

1 General

Aluminum alloy 7150 is a refinement of alloy 7050. The chemical composition of 7150 and 7050 are compatible, so an alloy can usually be defined either way. Composition limits for 7150 were adjusted to eliminate a small range of compositions which would produce mechanical properties at the lower end of the distribution, permitting a small increase in the allowable design strengths. Alloy 7150 has a marginally higher range of zinc content and a marginally lower range of copper and magnesium (Table 1.4.1). It should be noted, however, that as producers usually avoid the extremes of the composition ranges, 7150, as supplied to normal orders, will satisfy the requirements of 7050 as well. The more developed alloy, 7150, has been used as a vehicle for the introduction of improved tempers, e.g., T61511 and T7751, which have superior corrosion and other properties. In other tempers, the alloy has fatigue, stress corrosion, and exfoliation corrosion properties similar to 7050. It is the new tempers that have caused renewed interest in the alloy.

Its most conspicuous use is for wing plates on a majority of large commercial aircraft, where its relatively high compressive yield strength is an advantage; however, subject to specification legalities, it may be used technically anywhere that 7050 is used.

1.1 Commercial Designation

7150.

1.2 Alternate Designation

UNS No. A97150.

1.3 Specifications

1.3.1 [Table] AMS material specifications.

1.4 Composition

1.4.1 [Table] Aluminum Association registered chemical composition limits.

1.5 Heat Treatment

Heat treatments are generally proprietary to the producer. Solution heat treatments are similar to alloy 7050.

1.5.1 T Tempers. Peak aging treatments to T6 tempers are similar to 7050; however, the T6151, T61511, T7751, and T77511 aging treatments are not only proprietary, but also patented. The alloy may be produced in the same tempers as for alloy 7050. These include T6, T74, and T76 tempers (see Code 3222).

1.5.2 Annealing. Soak at 775F for 2 to 3 hours, cool at 50F per hour to 500F. The subsequent cooling rate is unimportant (Ref. 1).

1.6 Hardness**1.7 Forms and Conditions Available**

Sheet, plate, extrusions, die and hand forgings.

1.8 Melting and Casting Practices

This alloy is supplied in the wrought form and is not recommended for foundry applications.

1.9 Special Considerations

7150 has a high compressive yield strength (Ref. 4) which is particularly important in upper wing plates on large commercial aircraft.

This alloy is essentially similar to alloy 7050, and the majority of properties are closely similar or superior to 7050. It is recommended that data for 7050 in Code 3222 of this handbook be reviewed by the reader.

2 Physical Properties and Environmental Effects**2.1 Thermal Properties**

2.1.1 Melting Range. The melting range is expected to be the same as for alloy 7050; i.e., 910 - 1165F (Ref. Code 3222).

2.1.2 Phase Changes. The alloy is subject to precipitation, but the solid matrix is always face centered cubic.

2.1.2.1 Time temperature transformation diagrams.

2.1.3 Thermal Conductivity at Room Temperature. The thermal conductivity of 7150 is expected to be the same as that for the appropriate temper of 7050; i.e.,
T7651, 89 Btu/ft/hr/ft²/F
T7451, 91 Btu/ft/hr/ft²/F
T7351, 93 Btu/ft/hr/ft²/F
(Ref. Code 3222, Section 2.013)

2.1.4 Thermal Expansion (see Section 1.9).

2.1.5 Specific Heat.

2.1.6 Thermal Diffusivity.

2.2 Other Physical Properties

2.2.1 Density. 0.102 lb/cu in. (Ref. 4).

2.2.2 Electrical Properties.

2.2.2.1 Electrical conductivity.

2.2.3 Magnetic Properties. Alloy is non-magnetic.

Al
6.4 Zn
2.4 Mg
2.2 Cu
0.12 Zr

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2.3 Chemical Environments

2.3.1 **General Corrosion.** The corrosion performance of this alloy is markedly sensitive to the heat treatment condition. Overall, the corrosion resistance improves for T651, to T6151 or T61511, to T7751. The alloy is subject to exfoliation corrosion; however, the degree depends strongly on the product temper.

2.3.1.1 [Table] Exfoliation corrosion resistance of 7150 plate.

2.3.2 **Stress Corrosion Resistance.**

2.3.2.1 [Table] Stress corrosion resistance of 1.75-in. thick 7150-T7751 plate (Ref. 9).

2.3.2.2 [Table] Short transverse stress corrosion results for 1.75-in. thick 7150-T7751 plate (Ref. 9).

2.3.2.3 [Table] Stress corrosion test results on "C" ring specimens of 1.1-in. thick 7150-T77 plate (Ref. 11).

2.3.2.4 [Figure] Stress corrosion crack growth rates for a specimen of 1.1-in. thick 7150-T77 plate (Ref. 11).

2.4 Nuclear Properties

3 Mechanical Properties

3.1 Specified Mechanical Properties

3.1.1 [Table] Aluminum Association specified minimum tensile properties (Ref. 5).

3.1.2 [Table] Design mechanical properties of 7150-T6151 plate.

3.1.3 [Table] Minimum (S-Basis) design mechanical properties of 7150-T7751 plate.

3.1.4 [Table] Minimum (S-Basis) design mechanical properties of 7150-T61511 extrusions.

3.1.5 [Table] Minimum (S-Basis) design mechanical properties of 7150-T77511 extrusions.

3.2 Mechanical Properties at Room Temperature

3.2.1 **Tension.**

3.2.1.1 [Figure] Typical tensile stress-strain curves for 7150-T6151 plate.

3.2.1.2 [Figure] Typical tensile stress-strain curves for 7150-T61511 extrusion.

3.2.1.3 [Figure] Typical tensile stress-strain curves for 7150-T7751 plate.

3.2.1.4 [Figure] Typical tensile stress-strain curves for 7150-T77511 extrusion.

3.2.1.5 [Table] Producer guaranteed minimum long transverse mechanical properties of 7150-T6151 plate.

3.2.1.6 [Table] Mechanical properties and exfoliation rating in the longitudinal direction for various tempers of 7150 plate compared to alloys 7075 and 7050 (Ref. 3).

3.2.1.7 [Table] Tensile property variations through the thickness of 1-in. thick 7150-T6151 plate.

3.2.1.8 [Table] Tensile properties of 1-in. thick commercial 7150-T77 plate.

3.2.1.9 [Table] Tensile properties of 1.1-in. thick commercial 7150-T77 plate.

3.2.1.10 [Table] Tensile properties of 1.75-in. thick commercial 7150-T7751 plate.

3.2.2 **Compression** (see also 3.2.1.5 and 3.2.1.6 for F_{cy} data).

3.2.2.1 [Figure] Compressive stress-strain curves for 7150-T6151 plate.

3.2.2.2 [Figure] Compressive stress-strain curves for 7150-T61511 extrusion.

3.2.2.3 [Figure] Compressive stress-strain curves for 7150-T7751 plate.

3.2.2.4 [Figure] Compressive stress-strain curves for 7150-T77511 extrusion.

3.2.2.5 [Figure] Compressive tangent modulus curves for 7150-T6151 plate.

3.2.2.6 [Figure] Compressive tangent modulus curves for 7150-T61511 extrusion.

3.2.2.7 [Figure] Compressive tangent modulus curves for 7150-T7751 plate.

3.2.2.8 [Figure] Compressive tangent modulus curves for 7150-T77511 extrusion.

3.2.3 **Impact.**

3.2.4 **Bending.**

3.2.5 **Torsion and Shear.**

3.2.6 **Bearing.**

3.2.7 **Stress Concentration.**

3.2.7.1 **Notch properties.**

3.2.7.2 **Fracture toughness.**

3.2.7.2.1 [Table] Plane strain fracture toughness of 1-in. thick 7150-T6151 plate.

3.2.7.2.2 [Table] Plane strain fracture toughness of 1.75-in. thick 7150-T7751 plate.

3.2.7.2.3 [Table] Plane strain fracture toughness of 1.1-in. thick 7150-T7751 plate.

3.3 Mechanical Properties at Various Temperatures

3.3.1 Tension.

3.3.2 Compression.

3.3.3 Impact.

3.3.4 Bending.

3.3.5 Torsion and Shear.

3.3.6 Bearing.

3.3.7 Stress Concentration.

3.3.7.1 Fracture toughness.

3.3.8 Combined Properties.

3.4 Creep and Creep Rupture Properties

3.5 Fatigue Properties

3.5.1 Conventional High Cycle Fatigue Properties.

3.5.1.1 [Figure] Smooth and notched S-N fatigue data for 1.75-in. thick 7150-T7751 plate.

3.5.2 Low Cycle Fatigue.

3.5.2.1 [Figure] Low cycle fatigue behavior of 7150-T77 plate tested under strain control in longitudinal orientation.

3.5.2.2 [Figure] Low cycle fatigue behavior of 7150-T77 plate tested under strain control in transverse orientation.

3.5.2.3 [Figure] Cyclic stress response curves for a range of plastic strain amplitudes for 7150-T77 plate tested under strain control in longitudinal orientation.

3.5.2.4 [Figure] Cyclic stress response curves for a range of plastic strain amplitudes for 7150-T77 plate tested under strain control in transverse orientation.

3.5.3 Fatigue Crack Propagation.

3.5.3.1 [Figure] Fatigue crack growth data for 1.75-in. thick 7150-T7751 plate in L-T orientation.

3.5.3.2 [Figure] Fatigue crack growth data for 1.75-in. thick 7150-T7751 plate in T-L orientation.

3.5.3.3 [Figure] Fatigue crack growth rates at two stress ratios for 1-in. thick 7150 plate of various tempers.

3.5.3.4 [Figure] Fatigue crack growth rates for 1.1-in. thick 7150-T77 plate tested in high humidity air.

3.5.3.5 [Figure] Fatigue crack growth rates of 1-in. 7150 plate of various tempers. Small cracks and large cracks are compared.

3.5.3.6 Special considerations. The rates of growth of short cracks (i.e., those of sizes around 0.05 in. in length and which approach the dimensions of local microstructure or the local plastic region around the crack tip) are significant at stress intensity levels well below the fatigue threshold at which fatigue cracks are presumed dormant. These, in general, grow at rates much higher than "long" cracks (ca. 0.5 in. or greater). The use of "long" crack data to predict "short" crack behavior could lead to non-conservative predictions of structure life for this alloy and for many alloys of aluminum and other metals.

3.6 Elastic Properties

3.6.1 Poissons Ratio.

3.6.2 Tensile Elastic Modulus. Longitudinal - 68 GPa (9.86 x 10⁶ psi), Transverse - 71 GPa (10.3 x 10⁶ psi) (means of duplicate tests) (Ref. 10).

3.6.3 Compression Modulus.

4 Fabrication

4.1 Forming

4.2 Machining and Grinding

4.3 Joining

4.3.1 Weldability. Alloy 7150 is not weldable by conventional techniques.

4.4 Surface Treatment (see 1.9 and Code 3222, Section 4.4, of this handbook).

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Table 1.3.1 AMS material specifications (Ref. 4)

Alloy: 7150			
AMS Specifications	Form	Temper	Issue Date
4306	Bare plate	T6151	October 1988
4252	Bare plate	T7751	October 1989
4307	Extrusion	T61511	October 1988
4345	Extrusion	T77511	October 1989

Table 1.4.1 Aluminum Association registered composition limits (Ref. 1)

Alloy: 7150			
Element	Content (wt percent)		
	Minimum	Maximum	
Silicon	-	0.12	
Iron	-	0.15	
Copper	1.9	2.5	
Manganese	-	0.10	
Magnesium	2.0	2.7	
Chromium	-	0.04	
Zinc	5.9	6.9	
Zirconium	0.08	0.15	
Titanium	-	0.06	
Others	Each	-	0.05
	Total	-	0.15

Table 2.3.1.1 Exfoliation corrosion resistance of 7150 plate (Ref. 3)

Alloy: 7150		
Form	1-in. Plate	
	Temper	EXCO Rating
	T6151	EC
	T7751	EB

Table 2.3.2.1 Stress corrosion resistance of 1.75-in. thick 7150-T7751 plate (Ref. 9)

Alloy: 7150-T7751		
Form	1.75-in. Plate	
Specimen	ST tensile bars, 0.16-in. diameter, 0.5-in. gage length	
Environment	Submerged 10 min./hr in 3.5 percent NaCl/H ₂ O, -50 min./hr in 30 percent RH air at 72F	
Test Stress (ksi)	Exposure Time (hour)	Failure
65	98	Yes
60	116	Yes
55	112	Yes
50	170	Yes
45	239	Yes
40	243	Yes
35	459	Yes
30	467	Yes
20	1198	No

Table 2.3.2.2 Short transverse stress corrosion results for 1.75-in. thick 7150-T7751 plate (Ref. 9)

Alloy: 7150-T7751	
Form	1.75-in. Plate
Specimen	C(T), B = 1 in., W = 2 in., dead weight loading ^a
Orientation	Short - Longitudinal
Environment	Constant immersion in distilled water with 3.5 percent NaCl, aerated at RT
Failure (hours)	Applied Stress Intensity (ksi $\sqrt{\text{in.}}$)
868	21.0
751	22.8
691	18.6

^a Reference ASTM E 399.

Table 2.3.2.3 Stress corrosion test results on "C" ring specimens of 1.1-in. thick 7150-T7751 plate (Ref. 11)

Alloy: 7150-T7751	
Form	1.1-in. Plate
Specimen	"C" rings, 0.07-in. thick, screw loaded
Orientation	Short - Longitudinal
Environment	Alternate immersion in 3.5 percent NaCl/H ₂ O, 10 min., 50 min. in laboratory air at RT
Failure (hours)	Applied Stress (ksi)
21	70
24	50
504 ^a	25
168	35

^a Failure may have occurred earlier, but the crack was obscured by salt deposits.

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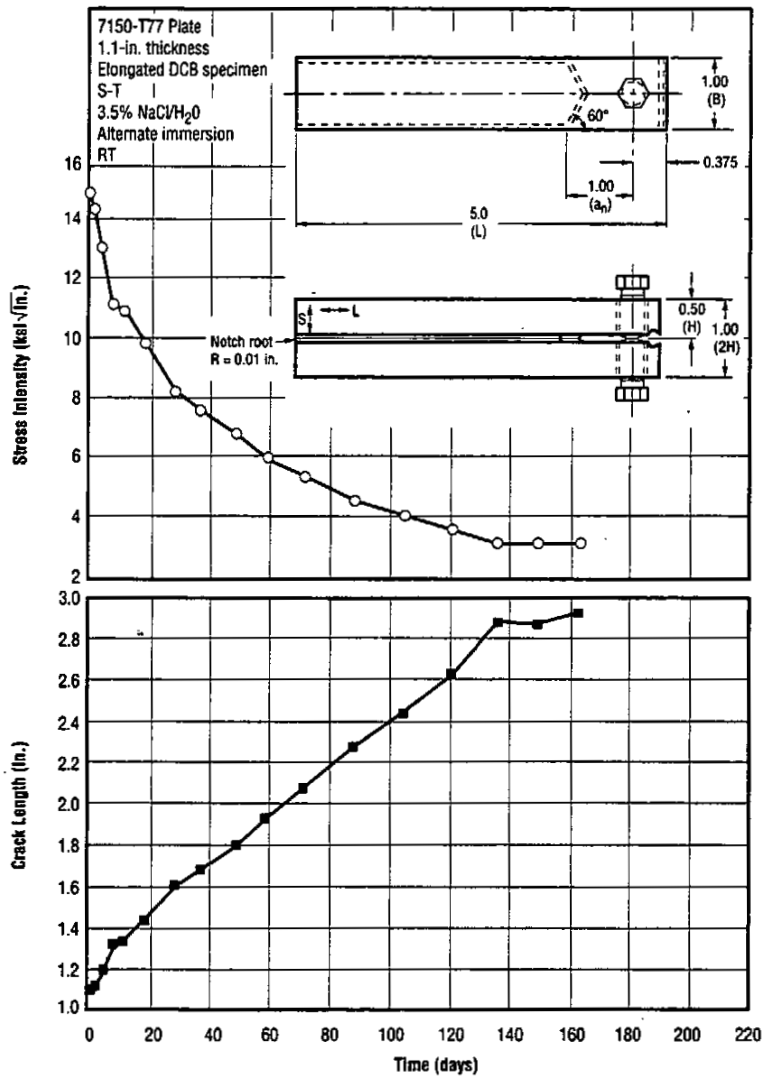


Fig. 2.3.2.4 Stress corrosion crack growth rates for a specimen of 1.1-in. thick 7150-T77 plate (Ref. 11)

Table 3.1.1 Aluminum Association registered minimum tensile properties (Ref. 5)

Alloy: 7150						
Form	Temper	Thickness (In.)	Orientation	F _{TU} (ksi)	F _{TY} (ksi)	e (percent)
Plate	T651	0.500 - 0.749	Longitudinal	83.0	78.0	8
			Transverse	84.0	77.0	8
		0.750 - 1.000	Longitudinal	84.0	78.0	8
			Transverse	84.0	78.0	8
		1.001 - 1.500	Longitudinal	84.0	78.0	8
			Transverse	84.0	77.0	8
Plate	T6151	0.750 - 1.000	Longitudinal	84.0	78.0	9
			Transverse	84.0	78.0	9
		1.001 - 1.500	Longitudinal	84.0	78.0	9
			Transverse	84.0	77.0	9
Extrusions	T6510 & T6511	0.250 - 0.749	Longitudinal	86.0	78.0	7
		0.750 - 2.00	Longitudinal	88.0	78.0	7
Extrusions	T61510 & T61511	0.249 max	Longitudinal	87.0	81.0	9
		0.250 - 0.499	Longitudinal	87.0	82.0	8
		0.500 - 0.749	Longitudinal	88.0	83.0	9
		0.750 - 2.000	Longitudinal	89.0	84.0	8
Plate	T7751	0.250 - 0.499	Longitudinal	80.0	74.0	8
			Transverse	80.0	74.0	8
		0.500 - 0.749	Longitudinal	83.0	77.0	8
			Transverse	83.0	76.0	8
		0.750 - 1.500	Longitudinal	84.0	78.0	8
			Transverse	84.0	77.0	8
1.501 - 3.000	Longitudinal	82.0	76.0	7		
	Transverse	82.0	75.0	6		
Extrusions	T77511	0.240 max	Longitudinal	85.0	78.0	7
		0.250 - 0.499	Longitudinal	87.0	82.0	8
			Transverse	82.0	76.0	-
		0.500 - 0.749	Longitudinal	88.0	83.0	9
			Transverse	83.0	79.0	-
		0.750 - 2.000	Longitudinal	89.0	84.0	8
Transverse	83.0		78.0	-		

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Table 3.1.2 Design mechanical properties of 7150-T6151 plate (Ref. 4)

Alloy: 7150-T6151					
Form		Plate			
Mechanical Properties		Thickness (in.)			
		0.750 - 1.000		1.001 - 1.500	
Basis ^a		A	B	A	B
F _{TU} (ksi)	Longitudinal	84 ^c	87	84 ^d	87
	Long Transverse	84	87	84 ^e	86
F _{TY} (ksi)	Longitudinal	78 ^c	81	78 ^d	81
	Long Transverse	77	79	77	78
F _{CY} (ksi)	Longitudinal	77	80	75	77
	Long Transverse	81	83	80	82
F _{SU} (ksi)		45	47	45	46
F _{BRU} (ksi) ^b	e/D = 1.5	121	125	121	124
	e/D = 2.0	155	160	155	158
F _{BRy} (ksi) ^b	e/D = 1.5	102	105	101	104
	e/D = 2.0	119	122	118	121
e, S-Basis (percent)	Longitudinal	9	-	9	-
	Long Transverse	9	-	9	-
E, 10 ³ (ksi)		10.2			
E _c , 10 ³ (ksi)		10.6			
G, 10 ³ (ksi)		3.9			
μ		0.33			

^a At least 99 percent (for A-Basis) and 90 percent (for B-Basis) of the population of values is expected to equal or exceed the mechanical property allowable, with a confidence of 95 percent.

^b Bearing values are "dry pin" values.

^c S-Basis - The A values are higher than specification minimum values as follows: F_{TU}(L) = 85 ksi and F_{TY}(L) = 79 ksi.

^d S-Basis - The A values are higher than specification minimum values as follows: F_{TU}(L) = 86 ksi and F_{TY}(L) = 80 ksi.

^e S-Basis - The A value is higher than specification minimum value as follows: F_{TU}(LT) = 85 ksi.

Table 3.1.3 Minimum (S-Basis)^a design mechanical properties of 7150-T7751 plate (Ref. 4)

Alloy: 7150-T7751					
Form		Plate			
Mechanical Properties		Thickness (in.)			
		0.250 - 0.499	0.500 - 0.749	0.750 - 1.500	1.501 - 3.000
F _{TU} (ksi)	Longitudinal	80	83	84	82
	Long Transverse	80	83	84	82
	Short Transverse	-	-	-	77
F _{TY} (ksi)	Longitudinal	74	77	78	76
	Long Transverse	74	76	77	75
	Short Transverse	-	-	-	67
F _{CY} (ksi)	Longitudinal	73	76	77	75
	Long Transverse	77	79	81	79
F _{SU} (ksi)		46	47	48	47
F _{BRU} (ksi) ^b	e/D = 1.5	119	124	125	122
	e/D = 2.0	154	160	162	158
F _{BRY} (ksi) ^b	e/D = 1.5	102	105	106	104
	e/D = 2.0	117	120	121	118
e (percent)	Longitudinal	8	8	8	7
	Long Transverse	8	8	8	6
	Short Transverse	-	-	-	1
E, 10 ³ (ksi)		10.3			
E _c , 10 ³ (ksi)		10.7			
G, 10 ³ (ksi)		3.9			
μ		0.33			

^a S-Basis - Minimum value specified by the governing industry specification (e.g. AMS, ASTM, etc.) or federal or military standards for the material.

^b Bearing values are "dry pin" values.

7150Table 3.1.4 Minimum (S-Basis)^a design mechanical properties of 7150-T61511 extrusions (Ref. 4)

Alloy: 7150-T61511						
Form		Extrusions				
Mechanical Properties		Thickness (in.)				
		0.250 - 0.499	0.500 - 0.749	0.750 - 0.999	1.000 - 1.499	1.500 - 2.000
F _{TU} (ksi)	Longitudinal	87	88	89	89	89
	Long Transverse	80	79	79	77	74
F _{TY} (ksi)	Longitudinal	82	83	84	84	84
	Long Transverse	73	73	73	71	68
F _{CY} (ksi)	Longitudinal	80	81	82	83	84
	Long Transverse	80	80	80	78	75
F _{SU} (ksi)		44	45	45	44	42
F _{BRU} (ksi) ^b	e/D = 1.5	119	120	120	118	116
	e/D = 2.0	152	153	154	152	150
F _{BRY} (ksi) ^b	e/D = 1.5	100	100	100	97	94
	e/D = 2.0	118	120	120	119	117
e (percent)	Longitudinal	8	9	8	8	8
E, 10 ³ (ksi)		10.4				
E _C , 10 ³ (ksi)		11.0				
G, 10 ³ (ksi)		4.0				
μ		0.33				

^a S-Basis - Minimum value specified by the governing industry specification (e.g. AMS, ASTM, etc.) or federal or military standards for the material.

^b Bearing values are "dry pin" values.

Table 3.1.5 Minimum (S-Basis)^a design mechanical properties of 7150-T77511 extrusions (Ref. 4)

Alloy: 7150-T77511					
Form		Extrusions			
Cross Sectional Area (in. ²)		≤ 20			
Mechanical Properties		Thickness (in.)			
		≤ 0.249	0.250 - 0.499	0.500 - 0.749	0.750 - 2.000
F _{TU} (ksi)	Longitudinal	85	87	88	89
	Long Transverse	81	82	83	83
F _{Ty} (ksi)	Longitudinal	78	82	83	84
	Long Transverse	74	76	79	78
F _{Cy} (ksi)	Longitudinal	78	82	83	85
	Long Transverse	76	80	81	82
F _{SU} (ksi)		44	45	46	46
F _{bru} (ksi) ^b	e/D = 1.5	122	124	125	123
	e/D = 2.0	158	161	162	159
F _{bry} (ksi) ^b	e/D = 1.5	100	105	106	108
	e/D = 2.0	118	124	125	127
e (percent)	Longitudinal	7	8	9	8
E, 10 ³ (ksi)		10.4			
E _C , 10 ³ (ksi)		10.9			
G, 10 ³ (ksi)		4.0			
μ		0.33			

^a S-Basis - Minimum value specified by the governing industry specification (e.g. AMS, ASTM, etc.) or federal or military standards for the material.

^b Bearing values are "dry pin" values.

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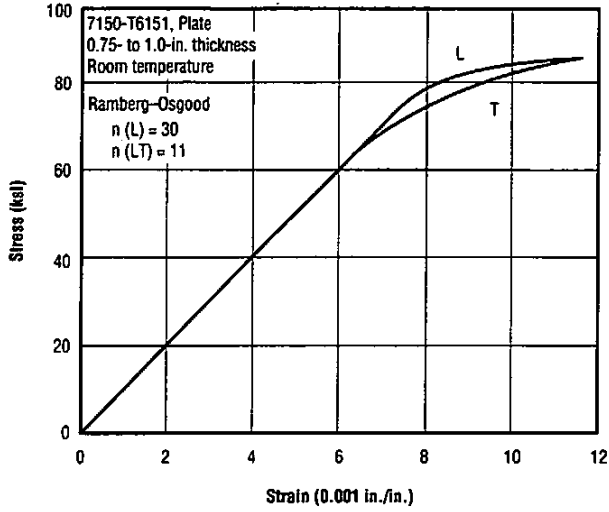


Fig. 3.2.1.1 Typical tensile stress-strain curves for 7150-T6151 plate (Ref. 4)

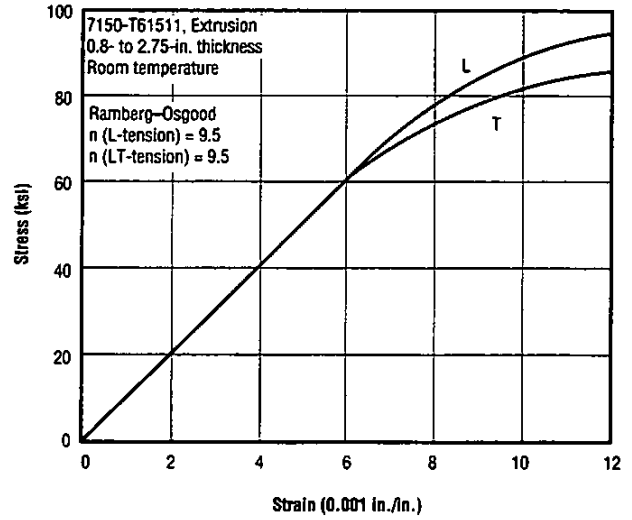


Fig. 3.2.1.2 Typical tensile stress-strain curves for 7150-T61511 extrusion (Ref. 4)

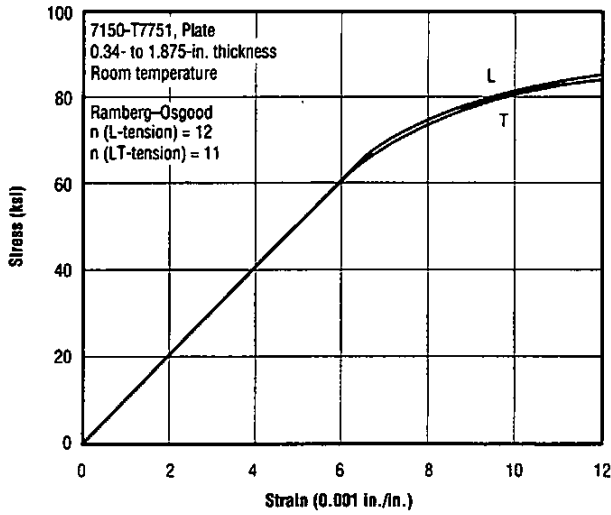


Fig. 3.2.1.3 Typical tensile stress-strain curves for 7150-T7751 plate (Ref. 4)

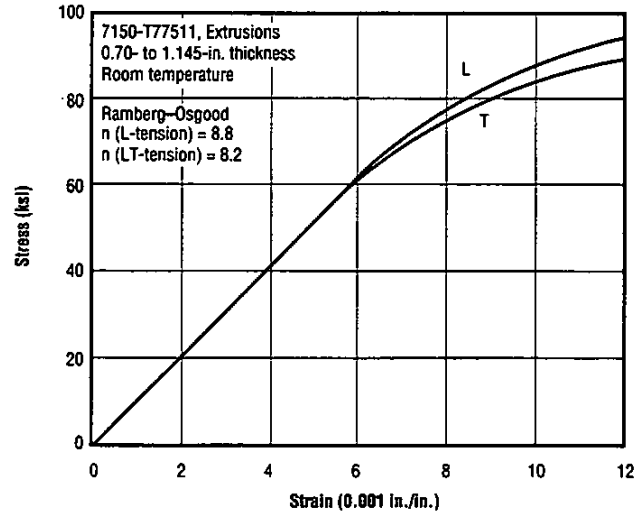


Fig. 3.2.1.4 Typical tensile stress-strain curves for 7150-T77511 extrusion (Ref. 4)

Table 3.2.1.5 Producer guaranteed minimum long transverse mechanical properties of 7150-T6151 plate (Ref. 2)

Alloy: 7150-T6151				
Form	Plate			
Thickness (in.)	F _{TU} (ksi)	F _{TY} (ksi)	F _{CY} (ksi)	e (percent)
0.750 - 1.000	84	78	77	9
1.001 - 1.500	84	77	77	9

Table 3.2.1.6 Mechanical properties and exfoliation rating in the longitudinal direction for various tempers of 7150 plate compared to alloys 7075 and 7050 (Ref. 3)

Alloy: 7150						
Form		1-in. Plate				
Alloy	Temper	F _{TU} (ksi)	F _{TY} (ksi)	F _{CY} (ksi)	e (percent)	EXCO Rating
7150	T7751	84	78	77	8	EB
7150	T6151	84	78	77	9	EC
7075	T651	76	69	66	6	ED
7075	T7651	70	59	59	6	EB
7050	T7651	76	66	65	6	EB
7050	T7451	74	64	63	10	EB

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Table 3.2.1.7 Tensile property variations through the thickness of 1-in. thick 7150-T6151 plate (Ref. 6)

Alloy: 7150-T6151 ^a				
Form	1-in. Plate			
Orientation	Longitudinal			
Location	F _{TU} (ksi)	F _{TY} (ksi)	e (percent)	RA (percent)
T/4	91	85	12	22
T/2	91	84	11	18
3T/4	92	84	12	18

Note: T/4 and 3T/4 refer to the quarter thickness and three quarter thickness of the plate, and T/2 to the mid thickness.

The diameters of the reduced sections of the tensile specimens were 0.5 in. at T/2, and 1/4 in. at T/4 and 3T/4.

^a Identified as early notation, T6E189, in reference.

Table 3.2.1.8 Tensile properties of 1-in. thick commercial 7150-T77 plate (Ref. 10)

Alloy: 7150-T77		
Form	1-in. Plate ^a	
	Orientation	
	Longitudinal	Transverse
F _{TY} (ksi)	77.7	81.3
F _{TU} (ksi)	84.0	85.3
e, 1-in. (percent)	13.5	10.5
RA (percent)	22	15
True Strain to Fracture (percent)	0.25	0.17
True Fracture Stress (ksi)	92.1	91.3

^a Tested at mid-thickness.

Table 3.2.1.9 Tensile properties of 1.1-in. thick commercial 7150-T77 plate (Ref. 11)

Alloy: 7150-T77		
Form	1.1-in. Plate ^a	
	Orientation	
	Longitudinal ^b	Transverse ^c
F _{TY} (ksi)	83.2	86.5
F _{TU} (ksi)	89.1	90.7
e, 1 in. (percent)	10.3	10.0
RA (percent)	32.3	26.4

^a Tested at mid-thickness.

^b Average of 3 specimens.

^c Average of 2 specimens.

Table 3.2.1.10 Tensile properties of 1.75-in. thick commercial 7150-T7751 plate (Ref. 9)

Alloy: 7150-T7751			
Form	1.75-in. Plate ^a		
Orientation	F _{TY} (ksi) ^b	F _{TU} (ksi) ^b	e, 1-in. (percent) ^b
Longitudinal	82.6	86.4	8.9
Transverse	80.3	86.1	8.3
Short Transverse	74.7	82.6	7.4

^a Tested at mid-plane.

^b Averages of 3 specimens.

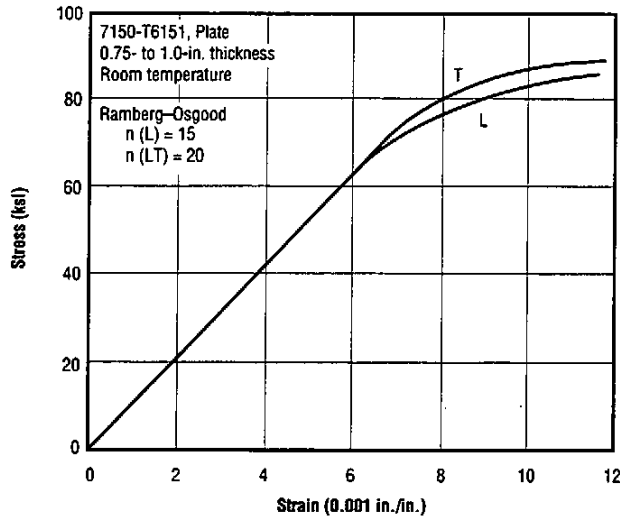


Fig. 3.2.2.1 Typical compressive stress-strain curves for 7150-T6151 plate (Ref. 4)

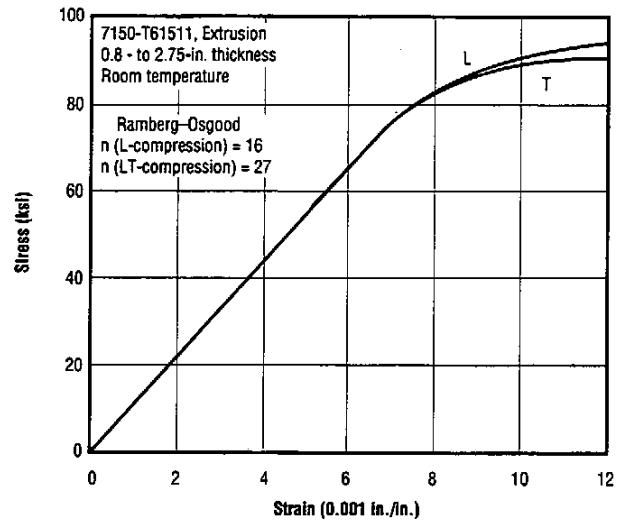


Fig. 3.2.2.2 Typical compressive stress-strain curves for 7150-T61511 extrusion (Ref. 4)

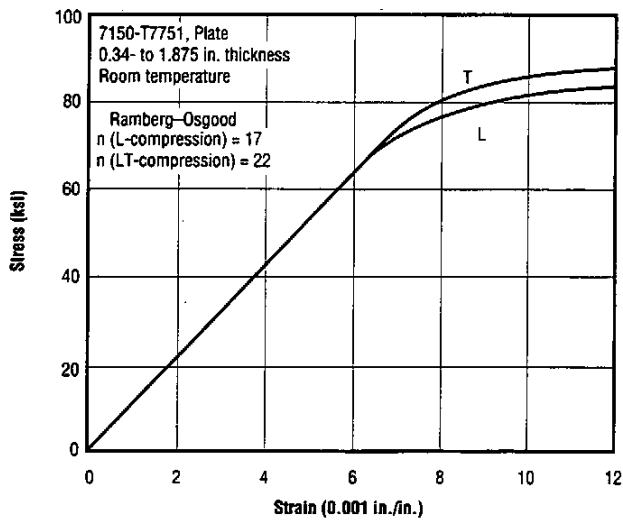


Fig. 3.2.2.3 Typical compressive stress-strain curves for 7150-T7751 plate (Ref. 4)

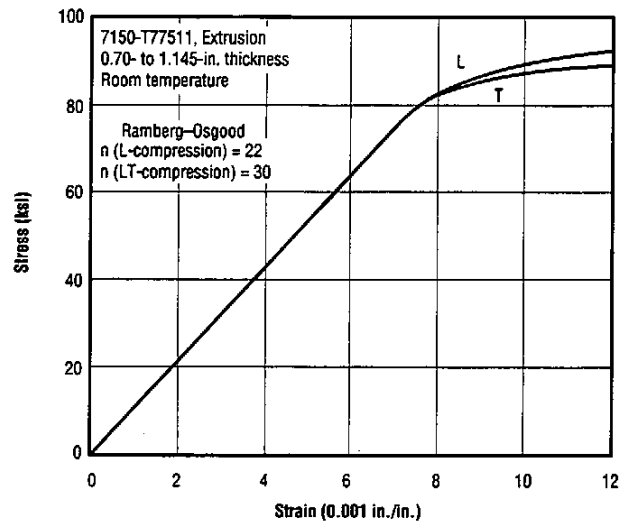


Fig. 3.2.2.4 Typical compressive stress-strain curves for 7150-T77511 extrusion (Ref. 4)

7150

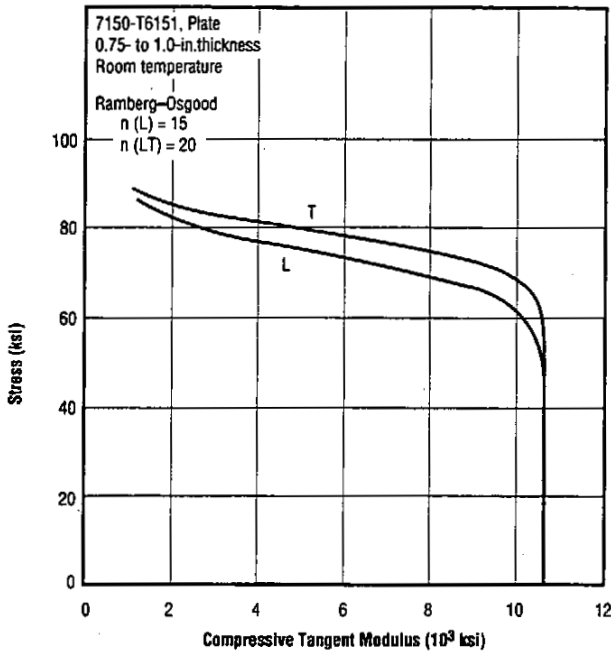


Fig. 3.2.2.5 Typical compressive tangent modulus curves for 7150-T6151 plate (Ref. 4)

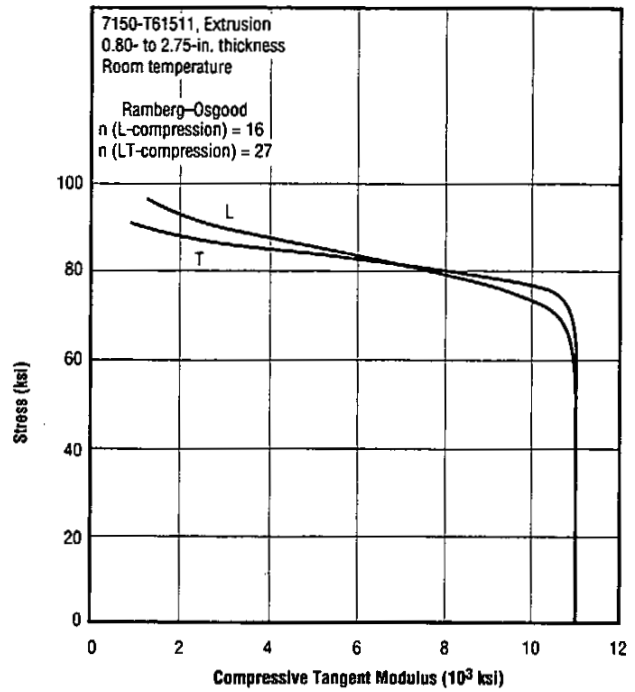


Fig. 3.2.2.6 Typical compressive tangent modulus curves for 7150-T61511 extrusion (Ref. 4)

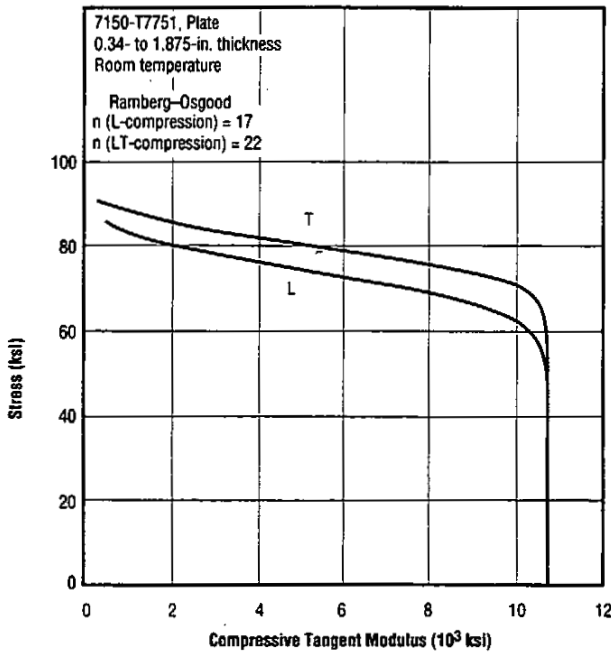


Fig. 3.2.2.7 Typical compressive tangent modulus curves for 7150-T7751 plate (Ref. 4)

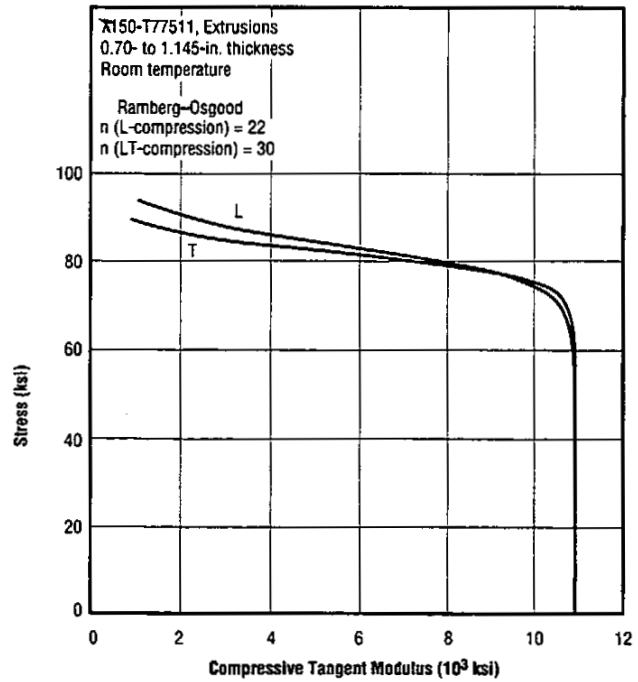


Fig. 3.2.2.8 Typical compressive tangent modulus curves for 7150-T77511 extrusion (Ref. 4)

Table 3.2.7.2.1 Plane strain fracture toughness of 1-in. thick 7150-T6151 plate (Ref. 6)

Alloy: 7150-T6151 ^a	
Form	1-in. Plate
Orientation	L-T
Fracture Toughness, K_{Ic} (ksi $\sqrt{\text{in.}}$) ^b	
27	
29	

^a Identified as early notation, T6E189, in reference.

^b Tests valid according to ASTM E 399, average of 2 tests.

Table 3.2.7.2.2 Plane strain fracture toughness of 1.75-in. thick 7150-T7751 plate (Ref. 9)

Alloy: 7150-T7751	
Form	1.75-in. Plate
Specimen	C(T), B = 1 in., W = 2 in. ^a
Orientation	Fracture Toughness, K_{Ic} (ksi $\sqrt{\text{in.}}$) ^b
L-T	20.7
T-L	20.9
S-L	22.8

^a Reference ASTM E 399.

^b Average of 5 tests.

Table 3.2.7.2.3 Plane strain fracture toughness of 1.1-in. thick 7150-T7751 plate (Ref. 11)

Alloy: 7150-T7751	
Form	1.1-in. Plate
Specimen	C(T), B = 1 in. ^a
Orientation	Fracture Toughness, K_{Ic} (ksi $\sqrt{\text{in.}}$) ^b
L-T	23.8
T-L	22.0

^a Reference ASTM E 399.

^b Average of 3 tests.

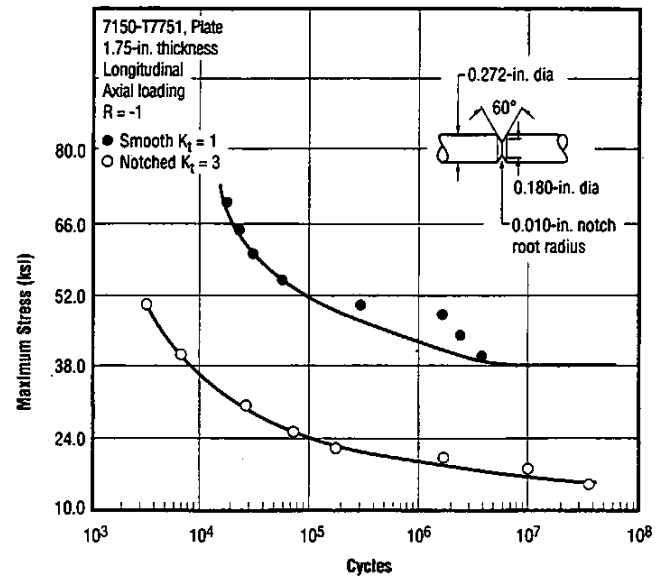


Fig. 3.5.1.1 Smooth and notched SN fatigue data for 1.75-in. thick 7150-T7751 plate (Ref. 9)

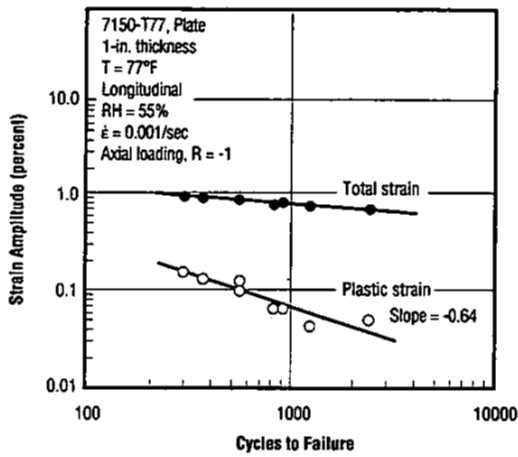


Fig. 3.5.2.1 Low cycle fatigue behavior of 7150-T77 plate tested under axial strain control in longitudinal orientation (Ref. 10)

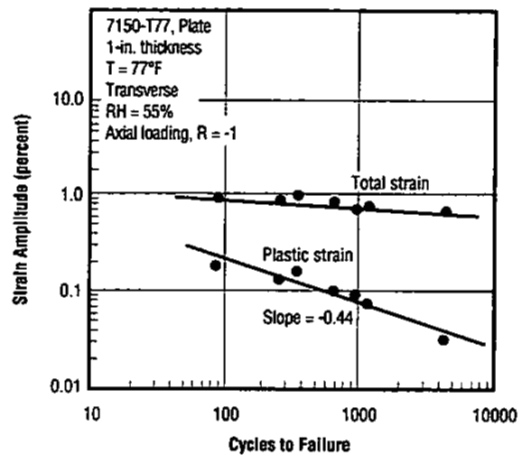


Fig. 3.5.2.2 Low cycle fatigue behavior of 7150-T77 plate tested under axial strain control in transverse orientation (Ref. 10)

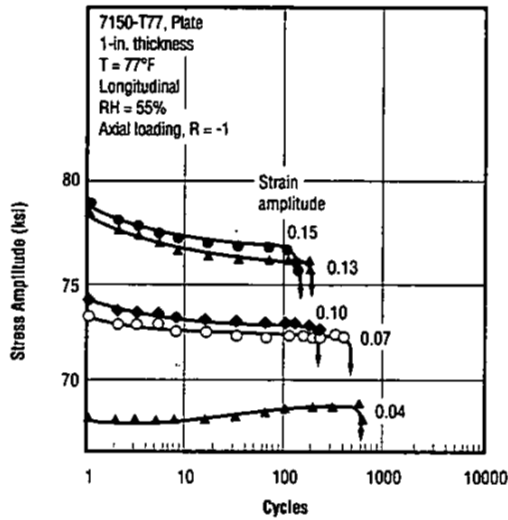


Fig. 3.5.2.3 Cyclic stress response curves for a range of plastic strain amplitudes for 7150-T77 plate tested under axial strain control in longitudinal orientation (Ref. 10)

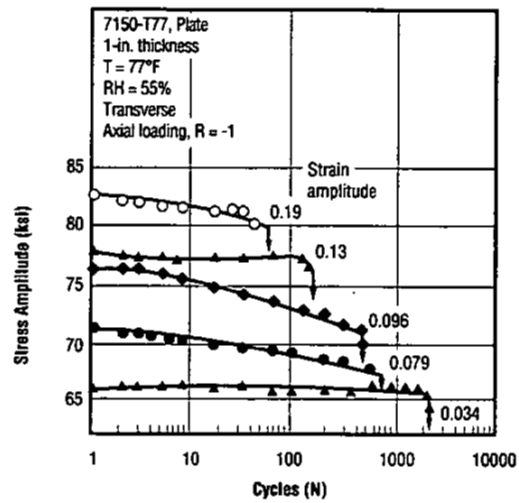


Fig. 3.5.2.4 Cyclic stress response curves for a range of plastic strain amplitudes for 7150-T77 plate tested under axial strain control in transverse orientation (Ref. 10)

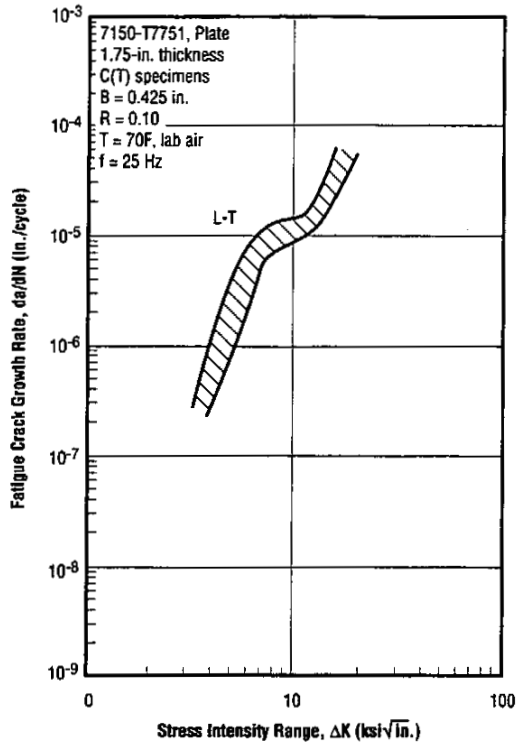


Fig. 3.5.3.1 Fatigue crack growth data for 1.75-in. thick 7150-T7751 plate in L-T orientation (Ref. 9)

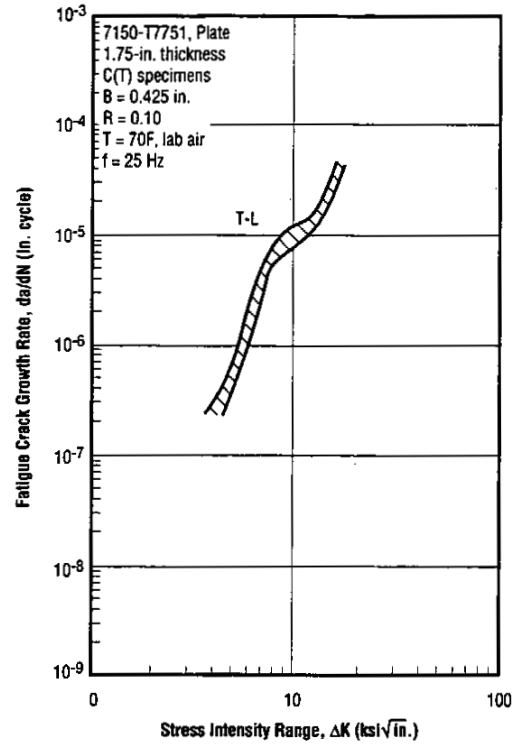


Fig. 3.5.3.2 Fatigue crack growth data for 1.75-in. thick 7150-T7751 plate in T-L orientation (Ref. 9)

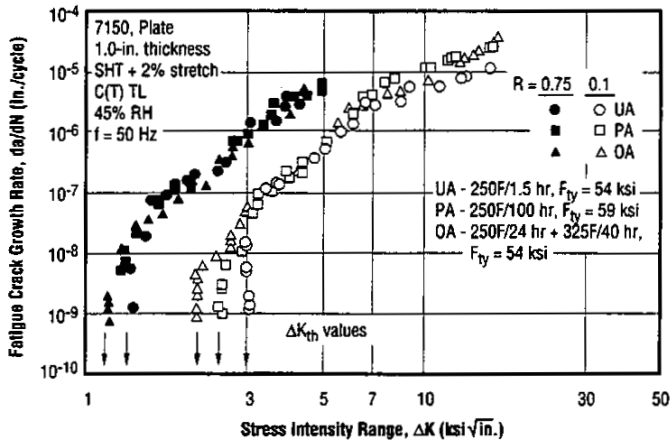


Fig. 3.5.3.3 Fatigue crack growth rates at two stress ratios for 1-in. plate of various tempers (Ref. 8)

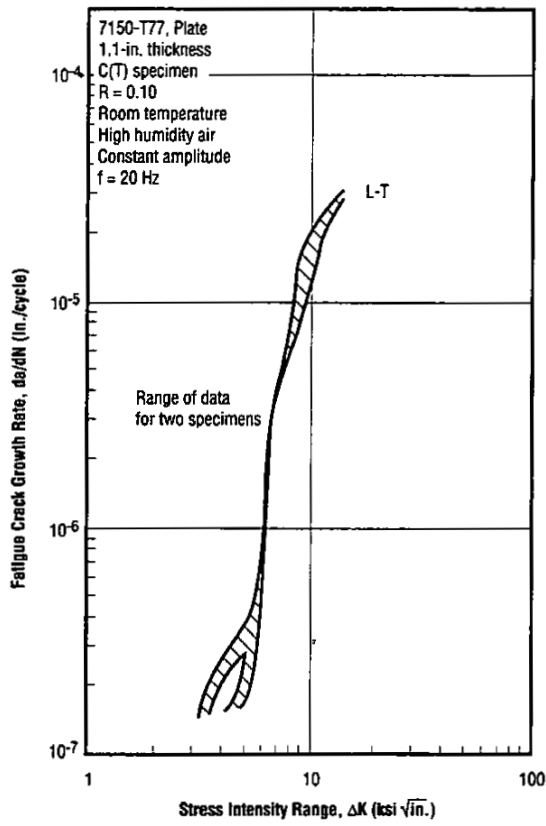


Fig. 3.5.3.4 Fatigue crack growth rates for 1.1-in. thick 7150-T77 plate tested in high humidity air (Ref. 11)

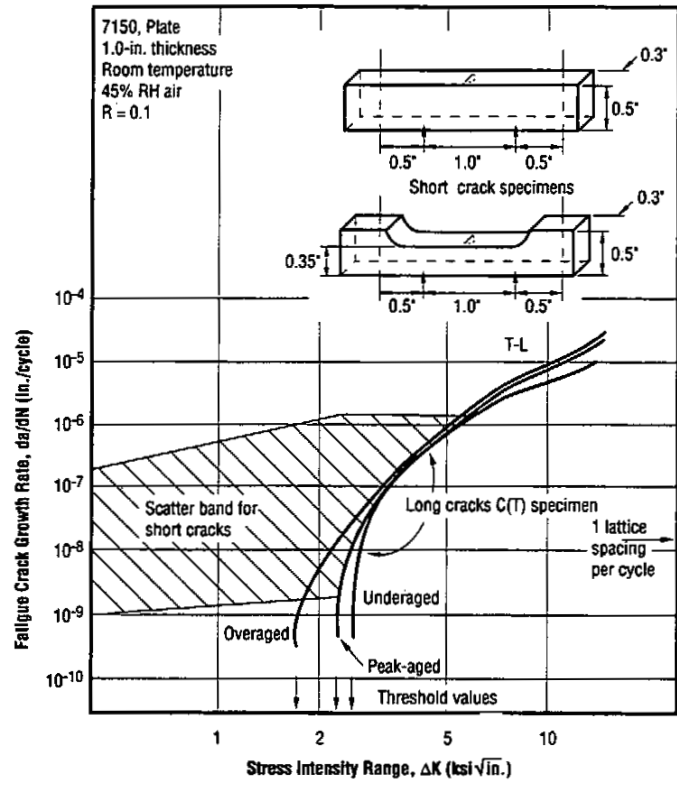


Fig. 3.5.3.5 Fatigue crack growth rates of 1.0 in. 7150 plate of various tempers. Small cracks and large cracks are compared (Ref. 8)

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