STATISTICAL DESIGN PROPERTIES FOR AEROSPACE METALLIC MATERIALS

BACKGROUND

MMPDS stands for Metallic Materials Properties Development and Standardization. The MMPDS technical coordination activity is an industry-government collaborative process in which consistent and reliable methods are used to collect, analyze, and present statistically based material and fastener allowable properties.

EVOLUTION OF THE HANDBOOK

The MMPDS Handbook, successor to MIL-HDBK-5, is the primary source of statistically based design allowable properties for metallic materials and fasteners used in commercial and military aircraft systems around the world. It is recognized and used by engineers worldwide to ensure that metallic material designs meet specifications for air worthiness in commercial and military aircraft systems.

HANDBOOK CONTENTS

The MMPDS Handbook contains mechanical property tables with design allowables for tensile, compression, shear, and bearing properties. Among other properties included in the handbook are effects of temperature on properties, plane-strain fracture toughness, and fastener joint allowables.

The MMPDS Handbook is updated on a regular basis to ensure that:

- Reliable, statistically based design properties are available for as many mature materials and/or product forms as possible
- Current statistical design properties are validated or updated on older “legacy” alloys
- Other supporting data (fatigue, crack growth, fracture toughness, effect of temperature) are represented
- Recently cancelled specifications are identified.

MMPDS ORGANIZATION

The MMPDS organization has a Secretariat, a Government Steering Group (GSG) and Industry Steering Group (ISG) in primary roles, and subordinate component-focused steering groups that work through a General Coordinating Committee to direct task groups.

Battelle has continued to hold the function of Secretariat since 1954 and serves as an impartial data reviewer. The GSG is composed of FAA and other government agencies who help fund MMPDS.

MEMBERSHIP

Government and Industry memberships help support the ongoing effort of this Handbook. A portion of the ISG membership is set aside for related activities and benefits available only to funding companies, such as analysis tools, and access to archived documents, as determined by the ISG member companies.

POINT OF CONTACT

For more information, including the range of paid membership levels, contact Anne Mundy at Battelle by phone (614) 424-6496 or e-mail MundyA@battelle.org or go to www.mmpds.org.

Reduce the cost of developing material properties. MMPDS builds synergy among OEMS and Material Producers, saving money for both by collaborating on data submission and inclusion in MMPDS.

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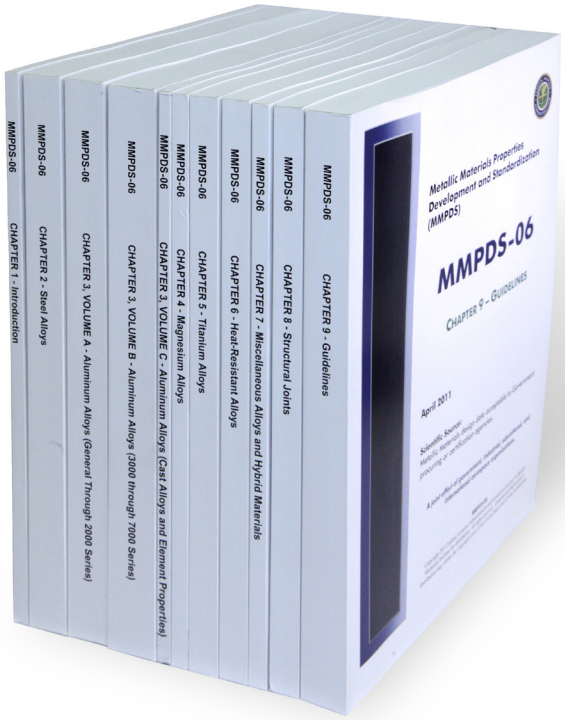
Per guidance provided by FAA Advisory Circular (AC) 25.613-1 and FAA policy memorandum PS-AIR100-2006-MMPDS, the 'A' and 'B' basis values published for materials in the MMPDS have been determined by the FAA to satisfy the material strength probability levels required by Title 14 of the Code of Federal Regulations (14 CFR) § 27.613(d), § 29.613(d), §25.613(b) and §23.613(b).

Chapter 1: Introduction
Chapter 2: Steel Alloys
Chapter 3: Aluminum Alloys
Chapter 4: Magnesium Alloys
Chapter 5: Titanium Alloys
Chapter 6: Heat-Resistant Alloys
Chapter 7: Miscellaneous Alloys and Hybrid Materials
Chapter 8: Structural Joints
Chapter 9: Guidelines

Per guidance provided in the Joint Service Specification Guide (JSSG) 2006 and MIL-STD-1530, the "A" and "B" basis design allowables published for materials in the MMPDS have been determined by Department of Defense (DoD) services to satisfy the strength and statistical variability requirements for airframe metallic materials.



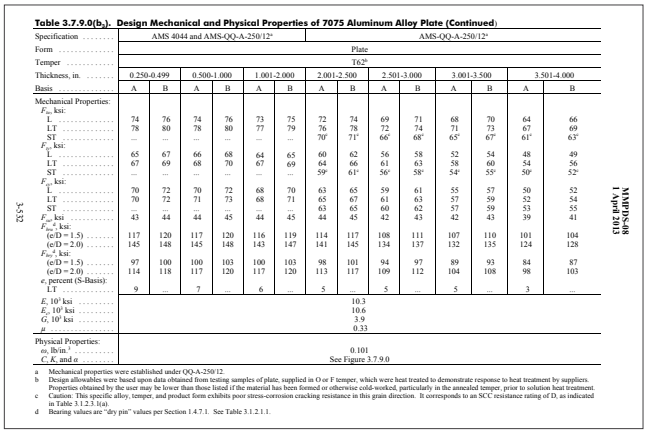
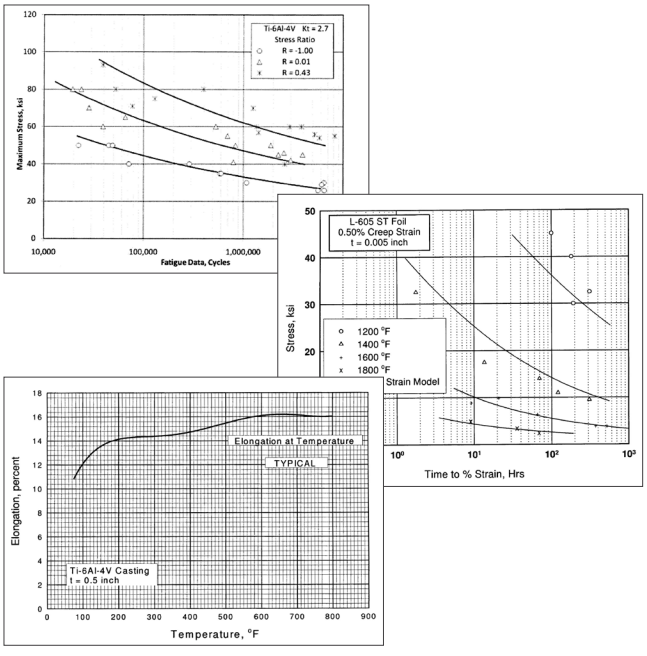


Table 3.7.9.0(b$_d$). Design Mechanical and Physical Properties of 7075 Aluminum Alloy Plate (Continued)

Specification	AMS 4044 and AMS-QQ-A-250/12[a]						AMS-QQ-A-250/12[a]							
Form	Plate													
Temper	T62[b]													
Thickness, in.	0.250-0.499		0.500-1.000		1.001-2.000		2.001-2.500		2.501-3.000		3.001-3.500		3.501-4.000	
Basis	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Mechanical Properties:														
F_{tu}, ksi:														
L	74	76	74	76	73	75	72	74	69	71	68	70	64	66
LT	78	80	78	80	77	79	76	78	72	74	71	73	67	69
ST	...	...	...	...	...	...	70[c]	71[c]	66[c]	68[c]	65[c]	67[c]	61[c]	63[c]
F_{cy}, ksi:														
L	65	67	66	68	64	65	60	62	56	58	52	54	48	49
LT	67	69	68	70	67	69	64	66	61	63	58	60	54	56
ST	...	...	...	...	...	...	59[c]	61[c]	56[c]	58[c]	54[c]	55[c]	50[c]	52[c]
F_{sy}, ksi:														
L	70	72	70	72	68	70	63	65	59	61	55	57	50	52
LT	70	72	71	73	68	71	65	67	61	63	57	59	52	54
ST	...	...	...	...	...	...	63	65	60	62	57	59	53	55
F_{bru}[d], ksi	43	44	44	45	44	45	44	45	42	43	42	43	39	41
F_{bru}[d], ksi:														
(e/D = 1.5)	117	120	117	120	116	119	114	117	108	111	107	110	101	104
(e/D = 2.0)	145	148	145	148	143	147	141	145	134	137	132	135	124	128
F_{bry}[d], ksi:														
(e/D = 1.5)	97	100	100	103	100	103	98	101	94	97	89	93	84	87
(e/D = 2.0)	114	118	117	120	117	120	113	117	109	112	104	108	98	103
e, percent (S-Basis):														
LT	9	...	7	...	6	...	5	...	5	...	5	...	3	...
E, 10^3 ksi	10.3													
E_c, 10^3 ksi	10.6													
G, 10^3 ksi	3.9													
μ	0.33													
Physical Properties:														
ω, lb/in.^{3}	0.101													
C, K, and α	See Figure 3.7.9.0													

a Mechanical properties were established under QQ-A-250/12.
b Design allowables were based upon data obtained from testing samples of plate, supplied in O or F temper, which were heat treated to demonstrate response to heat treatment by suppliers. Properties obtained by the user may be lower than those listed if the material has been formed or otherwise cold-worked, particularly in the annealed temper, prior to solution heat treatment.
c Caution: This specific alloy, temper, and product form exhibits poor stress-corrosion cracking resistance in this grain direction. It corresponds to an SCC resistance rating of D, as indicated in Table 3.1.2.3.1(a).
d Bearing values are "dry pin" values per Section 1.4.7.1. See Table 3.1.2.1.1.

3-532 MMPDS-08 1 April 2013



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