
**Steel wire ropes for lifts — Minimum
requirements**

Câbles en acier pour ascenseurs — Exigences minimales

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 4344 was prepared by Technical Committee ISO/TC 105, *Steel wire ropes*.

This second edition cancels and replaces the first edition (ISO 4344:1983), which has been technically revised.

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Introduction

This International Standard was developed in response to a worldwide demand for a specification giving minimum requirements for ropes for use on lifts.

As in previous editions of the standard, metric sizes and grades of rope are covered. Additionally, due to widespread application world-wide, information is given in this edition on imperial sizes and grades for comparison and to assist in ensuring that existing levels of safety can be maintained when ropes are selected. It is desirable in such cases that the equipment designer, rope manufacturer or other competent person be consulted prior to ordering a rope.

This International Standard does not limit itself to those classes and constructions covered by the tables. Other stranded rope constructions may also conform to the minimum requirements, and in such cases the manufacturer would specify the minimum breaking force and rope grade.

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Steel wire ropes for lifts — Minimum requirements

1 Scope

This International Standard specifies the minimum requirements for the manufacture and testing of stranded carbon steel wire ropes used for suspension duty on traction drive and roped hydraulic lifts, and for compensation and governor duties on passenger and freight lifts, dumbwaiters, personnel hoists and man lifts moving between guides. It gives the minimum breaking forces for the more common sizes, rope grades and rope classes and constructions.

It is applicable to ropes made from bright and galvanized wire finish in various constructions from 6 mm to 38 mm diameter supplied as bulk manufacture and manufactured after its publication date. It is not applicable to ropes for builder's hoists and temporary hoists not running between permanent guides — whether passenger-carrying or not — or to ropes for cableways.

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.

[ISO 4344:2004](#)

ISO 2232, *Round drawn wire for general purpose non-alloy steel wire ropes and for large diameter steel wire ropes — Specifications*

ISO 3108, *Steel wire ropes for general purposes — Determination of actual breaking load*

ISO 4101, *Drawn steel wire for elevator ropes — Specifications*

ISO 4345:1988, *Steel wire ropes — Fibre main cores — Specification*

ISO 4346, *Steel wire ropes for general purposes — Lubricants — Basic requirements*

ISO 17893 ¹⁾, *Steel wire ropes — Vocabulary, designations and classifications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17893 and the following apply.

3.1

single tensile rope

rope with outer strands having outer wires of the same tensile strength grade as the inner wires

EXAMPLE 1 570 N/mm² throughout the rope.

1) To be published.

3.2 dual tensile rope

rope with outer strands having outer wires of a lower tensile strength grade than that of its inner wires

EXAMPLE 1 370 N/mm² outer wires and 1 770 N/mm² inner wires.

3.3 production length

length of completed rope equating to one loading of the closing machine

4 Requirements

4.1 Materials

4.1.1 Wire

Before rope making, wires shall conform to the diameter, torsion and, where applicable, zinc-coating requirements of the wire specifications given in Table 1. The mechanical properties of galvanized wires according to ISO 4101 shall be the same as those for bright wires. The requirements for the amount of zinc shall be in accordance with ISO 2232.

Table 1 — Wire specifications

Position of wires in the rope	Wire tensile strength grade N/mm ²				
	1180 ^a and 1320 ^a	1370	1570 and 1620 ^b	1770	1960
Outer wires of outer strands	ISO 4101	ISO 4101	ISO 4101	ISO 4101	ISO 2232
Inner, centre and core wires	—	—	ISO 2232	ISO 2232	ISO 2232
Filler wires	ISO 4101	ISO 4101	ISO 2232	ISO 2232	ISO 2232
^a Torsion properties as per 1370 N/mm ² wire tensile strength grade. ^b Torsion properties as per 1770 N/mm ² wire tensile strength grade.					

The test methods shall be in accordance with those given in ISO 2232.

All wires in the same layer shall be of the same tensile strength grade.

For ropes having galvanized wires, the level of coating shall be Quality B.

The tensile strength grades of the inner wires shall be subject to the wire tensile strength grades limits given in Table 2,

Table 2 — Tensile strength grades of inner wires of dual tensile ropes

Rope grade designation relating to inner wires (nominal value)	Range of wire tensile strength grades N/mm ²
1570	1370 to 1770
1770	1570 to 1960
1960	1770 to 1960

4.1.2 Core

4.1.2.1 General

The core shall be one of the following types:

- a) fibre;
- b) steel;
- c) steel-based composite, i.e. steel plus fibre or steel plus polymer;
- d) non-metallic, other than fibre-only.

Because of the large variety of existing designs, such as those prescribed by c) and d), these core types should be the subject of negotiation between purchaser and manufacturer.

4.1.2.2 Fibre core

Fibre cores, before rope making, shall conform to ISO 4345 and, for rope diameters 8 mm and above, shall be doubly closed (i.e. from yarn into strand and from strand into rope).

Natural fibre cores shall be manufactured from new sisal or manila vegetable fibre and, when measured before rope closing in accordance with Annex C of ISO 4345:1988, shall have a lubricant content of 10 % to 15 % by weight of the dry fibre material.

Man-made fibre cores shall be manufactured from polypropylene, polyethylene, polyester or polyamide and, when measured before rope closing in accordance with Annex C of ISO 4345:1988, shall have a lubricant content of 4 % to 10 % by weight of the dry fibre material.

The lubricant and/or impregnating compound used in the manufacture of the fibre core shall be compatible with the lubricant used in rope making.

4.1.2.3 Steel core

Steel cores for ropes larger than 7 mm diameter shall be an independent wire rope.

4.1.3 Lubricant

The lubricant shall be in accordance with ISO 4346.

4.2 Rope manufacture

4.2.1 General

All the wires in a strand shall have the same direction of lay.

In a new rope under tension on the closing machine, there shall be clearance between the outer strands.

The completed rope shall be evenly laid and free from loose wires, distorted strands and other irregularities.

When uncoiled, and under no load, the rope shall not be wavy.

Unless otherwise specified, the rope shall be of bright wire. Galvanized wire ropes shall be subject to agreement between purchaser and supplier.

For galvanized ropes, all the wires shall be galvanized, including those of a steel core where applicable.

4.2.2 Wire joints

Wires over 0,4 mm diameter shall, where necessary, have their ends joined by brazing or welding.

Wires up to and including those of 0,4 mm diameter shall, where necessary, be joined by brazing or welding or simply by ends being inserted into their correct position in the strand's formation.

4.2.3 Fibre core joints

Joints in fibre cores shall be made by splicing.

4.2.4 Lubrication

All of the strands of suspension and compensating ropes shall be lubricated during the stranding process. No lubricant shall be applied during the final closing of the rope.

4.2.5 Preformation and postformation

The rope shall be preformed and/or postformed unless specified otherwise by the purchaser.

4.2.6 Prestretching load limit

Where rope is supplied in the prestretched condition, in order to avoid rope damage, the maximum load to which the rope shall be subjected during the prestretching process shall not exceed 55 % of the minimum breaking force of the rope. The loading may be through static or dynamic means.

4.2.7 Rope ends

The rope ends shall be secured such that they are prevented from unlaying.

4.2.8 Rope construction

The rope construction or class shall be agreed between purchaser and manufacturer and shall be

- a) one of the more common rope constructions or classes covered by Tables A.1 to A.5, or
- b) another single layer or parallel closed construction not covered by the tables but having no less than six or more than nine outer strands, or
- c) another stranded rope construction other than those covered by a) and b).

Where only the class is specified by the purchaser, the construction shall be decided by the manufacturer.

NOTE 1 Each class of rope consists of a number of strand constructions, e.g. 8 × 19 class comprises 8 × 19W (1-6-6+6), 8x19S (1-9-9), 8x21F (1-5-5F-10) and 8x25F (1-6-6F-12).

NOTE 2 Tables A.1, A.2, A.3 and A.4 apply to ropes for suspension and governor duties.

NOTE 3 Tables A.1, A.2, A.3, A.4 and A.5 apply to compensating ropes.

4.2.9 Rope grade

4.2.9.1 General

The rope grade shall reflect the tensile strength grades of the outer and inner wires respectively.

EXAMPLE 1 Dual tensile rope grade 1180/1770 represents wire tensile strength grade 1 180 N/mm² for the outer wires and wire tensile strength grade 1 770 N/mm² for the inner wires

EXAMPLE 2 Single tensile rope grade 1570 represents wire tensile strength grade 1 570 N/mm² for both the outer and inner wires (see Table 2).

For the more common classes of rope, the rope grade value R_r , shall be used in the calculation of minimum breaking force of single tensile ropes, and the rope grade value R_{dt} shall be used in the calculation of minimum breaking force of dual tensile ropes. See Annex B for values of R_{dt} .

The rope grades for the various duties shall be in accordance with 4.2.9.2 to 4.2.9.4.

NOTE For other rope grades not following the system given above, see Annex D, which also gives guidance for equivalence.

4.2.9.2 Suspension ropes

Suspension ropes shall be of the following grades.

- a) For traction drive lifts (see Tables A.1 to A.3 and Table A.5):
- rope with fibre core: 1180/1770, 1320/1620, 1370/1770, 1570, 1620, 1770;
 - rope with steel core and parallel closed ropes: 1370/1770, 1570/1770, 1570, 1770.
- b) For roped hydraulic lifts (see Tables A.1 and A.4):
- rope with fibre core: 1370/1770, 1570, 1770, 1320/1620 and 1620;
 - rope with steel core and parallel closed ropes: 1370/1770, 1570/1770, 1770.

4.2.9.3 Governor ropes

Governor ropes shall be of the following grades: 1180/1770, 1320/1620, 1370/1770, 1570, 1620, 1770, 1960. See Tables A.1, A.2 and A.3.

4.2.9.4 Compensating ropes

Compensating ropes shall have rope grades in accordance with 4.2.9.2, plus 1960 grade. See Tables A.1 to A.5.

4.2.10 Type and direction of lay

The direction and type of lay shall be one of the following:

- a) right ordinary lay (sZ)²);
- b) left ordinary lay (zS)³);
- c) right lang lay (zZ)⁴);
- d) left lang lay (sS)⁵).

2) Formerly referred to as right hand ordinary (designated RHO) and right regular lay (designated RRL)

3) Formerly referred to as left hand ordinary (designated LHO) and left regular lay (designated LRL).

4) Formerly referred to as right hand Langs (designated RHL) or right lang lay (designated RLL).

5) Formerly referred to as left hand Langs (designated LHL) or left lang lay (designated LLL).

The type and direction of lay shall be right ordinary lay (sZ), unless specified otherwise by the purchaser.

4.2.11 Lay length

The lay length of the completed rope shall not exceed 6,75 times the nominal rope diameter.

4.3 Rope designation and classification

Rope classification and designation shall conform to the system requirements of ISO 17893.

4.4 Dimensions

4.4.1 Diameter

4.4.1.1 General

The nominal diameter shall be the dimension by which the rope is designated.

4.4.1.2 Tolerances

When measured in accordance with 5.3, the measured diameter of the rope shall not vary from the nominal diameter when measured under no load, and, when measured under a load equivalent to either 5 % or 10 % of the minimum breaking force of the rope, shall not vary by more than the tolerances given in Tables 3 to 5, as appropriate.

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Table 3 — Tolerances on diameter for suspension ropes for traction drive lifts and governor ropes with cores of fibre or other non-metallic materials

Nominal rope diameter <i>d</i> mm	Diameter tolerance as percentage of nominal rope diameter		
	Max. at no load	Min. at 5 % of F_{min}	Min. at 10 % of F_{min}
≤ 10	+ 6	+ 1	0
> 10	+ 5	+ 1	0

Table 4 — Tolerances on diameter for suspension ropes of traction drive lifts and governor ropes with steel or steel-based composite cores (including parallel closed ropes)

Nominal rope diameter <i>d</i> mm	Diameter tolerance as percentage of nominal rope diameter		
	Max. at no load	Min. at 5 % of F_{min}	Min. at 10 % of F_{min}
≤ 10	+ 3	0	- 1
> 10	+ 2	0	- 1