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Aerospace — Mechanical system parts — Preformed flexible steel wire rope for aircraft controls — Technical specification

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 2020 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*.

ISO 2020 was first published in 1973. This second edition cancels and replaces the first edition, of which it constitutes a technical revision.

Aerospace — Mechanical system parts — Preformed flexible steel wire rope for aircraft controls — Technical specification

1 Scope and field of application

This International Standard defines the technical requirements which shall be satisfied by flexible wire ropes of the "pre-formed" type, made either of carbon steel wire or of corrosion-resisting steel wire, for aircraft controls. The wire rope shall be capable of operation within a temperature range of -54 to $+121$ °C.

2 References

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

ISO 2532, *Steel wire ropes — Vocabulary*.

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

3 Definitions

The definitions given in this clause only apply to this International Standard but, where appropriate, are in accordance with ISO 2532.

3.1 wire : Each cylindrical steel element.

3.2 strand : An element of rope consisting of an assembly of several wires of appropriate shape and dimensions laid helically in one or more layers over a straight centre wire.

3.3 wire rope : A construction of several strands wound helically in one or more layers over a straight centre strand.

3.4 preformed wire rope : A wire rope in which the wires in the strand and the strands in the rope are formed during rope manufacture into the shape that they will assume in the finished rope.

3.5 diameter :

3.5.1 nominal diameter : The value by which the diameter of the wire, strand or rope is designated.

3.5.2 measured (or actual) diameter : That diameter which is obtained by measuring in accordance with a specified method (see 7.2.2).

3.6 length of lay (or pitch) : The distance parallel to the axis of the strand or rope, in which a wire or strand makes one complete turn about the axis, is designated as the length of lay (or pitch) of the strand or wire rope.

3.7 core wire (king wire) : The centre wire of each strand.

3.8 centre or core strand (of a wire rope) : A straight strand composed of wire as for the other strands.

3.9 elongation : For the purpose of this International Standard only, that length by which the rope extends between defined upper and lower limits of load (i.e., between first and second reading), expressed as a percentage of the gauge length measured at the lower limit (see 7.4).

3.10 lot : A lot shall consist of not more than 6 000 m of wire rope of the same construction and diameter produced continuously by one machine or by one series of progressive processing machines.

4 Carbon steel wire for ropes

4.1 Wire manufacture

4.1.1 Steel

The steel shall be manufactured by any process other than the bottom blown converter process and the cast analysis shall be within the limits given in table 1.

Table 1 — Limits for the cast analysis

Element(s)	% (m/m)	
	min.	max.
Carbon	0,5	0,85
Silicon	—	0,35
Manganese	0,4	0,9
Phosphorus	—	0,04
Sulfur	—	0,04
Sulfur + phosphorus combined	—	0,065

4.1.2 Wire

The wire shall be cold drawn from rods free from harmful defects and shall be zinc coated at a suitable stage of manufacture.

ture to meet the specified properties and performance of the finished rope. The wire shall also satisfy the additional requirements given in 4.2.

4.2 Additional requirements

4.2.1 Wire diameter tolerance

Table 2 — Wire diameter tolerance
Dimensions in millimetres

Nominal diameter		Tolerance
from	to less than	±
0,15	0,40	0,010
0,40	1,00	0,015

4.2.2 Tensile strength

The wire tensile strength shall be specified by the ropemaker.

4.2.3 Zinc coating

The minimum amount of zinc coating on the finished wire shall correspond to the values in table 3.

Table 3 — Minimum amounts of zinc coating
Dimensions in millimetres

Wire diameter		Zinc coating min. g/m ²
from	to less than	
0,15	0,25	10
0,25	0,40	15
0,40	0,50	30
0,50	0,80	50

5 Corrosion-resisting steel wire for ropes

5.1 Wire manufacture

5.1.1 Steel

The steel shall be manufactured by an electric furnace process or any other process that will produce steel capable of meeting this specification. The cast analysis shall be within the limits given in table 4.

Table 4 — Limits for cast analysis

Element	% (m/m)	
	min.	max.
Carbon	—	0,15
Silicon	—	1,0
Manganese	—	2,0
Phosphorus	—	0,045
Sulfur	—	0,03
Chromium	17,0	20,0
Nickel	8,0	12,0

5.1.2 Wire

The wire shall be cold drawn from rods free from harmful defects and supplied in the cold drawn condition to meet the

specified properties and performance of the finished rope. The wire shall also satisfy the additional requirements given in 5.2.

5.2 Additional requirements

5.2.1 Wire diameter tolerance

Table 5 — Wire diameter tolerance
Dimensions in millimetres

Nominal diameter		Tolerance
from	to less than	±
0,20	0,40	0,010
0,40	1,00	0,015

5.2.2 Tensile strength

The wire tensile strength shall be specified by the ropemaker.

6 Manufacture of wire rope

6.1 Types of construction

Wire ropes covered by this specification may be of two types (see table 6).

6.1.1 7 × 7 construction

This shall be composed of six outer strands each of seven wires laid in a right-hand direction around a centre strand of seven wires, with a length of lay of between six and eight times the nominal diameter of the rope.

The centre strand shall be composed of a layer of six wires laid in a right-hand direction around a core or king wire. It shall be of sufficient diameter to give full support to the outer strands, and shall have a length of lay not exceeding 60 % of the length of lay of the complete rope.

The six outer strands shall be composed of a layer of six wires laid in a left-hand direction around a core or king wire; they shall have a length of lay not exceeding 60 % of the length of lay of the complete rope.

6.1.2 7 × 19 construction

This shall be composed of six outer strands of 19 wires laid in a right-hand direction around a centre strand of 19 wires.

The centre strand shall be composed of a first layer of six wires laid in a right-hand direction around a core or king wire, and a second layer of 12 wires laid in a right-hand direction. It shall be of sufficient diameter to give full support to the outer strands.

The six outer strands shall be composed of a first layer of 6 wires and a second layer of 12 wires laid in a left-hand direction around a core or king wire.

The length of lay of the centre strand and of the outer strands shall be as follows :