INTERNATIONAL STANDARD

ISO 10955

First edition
1999-09-01

Aerospace — End-fittings and turnbarrels for aircraft control wire rope — Technical specification

Aéronautique et espace — Embouts et tendeurs de câbles de commande d'aéronefs —Spécification technique

Reference number
ISO 10955:1999(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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 10955 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 12, *Mechanical system parts*.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet iso@iso.ch

Printed in Switzerland

Aerospace — End-fittings and turnbarrels for aircraft control wire rope — Technical specification

1 Scope

This International Standard specifies the characteristics, the inspection and test methods as well as the quality assurance requirements for:

— end-fittings swaged on wire ropes, as specified in ISO 9737, ISO 9747, ISO 9748, ISO 9749, ISO 9759 and ISO 9760,

— wire rope turnbarrel parts, as specified in ISO 9736, ISO 9738, ISO 9757, ISO 9758 and ISO 9761, and

— wire rope turnbarrel assemblies (as defined in 3.1),

used in aircraft controls.

This International Standard is applicable to the parts cited above providing that reference is made to it in the product standard or the definition document.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2020-1:1997, *Aerospace — Preformed flexible steel wire rope for aircraft controls — Part 1: Dimensions and loads.*

ISO 2859-1:—[1)], *Sampling procedures for inspection by attributes — Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.*

ISO 5855-2:—[2)], *Aerospace — MJ thread — Part 2: Limit dimensions for bolts and nuts.*

ISO 8074:1985, *Aerospace — Surface treatment of austenitic stainless steel parts.*

ISO 8785:1998, *Geometrical Product Specification (GPS) — Surface imperfections — Terms, definitions and parameters.*

ISO 9001:1994, *Quality systems — Model for quality assurance in design, development, production, installation and servicing.*

ISO 9002:1994, *Quality systems — Model for quality assurance in production, installation and servicing.*

---

1) To be published. (Revision of ISO 2859-1:1989)

2) To be published. (Revision of ISO 5855-2:1988)

ISO 9003:1994, *Quality systems — Model for quality assurance in final inspection and test.*

ISO 9736:1999, *Aerospace — Eye-ends, in corrosion-resistant steel, threaded, for aircraft control wire rope — Dimensions and loads.*

ISO 9737:1999, *Aerospace — Eye-ends, in corrosion-resistant steel, swaged on aircraft control wire rope — Dimensions and loads.*

ISO 9738:1999, *Aerospace — Turnbarrels, for aircraft control wire rope — Dimensions and loads.*

ISO 9747:1999, *Aerospace — Double-shank ball-ends, in corrosion-resistant steel, swaged on aircraft control wire rope — Dimensions and loads.*

ISO 9748:1999, *Aerospace — Ball-ends, in corrosion-resistant steel, swaged on aircraft control wire rope — Dimensions and loads.*

ISO 9749:1999, *Aerospace — Stud-ends, in corrosion-resistant steel, swaged on aircraft control wire rope — Dimensions and loads.*

ISO 9757:1999, *Aerospace — Fork-ends, in corrosion-resistant steel, threaded, for aircraft control wire rope turnbarrels — Dimensions and loads.*

ISO 9758:1999, *Aerospace — Fork-ends, in corrosion-resistant steel, threaded, for rolling bearings, for aircraft control wire rope — Dimensions and loads.*

ISO 9759:1999, *Aerospace — Fork-ends, in corrosion-resistant steel, swaged aircraft control wire rope — Dimensions and loads.*

ISO 9760:1999, *Aerospace — Fork-ends, in corrosion-resistant steel, swaged on aircraft control wire rope, for rolling bearings — Dimensions and loads.*

ISO 9761:1999, *Aerospace — Locking clips, in corrosion-resistant steel, for aircraft control wire rope turnbuckles — Dimensions.*

ISO 9762:1999, *Aerospace — Aircraft control wire rope assemblies — Dimensions and end-fitting combinations.*

ISO 9763:1999, *Aerospace — Aircraft control wire rope assemblies — Technical specification.*

3 Terms and definitions

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

3.1
wire rope turnbarrel assemblies
assemblies consisting of two preformed flexible steel wire ropes, which have a swaged end-fitting on one side and a threaded end-fitting on the other

NOTE 1 The threaded ends are connected by means of a turnbuckle and secured by means of a locking clip.

NOTE 2 Specifications for turnbarrels and locking clips are given in ISO 9738 and ISO 9761, respectively.

3.2
surface imperfections
burrs, cracks, laps and scratches as defined in ISO 8785

3.3
manufacturing batch
number of elements with the same identity block, produced within the same production cycle, manufactured from the same batch of raw material and subjected to the same heat treatment

3.4
delivery batch
⟨homogeneous⟩ batch from the same manufacturing batch for which the sampling plan applies to the whole of this delivery batch

3.5
delivery batch
⟨heterogeneous⟩ batch made up of several manufacturing batches for which the sampling plan applies to each manufacturing batch

4 Requirements

The requirements are given in Table 1 and, unless otherwise specified, they also apply to ready for use parts. The test temperature shall, unless otherwise specified, be ambient temperature. These requirements shall be taken into account along with the conditions which figure in all the other standards or specifications cited in the product standards or the definition documents for end-fittings and cable turnbarrels.

Table 1 — Technical requirements and inspection and test methods

No.	Characteristic	Technical requirements	Inspection and test methods	Q[a]	A[b]
4.1	Dimensions and masses	In accordance with the product standards or definition documents.	Usual measuring instruments. Thread: GO-NO GO gauge.	×	×
4.2	Material	In accordance with the product standards or definition documents.	Chemical analysis or by the intermediary of a certificate of conformity supplied by the manufacturer for the half-finished product.	×	
4.3	Surface treatment	In accordance with the product standards or definition documents.	In accordance with the surface treatment standard.	×	×
4.4	Surface roughness	In accordance with the product standards or definition documents.	Usual instruments or visuotactile samples.	×	
4.5	Surface appearance	Absence of any surface imperfections other than those permitted in 4.9. Burrs acceptable in the thread/groove area for the locking clip if they do not hinder assembly of the end-fitting and the locking clip.	Usual inspection methods.	×	×
4.6	Marking	In accordance with the product standards or definition documents. It shall be legible and shall not damage the material or affect proper operation.	Visual examination.	×	×
4.7	Left-hand thread mark	In accordance with the product standards or definition documents.	Visual examination.	×	×
4.8	Thread	External thread rolled and free of burrs.	Visual examination.	×	×

Table 1 (*continued*)

No.	Characteristic	Technical requirements	Inspection and test methods	Q[a]	A[b]
4.9	Thread breaks	External thread: in accordance with Figures 1 and 2. Internal thread: in accordance with Figure 3.	Inspection on micrographic section: — for qualification, on finished parts; — for acceptance, by sampling during manufacture.	×	×
4.10	Turnbarrel assembly device locking play	Angular movement of the end-fittings in relation to the turnbarrel: see Table 7.	Hold the turnbarrel assembly in a vice. Apply torque to each end-fitting: — of a value in accordance with Table 7; — clockwise then anticlockwise. Measure the angle of rotation of each end-fitting in relation to the turnbarrel: — while the torque is being applied; — using a normal instrument.	×	
4.11	Effectiveness of the locking of turnbarrel assemblies	The locking clip shall: — stay in place; — maintain its effectiveness.	Apply to the turnbarrel for 25 hours: — a longitudinal pulling force equal to 25 % of the minimum breaking force given in Table 9; — vibrations at a frequency of 50 Hz and of a range of 3,15 mm along a perpendicular axis in relation to the turnbarrel. Carry out a visual examination of the turnbarrel assembly.	×	
4.12	Torsional strength of turnbarrel assemblies	After testing there shall be: — neither cracking, — nor distortion, — nor fracture, of the turnbarrel parts.	Hold one of the ends of the turnbarrel assembly in a vice. Apply to the other end torque of a value equal to that given in Table 8, first clockwise then anticlockwise. Do this five times (i.e. 10 inversions). Carry out a visual examination and/or use the usual measuring methods.	×	

Table 1 (*continued*)

No.	Characteristic	Technical requirements	Inspection and test methods	Q[a]	A[b]
4.13	Fatigue strength of turnbarrel assemblies under tensile load	After testing there shall be: — neither permanent elongation $> 0{,}1$ %, — nor fracture, of the turnbarrel parts.	Use a test device capable of transmitting the test load to the turnbarrel assembly under exactly the same conditions as during normal use. If this device contains a swaged cable, the latter shall be: — flexible, — in accordance with ISO 2020-1, — have a nominal diameter corresponding to that of the turnbarrel used, — swaged in accordance with ISO 9763. Screw the threaded ends until the thread is no longer visible. Apply an increasing and decreasing force between the maximum and minimum values given in Table 9 longitudinal to the turnbarrel assembly. Do this 300 times (i.e. 600 inversions). Carry out a visual examination or using the usual means.	×	
4.14	Ultimate tensile resistance of turnbarrel assemblies	After testing, there shall be no fracture of the turnbarrel parts.	Use the same device as in 4.13. Apply a tensile force equal or superior to the cable's minimum breaking load given in Table 9 longitudinal to the turnbarrel assembly. Perform a visual examination and/or using the usual means.	×	

[a] Q = conditions for executing qualification controls and tests (in accordance with 5.2)

[b] A = conditions for executing qualification controls and tests (in accordance with 5.3)

5 Quality assurance

5.1 General

5.1.1 Manufacturers' approval

The manufacturer shall satisfy the quality assurance and approval procedures defined in ISO 9001, 9002 or 9003. The aim of these procedures is to ensure that a manufacturer has a quality system and that he is capable of manufacturing, on a regular basis, control cable assemblies which fulfil the specified quality conditions.

The manufacturer's approval shall be granted by the Certification Authorities, or their delegated representative, who may be the main contractor.

5.1.2 Qualification of end-fittings and wire rope turnbarrels

The purpose of qualification inspections and tests for end-fittings and wire rope turnbarrels is to verify that the design and that the manufacturing conditions of these parts are such that the conditions of this International Standard are satisfied.

The qualification of end-fittings and wire rope turnbarrels shall be granted by the Certification Authorities in the buyer's country, or their appointed representative, who may be the main contractor.

5.1.3 Acceptance of end-fittings and wire rope turnbarrels

The purpose of acceptance inspections and tests for end-fittings and wire rope turnbarrels is to check as simply and cheaply as possible and with the inherent uncertainty of a statistical test, that the conditions of this International Standard can be satisfied.

Acceptance tests shall be carried out by the manufacturer, or under his responsibility. The manufacturer is responsible for the quality of the end-fittings and the wire rope turnbarrels.

5.2 Conditions for the execution of qualification inspections and tests

The qualification inspections and tests are given in Table 1. They shall be carried out again on every part for which the manufacturing conditions have been changed.

The order of the inspections and tests are left at the qualification authority's option.

5.2.1 End-fittings swaged on wire ropes and wire rope turnbarrel parts

Qualification shall be in accordance with Table 2.

5.2.2 Wire rope turnbarrel assemblies

Although they are not the subject of a product standard, wire rope turnbarrel assemblies shall be subjected to the inspections and tests given in Table 3 in order to qualify their components in service.

5.3 Conditions for the execution of acceptance inspections and tests

The acceptance inspections and tests are given in Table 1. They shall be carried out on each delivery batch in accordance with Table 4.

5.3.1 Sampling plan and sanctions

5.3.1.1 Dimensions checks

Sampling plan: single for normal level II inspection in accordance with ISO 2859-1.

Classification of faults: in accordance with Table 5.

5.3.1.2 Inspection of surface treatment; appearance and marking

Sampling plan: in accordance with Table 4.

Sanctions: any article not satisfying the conditions defined in 4.3, 4.5 and 4.6 shall be eliminated individually without leading to a rejection of the whole delivery batch.

5.3.2 User quality check

The user may, on receipt of the delivery batch, carry out his own check using all or part of the inspections given in Table 4 in order to ensure that the articles comply with the specified level of quality and to determine whether the delivery batch is acceptable.

This check may be carried out on the user's premises or, with the manufacturer agreement, at the place of manufacture.

6 Packaging

The products shall be packaged individually and in such a way that there is no deterioration during transportation. They shall be protected against corrosion, soiling and other harmful agents. The packaging material in contact with the products shall ensure this protection.

The following indications at least shall figure on every individual package:

— name and address of manufacturer;

— identity block defined by the product standard or the definition document;

— packing date;

— guaranteed storage period.

The following indications at least shall figure on the packaging of a grouped delivery:

— name and address of manufacturer;

— deal or order number;

— quantity (number of article contained in each grouped or intermediary package);

— name of article;

— identity block defined by the product standard or the definition document.

7 Certificate of conformity

All products supplied in accordance with this International Standard shall be accompanied by a certificate of conformity supplied by the manufacturer.

Table 2 — Qualification inspections and tests for swaged end-fittings and wire rope turnbarrel parts

Type of inspection and test	Defined in	Sample sequence number				
		1	2	3	4	5
Non destructive						
Dimensions and masses	4.1	×	×	×	×	×
Materials	4.2	Optional				
Surface treatment	4.3	Optional				
Surface roughness	4.4	×	×			
Surface appearance	4.5	×	×	×	×	×
Marking	4.6	×	×	×	×	×
Left-hand thread mark[a]	4.7	×	×	×	×	×
Destructive						
Thread[a]	4.8, 4.9	×	×	×	×	×

[a] Only applies to ISO 9736, ISO 9738, ISO 9749, ISO 9757 and ISO 9758.

Table 3 — Qualification tests for wire rope turnbarrel assemblies

Type of inspection and test	Defined in	Sample sequence number		
		1	2	3
Non destructive				
Locking device play	4.10	×	×	×
Destructive				
Locking effectiveness	4.11	×		
Torsional strength[a]	4.12		×	
Fatigue strength under traction	4.13		×	
Ultimate tensile strength	4.14			×

[a] To be carried out before testing fatigue strength under tensile loads.

Table 4 — Acceptance inspections and tests

Type of inspection and test	Defined in	Sampling plan
Dimensions	4.1	See 5.3.1.1
Surface treatment	4.3	At the manufacturer's discretion
Surface roughness	4.4	See Table 6
Surface appearance	4.5	100 %
Marking	4.6	100 %
Thread[a]	4.7, 4.8, 4.9	See Table 6

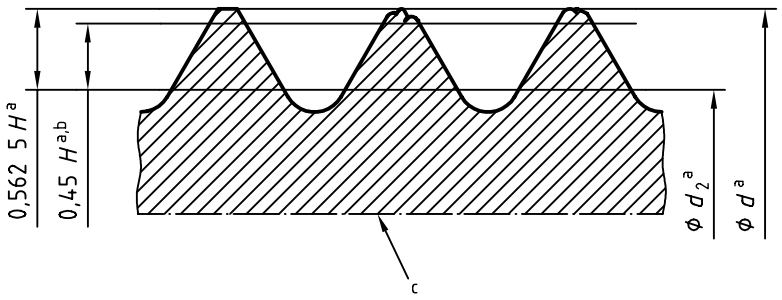
[a] Does not apply to ISO 9736, ISO 9738, ISO 9749, ISO 9757 and ISO 9758.

Table 5 — Acceptable quality level plan

International Standard	Major faults	Minor faults	
	AQL: 1,5	AQL: 2,5	AQL: 4
ISO 9736 ISO 9757 ISO 9758	— Width of the groove of the locking system — Thread tolerance class (4h 6h) — D_2 — D_2 perpendicularity tolerance — P	— D_2 localisation tolerance — D_3 — E	— H — L_1 — L_4
ISO 9737	— D_2 — D_2 perpendicularity tolerance — D_4 — L_4	— D_2 localisation tolerance — D_3 — D_4 coaxiality tolerance — E	— Symmetry tolerance of E — H — L_1
ISO 9738	— Width of the groove of the locking system — Thread tolerance class (4H 6H or 4H 5H) — P	— Groove's symmetry tolerance — D_2 — D_2 and D_3 coaxiality tolerance	— L_1 — L_2
ISO 9747 ISO 9748	— D_3	— D_1 — D_2 — D_2 and D_3 coaxiality tolerance	— L
ISO 9749	— Width of the groove — Thread tolerance class: 4h 6h — D_4 — L_6 — P	— D_1 — D_3 — D_4 coaxiality tolerance	— D_1 — L_1 — L_4 — L_5
ISO 9759 ISO 9760	— D_2 — D_2 perpendicularity tolerance — D_4	— D_2 localisation tolerance — D_3 — D_4 coaxiality tolerance — E — F	— Symmetry tolerance of E — H — L_1
The dimensions not specified in the table shall be checked with a AQL equal to 25.			
NOTE The dimension letter codes given in the table are those in the product standards.			

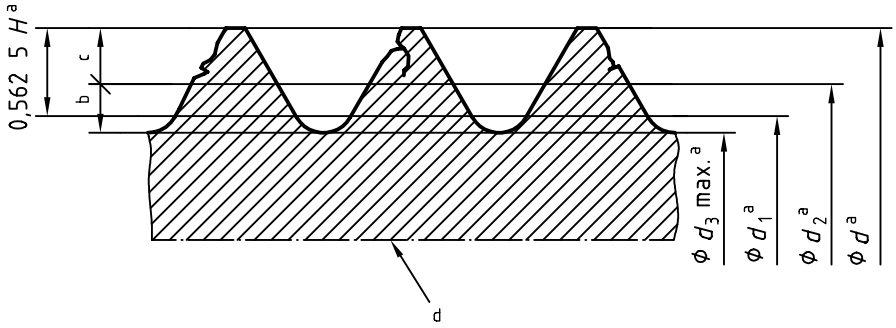
Table 6 — Sampling plan

Number of items in delivery batch	Number of samples	Acceptance criteria	Non-conformity criterion
		A	R
1 to 90	2	0	1
91 to 150	2	0	1
151 to 280	2	0	1
281 to 500	2	0	1
501 to 1 200	3	0	1
1 201 to 3 200	6	0	1



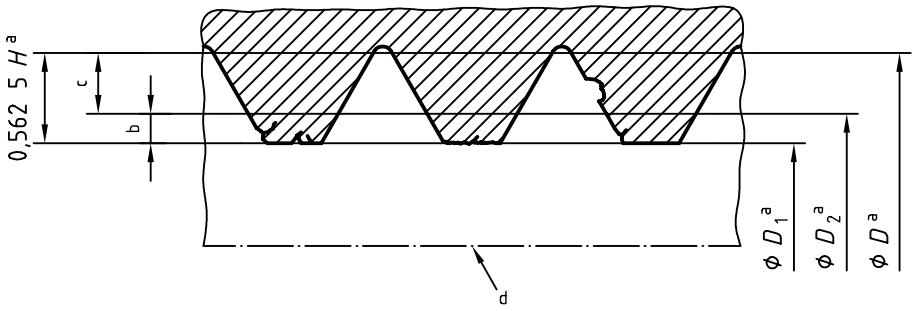
a In accordance with ISO 5855-2.
b No imperfection is allowed in this area.
c Axis of end-fitting

Figure 1 — Imperfections in external threading at the crest of the threads



a In accordance with ISO 5855-2.
b No imperfection in this area.
c Area in which discontinuities not exceeding 0,112 5 H are tolerated.
d Axis of end-fitting

Figure 2 — Imperfections in external threading on the flank of the threads



a In accordance with ISO 5855-2.
b Hollows and cracks are allowed in this area.
c No cracks are tolerated in this area. Only hollows of a depth of 50 μm are allowed except in the thread's bottom radius.
d Axis of body of turnbarrel

Figure 3 — Imperfections in internal threading

Table 7 — Maximum angular movement

Nominal diameter of the cable mm	Torque Nm	Maximum angle of rotation in degrees
1,6	0,09	15
2,4	0,29	11
3,2	0,94	8
4	0,94	8
4,8	1,84	7
5,6	3,6	6
6,4	3,6	6

Table 8 — Load limits

Nominal diameter of the cable mm	Torque Nm
1,6	0,9
2,4	2,9
3,2	9,4
4	9,4
4,8	18,4
5,6	36
6,4	36

Table 9 — Load limits

Nominal diameter of the cable mm	Tensile load limits kN	Minimum breaking load of the cable[a] kN
1,6	from 0,4 to 1,3	2,15
2,4	from 0,8 to 2,6	4,45
3,2	from 1,7 to 5,7	8,9
4	from 2,4 to 8	12,45
4,8	from 3,7 to 12	18,6
5,6	from 5 to 16	24,9
6,4	from 6 to 20	31,2

[a] These values correspond to the cable with the highest performance (material, type of composition) for each given nominal diameter, see ISO 2020-1.

ICS 49.035

Price based on 12 pages