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Aerospace series — Tube fittings for fluid systems, 5 080 psi (35 000 kPa) — Qualification specification

Série aérospatiale — Raccordements de tubes pour les systèmes fluides, 5 080 psi (35 000 kPa) — Spécification de qualification

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Foreword

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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 meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.

Introduction

This International Standard establishes the basic performance for 5 080 psi (35 000 kPa) tube fitting assemblies used in aerospace fluid systems.

The test requirements are intended to satisfy the most strenuous demands encountered in a high-performance aircraft hydraulic system.

International Standards use the International System of units (SI); however, large segments of the aerospace industry make use of other measurement systems as a matter of common working practice.

All dimensions and units used in this International Standard are given in SI units, with other units also indicated for the convenience of the user.

The decimal sign used in International Standards is the comma (“,”); however, the comma is not used in common working practice with non-SI dimensions. Therefore, in common with many other aerospace standards, the decimal point (“.”) is used in this International Standard when providing dimensions in inch-pound units.

NOTE The use of non-SI units and the decimal point in this International Standard does not constitute general acceptance of measurement systems other than SI within International Standards.

Aerospace series — Tube fittings for fluid systems, 5 080 psi (35 000 kPa) — Qualification specification

1 Scope

This International Standard specifies performance and quality requirements for the qualification and manufacture of standard tube fittings to ensure reliable performance in aircraft hydraulic 5 080 psi (35 000 kPa) systems.

This International Standard specifies baseline criteria for the design and manufacture of system fittings that are qualification tested on engines.

This International Standard covers fittings from size –04 to –20 used for the following:

— separable/permanent pipe end fittings;

— permanent connection fittings;

— separable connection fittings.

This International Standard covers fittings of the temperature types and pressure classes specified in ISO 6771.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2685, *Aircraft — Environmental test procedure for airborne equipment — Resistance to fire in designated fire zones*

ISO 6772, *Aerospace — Fluid systems — Impulse testing of hydraulic hose, tubing and fitting assemblies*

ISO 6773, *Aerospace — Fluid systems — Thermal shock testing of piping and fittings*

ISO 7137, *Aircraft — Environmental conditions and test procedures for airborne equipment*

ISO 7257, *Aircraft — Hydraulic tubing joints and fittings — Rotary flexure test*

ISO 10583:1993, *Aerospace fluid systems — Test methods for tube/fitting assemblies*

EUROCAE ED-14E/RTCA DO-160E, Section 22, *Lightning Induced transient Susceptibility*

3 Requirements

3.1 Qualification

Fittings claiming conformity with this International Standard shall be representative of products, which have successfully met the requirements and have passed the tests in this International Standard.

3.1.1 Manufacturer qualification

Manufacturer approval shall be granted by purchaser qualification procedure.

Outside agency procedure can be used if no specific procedure exists (see Annex A, Table A.3, Procedure 1).

3.1.2 Product qualification

Product approval shall be granted by purchaser qualification procedure.

Outside agency procedure can be used if no specific procedure exists (see Annex A, Table A.3, Procedure 1).

3.2 Materials

3.2.1 Fittings

Fitting parts shall be manufactured from materials as given in Table 1 or equivalent passing the specified tests. The various materials shall be used according to the pressure and temperature requirements of the system, as shown in Table 2.

Table 1 — Materials for fittings

Material	Type[a]	Material code	Starting stock
Titanium alloy	I, II, III	T	Bar, forgings, or rings
Corrosion-resistant steel	I, II, III, IV	V	Bar, forgings, or rings
Other	To be defined	To be defined	To be defined

[a] Temperature types and system pressure classes are defined in ISO 6771.

Magnesium and magnesium alloy shall not be used.

3.2.2 Tubing

Table 2 — Materials for tubing

Material	Material code	Starting stock
Titanium alloy	T	Hollows
Corrosion-resistant steel	V	Hollows
Other	To be defined	To be defined

3.2.3 Testfluid

Unless otherwise specified, fluid for testing shall be used in accordance with Annex A, Table A.1.

3.3 Environmental conditions

3.3.1 Pressures

Table 3 — Pressure test requirements, 35 000 kPa (5 080 psi) fittings

Dimensions in SI-metric (and imperial) units

Fitting and tube size[a]	Design operating pressure (DOP)		Proof pressure (2 × DOP)		Burst pressure (3 × DOP)	
	kPa	(psi)	kPa	(psi)	kPa	(psi)
04	35 000	(5 080)	70 000	(10 160)	105 000	(15 240)
06						
08						
10						
12						
16						
20						

[a] Dash size in 1/16 in, example: 08 = 8/16 in diameter.

3.3.2 Temperature

3.2.2.1 Ambient Air: −54 °C to +135 °C

3.2.2.2 Hydraulic Fluid: −54 °C to +135 °C

3.4 Design and manufacture

3.4.1 Fluid passages

On fittings where the fluid passage is drilled from each end, the offset between the drilled holes at the meeting point shall not exceed 0,25 mm (0.10 in). It shall be possible to pass through the fitting passage a ball whose diameter is 0,37 mm (0.015 in) less than the minimum diameter specified for the passage.

Angular misalignment shall not exceed 1° for straight fittings and 2° for shaped fittings.

3.5 Performance

The tubing/fitting assembly shall be capable of meeting the performance requirements specified in 3.5.1 to 3.5.21.

3.5.1 Specimen preparation

Test specimens shall be assembled as specified in Table 11. Sleeve installations on the tube end shall be in accordance with user instructions.

The fitting shall be assembled to tightening torques given by purchaser procurement specification, using the maximum installing torque for half of the test specimens and the minimum torque for the other half.

3.5.1.1 Lubricants

Hydraulic system fittings shall be assembled using system fluid as lubricant on the union thread and sleeve shoulder only. No lubricant on the sealing surfaces (especially during pneumatic leakage testing) is allowed.

3.5.1.2 Qualification inspection

Test assemblies shall consist of the parts specified in 3.5.1. Tests shall be conducted in accordance with Table 11 and with ISO 10583 for each size and material for which qualification is required.

Fittings claiming conformity with this specification shall be considered qualified if they are manufactured to the same dimensions, using the same materials and processes as products that have successfully met the requirements and have passed the tests in this specification.

3.5.2 Proof pressure

When testing in accordance with ISO 10583:1993, 5.1, the test assembly shall withstand the proof pressure specified in Table 3 without leakage, evidence of permanent deformation, or other malfunction that might affect the ability to disconnect or connect the joint in the normal manner (to the interface point by hand and then using the specified range of torque values).

Specimens to be proof tested are given in Table 11.

3.5.3 Gaseous pressure

When tested in accordance with ISO 10583:1993, 5.2, assemblies shall pass the gaseous pressure test to the DOP specified in Table 3 without leakage or other failure.

Specimens to be gaseous pressure tested are given in Table 11.

3.5.4 Hydraulic impulse resistance

Six specimens shall be tested with the following distribution:

— 2 non aged specimens;

— 2 fuel aged specimens as per 3.5.16;

— 2 hydraulic fluid aged specimens as per 3.5.17.

When tested in accordance with ISO 6772 and ISO 10583:1993, 5.3, the test assembly shall withstand, without leakage, 300 000 impulse pressure cycles with pressure peaks specified and temperatures in Table 4.

Table 4 — Peak pressure and temperature

Peak pressure % of nominal pressure	Peak pressure kPa (psi)	Maximum ambient temperature	Minimum ambient temperature
150	52 500 (7 620)	+94 °C (+201 °F)	−40 °C (−40 °F)

After hydraulic impulse test, three specimens (1 non aged, 1 fuel aged, and 1 hydraulic fluid aged) shall be tested at nominal torque and pass the pressure tests as per 3.5.3 and 3.5.15.

For margin evaluation, testing is to be continued on the other three specimens at +110 °C (+230 °F) up to failure or completion 450 000 cycles.

Specimens which passed these additional cycles shall pass to minimum burst pressure test as per 3.5.5.

Specimens to be impulse tested are given in Table 11.

3.5.5 Ultimate pressure

When tested as follows, the test assemblies shall be pressurized to the burst pressure specified in Table 3 and held at that pressure for 3 min after stabilization of the pressure. The pressure shall then be increased at a rate of 137 894 kPa/min ± 34 474 kPa/min (20 000 psi/min ± 5 000 psi/min) until failure occurs. No burst, slippage, leakage, or other failure shall occur at a pressure below 4 × DOP.

Seven specimens shall be tested to failure with the following distribution:

— Two non aged specimens shall be tested at +94 °C (+201 °F).

— Two aged specimens after salt spray as per 3.5.11 at +94 °C (+201 °F).

— Three specimens from hydraulic impulse resistant (3.5.3) at room temperature.

Specimens to be ultimate pressure tested are given in Table 11.

3.5.6 Flexure fatigue resistance

When tested in accordance with ISO 7257 and ISO 10583:1993, 5.5, test assemblies shall not fail.

Eight specimens with straight unions shall be tested. Two specimens shall withstand 10^7 flexure cycles with a bending stress level defined in Table 5. The other specimens shall be used to produce a S-N curve as described in ISO 7257.

Table 5 — Test requirements for testing on titanium pipes

Fitting size	DOP		Dynamic bending stress for titanium tubes[a] +0 %/-10 %	
	kPa	(psi)	kPa	(psi)
04	35 000	(5 080)	137 900	(20 000)
06			131 000	(19 000)
08			124 100	(18 000)
10			117 200	(17 000)
12			110 300	(16 000)
16			103 400	(15 000)
20			96 500	(14 000)

[a] Bending stresses for other tube materials shall be calculated with the same deflection.

Specimens to be fatigue flexure tested are given in Table 11.

3.5.7 Re-use capability

Two specimens shall be tested (only end fittings and separable fittings shall be tested).

When tested in accordance with ISO 10583:1993, 5.7.2, there shall be none of the following defects:

— leakage during any of the proof pressure tests, when tested in accordance with 3.5.2;

— inability to assemble the fitting to the interface point by hand;

— nut deformation preventing engagement of the nut hexagon with an open-end wrench;

— gaseous leakage following final assembly, when tested in accordance with 3.5.3.

Specimens to be re-use tested are given in Table 11.