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Aerospace — Fluid systems — Hydraulic system tubing

Série aérospatiale — Systèmes de fluides — Tubes pour systèmes hydrauliques

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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 8575:1990), which has been technically revised.

Introduction

The purpose of this document is to provide information relating to the sizes and materials of tubing for use in aerospace hydraulic pressure and return and suction lines.

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. Although tube sizes were originally defined (and are frequently cited) using non-SI units, all dimensions used in this document are given in SI units, with inch 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 for inch dimensions. Therefore, in common with many other aerospace standards, the decimal point is used in this document when providing dimensions in inches.

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

Aerospace — Fluid systems — Hydraulic system tubing

1 Scope

This document provides information relating to the sizes and materials of tubing for use in aerospace hydraulic pressure and return and suction lines. For pressure lines, the requirements apply to the pressure and temperature ranges covered by pressure class D, E and J and temperature type 13 and type 20 as specified in ISO 6771.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 8574, *Aerospace — Hydraulic system tubing — Qualification tests for bent tubes*

ISO 6771, *Aerospace — Fluid systems and components — Pressure and temperature classifications*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp/

3.1
inch — tubing
tubing diameters and wall thickness in fractional inch increments and based on industry standards

3.2
metric tubing
tubing diameters and wall thickness in SI-metric units

Note 1 to entry: Metric tubing is in compliance with ISO 2964.

4 Requirements

4.1 General

The pipe dimensions quoted are in common use for the stated materials in the different pressure and temperature classes. Inclusion of a dimension under a pressure and temperature class in this document does not constitute a guarantee of fitness for purpose in all circumstance. Aircraft Systems designers should verify each tube assembly application with the appropriate stress authority.

4.2 Pressure lines

4.2.1 Tubing material

Material for tubing used in hydraulic system pressure line shall be in accordance with Table 1 and shall conform to the appropriate physical properties specified in Table 1.

4.2.2 Tube sizes

The outside diameters, wall thicknesses and materials of tubing used in the manufacture of tube assemblies shall conform, where applicable, to the relevant requirements given in Table 2 or Table 3 for inch tubing and Table 4 or Table 5 for metric tubing.

Where no wall thickness is shown in the tables for a particular combination of tube outside diameter and material and it is desired to use that combination, a suitable wall thickness shall be selected and verified by testing in accordance with ISO 8574.

4.2.3 Qualification

Tubing having outside diameters, wall thicknesses and materials as specified in Table 2 and Table 3 shall have been verified by testing in accordance with the requirements of ISO 8574.

4.3 Suction and return lines

4.3.1 Tubing Material

Materials for tubing used in hydraulic system suction and return lines may be as given in Table 1 and verified in accordance with ISO 8574 or at the discretion of the aircraft designer.

4.3.2 Tube sizes

Unless otherwise specified, the outside diameters for inch tubing used in suction and return lines shall be selected from those specified in Table 2 or Table 3 for inch tubing, and from Table 4 or Table 5 for metric tubing.

The corresponding wall thicknesses shall be selected and verified in accordance with Table 2 to Table 5 or at the discretion of the aircraft designer.

Table 1 — Tubing materials

Material		Ultimate tensile strength		Yield strength		Percent elongation $A_{min.}$
Code no.	**Description**	**R_m min.** MPa	**min.** (psi)	**$R_{p0,2}$ min.** MPa	**min.** (psi)	%
1	Cold worked corrosion resistant steel 304-1/8H	725	(105 000)	515	(75 000)	20
2	High strength corrosion resistant steel 21-6-9	980	(142 000)	825	(120 000)	20
3	Re-annealed corrosion resistant steel UNS S32100	500	(72 500)	210	(30 500)	40
4	Cold-worked and stress relieved titanium Ti-3AL-2.5V	860	(125 000)	720	(105 000)	10
5		690	(100 000)	655	(95 000)	14
6	Unalloyed titanium TiCP	350	(50 000)	250	(35 000)	28
7	Aluminium alloy (6061), Solution treated and artificially aged (T6)	290	(42 000)	240	(34 000)	10

NOTE While waiting for the publication of International Standards for the materials described in Table 1, national standards accepted by the corresponding country conforming to the requirements specified in this table are given in Annex A for information.

Table 2 — Outside diameters, wall thicknesses and materials for hydraulic tubing, pressure lines — Inch tubing

Temperature[a]			**Type 13** -65 °F to 275 °F (-55 °C to 135 °C)									
Pressure class[a] **Design-Operating-Pressure (DOP)**			**Class D** 21 000 kPa (3 000 psi)						**Class J** 35 000 kPa (5 000 psi)			
Material code no.			1		2		4 or 5		4 or 5			
Material designation			304-1/8H		21-6-9		Ti-3AL-2.5V		Ti-3AL-2.5V			
Tube outside diameter			**Tube wall thickness**						**Tube wall thickness**			
									Type A		**Type B**	
Dash size	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
4	6,35	(.250)	0,51	.020	0,41	(.016)	0,41	(.016)	0,64	(.025)	0,55	(.022)
6	9,525	(.375)	0,71	.028	0,51	(.020)	0,48	(.019)	0,76	(.030)	0,81	(.032)
8	12,70	(.500)	0,89	.035	0,66	(.026)	0,66	(.026)	1,02	(.040)	1,09	(.043)
10	15,875	(.625)	1,24	.049	0,84	(.033)	0,81	(.032)	1,27	(.050)	1,37	(.054)
12	19,05	(.750)	1,47	.058	0,99	(.039)	0,99	(.039)	1,50	(.059)	1,65	(.065)
16	25,4	(1.000)	1,65	.065	1,32	(.052)	1,32	(.051)	2,01	(.079)	2,23	(.088)
20	31,75	(1.250)			1,78	(.070)	1,78	(.070)	2,49	(.098)	2,67	(.105)
24	38,1	(1.500)									3,18	(.125)
32	50,8	(2,000)										

[a] Temperature and pressure classes according to ISO 6771.

Table 3 — Outside diameters, wall thicknesses and materials for hydraulic tubing, suction and return lines — Inch tubing

Temperature[a]			**Type 13** -65 °F to 275 °F (-55 °C to 135 °C)									
Pressure class[a] **Design-Operating-Pressure (DOP)**			**Class N/A**[b] 1 500 kPa (220 psi)		**Class N/A**[b] 1 500 kPa (220 psi)		**Class A** 4 200 kPa (600 psi)		**Class N/A or B**[b] 7 000 or 10 500 kPa[c] (1 000 or 1 500 psi)[c]		**Class A or N/A**[b] 4 200 or 7 000 KPa[c] (600 or 1 000 psi)[c]	
Material code no.			3		7						2	
Material designation			UNS S32100		6061-T6						21-6-9	
Tube outside diameter			**Tube wall thickness**		**Tube wall thickness**						**Tube wall thickness**	
Dash size	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
4	6,35	(.250)							0,89	(.035)		
6	9,525	(.375)							0,89	(.035)		
8	12,70	(.500)							0,89	(.035)		
10	15,875	(.625)							0,89	(.035)		
12	19,05	(.750)							0,89	(.035)		
16	25,4	(1.000)							1,22	(.048)		
20	31,75	(1.250)			0,89	(.035)	1,24	(.049)	1,52	(.060)	0,61	(.024)
24	38,1	(1.500)			0,89	(.035)	1,24	(.049)	1,85	(0,73)	0,61	(.024)
32	50,8	(2,000)	0,71	(.028)								

[a] Temperature and pressure classes according to ISO 6771.

[b] No pressure class definition in ISO 6771 at the time of the preparation of this document, N/A: Not applicable.

[c] Used for different DOPs.

Table 4 — Outside diameter, wall thicknesses, and materials for hydraulic tubing pressure and return lines — Metric tubing

Temperature[a]			**Type 13**[b] -55 °C to 135 °C (- 65 °F to 275 °F)																	
Pressure[a]			**Class H** 14 000 kPa (2 000 psi)						**Class D** 21 000 kPa (3 000 psi)						**Class E** 28 000 kPa (4 000 psi)					
Material code no.			1		2		4		1		2		4		2		4		6	
Material designation			304-1/8H		21-6-9		Ti-3AL-2.5V		304-1/8H		21-6-9		Ti-3AL-2.5V		21-6-9		Ti-3AL-2.5V		TiCP	
Tube outside diameter			**Tube wall thickness**						**Tube wall thickness**						**Tube wall thickness**					
DN Size	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
DN05	5	(.196)	—	—	—	—	(0,4)[c] 0,5	(.015) (.019)	0,4	(.015)	0,4	(.015)	0,4	(.015)	0,6	(.023)	(0,4)[c] 0,5	(.015) (.019)	—	—
DN06	6	(.236)	—	—	—	—	(0,4)[c] 0,5	(.015) (.019)	0,5	(.019)	0,4	(.015)	0,4	(.015)	0,6	(.023)	0,5	(.019)	0,8	(.031)
DN08	8	(.314)	—	—	—	—	(0,4)[c] 0,5	(.015) (.019)	0,5	(.019)	0,5	(.019)	0,5	(.019)	0,8	(.031)	0,6	(.023)	0,9	(.035)
DN10	10	(.393)	—	—	—	—	0,5	(.019)	0,7	(.028)	0,5	(.019)	0,5	(.019)	0,8	(.031)	0,8	(.031)	1,2	(.047)
DN12	12	(.472)	—	—	—	—	0,5	(.019)	0,8	(.031)	0,7	(.028)	0,7	(.028)	0,9	(.035)	0,9	(.035)	1,4	(.055)
DN14	14	(.551)	—	—	—	—	0,5	(.019)	1,0	(.039)	0,8	(.031)	0,8	(.031)	—	—	1,0	(.039)	1,6	(.063)
DN16	16	(.660)	—	—	—	—	0,6	(.023)	1,0	(.039)	1,0	(.039)	0,8	(.031)	1,2	(.047)	1,2	(.047)	1,8	(.071)
DN18	18	(.709)	—	—	—	—	0,7	(.028)	—	—	—	—	—	—	—	—	1,3	(.051)	—	—
DN20	20	(.787)	—	—	—	—	0,7	(.028)	1,5	(.059)	1,0	(.039)	1,0	(.039)	1,5	(.059)	1,5	(.059)	—	—
DN22	22	(.866)	—	—	—	—	0,8	(.031)	—	—	—	—	1,2	(.047)	—	—	1,6	(.063)	—	—
DN25	25	(.984)	—	—	—	—	0,9	(.035)	1,6	(.063)	1,3	(.051)	1,3	(.051)	1,9	(.075)	1,8	(.071)	—	—
DN28	28	(1.102)	—	—	—	—	1,0	(.031)	—	—	—	—	1,6	(.063)	—	—	2,0	(.078)	—	—
DN32	32	(1.260)	—	—	—	—	1,2	(.039)	2,2	(.087)	—	—	1,8	(.071)	2,2	(.087)	2,2	(.087)	—	—

[a] Temperature and pressure classes according to ISO 6771.

[b] For higher temperature (Type 20), refer to Table 5.

[c] Values in ( ) are based on calculation only. Values below 0,5 mm wall thickness are critical due to manufacturing reason.