤d<7		3						2		

Table 3B — Minimum number of reverse bends for High Duty wire

Nominal Wire Diameter <i>d</i> (mm)	Radius of curvature of supports mm	Bright and Zn or Zn/Al alloy coated wire Quality B						Zn or Zn/Al alloy coated wire Quality A		
		Tensile strength grade - MPa						Tensile strength grade - MPa		
		1570	1770	1960	2160	2260	2360	1570	1770	1960
0,2≤d<0,25										
0,25≤d<0,3										
0,3≤d<0,4										