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Round drawn wire for general purpose non-alloy steel wire ropes and for large diameter steel wire ropes — Specifications

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*Fils tréfilés ronds pour câbles d'usages courants en acier non allié et
pour câbles en acier de gros diamètre — Spécifications*

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ISO 2232:1990(E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 2232 was prepared by Technical Committee ISO/TC 105, *Steel wire ropes*.

This second edition cancels and replaces the first edition (ISO 2232:1973), of which it constitutes a technical revision.

Annexes A, B and C form an integral part of this International Standard. Annexes D and E are for information only.

ISO 2232:1990

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Round drawn wire for general purpose non-alloy steel wire ropes and for large diameter steel wire ropes — Specifications

1 Scope

This International Standard specifies round non-alloy steel drawn wires to be used in the manufacture of

- general purpose steel wire ropes as defined in ISO 2408;
- large diameter steel wire ropes as defined in ISO 8369.

It specifies

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

It applies to round bright or galvanized (quality A or B) wires of nominal diameters between 0,2 mm and 6 mm.

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

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

- winding ropes for mining purposes;
- ropes for aircraft controls;
- ropes for deep drilling equipment;
- ropes for aerial ropeways;

- ropes for elevators;
- ropes for prestressed concrete.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2408:1985, *Steel wire ropes for general purposes — Characteristics*.

ISO 6892:1984, *Metallic materials — Tensile testing*.

ISO 7800:1984, *Metallic materials — Wire — Simple torsion test*.

ISO 7801:1984, *Metallic materials — Wire — Reverse bend test*.

ISO 7802:1983, *Metallic materials — Wire — Wrapping test*.

ISO 8369:1986, *Large diameter steel wire ropes*.

3 Wire characteristics

3.1 General conditions of manufacture

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

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 applied by the hot-dip or the electrolytic process. For the former case, the zinc used shall be 99,9 % pure.

3.2 Diameter

3.2.1 Nominal diameter, d

The nominal diameter of the wire, in millimetres, 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.

3.2.2 Actual diameter

The actual diameter of the wire is the arithmetic mean of two measurements carried out in accordance with 5.1.

It shall be within the limits of tolerance specified in table 1.

Table 1 — Tolerances on diameter

Values in millimetres

Nominal diameter of wire d	Tolerance on diameter	
	Bright wires and galvanized wires quality B	Galvanized wires quality A
$0,2 \leq d < 0,4$	$\pm 0,01$	—
$0,4 \leq d < 0,8$	$\pm 0,015$	$\pm 0,03$
$0,8 \leq d < 1$	$\pm 0,02$	$\pm 0,03$
$1 \leq d < 1,6$	$\pm 0,02$	$\pm 0,04$
$1,6 \leq d < 2,4$	$\pm 0,03$	$\pm 0,05$
$2,4 \leq d < 3,7$	$\pm 0,03$	$\pm 0,06$
$3,7 \leq d < 5,2$	$\pm 0,04$	—
$5,2 \leq d \leq 6$	$\pm 0,05$	—

3.2.3 Ovality of the wire

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

3.3 Tensile grades

The tensile grades of wire are:

- 1 570 N/mm² for wires of all qualities;

- 1 770 N/mm² for bright wires and galvanized wires quality B;

- 1 960 N/mm² for bright wires and galvanized wires quality B.

These nominal values are the lower limits of strength. The upper limits are equal to the lower limits in addition to the tolerances specified in table 2.

Table 2 — Tolerances on tensile grade

Nominal diameter of wire d mm	Tolerance on tensile grade N/mm ²
$0,2 \leq d < 0,5$	390
$0,5 \leq d < 1$	350
$1 \leq d < 1,5$	320
$1,5 \leq d < 2$	290
$2 \leq d$	260

NOTE 1 Other tensile grades may be used on agreement between the manufacturer and the supplier.

The test shall be performed in accordance with 5.2.

3.4 Reverse bend strength

This test applies only to wire of nominal diameter between 0,5 mm inclusive and 3,7 mm inclusive. For wires of nominal diameter less than 0,5 mm, see 3.6.

The wire shall withstand without breaking the minimum number of reverse bends specified in table 3 for the appropriate diameter, tensile grade and finish. The radius of curvature of the supports for the various wire diameters is also given.

The test shall be performed 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.

NOTE 2 The reverse bend test is not mandatory for wires to comply with this International Standard.

Table 3 — Minimum number of reverse bends

Nominal diameter of wire d mm	Radius of curvature of supports mm	Minimum number of reverse bends			
		Bright wires and galvanized wires quality B			Galvanized wires quality A
		Tensile grade N/mm ²			
		1 570	1 770	1 960	1 570
$0,5 \leq d < 0,55$	1,75	15	14	13	—
$0,55 \leq d < 0,6$		14	13	12	—
$0,6 \leq d < 0,65$		12	11	10	—
$0,65 \leq d < 0,7$		11	10	9	—
$0,7 \leq d < 0,75$	2,5	15	14	13	12
$0,75 \leq d < 0,8$		14	13	12	11
$0,8 \leq d < 0,85$		13	12	11	10
$0,85 \leq d < 0,9$		11	10	9	8
$0,9 \leq d < 0,95$		10	9	8	7
$0,95 \leq d < 1$		10	9	8	7
$1 \leq d < 1,1$	3,75	15	14	13	12
$1,1 \leq d < 1,2$		13	12	11	10
$1,2 \leq d < 1,3$		12	11	10	9
$1,3 \leq d < 1,4$		10	9	8	7
$1,4 \leq d < 1,5$		9	8	7	6
$1,5 \leq d < 1,6$	5	12	11	10	9
$1,6 \leq d < 1,7$		11	10	9	8
$1,7 \leq d < 1,8$		10	9	8	7
$1,8 \leq d < 1,9$		9	8	7	6
$1,9 \leq d < 2$		8	7	6	5
$2 \leq d < 2,1$	7,5	13	12	11	10
$2,1 \leq d < 2,2$		12	11	10	9
$2,2 \leq d < 2,4$		11	10	9	8
$2,4 \leq d < 2,5$		10	9	8	7
$2,5 \leq d < 2,6$		9	8	7	6
$2,6 \leq d < 2,7$		8	7	6	5
$2,7 \leq d < 3$		7	6	5	4
$3 \leq d < 3,1$	10	11	10	9	8
$3,1 \leq d < 3,2$		10	9	8	7
$3,2 \leq d < 3,3$		9	8	7	6
$3,3 \leq d < 3,4$		9	8	7	6
$3,4 \leq d < 3,5$		8	7	6	5
$3,5 \leq d < 3,6$		7	6	5	4
$3,6 \leq d \leq 3,7$		7	6	5	4

3.5 Torsional strength

This test applies only to wire of nominal diameter equal to or greater than 0,5 mm. For wires of diameter less than 0,5, see 3.6.

The wire shall withstand without breaking the minimum number of torsions specified in table 4 for given diameter, tensile grade and finish.

The test shall be performed in accordance with 5.4.

If the tensile grade of a wire lies between two tensile grades given in table 4, then the number of torsions for the next upper tensile grade shall be chosen.

3.6 Tensile test on knotted wire

Wire of nominal diameter less than 0,5 mm with a single knot shall withstand without breaking a load of at least 50 % of the load corresponding to their tensile grade.

The test shall be performed in accordance with 5.5.

NOTE 3 This requirement replaces the reverse bend test (3.4) and torsional strength test (3.5).

3.7 Zinc coating

Two qualities of zinc coating¹⁾ are recognized in this International Standard:

- quality B for tensile grades 1570 N/mm², 1770 N/mm² and 1960 N/mm² and for nominal wire diameters between 0,2 mm inclusive and 6 mm inclusive;
- quality A for tensile grade 1570 N/mm² and for nominal wire diameters between 0,4 mm inclusive and 3,7 mm exclusive.

The zinc coating process is not specified.

The quality of the coating is defined by the minimum mass of zinc, in grams per square metre, as specified in table 5.

The inspection of zinc coating shall be performed in accordance with 5.6.

4 Sampling and criteria of conformity

The evidence of the wire manufacturer's test made in accordance with an agreed method should be accepted by the ropemaker.

If the ropemaker wishes to have acceptance tests carried out, the size of sample and the acceptance criteria shall be as given in table 6. To ensure representative sampling, the test lengths shall be taken at random.

If the number of defectives is greater than is shown in the third column of table 6, then all the units (units of product) shall be tested (100 %), but only for the defective characteristic(s).

In the case where one (or more) of these new tests is/are not satisfactory, the unit(s) represented by this test length does/do not conform.

Acceptance or refusal of a lot which does not conform shall be decided by agreement between the interested parties.

5 Tests

5.1 Measurement of diameter

The diameter shall be determined from two measurements in two perpendicular directions on the same section and the same diametrical plane using a micrometer accurate to 0,01 mm.

5.2 Tensile test

The tensile test shall be carried out in accordance with ISO 6892. The rate of stressing may be greater than that specified in ISO 6892 in view of the number of tests on wire involved in the inspection of the batch. However, it shall not exceed a rate producing an elongation of 25 % of the distance between grips within 1 min. The length of the test piece shall preferably be such that the distance between the grips of the testing machine is 100 mm.

In case of dispute, the tensile test shall be performed strictly in accordance with ISO 6892, particularly with regard to the rate of stressing.

5.3 Reverse bend test

The test shall be carried out in accordance with ISO 7801 with supports of radius of curvature specified in table 3.

1) Zinc coating quality AB is being used less and less; however, its wire characteristics are given in annex C.