



777

Training Manual

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FASTENER - CODES AND PART NUMBERS

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FASTENER	PART NUMBER	FASTENER TYPE	MATERIAL	SURFACE FINISH	F _{su} (ksi)	NOTES
YJA	BACB30NW*K	<u>HEX DRIVES</u> 100° FLUSH SHEAR HEAD	TI 6AL-4V	ALUMINUM COAT	95	CETYL LUBE
YLR	BACB30NY*K	100° FLUSH TENSION HEAD	TI 6AL-4V	ALUMINUM COAT	95	CETYL LUBE
YHY	BACB30MY*K	PROTRUDING SHEAR HEAD	TI 6AL-4V	ALUMINUM COAT	95	CETYL LUBE
YLK	BACB30NX*K	PROTRUDING TENSION HEAD	TI 6AL-4V	ALUMINUM COAT	95	CETYL LUBE
XDA	BACB30FN	100° FLUSH SHEAR HEAD	4340 STEEL	CADMUM PLATE	95	CETYL LUBE
XNB	BACB30JC	100° FLUSH TENSION HEAD	4340 STEEL	CADMUM PLATE	95	CETYL LUBE
XCZ	BACB30FM	PROTRUDING SHEAR HEAD	4340 STEEL	CADMUM PLATE	95	CETYL LUBE
XMX	BACB30MB	PROTRUDING TENSION HEAD	4340 STEEL	CADMUM PLATE	95	CETYL LUBE
<u>LOCKBOLTS</u>						
XFV	BACB30GY	100° FLUSH SHEAR HEAD	4340 STEEL	CADMUM PLATE	95	CETYL LUBE
XFR	BACB30GW	PROTRUDING SHEAR HEAD	4340 STEEL	CADMUM PLATE	95	CETYL LUBE
XFL	BACB30GX	100° FLUSH TENSION HEAD	4340 STEEL	CADMUM PLATE	95	CETYL LUBE
<u>RIVETS</u>						
XZK	BACR15BB*D	PROTRUDING UNIVERSAL HEAD	2017	ANODIZED	38	
XF	BACR15CE*D	100° FLUSH SHEAR HEAD	2017	ANODIZED	38	
XZG	BACR15BA*D	100° FLUSH HEAD	2017	ANODIZED	38	
YNE	BACR15FV*KE	120° MODIFIED SHEAR HEAD	7050-T73		41	BRILES RIVET
BF	MS20427M	100° FLUSH HEAD	MONEL	ANODIZED	49	HIGH TEMP, CORR RESISTANT
XD	BACR15BB*DD	PROTRUDING UNIVERSAL HEAD	2024	ANODIZED	41	ICE BOX RIVET
XB	BACR15BA*DD	100° FLUSH HEAD	2024	ANODIZED	41	
BM	MS20470D	PROTRUDING UNIVERSAL HEAD	2017	ANODIZED	38	

FASTENER - CODES AND PART NUMBERS

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FASTENER JOINT ALLOWABLES - INDEX

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1. The fastener strength values given in these pages take into consideration the bearing strength of the material in which the fasteners are installed. This means that where the material will fail in bearing before fastener failure, the lower figure will be shown as the strength of the fastener.
2. The fastener strength values assume that the correct hole sizes have been used per the SRM, 51-40-05, and that edge margin requirements have been met per the SRM, 51-40-06.
3. Refer to the following tables for the location of fastener strengths.

FASTENER		MATERIAL	LOCATION	
TYPE	PART NUMBER		FIG	TABLE
UNIVERSAL HEAD AL RIVETS	XZK-BACR15BB*D	2024-T3	1	I
	XD-BACR15BB*DD	2024-T4, 2024-T42	1	II
	BM-MS20470D	7075-T6	1	III
		7075-T6, -T6510, -T6511 EXT	1	III
FLUSH HEAD AL RIVETS	XZG-BACR15BA*D	2024-T3, 2024-T42	1	IV
	XB-BACR15BA*DD	7075-T6	1	IV
FLUSH HEAD MONEL RIVET	BF-MS20427M	301-1/4 HARD CRES	1	V
		301-1/2 HARD CRES	1	V
		301-FULL HARD	1	V
		302-ANNEALED	1	V
PROTRUDING TENSION HEAD LOCKBOLTS AND HEX-DRIVES	XMX-BACB30MB	2024-T3	3	I
	YLK-BACB30NX	2024-T4, 2024-T42	3	II
		7075-T6	3	III
		7075-T6, -T6510, -T6511 EXT	3	III
FLUSH TENSION HEAD LOCKBOLTS AND HEX-DRIVES	XNB-BACB30JC	2024-T3	4	II
	YLR-BACB30NY	7075-T6	4	IV
	XFL-BACB30GX			
FLUSH & PROTRUDING SHEAR HEAD LOCKBOLTS AND HEX-DRIVES	XCZ-BACB30FM	YHY-BACB30MY	2024-T3	5
	XDA-BACB30FN	YJA-BACB30NW	7075-T6	I
	XFR-BACB30GW		5	III
	XFV-BACB30GY			

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FASTENER JOINT ALLOWABLES - SOLID RIVETS

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RIVET DIAMETER	5/32 (0.1562)			3/16 (0.1875)			1/4 (0.2500)			5/16 (0.3125)		
RIVET MATERIAL	2017	2024	7050	2017	2024	7050	2017	2024	7050	2017	2024	7050
FASTENER CODES	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN
SINGLE SHEAR (LBS)	730	785	785	1050	1130	1130	1870	2010	2010	2910	3140	3140
PART THICKNESS 0.032	510	510	510									
SINGLE SHEAR ALLOWABLES	0.040	635	635	635	765	765	765					
	0.050	725	780	780	955	955	955	1270	1270	1270		
	0.056	730	785	785	1030	1070	1070	1430	1430	1430		
	0.063				1050	1130	1130	1650	1650	1650	2070	2070
	0.071							1830	1830	1830	2330	2330
	0.080							1860	2000	2000	2620	2620
	0.090							1870	2010	2010	2850	2850
	0.100										2890	3120
	0.112										2910	3140
	0.125											
	0.140											
	0.160											

XZK = BACR15BB*D

BM = MS20470D

XD = BACR15BB*DD

YTN = BACR15FT*KE*C

UNIVERSAL AND MODIFIED UNIVERSAL HEAD

RIVETS INSTALLED IN:

1. CLAD OR BARE 2024-T3 SHEET

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FIGURE I	TABLE I
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FASTENER JOINT ALLOWABLES - SOLID RIVETS

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RIVET DIAMETER	5/32 (0.1562)			3/16 (0.1875)			1/4 (0.2500)			5/16 (0.3125)		
RIVET MATERIAL	2017	2024	7050	2017	2024	7050	2017	2024	7050	2017	2024	7050
FASTENER CODES	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN
DOUBLE SHEAR (LBS)	1460	1570	1570	2100	2260	2260	3740	4020	4020	5820	6280	6280
PART THICKNESS 0.050	795	795	795	955	955	955	1270	1270	1270			
DOUBLE SHEAR ALLOWABLES	0.056	890	890	890	1070	1070	1070	1430	1430	1430		
	0.063	1030	1030	1030	1240	1240	1240	1650	1650	1650	2070	2070
	0.071	1160	1160	1160	1400	1400	1400	1860	1860	1860	2330	2330
	0.080	1310	1310	1310	1570	1570	1570	2100	2100	2100	2620	2620
	0.090	1410	1480	1480	1770	1770	1770	2360	2360	2360	2950	2950
	0.100	1450	1560	1560	1970	1970	1970	2620	2620	2620	3280	3280
	0.112	1460	1570	1570	2050	2200	2200	2940	2940	2940	3670	3670
	0.125				2100	2260	2260	3280	3280	3280	4100	4100
	0.140							3710	3990	3990	5300	5300
	0.160							3740	4020	4020	5700	6150
	0.190										5820	6280
	0.250											

XZK = BACR15BB*D

BM = MS20470D

XD = BACR15BB*DD

YTN = BACR15FT*KE*C

UNIVERSAL AND MODIFIED UNIVERSAL HEAD

RIVETS INSTALLED IN:

1. CLAD OR BARE 2024-T3 SHEET

FIGURE I	TABLE I
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FASTENER JOINT ALLOWABLES - SOLID RIVETS

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RIVET DIAMETER	5/32 (0.1562)			3/16 (0.1875)			1/4 (0.2500)			5/16 (0.3125)		
RIVET MATERIAL	2017	2024	7050	2017	2024	7050	2017	2024	7050	2017	2024	7050
FASTENER CODES	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN
SINGLE SHEAR (LBS)	730	785	785	1050	1130	1130	1870	2010	2010	2910	3140	3140
PART THICKNESS 0.032	390	390	390									
SINGLE SHEAR ALLOWABLES	0.040	487	487	487	585	585	585					
	0.050	610	610	610	730	730	730	975	975	975		
	0.056	680	680	680	820	820	820	1090	1090	1090		
	0.063	730	785	785	990	990	990	1320	1320	1320	1650	1650
	0.071				1050	1120	1120	1490	1490	1490	1860	1860
	0.080					1130	1130	1680	1680	1680	2100	2100
	0.090							1870	1890	1890	2360	2360
	0.100								2010	2010	2620	2620
	0.112										2910	2940
	0.125											3140
	0.140											
	0.160											

XZK = BACR15BB*D

UNIVERSAL AND MODIFIED UNIVERSAL HEAD

BM = MS20470D

RIVETS INSTALLED IN:

XD = BACR15BB*DD

1. CLAD OR BARE 2024-T4 SHEET OR,

YTN = BACR15FT*KE*C

2. CLAD OR BARE 2024-T42 SHEET.

FIGURE I	TABLE II
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FASTENER JOINT ALLOWABLES - SOLID RIVETS

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RIVET DIAMETER	5/32 (0.1562)			3/16 (0.1875)			1/4 (0.2500)			5/16 (0.3125)		
RIVET MATERIAL	2017	2024	7050	2017	2024	7050	2017	2024	7050	2017	2024	7050
FASTENER CODES	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN
DOUBLE SHEAR (LBS)	1460	1570	1570	2100	2260	2260	3740	4020	4020	5820	6280	6280
PART THICKNESS 0.050	610	610	610	730	730	730	975	975	975			
DOUBLE SHEAR ALLOWABLES	0.056	680	680	680	820	820	820	1090	1090	1090		
	0.063	825	825	825	990	990	990	1320	1320	1320	1650	1650
	0.071	930	930	930	1120	1120	1120	1490	1490	1490	1860	1860
	0.080	1050	1050	1050	1260	1260	1260	1680	1680	1680	2100	2100
	0.090	1180	1180	1180	1420	1420	1420	1890	1890	1890	2360	2360
	0.100	1310	1310	1310	1570	1570	1570	2100	2100	2100	2620	2620
	0.112	1460	1470	1470	1760	1760	1760	2350	2350	2350	2940	2940
	0.125		1570	1570	1970	1970	1970	2620	2620	2620	3280	3280
	0.140				2100	2260	2260	3360	3360	3360	4200	4200
	0.160						3740	3990	3990	4990	4990	4990
	0.190							4020	4020	5820	6200	6200
	0.250										6280	6280

XZK = BACR15BB*D

BM = MS20470D

XD = BACR15BB*DD

YTN = BACR15FT*KE*C

UNIVERSAL AND MODIFIED UNIVERSAL HEAD
RIVETS INSTALLED IN:

1. CLAD OR BARE 2024-T4 SHEET OR,
2. CLAD OR BARE 2024-T42 SHEET.

FASTENER JOINT ALLOWABLES - SOLID RIVETS

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RIVET DIAMETER	5/32 (0.1562)			3/16 (0.1875)			1/4 (0.2500)			5/16 (0.3125)		
RIVET MATERIAL	2017	2024	7050	2017	2024	7050	2017	2024	7050	2017	2024	7050
FASTENER CODES	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN
SINGLE SHEAR (LBS)	730	785	785	1050	1130	1130	1870	2010	2010	2910	3140	3140
PART THICKNESS 0.032	565	565	565									
SINGLE SHEAR ALLOWABLES	0.040	705	720	720	860	860	860					
	0.050	725	780	780	1020	1080	1080	1440	1440	1440		
	0.056	730	785	785	1030	1110	1110	1610	1610	1610		
	0.063				1050	1130	1130	1800	1830	1830	2280	2280
	0.071							1830	1970	1970	2570	2570
	0.080							1860	2000	2000	2810	2900
	0.090							1870	2010	2010	2850	3080
	0.100										2890	3120
	0.112										2910	3140
	0.125											
	0.140											
	0.160											

XZK = BACR15BB*D

BM = MS20470D

XD = BACR15BB*DD

YTN = BACR15FT*KE*C

UNIVERSAL AND MODIFIED UNIVERSAL HEAD RIVETS
INSTALLED IN:

1. CLAD OR BARE 7075-T6 SHEET.
2. 7075-T6 EXTRUSION OR,
3. 7075-T6510 EXTRUSION OR,
4. 7075-T6511 EXTRUSION LESS THAN .188 INCH.

FIGURE I	TABLE III
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FASTENER JOINT ALLOWABLES - SOLID RIVETS

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RIVET DIAMETER	5/32 (0.1562)			3/16 (0.1875)			1/4 (0.2500)			5/16 (0.3125)		
RIVET MATERIAL	2017	2024	7050	2017	2024	7050	2017	2024	7050	2017	2024	7050
FASTENER CODES	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN	XZK BM	XD	YTN
DOUBLE SHEAR (LBS)	1460	1570	1570	2100	2260	2260	3740	4020	4020	5820	6280	6280
PART THICKNESS 0.050	900	900	900	1080	1080	1080	1440	1440	1440			
DOUBLE SHEAR ALLOWABLES	0.056	1010	1010	1010	1210	1210	1210	1610	1610	1610		
	0.063	1140	1140	1140	1370	1370	1370	1830	1830	1830	2280	2280
	0.071	1290	1290	1290	1540	1540	1540	2060	2060	2060	2570	2570
	0.080	1370	1450	1450	1740	1740	1740	2320	2320	2320	2900	2900
	0.090	1410	1520	1520	1940	1960	1960	2610	2610	2610	3260	3260
	0.100	1450	1560	1560	2000	2150	2150	2900	2900	2900	3620	3620
	0.112	1460	1570	1570	2050	2210	2210	3250	3250	3250	4060	4060
	0.125				2100	2260	2260	3500	3620	3620	4530	4550
	0.140							3710	3990	3990	5500	5800
	0.160							3740	4020	4020	5700	6150
	0.190										5820	6280
	0.250											

XZK = BACR15BB*D

BM = MS20470D

XD = BACR15BB*DD

YTN = BACR15FT*KE*C

UNIVERSAL AND MODIFIED UNIVERSAL HEAD RIVETS
INSTALLED IN:

1. CLAD OR BARE 7075-T6 SHEET.
2. 7075-T6 EXTRUSION OR,
3. 7075-T6510 EXTRUSION OR,
4. 7075-T6511 EXTRUSION LESS THAN .188 INCH.

FIGURE I	TABLE III
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FASTENER JOINT ALLOWABLES - SOLID RIVETS

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RIVET DIAMETER		5/32 (0.1562)				3/16 (0.1875)				1/4 (0.2500)			
RIVET MATERIAL		2017	2017	7050	2024	2017	2017	7050	2024	2017	2017	7050	2024
FASTENER CODES		XF	XZG	YNE A	XB	XF	XZG A	YNE A	XB	XF	XZG	YNE A	XB
SINGLE SHEAR (LBS)		730	730	785		1050	1050	1130	1130	1870	1870	2010	2010
PART THICKNESS 0.032		315		346									
SINGLE SHEAR ALLOWABLES	0.040	435	405	478		485		530					
	0.050	560	520	670		665	630	730	760	780		860	
	0.056	620	550	760		760	680	875	830	925		1020	
	0.063	675	600	780		840	775	1045	885	1000	915	1200	1210
	0.071	730	690	785		925	835	1110	940	1280	1060	1445	1350
	0.080		720			1010	935	1130	990	1440	1180	1735	1470
	0.090		730			1050	1010		1030	1580	1290	1990	1580
	0.100						1050		1070	1720	1520	2010	1670
	0.112								1130	1870	1700		1780
	0.125										1770		1880
	0.140										1870		2000
	0.160												2010

XF = BACR15CE*D

XZG = BACR15BA*D

YNE = BACR15FV*KE

XB = BACR15BA*DD

COUNTERSUNK HEAD RIVETS INSTALLED IN:

1. CLAD OR BARE 2024-T42 SHEET.
2. CLAD OR BARE 2024-T3 SHEET.
3. CLAD OR BARE 7075-T6 SHEET.

A ALLOWABLES ARE GOOD ONLY IN 2024-T3 CLAD AND BARE

FASTENER JOINT ALLOWABLES - SOLID RIVETS

FIGURE I TABLE IV

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RIVET DIAMETER	<input type="checkbox"/> 1	5/32	3/16		<input type="checkbox"/> 2	5/32	3/16		<input type="checkbox"/> 3	5/32	3/16	
RIVET MATERIAL		MONEL	MONEL			MONEL	MONEL			MONEL	MONEL	
FASTENER CODES		BF	BF			BF	BF			BF	BF	
SINGLE SHEAR (LBS)		940	1350			940	1350			940	1350	
PART THICKNESS 0.032		590	705			625	765			384	457	
SINGLE SHEAR ALLOWABLES	0.040	665	860			665	915			481	580	
	0.050	675	955			675	955			605	720	
	0.063	730	970			690	970			760	905	
	0.071	830	990			740	985			855	1030	
	0.080	935	1120			850	995			940	1160	
	0.090	940	1250			940	1130			1300		
	0.100		1350				1280				1350	
	0.125						1350					

BF = MS20427M

COUNTERSUNK HEAD RIVETS INSTALLED IN:

- 1 301-1/4 HARD CRES SHEET.
- 2 301-1/2 & 301 FULL HARD CRES SHEET.
- 3 302 ANNEALED CRES SHEET.

FIGURE I TABLE V

FASTENER JOINT ALLOWABLES - SOLID RIVETS

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FASTENER JOINT ALLOWABLES – TENSION PROTRUDING BOLTS

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BOLT DIAMETER	3/16 (0.1875)		1/4 (0.2500)		5/16 (0.3125)	
BOLT MATERIAL	TI	4340	TI	4340	TI	4340
FASTENER CODES	YLK	XMX	YLK	XMX	YLK	XMX
SINGLE SHEAR (LBS)	2690		4650		7250	
PART THICKNESS 0.063	1260		1650		2070	
SINGLE SHEAR ALLOWABLES	0.071	1420	1860	2330		
	0.080	1600	2100	2620		
	0.090	1790	2360	2950		
	0.100	1990	2620	3280		
	0.125	2490	3280	4100		
	0.140	2690	3710	4640		
	0.160		4240	5300		
	0.180		4650	5960		
	0.200			6600		
	0.224			7250		
	0.250					
	0.312					

YLK = BACB30NX

XMX = BACB30MB

TENSION PROTUDING HEAD LOCKBOLTS

AND HEX-DRIVES INSTALLED IN:

1. CLAD OR BARE 2024-T3 SHEET.

FIGURE 3 TABLE I

FASTENER JOINT ALLOWABLES - TENSION PROTRUDING BOLTS

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BOLT DIAMETER	3/16 (0.1875)		1/4 (0.2500)		5/16 (0.3125)	
BOLT MATERIAL	TI	4340	TI	4340	TI	4340
FASTENER CODES	YLK	XMX	YLK	XMX	YLK	XMX
SINGLE SHEAR (LBS)	2690		4650		7250	
PART THICKNESS 0.063	1000		1320		1650	
SINGLE SHEAR ALLOWABLES	0.071	1130	1490	1860		
	0.080	1280	1680	2100		
	0.090	1440	1890	2360		
	0.100	1600	2100	2620		
	0.125	1990	2620	3280		
	0.140	2230	2940	3670		
	0.160	2550	3360	4200		
	0.180	2690	3780	4720		
	0.200		4200	5250		
	0.224		4650	5900		
	0.250			6200		
	0.312			7250		

YLK = BACB30NX

TENSION PROTUDING HEAD LOCKBOLTS

XMX = BACB30MB

AND HEX-DRIVES INSTALLED IN:

1. CLAD OR BARE 2024-T42 SHEET.
2. CLAD OR BARE 2024-T4 SHEET.

FASTENER JOINT ALLOWABLES - TENSION PROTRUDING BOLTS

FIGURE 3 TABLE II

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BOLT DIAMETER	3/16 (.1875)		1/4 (.2500)		5/16 (.3125)	
BOLT MATERIAL	TI	4340	TI	4340	TI	4340
FASTENER CODES	YLK	XMX	YLK	XMX	YLK	XMX
SINGLE SHEAR (LBS)	2690		4650		7250	
PART THICKNESS 0.063	1390		1830		2280	
SINGLE SHEAR ALLOWABLES	0.071	1560	2060	2570		
	0.080	1760	2320	2900		
	0.090	1980	2610	3260		
	0.100	2200	2900	3620		
	0.125	2690	3620	4530		
	0.140		4060	5050		
	0.160		4640	5800		
	0.180		4650	6500		
	0.200			7250		
	0.224					
	0.250					
	0.312					

YLK = BACB30NX

TENSION PROTUDING HEAD LOCKBOLTS AND

XMX = BACB30MB

HEX-DRIVES INSTALLED IN:

1. CLAD OR BARE 7075-T6 SHEET.
2. EXTRUSIONS 7075-T6, -T6510, -T6511.

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FIGURE 3 TABLE III

FASTENER JOINT ALLOWABLES - TENSION PROTRUDING BOLTS

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FASTENER JOINT ALLOWABLES – STANDARD FLUSH BOLTS

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BOLT DIAMETER	3/16 (0.1875)	1/4 (0.2500)	5/16 (0.3125)
BOLT MATERIAL	TI 4340	TI 4340	TI 4340
FASTENER CODES	YLR XNB XFL	YLR XNB XFL	YLR XNB XFL
SINGLE SHEAR (LBS)	2690	4650	7300
PART THICKNESS 0.063	1080	1430	
SINGLE SHEAR ALLOWABLES	0.071	1220	1920
	0.080	1380	2250
	0.090	1550	2580
	0.100	1720	2870
	0.125	2150	3590
	0.140	2410	4020
	0.160	2690	4600
	0.180		5150
	0.200		5750
	0.224		6450
	0.250		6900
	0.312		7300

YLR = BACB30NY

TENSION FLUSH HEAD LOCKBOLTS AND

XNB = BACB30JC

HEX-DRIVES INSTALLED IN:

XFL = BACB30GX

1. CLAD OR BARE 2024-T3 SHEET.

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FIGURE 4 TABLE II

FASTENER JOINT ALLOWABLES - STANDARD FLUSH BOLTS

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Maintenance Training Manual

BOLT DIAMETER	3/16 (0.1875)		1/4 (0.2500)		5/16 (0.3125)	
BOLT MATERIAL	TI	4340	TI	4340	TI	4340
FASTENER CODES	YLR	XNB XFL	YLR	XNB XFL	YLR	XNB XFL
SINGLE SHEAR (LBS)	2690		4650		7300	
PART THICKNESS 0.063	1180		1690		1900	
SINGLE SHEAR ALLOWABLES	0.071	1270	1870	2390		
	0.080	1420	2020	2700		
	0.090	1590	2170	2980		
	0.100	1800	2370	3180		
	0.125	2460	2920	3710		
	0.140	2690	3370	4140		
	0.160		4080	4770		
	0.180		4640	5450		
	0.190		4650	5950		
	0.200			6350		
	0.224			7240		
	0.250			7300		

YLR = BACB30NY

TENSION FLUSH HEAD LOCKBOLTS AND

XNB = BACB30JC

HEX-DRIVES INSTALLED IN:

XFL = BACB30GX

1. CLAD OR BARE 7075-T6 SHEET.

FIGURE 4 TABLE IV

FASTENER JOINT ALLOWABLES - STANDARD FLUSH BOLTS

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FASTENER JOINT ALLOWABLES - SHEAR BOLTS

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BOLT DIAMETER		3/16 (.1875)		1/4 (.2500)		5/16 (.3125)	
BOLT MATERIAL		TI	4340	TI	4340	TI	4340
FASTENER CODES		YJA YHY	XDA XCZ XFV XFR	YJA YHY	XDA XCZ XFV XFR	YJA YHY	XDA XCZ XFV XFR
SINGLE SHEAR (LBS)		2690		4650		7300	
PART THICKNESS .063		1080		1440		1630	
SINGLE SHEAR ALLOWABLES	0.071	1220		1630		1960	
	0.080	1380		1840		2290	
	0.090	1550		2070		2580	
	0.100	1720		2300		2870	
	0.125	2020		2870		3590	
	0.140	2130		3220		4020	
	0.160	2170		3490		4590	
	0.180	2250		3670		5200	
	0.200	2330		3790		5600	
	0.224	2430		3920		5750	
	0.250	2540		4050		5950	
	0.312			4650		6350	
	0.375					6500	

YJA = BACB30NW

SHEAR FLUSH & PROTUDING HEAD LOCKBOLTS

YHY = BACB30MY

AND HEX-DRIVES INSTALLED IN:

XDA = BACB30FN

1. CLAD OR BARE 2024-T3 SHEET.

XCZ = BACB30FM

XFV = BACB30GY

XFR = BACB30GW

FIGURE 5 | TABLE I

FASTENER JOINT ALLOWABLES - SHEAR BOLTS

70-10-00



BOLT DIAMETER	3/16 (.1875)		1/4 (.2500)		5/16 (.3125)	
BOLT MATERIAL	TI	4340	TI	4340	TI	4340
FASTENER CODES	YJA YHY	XDA XCZ XFV XFR	YJA YHY	XDA XCZ XFV XFR	YJA YHY	XDA XCZ XFV XFR
SINGLE SHEAR (LBS)	2690		4650		7300	
PART THICKNESS .063	1270		1700		1980	
SINGLE SHEAR ALLOWABLES	0.071	1430	1910	2390		
	0.080	1620	2150	2700		
	0.090	1820	2430	3030		
	0.100	2020	2700	3370		
	0.125	2530	3370	4220		
	0.140	2690	3780	4720		
	0.160		4320	5400		
	0.180		4580	6050		
	0.190		4650	6350		
	0.200			6500		
	0.224					
	0.250					
	0.312					

YJA = BACB30NW

SHEAR FLUSH & PROTUDING HEAD LOCKBOLTS

YHY = BACB30MY

AND HEX-DRIVES INSTALLED IN:

XDA = BACB30FN

1. CLAD OR BARE 7075-T6 SHEET.

XCZ = BACB30FM

XFV = BACB30GY

XFR = BACB30GW

FIGURE 5 TABLE III

FASTENER JOINT ALLOWABLES - SHEAR BOLTS

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FASTENER - AVERAGE HOLE DIAMETERS

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AVERAGE HOLE DIAMETER FOR 100° FLUSH HEAD TENSION LOCKBOLTS AND HEX DRIVE BOLTS.								
SHEET THICKNESS	FASTENER DIAMETER							
	.1875	.2500	.3125	.3750	.4375	.5000	.5625	.6250
.040	.351	.474	.602	.730	.858	.986	1.109	1.237
.045	.345	.468	.596	.724	.852	.980	1.103	1.231
.050	.339	.462	.590	.718	.846	.974	1.097	1.225
.056	.332	.455	.583	.711	.839	.967	1.090	1.218
.063	.324	.477	.575	.703	.831	.959	1.082	1.209
.071	.314	.437	.565	.693	.821	.949	1.072	1.200
.080	.304	.427	.555	.683	.811	.939	1.062	1.189
.090	.291	.415	.543	.671	.799	.927	1.050	1.177
.100	.281	.403	.531	.659	.787	.915	1.038	1.165
.112	.272	.388	.516	.644	.772	.900	1.023	1.151
.125		.264	.375	.501	.629	.757	.885	1.008
.140		.256	.362	.483	.611	.739	.867	.990
.160	.248	.349	.462	.587	.715	.843	.966	1.094
.180	.242		.338	.446	.564	.691	.819	.942
.190	.240		.334	.439	.554	.680	.808	.931
.200	.238	.330	.433	.546	.668	.796	.919	1.046
.224	.233	.322		.420	.528	.643	.766	.890
.250	.229	.314	.409		.512	.622	.739	.860
.313	.222	.302	.391	.485	.586	.692	.801	.919
.375	.217	.294	.378	.468	.562	.661	.762	.872
.500	.211	.284	.363	.446	.532	.622	.713	.811
.625	.208	.278	.353	.432	.514	.599	.684	.775

Sheet thickness/fastener diameter combinations above the heavy Line result in countersink depths >.667 of sheet/plate thickness. Do not use these values for fatigue-rated structure.

FASTENER - AVERAGE HOLE DIAMETERS

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AVERAGE HOLE DIAMETER FOR THE BRILES RIVET BACR15FV.							
Sheet Thickness	FASTENER DIAMETER						
	1/8	5/32	3/16	7/32	1/4	9/32	5/16
0.040	0.150	0.198	0.252	0.317	0.378	0.444	0.516
0.045	0.148	0.194	0.246	0.307	0.365	0.427	0.495
0.050	0.146	0.191	0.241	0.300	0.354	0.414	0.477
0.056	0.144	0.188	0.236	0.292	0.344	0.401	0.461
0.063	0.063	0.185	0.232	0.286	0.335	0.389	0.445
0.071	0.071	0.183	0.228	0.280	0.327	0.378	0.431
0.080	0.080	0.181	0.224	0.274	0.319	0.369	0.419
0.090	0.090	0.179	0.221	0.269	0.313	0.361	0.408
0.100	0.100	0.178	0.219	0.266	0.308	0.354	0.399
0.112	0.112	0.176	0.216	0.262	0.302	0.348	0.391
0.125	0.125	0.175	0.214	0.259	0.298	0.342	0.384
0.140	0.140	0.174	0.212	0.256	0.294	0.337	0.377
0.160	0.160	0.172	0.210	0.253	0.290	0.331	0.370
0.180	0.180	0.172	0.209	0.250	0.287	0.327	0.365
0.190	0.190	0.171	0.208	0.249	0.286	0.326	0.363
0.200	0.200	0.171	0.208	0.249	0.284	0.324	0.360
0.224	0.224	0.170	0.206	0.247	0.282	0.321	0.365
0.250	0.250	0.169	0.205	0.245	0.280	0.318	0.353
0.313	0.313	0.168	0.204	0.242	0.276	0.313	0.346
0.375	0.375	0.168	0.202	0.241	0.273	0.310	0.342
0.500	0.500	0.167	0.201	0.238	0.270	0.306	0.337
0.625	0.625	0.166	0.200	.237	.268	.304	0.334

FASTENER - AVERAGE HOLE DIAMETERS

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FASTENER - FLUSH HEAD DIMENSIONS

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DIMENSIONS OF FLUSH HEAD FASTENERS - RIVETS

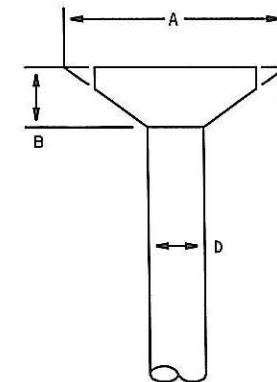
REPAIR RIVET - FOR BACR15CE (BACR15EA)			
NOM.	A	B	D
SIZE	MAX	MAX	MIN
7/32	.340	.046	.236
9/32	.440	.061	.299
			.296

BLIND NONSTRUCTURAL (BACR15DR)			
NOM.	A	B	D
SIZE	MAX	MAX	MIN
1/8	.229	.042	.128
5/32	.290	.055	.159
3/16	.357	.070	.190
1/4	.480	.095	.253
			.248

BLIND RIVETS (BACR15FP, NAS 1739)			
NOM.	A	B	D
SIZE	MAX	MAX	MIN
1/8	.229	.035	.143
5/32	.290	.047	.176
3/16	.357	.063	.204
1/4			.200

STANDARD HEAD RIVETS (BACR15BA* = BACR15AD)			
NOM.	A	B	D
SIZE	MAX	MAX	MIN
3/32	.184	.038	.0963
1/8	.230	.045	.1275
5/32	.292	.058	.1585
3/16	.358	.073	.1895
7/32*	.358	.060	.222
1/4	.482	.099	.2525
9/32*	.482	.085	.285
5/16	.570	.110	.3145
3/8	.701	.139	.3775
7/16	.824	.161	.4400
			.4375

SHEAR HEAD RIVETS (BACR15CE/* = BACR15DS)			
NOM.	A	B	D
SIZE	MAX	MAX	MIN
3/32	.148	.024	.095
1/8	.195	.030	.127
5/32	.248	.039	.158
3/16	.298	.048	.189
7/32*	.324	.046	.220
1/4	.396	.062	.252
9/32*	.424	.061	.283
5/16			.285
3/8			
7/16			



MS20426 RIVETS NAS 1399 BLIND RIVETS			
NOM.	A	B	D
SIZE	MAX	MAX	MIN
1/8	.229	.042	.128
5/32	.290	.055	.159
3/16	.357	.070	.190
1/4	.480	.095	.253
5/16	.568	.106	.315
3/8	.698	.134	.378
			.374

FASTENER - FLUSH HEAD DIMENSIONS

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FASTENER - EDGE MARGINS
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EDGE MARGINS FOR 95 KSI SHEAR STRENGTH LOCKBOLTS AND HEX DRIVE BOLTS, AND 100 DEG FLUSH HEAD BLIND FASTENERS IN ALUMINUM ALLOY SHEET																			
Head Style		Tension Protruding Head Lockbolts and Hex Drive Bolts								100 deg Head and Shear Protruding Head Lockbolts and Hex Drive Bolts and 100 deg Flush Head Blind Fasteners									
Loading		Single Shear								Single Shear									
Nominal Diameter (in)		.1900	.2500	.3125	.3750	.4375	.5000	.5625	.6250	.1250	.1562	.1900	.2500	.3125	.3750	.4375	.5000	.5625	.6250
Sheet		Design Edge Margins (in)																	
Alloy	Gage	.032	.37	.49						.30	.36								
ALL Aluminum Alloys	.036	.37	.49							.30	.36								
	.040	.37	.49							.30	.36								
	.045	.37	.49							.30	.36								
	.050	.37	.49	.59						.30	.36	.43	.57						
	.056	.37	.49	.59						.30	.36	.43	.57						
	.063	.37	.49	.59	.69					.30	.36	.43	.57	.70	.84	.97	1.12		
	.071	.37	.49	.59	.69					.30	.36	.43	.56	.70	.84	.97	1.11	1.25	
	.080	.37	.49	.59	.69	.79	.90			.30	.36	.43	.56	.69	.83	.96	1.11	1.25	
	.090	.37	.49	.59	.69	.79				.30	.36	.43	.55	.68	.83	.96	1.10	1.24	
	.100	.37	.49	.59	.69	.79	.90	1.01		.30	.36	.43	.55	.68	.82	.95	1.09	1.24	
	.112	.37	.49	.59	.69	.79	.90	1.01		.30	.36	.43	.55	.68	.82	.95	1.09	1.23	
	.125	.37	.49	.59	.69	.79	.90	1.01	1.11	.30	.36	.43	.55	.68	.81	.94	1.08	1.22	
	.140	.37	.49	.59	.69	.79	.90	1.01	1.11	.30	.36	.43	.55	.68	.80	.93	1.06	1.20	
	.160	.37	.49	.59	.69	.79	.90	1.01	1.11	.30	.36	.43	.55	.68	.80	.92	1.06	1.20	
	.180	.35	.49	.59	.69	.79	.90	1.01	1.11	.30	.36	.43	.55	.68	.80	.92	1.05	1.19	
	.190	.34	.49	.59	.69	.79	.90	1.01	1.11	.30	.36	.43	.55	.68	.80	.92	1.05	1.18	
	.200	.33	.49	.59	.69	.79	.90	1.01	1.11	.30	.36	.43	.55	.68	.80	.92	1.05	1.18	
	.224	.31	.46	.59	.69	.79	.90	1.01	1.11	.30	.36	.43	.55	.68	.80	.92	1.05	1.17	
	.250	.29	.43	.58	.69	.79	.90	1.01	1.11	.30	.36	.43	.55	.68	.80	.92	1.05	1.17	
	.312	.29	.38	.53	.69	.79	.90	1.01	1.11	.30	.36	.43	.55	.68	.80	.92	1.05	1.17	
	.375	.29	.37	.48	.63	.79	.90	1.01	1.11	.30	.36	.43	.55	.68	.80	.92	1.05	1.17	
	.500	.29	.37	.46	.54	.67	.82	.99	1.11	.30	.36	.43	.55	.68	.80	.92	1.05	1.17	
	.625	.29	.37	.46	.54	.62	.72	.86	1.01	.30	.36	.43	.55	.68	.80	.92	1.05	1.17	
	.750	.29	.37	.46	.54	.62	.70	.78	.90	.30	.36	.43	.55	.68	.80	.92	1.05	1.17	

FASTENER - EDGE MARGINS

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MATERIAL ALLOWABLES - 2024 ALUMINUM

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2024 CLAD, SHEET AND PLATE																										
TEMPER	-T3				-T4				-T4 COILED SHEET				-T42													
CROSS SECTION (in ²)	ALL				ALL				ALL				ALL													
THICKNESS (in)	.010-.062		.063-.128		.129-.249		.021-.062		.063-.128		.010-.062		.063-.128													
BASIS	A	B	A	B	A	B	A	B	A	B	A	B	A	B												
F _{tu} (ksi)	L	60	61	62	63	63	64	58	59	61	63	58	59	61	62											
	LT	59	60	61	62	62	63	58	59	61	63	58	59	61	62											
F _{ty} (ksi)	L	44	45	45	47	45	47	36	39	38	41	36	38	38	39											
	LT	39	40	40	42	40	42	36	39	38	41	36	38	39	35											
F _{cy} (ksi)	L	36	37	37	39	37	39	38	41	41	44	36	38	38	39											
	LT	42	43	43	45	43	45	38	41	40	43	36	38	39	35											
F _{su} (ksi)	37	38	38	39	39	40	38	39	39	40	37	37	38	39	35											
F _{bru} e/D = 1.5	87	89	91	92	92	93	81	83	86	88	86	87	91	92	82											
(ksi) e/D = 1.7	96	97	99	101	101	102	91	93	96	99	94	96	100	101	90											
e/D = 2.0	109	110	112	114	114	116	105	108	112	114	107	109	112	114	102											
F _{bry} e/D = 1.5	61	63	63	65	63	65	50	55	54	58	57	59	59	61	54											
(ksi) e/D = 1.7	66	68	68	71	68	71	55	59	58	63	61	65	65	67	58											
e/D = 2.0	74	75	75	79	75	79	61	67	65	70	68	72	72	74	65											
G (10 ⁶ psi)	3.6		3.8				3.6		3.8		3.6		3.8													
E (10 ⁶ psi)	10.5																									
E _c (10 ⁶ psi)	10.7																									
μ (elastic region)	.33																									

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MATERIAL ALLOWABLES - 2024 ALUMINUM

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Spec sheet 1/2

2024 BARE, SHEET AND PLATE											
TEMPER	-T3			-T4		T4 COILED		-T42		-T351	
CROSS SECTION (in ²)	ALL			ALL		ALL		ALL		ALL	
THICKNESS (in)	.010-.128		.129-.249		.021-.128		.010-.249		.010-.249		
BASIS	A	B	A	B	A	B	A	B	S	A	B
F _{tu} (ksi) L	64	65	65	66	62	65	62	64	62	64	66
	LT	63	64	64	65	62	65	62	64	62	64
F _{ty} (ksi) L	47	48	47	48	40	43	40	42	38	48	50
	LT	42	43	42	43	40	43	40	42	38	42
F _{cy} (ksi) L	39	40	39	40	42	45	37	42	42	39	41
	LT	45	46	45	46	42	45	24	42	41	45
F _{su} (ksi)	39	40	40	41	41	43	37	38	37	38	39
F _{bru} e/D = 1.5	94	95	95	96	86	89	93	96	89	87	90
(ksi) e/D = 1.7	103	104	104	106	96	101	103	106	98	95	98
e/D = 2.0	116	118	118	120	113	119	118	122	111	107	110
F _{bry} e/D = 1.5	66	68	66	68	58	61	56	59	60	65	68
(ksi) e/D = 1.7	71	73	71	73	63	67	59	62	65	70	73
e/D = 2.0	79	81	79	81	71	76	64	67	72	77	81
G (10 ⁶ psi)	4.0							4.0			
E (10 ⁶ psi)	10.5							10.7			
E _c (10 ⁶ psi)	10.7							10.9			
μ (elastic region)	.33							.33			

MATERIAL ALLOWABLES - 2024 ALUMINUM

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2024 EXTRUSION										
TEMPER	-T3, -T3510, -T3511						-T42			
CROSS SECTION (in ²)	< 20						≤ 25			
THICKNESS (in)	≤ .249		.250-.449		.500-.749		.750-1.50		≤ .249	.250-.449
BASIS	A	B	A	B	A	B	A	B	S	S
F _{tu} (ksi) L	57	61	60	62	60	62	65	70	57	57
	LT	54	58	56	57	54	56	56	55	54
									52	51
F _{ty} (ksi) L	42	47	44	47	44	47	46	54	38	38
	LT	37	41	38	40	37	39	37	43	36
									35	34
									38	33
F _{cy} (ksi) L	34	38	37	39	38	40	41	48	38	38
	LT	41	45	41	44	40	43	40	47	39
									38	37
									37	36
F _{su} (ksi)	29	31	31	32	30	31	33	35	29	29
F _{bru} e/D = 1.5	76	81	70	73	70	72	76	81	73	72
(ksi) e/D = 1.7	84	90	77	80	76	79	83	89	79	71
e/D = 2.0	97	104	88	91	87	91	94	102	89	69
									78	77
									77	76
F _{bry} e/D = 1.5	55	61	50	53	50	53	51	60	50	48
(ksi) e/D = 1.7	58	65	54	58	54	58	56	65	55	52
e/D = 2.0	64	71	60	64	60	64	62	73	62	50
G (10 ⁶ psi)	4.1						4.1			
E (10 ⁶ psi)	10.8						10.8			
E _c (10 ⁶ psi)	11.0						11.0			
μ (elastic region)	.33						.33			

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MATERIAL ALLOWABLES - 2024 ALUMINUM

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2524 CLAD, SHEET AND PLATE							
TEMPER	-T3				-T42		
CROSS SECTION (in ²)	ALL				ALL		
THICKNESS (in)	.032-.062	.063-.128	.129-.249	.036-.062	.063-.128	.129-.249	
BASIS	A	B	A	B	A	S	S
F _{tu} (ksi)	L	60	61	62	63	58	61
	LT	59	60	61	62	57	60
F _{ty} (ksi)	L	45	46	45	49	35	37
	LT	39	40	40	43	34	36
F _{cy} (ksi)	L	38	39	39	42	37	39
	LT	42	43	43	46	36	38
F _{su} (ksi)		39	39	40	41	42	36
F _{bru} e/D = 1.5		85	85	87	89	82	87
(ksi) e/D = 1.7		93	94	96	98	95	97
e/D = 2.0		106	108	110	112	107	109
F _{bry} e/D = 1.5		56	57	58	62	59	61
(ksi) e/D = 1.7		60	61	62	66	63	65
e/D = 2.0		65	67	67	72	69	71
G (10 ⁶ psi)		3.7				3.9	
E (10 ⁶ psi)		9.8				10.2	
E _c (10 ⁶ psi)		10.0				10.4	
μ (elastic region)		.33				.33	

MATERIAL ALLOWABLES - 2524 ALUMINUM

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2524 BARE, SHEET AND PLATE							
TEMPER	-T3						
CROSS SECTION (in ²)	ALL						
THICKNESS (in)	.032-.062		.063-.128		.129-.249		.250-.310
BASIS	A	B	A	B	A	B	A
F _{tu} (ksi)	L	63	65	63	65	63	65
	LT	63	65	63	65	63	65
F _{ty} (ksi)	L	48	49	47	49	46	48
	LT	42	43	42	43	41	43
F _{cy} (ksi)	L	41	42	41	42	40	42
	LT	45	46	45	46	44	46
F _{su} (ksi)		42	43	42	43	43	45
F _{bry} e/D = 1.5		91	94	90	93	88	91
(ksi) e/D = 1.7		100	103	99	103	97	100
e/D = 2.0		113	117	113	117	110	113
		107	111				
F _{bry} e/D = 1.5		63	65	63	65	61	65
(ksi) e/D = 1.7		67	69	67	69	65	69
e/D = 2.0		74	76	74	76	72	76
G (10 ⁶ psi)	3.9						
E (10 ⁶ psi)	10.3						
E _c (10 ⁶ psi)	10.5						
μ (elastic region)	.33						

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MATERIAL ALLOWABLES - 2524 ALUMINUM

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MATERIAL ALLOWABLES - 7050 ALUMINUM

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7050 BARE, SHEET AND PLATE						
TEMPER	-T76		-T762		-T7651	
CROSS SECTION (in ²)	ALL			ALL		
THICKNESS (in)	.040-.125		.040-.125		.250-1.00	1.00-1.50
BASIS	S	A	B	S	A	B
F _{tu} (ksi) L	75	74	76	76	77	79
	LT	76	75	78	76	79
F _{ty} (ksi) L	69	66	70	66	66	71
	LT	69	65	70	66	66
F _{cy} (ksi) L	69	65	70	64	64	68
	LT	73	69	74	68	68
F _{su} (ksi)	45	44	46	43	44	46
F _{bru} e/D = 1.5	105	103	108	99	101	105
(ksi) e/D = 1.7	117	115	120	111	113	117
e/D = 2.0	135	133	139	128	130	135
F _{bry} e/D = 1.5	86	81	87	78	81	86
(ksi) e/D = 1.7	91	86	92	84	86	92
e/D = 2.0	98	93	100	92	94	100
G (10 ⁶ psi)	3.8			4.0		
E (10 ⁶ psi)	10.2			10.3		
E _c (10 ⁶ psi)	10.4			10.8		
μ (elastic region)	.33			.33		

MATERIAL ALLOWABLES - 7050 ALUMINUM

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7050 EXTRUSION			
TEMPER	-T76511		
CROSS SECTION (in ²)	ALL		ALL
THICKNESS (in)	.032-.499		.500-1.00
BASIS	A	B	S
F _{tu} (ksi)	L	77	79
	LT	76	78
F _{ty} (ksi)	L	68	71
	LT	67	69
F _{cy} (ksi)	L	68	71
	LT	70	73
F _{su} (ksi)		42	44
F _{bru} e/D = 1.5		102	104
(ksi) e/D = 1.7		114	117
e/D = 2.0		132	136
F _{bry} e/D = 1.5		85	88
(ksi) e/D = 1.7		90	94
e/D = 2.0		98	103
G (10 ⁶ psi)		3.9	
E (10 ⁶ psi)		10.3	
E _c (10 ⁶ psi)		10.7	
μ (elastic region)		.33	

MATERIAL ALLOWABLES - 7050 ALUMINUM

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MATERIAL ALLOWABLES- 7075 ALUMINUM

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7075 CLAD, SHEET AND PLATE											
TEMPER	-T6, -T62								-T651	-T76	
CROSS SECTION (in ²)	ALL								ALL	ALL	
THICKNESS (in)	.012-.039	.040-.062	.063-.187	.188-.249	.250-.499	.300-.499	.400-.499	.500-.699	.600-.799	.700-.799	.800-.999
BASIS	A	B	A	B	A	B	A	B	A	B	S
F _{tu} (ksi) L	70	73	72	74	73	75	75	77	74	76	66
F _{tu} (ksi) LT	70	73	72	74	73	75	75	77	75	77	67
F _{ty} (ksi) L	62	65	64	66	65	67	66	68	67	69	56
F _{ty} (ksi) LT	60	63	62	64	63	65	64	66	65	67	57
F _{cy} (ksi) L	61	64	63	65	64	66	65	67	65	67	55
F _{cy} (ksi) LT	64	67	66	68	67	69	68	70	69	71	59
F _{su} (ksi)	42	44	43	44	44	45	45	46	42	43	41
F _{bru} e/D = 1.5 (ksi) e/D = 1.7 e/D = 2.0	97	101	101	103	101	104	104	107	101	104	93
F _{bru} e/D = 1.5 (ksi) e/D = 1.7 e/D = 2.0	108	113	112	115	113	116	116	119	110	113	104
F _{bry} e/D = 1.5 (ksi) e/D = 1.7 e/D = 2.0	126	131	129	133	131	135	135	138	125	128	121
G (10 ⁶ psi)	3.9								-	3.9	
E (10 ⁶ psi)	10.3								10.3	10.3	
E _c (10 ⁶ psi)	10.5								10.6	10.5	
μ (elastic region)	.33								.33	.33	

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MATERIAL ALLOWABLES - 7075 ALUMINUM

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7075 BARE, SHEET AND PLATE											
TEMPER		-T6, T-62				-T651		-T73	-T7351	-T76	-T7651
CROSS SECTION (in ²)		ALL				ALL		ALL	ALL	ALL	ALL
THICKNESS (in)		.012-.039	.040-.125	.126-.249	.250-.499	.040-.249	.250-.499	.063-.249	.250-.499		
BASIS		A	B	A	B	A	B	S	S	S	S
F _{tu} (ksi)	L	76	78	78	80	78	80	77	79	67	68
	LT	76	78	78	80	78	80	80	80	67	69
F _{ty} (ksi)	L	69	72	70	72	71	73	69	71	56	57
	LT	67	70	68	70	69	71	67	69	56	57
F _{cy} (ksi)	L	68	71	69	71	70	72	67	69	55	56
	LT	71	74	72	74	73	75	71	73	58	59
F _{su} (ksi)		46	47	47	48	47	48	43	44	38	38
F _{bry} e/D = 1.5		106	109	109	111	109	112	105	108	94	92
(ksi) e/D = 1.7		118	121	121	125	121	125	115	118	105	102
e/D = 2.0		137	140	140	144	140	144	130	133	121	118
F _{bry} e/D = 1.5		90	94	92	94	93	95	87	90	76	71
(ksi) e/D = 1.7		96	100	98	100	99	102	93	96	82	76
e/D = 2.0		105	110	107	110	109	112	102	106	92	85
G (10 ⁶ psi)		3.9				3.9		3.9	3.9	3.9	3.9
E (10 ⁶ psi)		10.3				10.3		10.3	10.3	10.3	10.3
E _c (10 ⁶ psi)		10.5				10.6		10.5	10.6	10.5	10.6
μ (elastic region)		.33				.33		.33	.33	.33	.33

MATERIAL ALLOWABLES - 7075 ALUMINUM

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7075 EXTRUSION										
TEMPER	T6	T6510	T6511	T62	T73	73510	T73511	T76	T76510	T76511
CROSS SECTION (in ²)	≤ 20			≤ 20		≤ 25		≤ 20		
THICKNESS (in)	.040-.249		.250-.499		.063-.249	.250-.499		.040-.249	.250-.499	
BASIS	A	B	A	B	A	B	A	B	A	B
F _{tu} (ksi)	L	78	82	81	85	68	72	70	74	71
	LT	76	80	78	81	66	70	68	72	68
F _{ty} (ksi)	L	70	74	73	77	58	61	60	63	61
	LT	66	70	68	72	56	59	57	60	57
F _{cy} (ksi)	L	70	74	73	77	58	61	60	63	61
	LT	72	76	74	78	59	62	60	63	62
F _{su} (ksi)		42	44	43	45	37	39	38	40	38
F _{bru} e/D = 1.5		101	106	105	110	91	96	93	99	93
(ksi) e/D = 1.7		111	117	115	121	101	107	104	110	103
e/D = 2.0		127	133	131	137	116	123	120	127	118
F _{bry} e/D = 1.5		84	89	87	92	74	77	76	80	74
(ksi) e/D = 1.7		90	95	93	99	79	83	81	85	79
e/D = 2.0		99	105	103	109	87	92	90	94	88
G (10 ⁶ psi)								4.0		
E (10 ⁶ psi)								10.4		
E _c (10 ⁶ psi)								10.7		
μ (elastic region)								.33		

MATERIAL ALLOWABLES - 7075 ALUMINUM

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MATERIAL ALLOWABLES - TI-6AL-4V TITANIUM

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TI-6AL-4V											
FORM	SHEET, STRIP & PLATE					EXTRUSION					
CONDITION	ANNEALED			SOLUTION TREATED AND AGED		SOLUTION TREATED AND AGED					
THICKNESS (in)	$\leq .187$.188-2.00		$\leq .187$.188-.750		$\leq .500$.501-.750		
BASIS	A	B	A	B	S	S	A	B	A	B	
F_{tu} (ksi)	L	134	139	130	135	160	160	155	163	151	157
	LT	134	139	130	138	160	160	155	163	151	157
F_{ty} (ksi)	L	126	131	120	125	145	145	138	147	138	143
	LT	126	131	120	131	145	145	138	147	138	145
F_{cy} (ksi)	L	133	138	124	129	154	150	147	157	147	153
	LT	135	141	130	142	162	---	147	157	147	155
F_{su} (ksi)		87	90	79	84	100	93	94	99	92	96
F_{bru} e/D = 1.5		192	199	185	193	236	248	219	230	213	221
(ksi) e/D = 1.7		213	221	204	214	256	272	243	256	237	247
e/D = 2.0		245	255	234	248	286	308	280	294	273	283
F_{bry} e/D = 1.5		154	160	148	161	210	210	187	200	187	194
(ksi) e/D = 1.7		167	174	158	173	219	224	200	212	200	207
e/D = 2.0		187	195	175	191	232	243	218	231	218	225
G (10^6 psi)		6.2					6.5				
E (10^6 psi)		16.0					16.9				
E_c (10^6 psi)		16.4					17.2				
U {elastic region}		.31					.31				

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MATERIAL ALLOWABLES - TI-6AL-4V TITANIUM

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MATERIAL ALLOWABLES - 301 CRES

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301 CRES										
FORM	SHEET AND STRIP									
CONDITION	ANNEALED	1/4 HARD		1/2 HARD		3/4 HARD		FULL HARD		
THICKNESS (in)	ALL	ALL		ALL		ALL		ALL		
BASIS	S	A	B	A	B	A	B	A	B	
F_{tu} (ksi)	L	73	124	129	141	151	157	168	174	185
	LT	75	122	127	142	152	163	173	175	186
F_{ty} (ksi)	L	26	69	83	93	110	118	135	137	153
	LT	30	67	82	92	105	113	133	125	142
F_{cy} (ksi)	L	23	44	54	61	69	75	88	83	94
	LT	29	71	88	100	116	127	152	142	164
F_{su} (ksi)		50	66	69	77	82	88	93	95	100
F_{bru} e/D = 1.5	-	183	190	213	228	244	259	262	279	
(ksi) e/D = 1.7	-	215	223	245	261	277	292	296	312	
e/D = 2.0	162	262	273	292	310	327	342	346	361	
F_{bry} e/D = 1.5	-	100	123	138	157	169	199	187	213	
(ksi) e/D = 1.7	-	109	133	150	170	182	213	201	227	
e/D = 2.0	55	123	149	167	189	202	234	222	249	
G (10^6 psi)		11.2	10.6		10.5					
E (10^6 psi)		29.0	27.0		26.0					
E_c (10^6 psi)		28.0	26.0		26.0					
μ (elastic region)		.27	.27		.27					

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MATERIAL ALLOWABLES - 301 CRES

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MATERIAL ALLOWABLES - 15-5/17-4/17-7 PH CRES

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	15-5PH			17-4PH			17-7PH	
FORM	SHEET AND PLATE			SHEET AND PLATE			SHEET AND PLATE	
CONDITION	H925	H1050	H1150	H900	H1025	H1150	TH1050	
THICKNESS (in)	≤ 12	≤ 12	≤ 12	≤ 4	≤ 4	≤ 4	$.015-.187$	
BASIS	S	S	S	S	S	S	A	B
F_{tu} (ksi)	L LT	180 180	150 125	125 190	190 155	135 135	177 177	183 184
F_{ty} (ksi)	L LT	165 165	135 135	85 85	170 170	145 145	105 105	150 150
F_{cy} (ksi)	L LT	165 165	133 133	81 81	170 170	139 139	95 95	160 166
F_{su} (ksi)		115	97	80	123	95	86	112
F_{bru} e/D = 1.5 (ksi) e/D = 1.7 e/D = 2.0		275 303 346	229 253 289	191 212 244	313 340 380	237 262 299	207 229 262	305 323 351
F_{bry} e/D = 1.5 (ksi) e/D = 1.7 e/D = 2.0		217 232 255	177 190 209	121 131 146	255 265 280	190 204 225	144 155 171	228 233 240
G (10^6 psi)		11.2			11.2			11.5
E (10^6 psi)		28.5			28.5			29.0
E_c (10^6 psi)		29.2			30.0			30.0
μ (elastic region)		.272			.27			.28

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MATERIAL ALLOWABLES - 15-5/17-4/17-7 PH CRES

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MATERIAL ALLOWABLES - 4000 SERIES STEEL

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4000 SERIES STEEL									
MATERIAL	4130 4135		4130 4140 4340 4330M 4335V				4330M		4340M
FORM	SHEET, STRIP, PLATE								
CONDITION (ksi)	NORMALIZED		125-145	150-170	160-180	180-200	200-220	220-240	275-300
THICKNESS (in)	≤ .187	.188-.250	(1)	(1)	(1)	(1)	(1)	(1)	(2)
BASIS	S	S	S	S	S	S	S	S	A B
F _{tu} (ksi)	L	95	90	125	150	160	180	200	220
	LT	95	90	125	150	160	180	200	220
F _{ty} (ksi)	L	75	70	100	132	142	163	176	185
	LT	75	70	100	132	142	163	176	185
F _{cy} (ksi)	L	75	70	109	145	154	173	181	193
	LT	75	70	109	145	154	173	181	193
F _{su} (ksi)		57	54	75	90	96	108	120	132
F _{bru} e/D = 1.5		140	130	194	219	230	250	272	297
(ksi) e/D = 1.7		164	154	217	246	258	280	305	332
e/D = 2.0		200	190	251	287	300	326	355	385
F _{bry} e/D = 1.5		110	102	146	189	202	230	255	267
(ksi) e/D = 1.7		118	109	158	201	214	240	265	278
e/D = 2.0		129	120	175	218	231	256	280	294
G (10 ⁶ psi)						11.0			
E (10 ⁶ psi)						29.0			
E _c (10 ⁶ psi)						29.0			
μ (elastic region)						.32			

(1) Thickness for: 4130 < 0.17; 4140 < 0.67; 4340 < 2.0; 4330M < 2.0; 4335V < 2.3.

(2) Thickness for 4340M < 2.67.

MATERIAL ALLOWABLES - 4000 SERIES STEEL

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MATERIAL - MINIMUM BEND RADII

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Thickness (in)	MINIMUM DESIGN BEND RADII FOR STRAIGHT BEND LINES - FERROUS ALLOYS AND HEAT RESISTANT ALLOYS													
	Ferrous Alloys								Heat Resistant Alloys					
	1020 4130	All Other Alloy Steels	18-8 and All 300- series CRES				15-5PH 17-4PH	15-7, 17- 7PH and Ph15-7MO		Inconel 625	Inconel 718	Haynes Stellite 25 L-605	A286	
	Annealed		Annealed	1/4H	1/2H	3/4H	FH	Solution Treated	Annealed	AGED TH105 0	Annealed	Solution Treated	Annealed	Solution Treated
Minimum Design Bend Radii (in)														
.010											.03	.03	.03	.03
.016	.06	.06	.06	.06	.06	.09	.09		.03	.16	.03	.03	.03	
.020	.06	.06	.06	.06	.06	.09	.12		.03	.16	.03	.03	.03	
.025	.06	.06	.06	.06	.06	.09	.16		.03	.16	.03	.03	.03	
.028	.06	.09	.06	.06	.09	.12	.19		.03	.19	.03	.06	.03	
.032	.06	.09	.06	.06	.09	.12	.19		.03	.25	.06	.06	.06	
.036	.09	.12	.06	.09	.12	.16	.22		.03	.31	.06	.06	.06	
.040	.09	.12	.06	.09	.12	.16	.25		.06	.31	.06	.09	.06	
.045	.09	.16	.06	.09	.12	.19	.31		.06	.38				
.050	.09	.16	.09	.09	.12	.22	.31	.19	.06	.38	.06	.12	.06	
.056	.09	.19	.09	.12	.16	.22	.34		.06	.44	.06	.12	.06	
.063	.09	.19	.09	.12	.19	.25	.38	.22	.09	.50	.06	.16	.09	
.071	.09	.22	.09	.16	.22	.31	.44	.25	.09	.62	.09	.16	.09	
.080	.12	.25	.09	.16	.22	.34	.50	.38	.09	.62	.09	.19	.09	
.090	.12	.28	.09	.19	.25	.38	.62	.44	.09	.75	.09	.22	.09	
.100	.12	.31	.12	.22	.28	.44	.62	.44	.12	.88	.12	.22	.12	
.112	.12	.34	.12	.22	.31	.50	.75	.50	.12		.12	.25	.12	
.125	.12	.38	.12	.25	.34	.50	.75	.63	.12		.16	.28	.16	
.140	.19	.38	.16	.31	.38	.62	.88		.16		.16	.31	.16	
.160	.22	.44	.19	.34	.44	.62	1.00	.63	.16		.16	.34	.16	
.180	.28	.50	.18	.38	.50	.75	1.12		.19		.19	.38	.19	
.190	.34	.50	.19	.39	.50	.80	1.25	.75	.19					
.200	.40	.62	.22	.44	.50	.80	1.25		.25		.22	.44	.22	
.225											.25	.44	.25	
.250											.25	.50	.25	

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MATERIAL - MINIMUM BEND RADII

70-16-00



MINIMUM DESIGN BEND RADII FOR STRAIGHT BEND LINES - ALUMINUM AND TITANIUM													
Thickness (in)	Aluminum Alloy, Series and Temper								MIL-T-9046 Titanium Alloys, Annealed				
	1100-0	2024-0	2219-T31	7075-0	2024-T3	2024-T36	2024-T86	2024-T3	Room Temperature Forming		Hot Forming		
	2219-0	2219-T42	2219-T37	7178-0	2024-T4	7075-T6	2219-T87	LAMINATE	Commercially Pure		Alpha-beta Titanium Alloys		
	3003-0	3003-H14	2024-W		2219-T62	7075-T73		(CBMS 5-69)	CP-1	CP-2	CP-3	AB-1 (Ti-6Al-4V)	AB-1 (Ti-6Al-4V)
	5052-0	5052-H34	7075-W		2219-T81	7075-T76						AB-4 (Ti6Al-2Sn-4Zr-2Mo)	
Minimum Design Bend Radii (in)													
.016	.03	.03	.03	.03	.06	.09	.09		.06	.06	.06	.09	.03
.020	.03	.03	.06	.03	.06	.09	.09		.06	.06	.06	.12	.06
.025	.03	.03	.06	.06	.09	.12	.12		.09	.06	.06	.16	.06
.028									.09	.09	.09	.16	.09
.032	.03	.06	.06	.06	.12	.16	.16	.09	.09	.09	.09	.19	.09
.036	.06	.06	.09	.06	.16	.19	.19		.12	.09	.09	.22	.09
.040	.06	.06	.09	.06	.16	.19	.19	.16	.12	.12	.12	.22	.09
.045	.06	.09	.09	.09	.19	.25	.25						
.050	.06	.09	.12	.09	.19	.25	.25	.19	.16	.12	.12	.28	.09
.056	.06	.12	.12	.12	.22	.28	.28		.19	.16	.16	.31	.12
.063	.06	.12	.16	.12	.22	.31	.31		.22	.16	.16	.34	.12
.071	.09	.12	.16	.12	.28	.38	.38	.22	.25	.22	.22	.38	.16
.080	.09	.16	.19	.19	.34	.44	.44		.28	.25	.22	.44	.16
.090	.09	.19	.19	.19	.38	.50	1.12		.34	.28	.28	.50	.19
.100	.12	.22	.25	.25	.44	.62	1.25		.38	.34	.31	.56	.22
.112	.12	.25	.34	.28	.50	.75	1.75		.44	.38	.34	.62	.22
.125	.12	.25	.50	.28	.56	.88			.50	.38	.28	.69	.25
.140	.12	.34	.56	.38	.62	1.00			.50	.38	.38		.31
.160	.16	.38	.62	.44	.75	1.12			.56	.44	.44		.31
.180	.19	.44	.69	.50	.88	1.25			.62	.50	.50		.38
.190	.19	.50	.75	.56	.88	1.25			.62	.56	.56		.38
.200													.41

MATERIAL - MINIMUM BEND RADII

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MATERIAL - STANDARD GAGE CHART

NOTES:

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BOEING PROPRIETARY



STANDARD ALUMINUM SHEET METAL THICKNESSES (INCHES)
0.040
0.050
0.063
0.071
0.080
0.090
0.100
0.125
0.140
0.160

STANDARD GAGES PER BOEING SRM

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MATERIAL - STANDARD GAGE CHART

70-16-00



MATERIAL CURVES - TANGENT MODULUS

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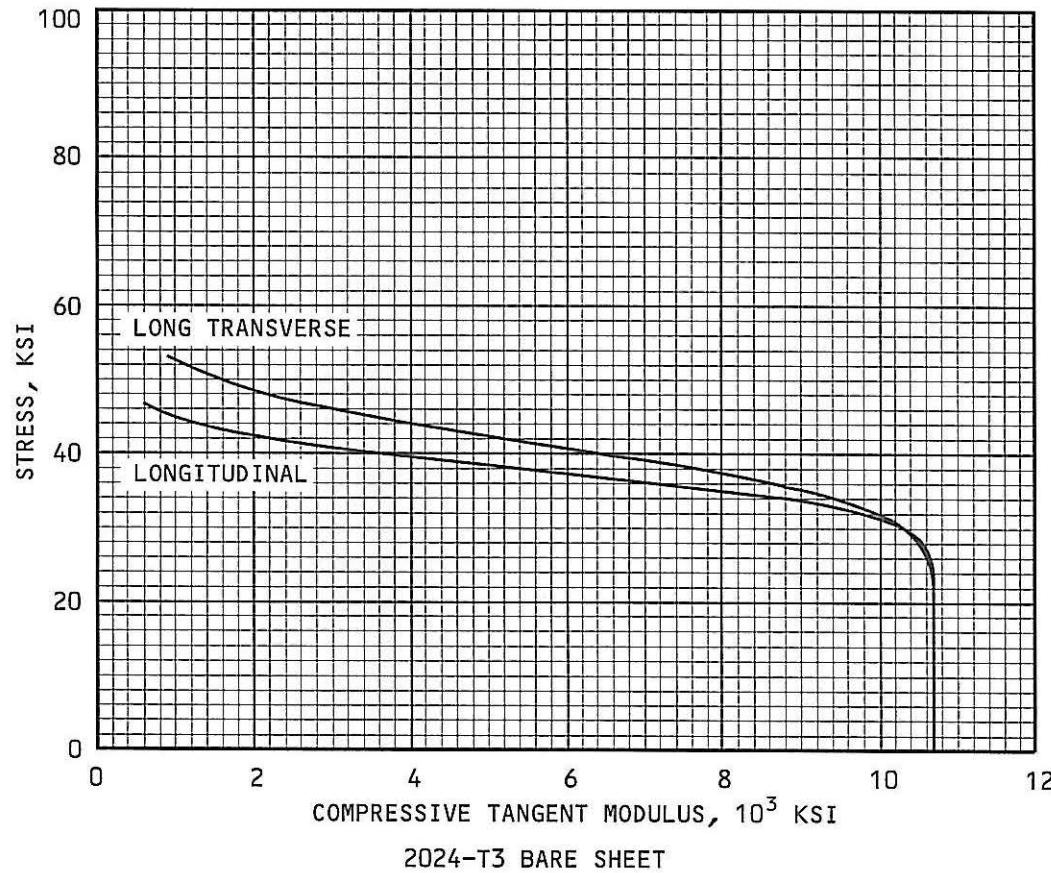
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Tangent Modulus Curves (from MMPDS-01)

The figures below give the curves for the following materials:

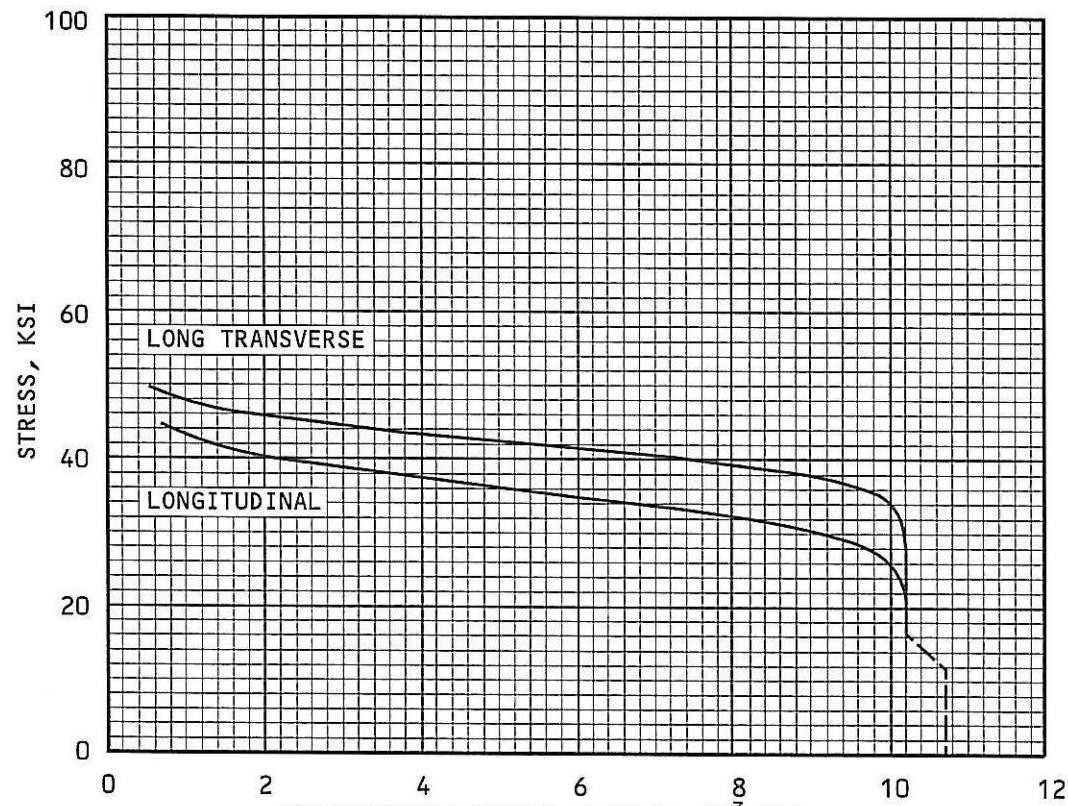
- 2024-T3 bare sheet
- 2024-T3 clad sheet
- 2024-T42 clad sheet
- 7075-T6 clad sheet
- 7075-T62 extrusion
- 7075-T651X extrusion
- 7050-T7651 extrusion, $t < 2"$
- 7050-T7651 extrusion, $2" \leq t \leq 5"$



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MATERIAL CURVES – TANGENT MODULUS

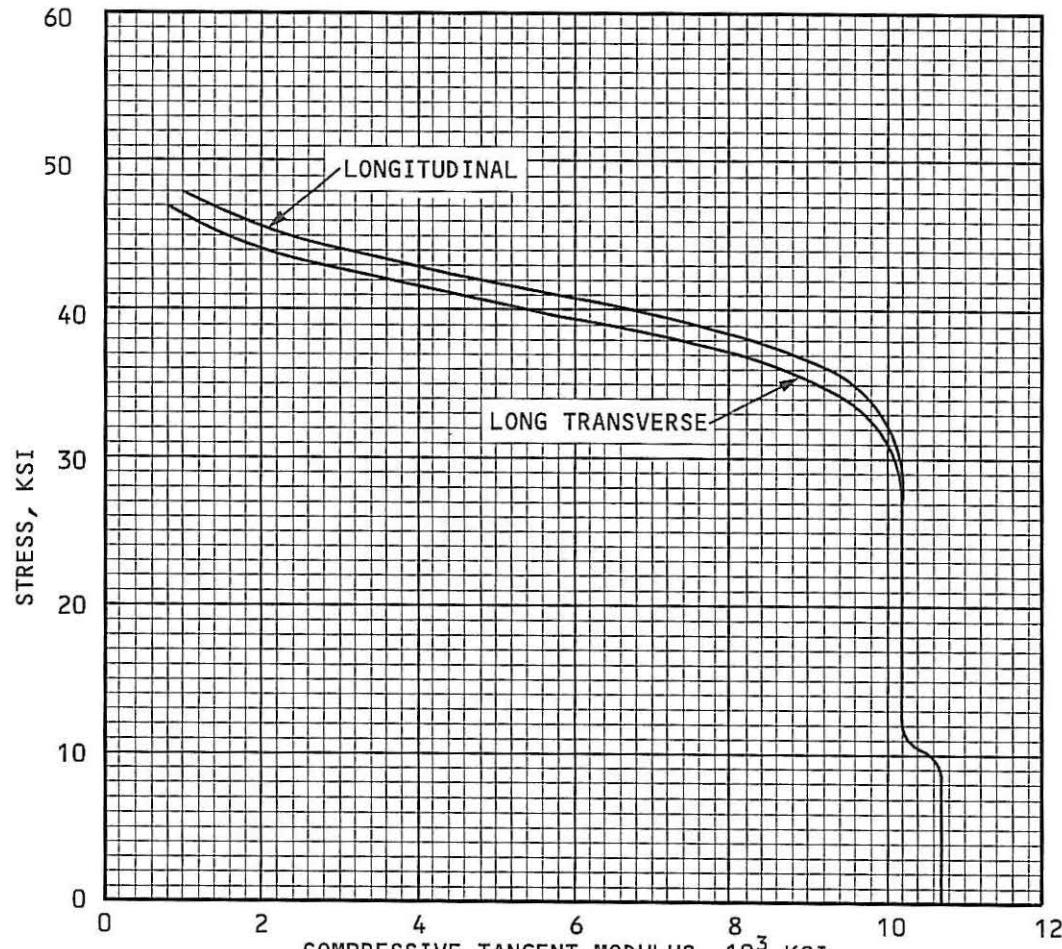
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MATERIAL CURVES - TANGENT MODULUS

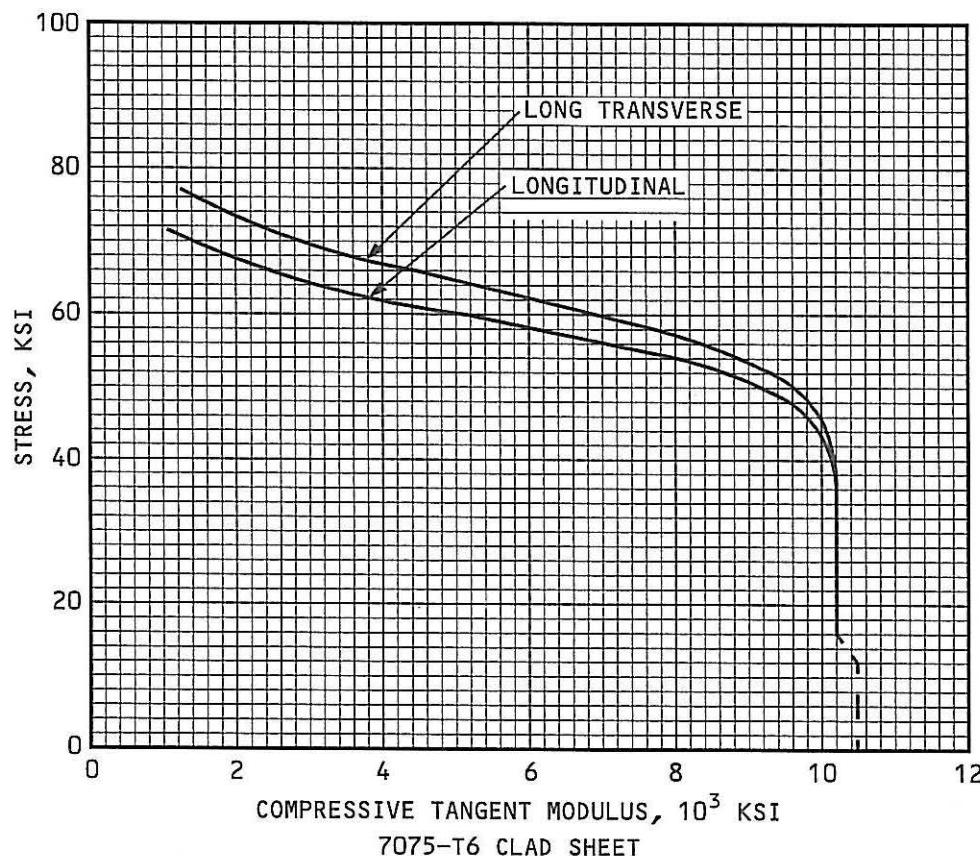
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MATERIAL CURVES - TANGENT MODULUS

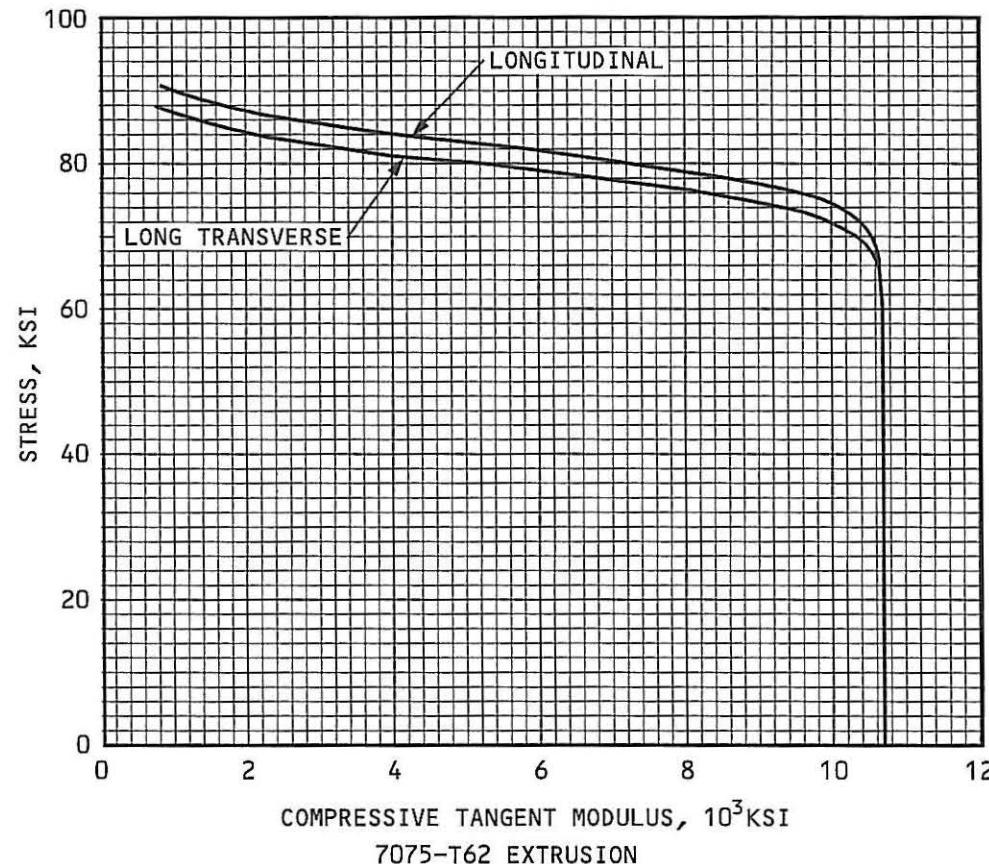
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MATERIAL CURVES - TANGENT MODULUS

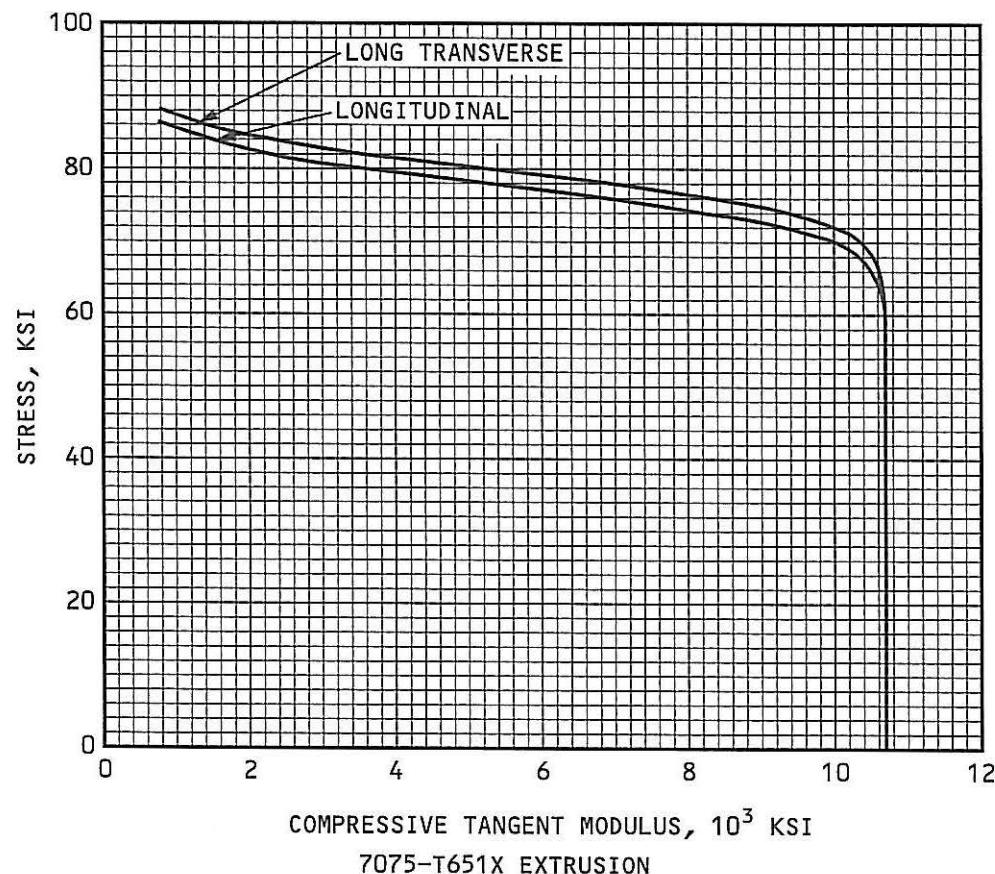
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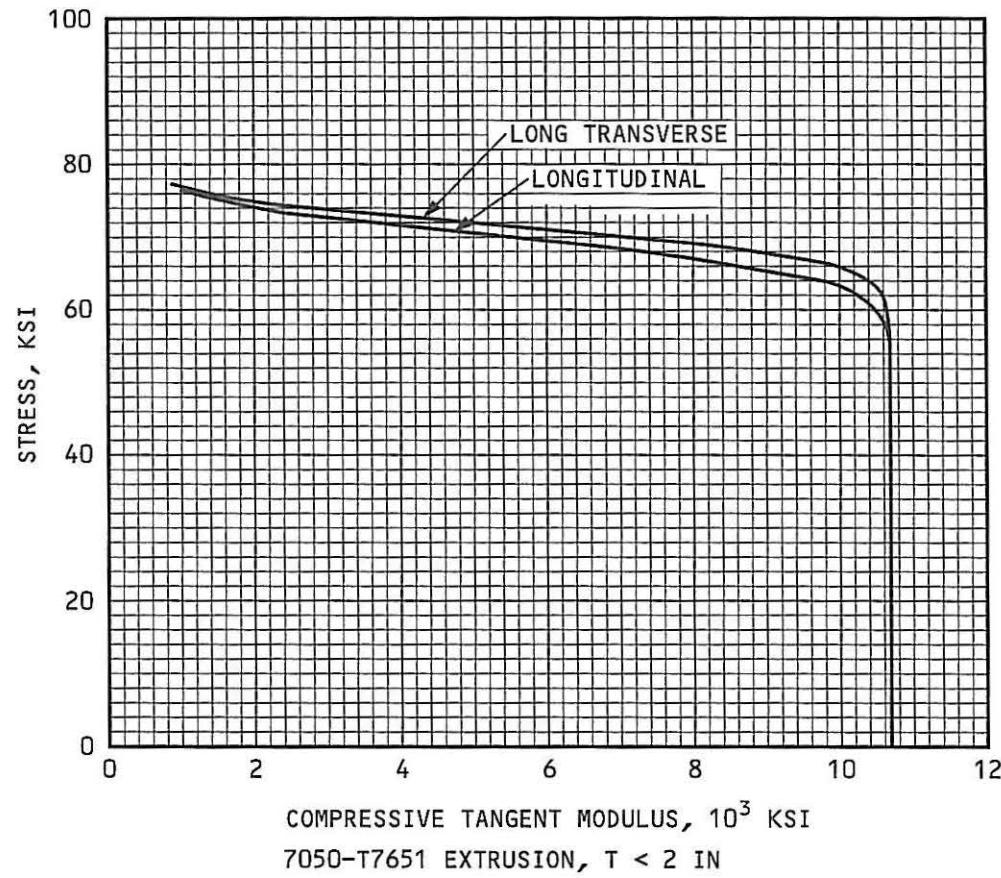
MATERIAL CURVES - TANGENT MODULUS

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MATERIAL CURVES - TANGENT MODULUS

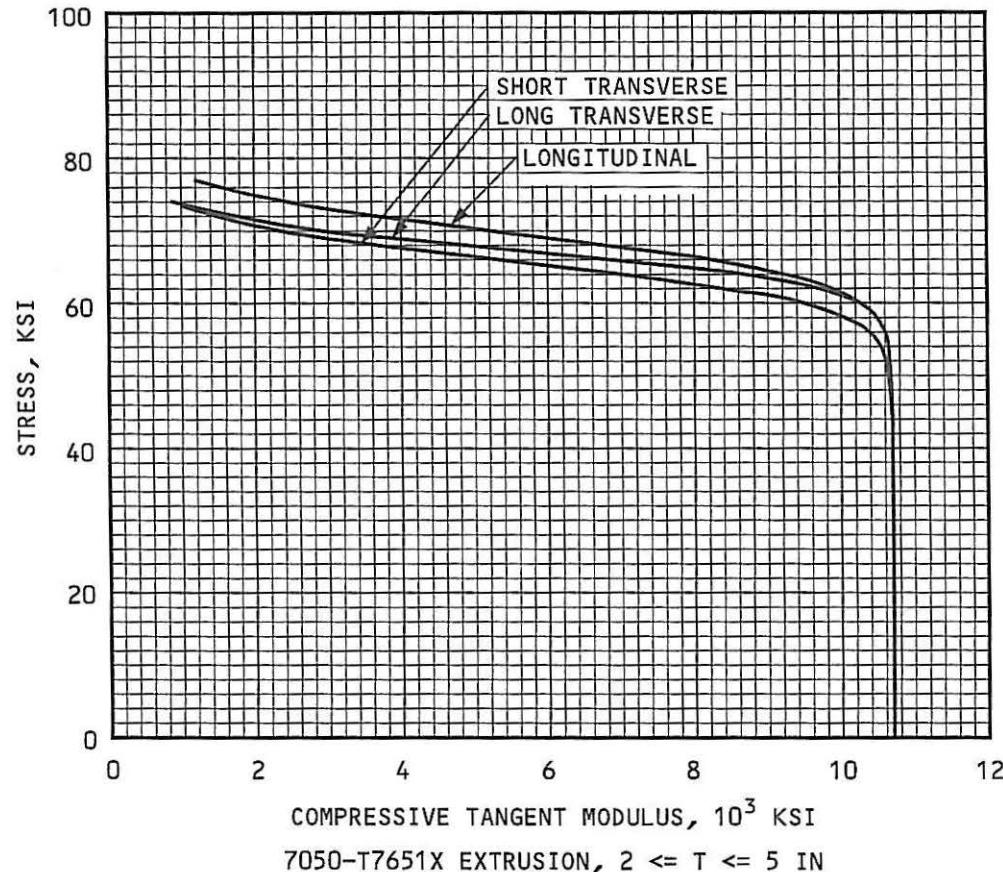
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MATERIAL CURVES - TANGENT MODULUS

70-18-00



MATERIAL CURVES - TANGENT MODULUS

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MATERIAL CURVES - 2024-T3 UNNOTCHED S-N

NOTES:

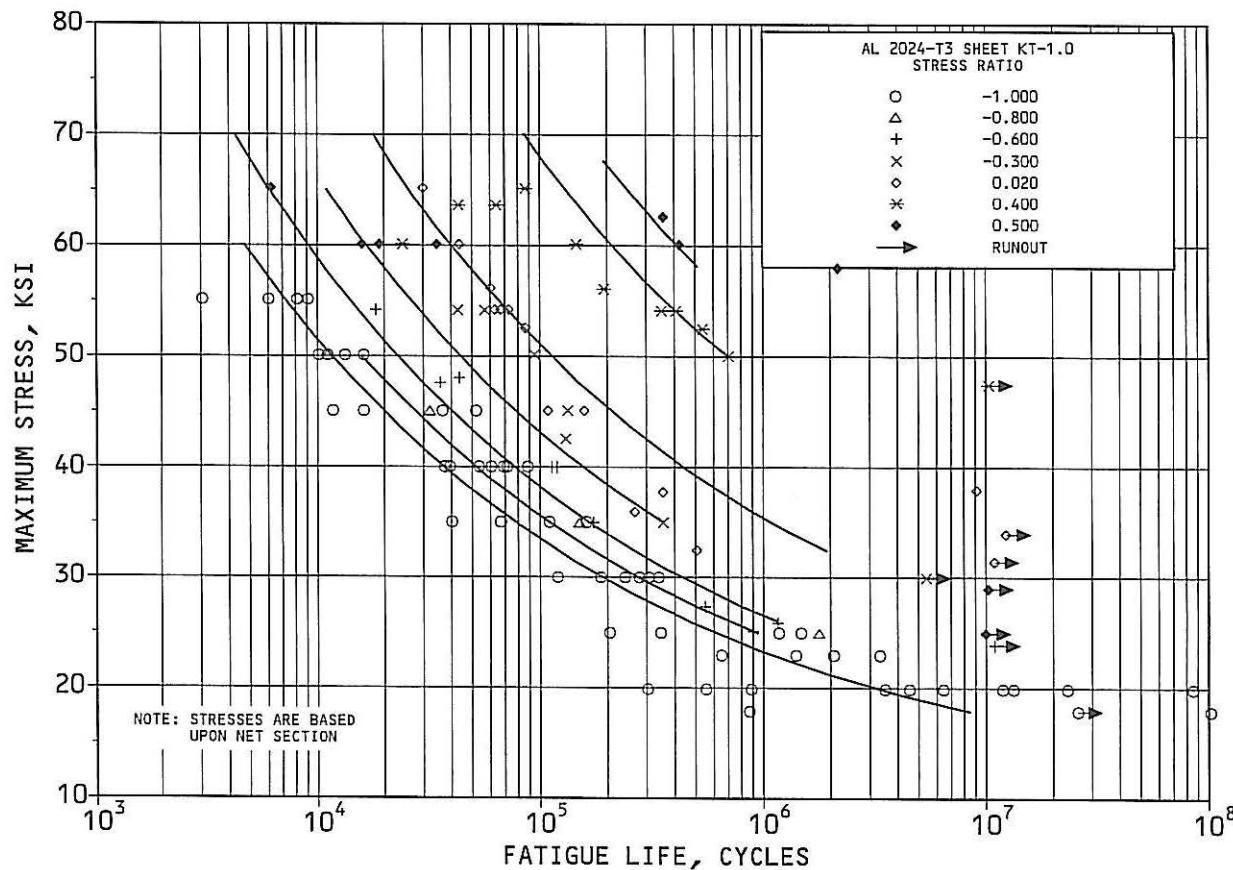
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Ref: MMPDS-03, Fig. 3.2.4.1.8(e)

BEST-FIT S/N CURVES FOR UNNOTCHED, K = 1.0, 2024-T3
ALUMINUM ALLOY SHEET, LONGITUDINAL DIRECTION.

MATERIAL CURVES - 2024-T3 UNNOTCHED S-N

70-18-00



Maintenance Training Manual

MATERIAL CURVES - Ti-6Al-4V S-N

NOTES:

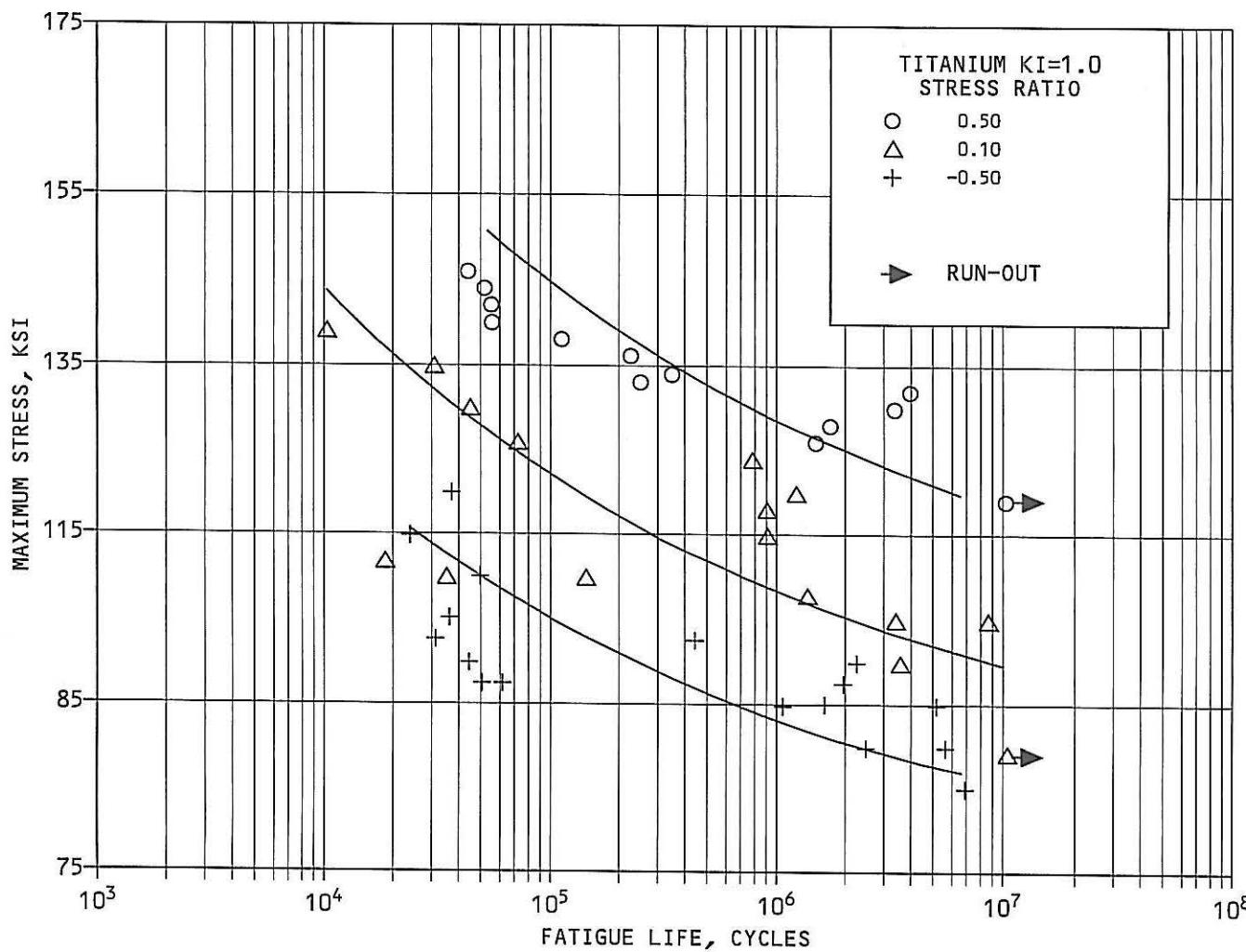
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Ref: MMPDS-03, Fig. 5.4.1.1.8(f)

BEST-FIT S/N CURVES FOR Ti-6AL-4V
 ANNEALED SHEET, LONG TRANSVERSE DIRECTION.

MATERIAL CURVES - Ti-6AL-4V S-N

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MATERIAL CURVES - 7075-T6 FATIGUE CRACK PROPAGATION

NOTES:

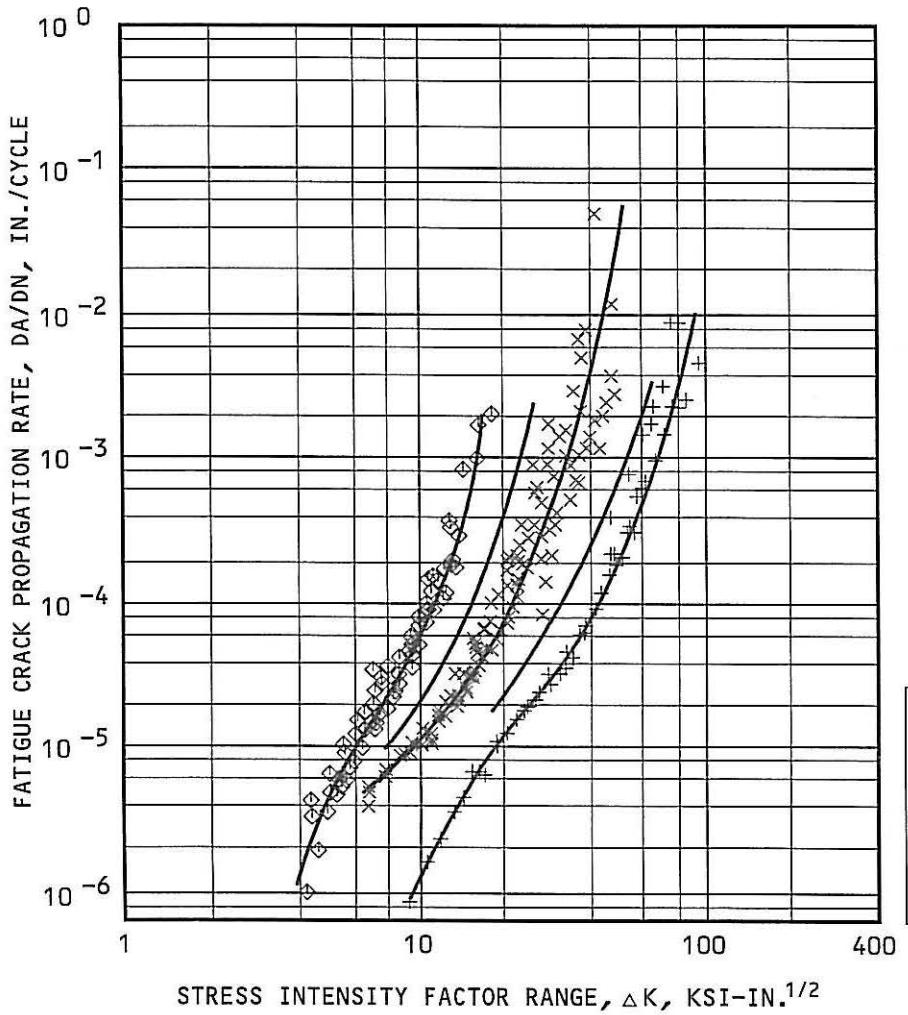
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FATIGUE-CRACK-PROPAGATION DATA FOR
0.090-INCH-THICK 7075-T6 ALUMINUM ALLOY
SHEET WITH BUCKLING RESTRAINT.

STRESS RATIO, R	FREQ f, Hz	NO. OF SPECIMENS	NO. OF DATA POINTS
-1.0	0.5-30	6	55
-0.7	13.7-30	5	44
0.0	0.5-33	18	135
0.3	0.5-33	11	85
0.7	0.5-33	11	93

Ref: MMPDS-03, Fig. 3.7.7.1.9

MATERIAL CURVES - 7075-T6 FATIGUE CRACK PROPAGATION

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MATERIAL CURVES - 7075-T6 RESIDUAL STRENGTH

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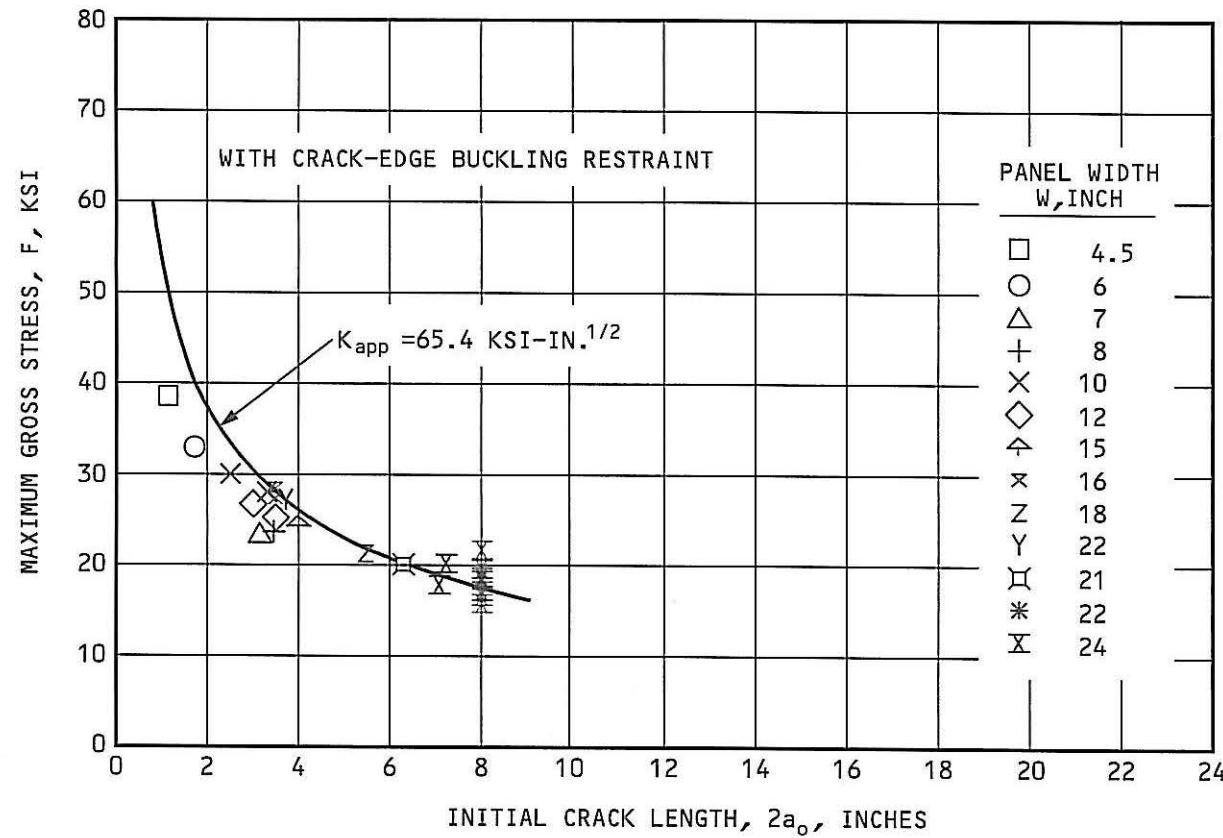


Maintenance Training Manual

NOTES:

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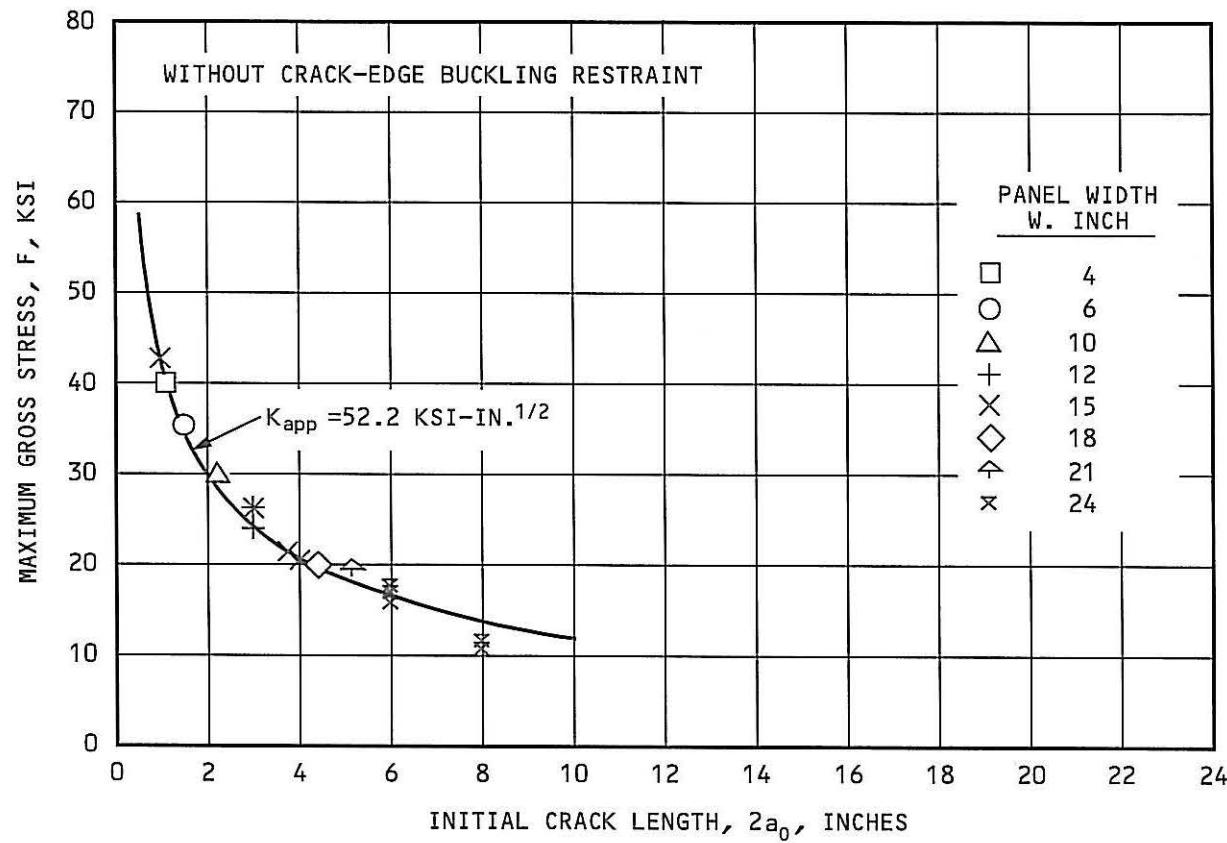
RESIDUAL STRENGTH BEHAVIOR OF 0.063 INCH THICK 7075-T6 ALUMINUM SHEET WITH RESTRAINT AT ROOM TEMPERATURE.
 CRACK ORIENTATION IS T-L.

70-18-00-124.fm

Ref: MMPDS-03, Fig. 3.7.7.1.10(a)

MATERIAL CURVES - 7075-T6 RESIDUAL STRENGTH

70-18-00



RESIDUAL STRENGTH BEHAVIOR OF 0.063 INCH THICK 7075-T6 ALUMINUM SHEET WITHOUT RESTRAINT AT ROOM TEMPERATURE.
CRACK ORIENTATION IS T-L.

70-18-00-124 fm

Ref: MMPDS-03, Fig. 3.7.7.1.10(b)

MATERIAL CURVES - 7075-T6 RESIDUAL STRENGTH

70-18-00



MATERIAL CURVES - COMPRESSIVE BUCKLING COEFFICIENTS

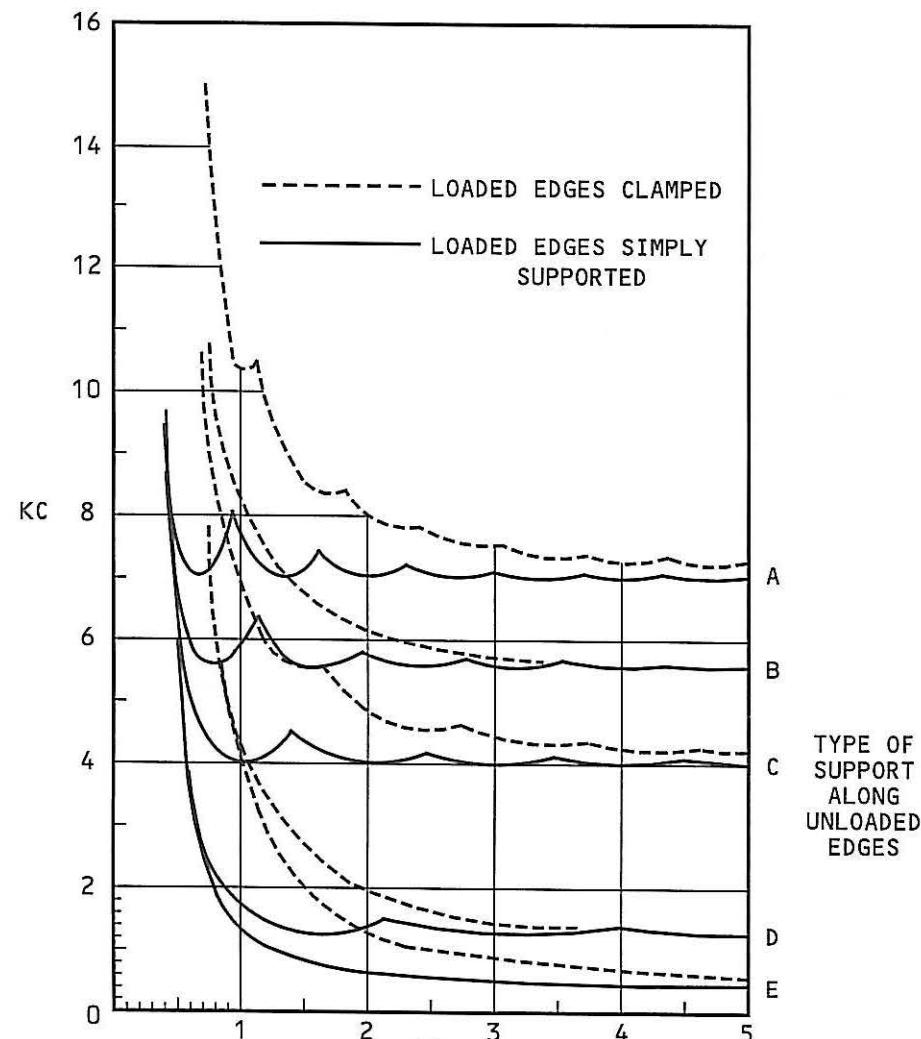
NOTES:

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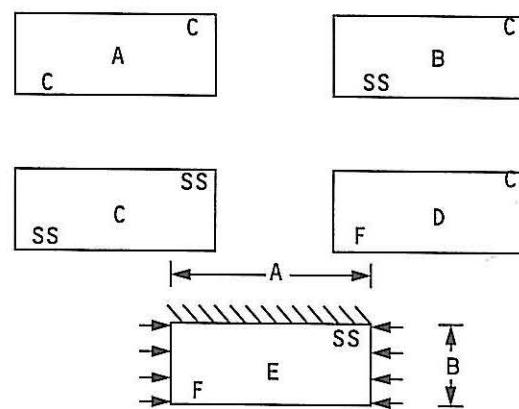
70-18-00

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MATERIAL CURVES - COMPRESSIVE BUCKLING COEFFICIENTS



REF: BRUHN, FIG C5.2

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MATERIAL CURVES - COMPRESSIVE BUCKLING STRESS

NOTES:

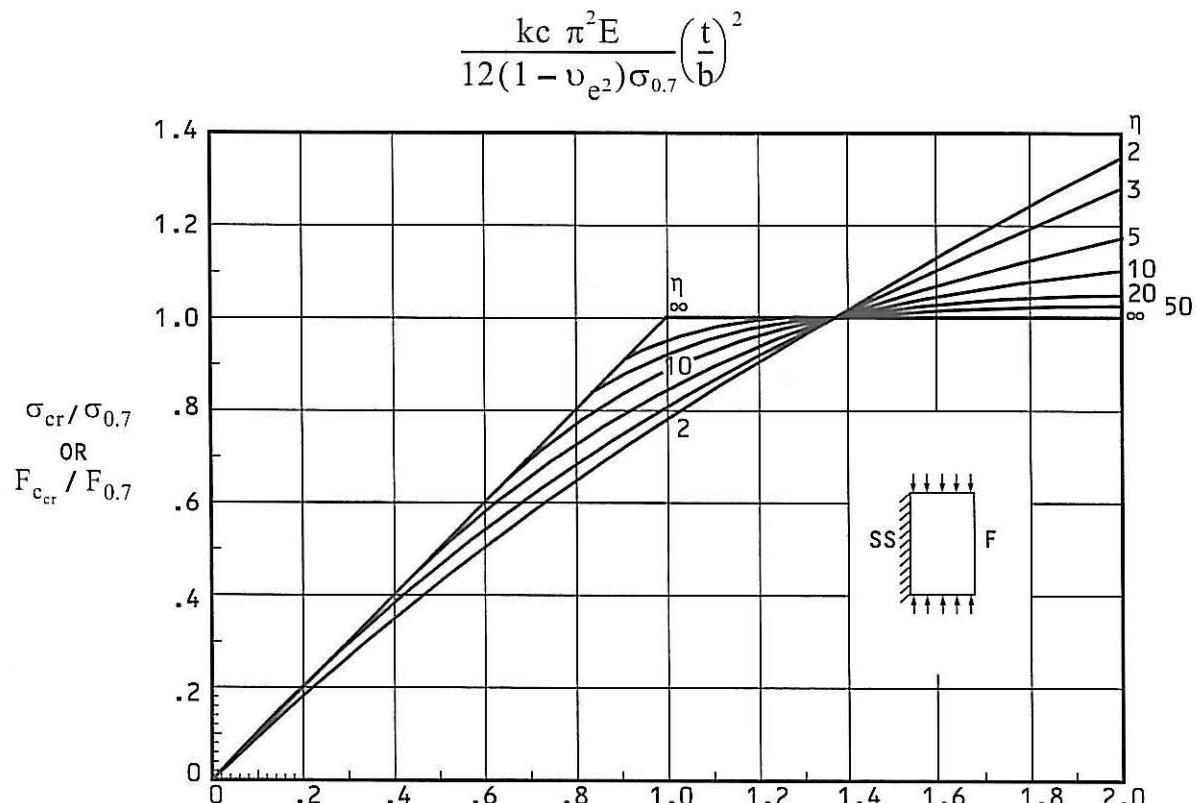
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REF: BRUHN FIG C5.7

MATERIAL CURVES - COMPRESSIVE BUCKLING STRESS

70-18-00



MATERIAL CURVES - EFFECTIVE STRESS - FATIGUE LIFE ESTIMATION

NOTES:

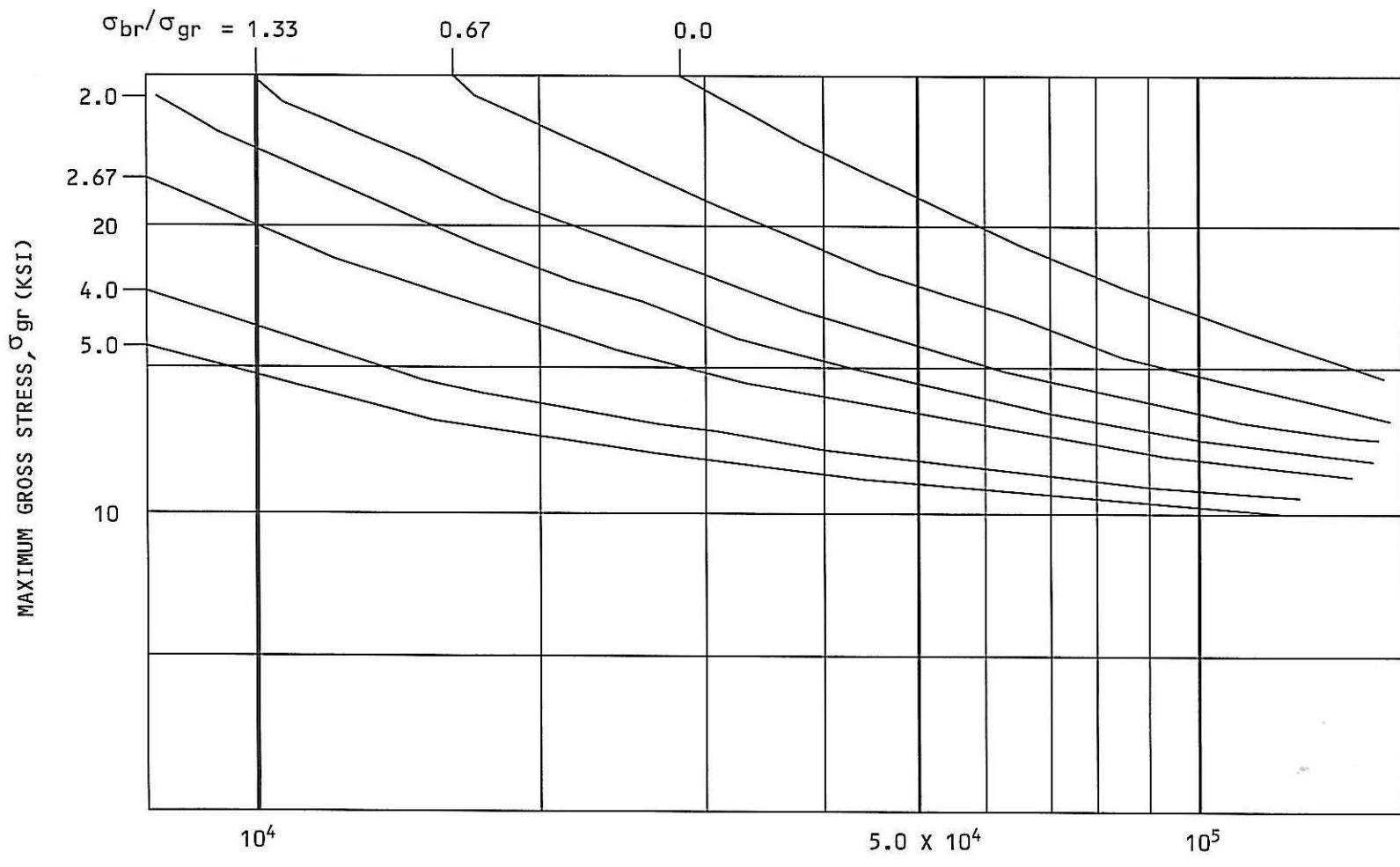
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Ref: FAA-AIR-90-01, Fig. 13

FATIGUE S-N DATA 2024-T3, STRESS RATIO = 0.0

MATERIAL CURVES - EFFECTIVE STRESS - FATIGUE LIFE ESTIMATION

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MATERIAL CURVES -- STRESS SEVERITY FACTORS

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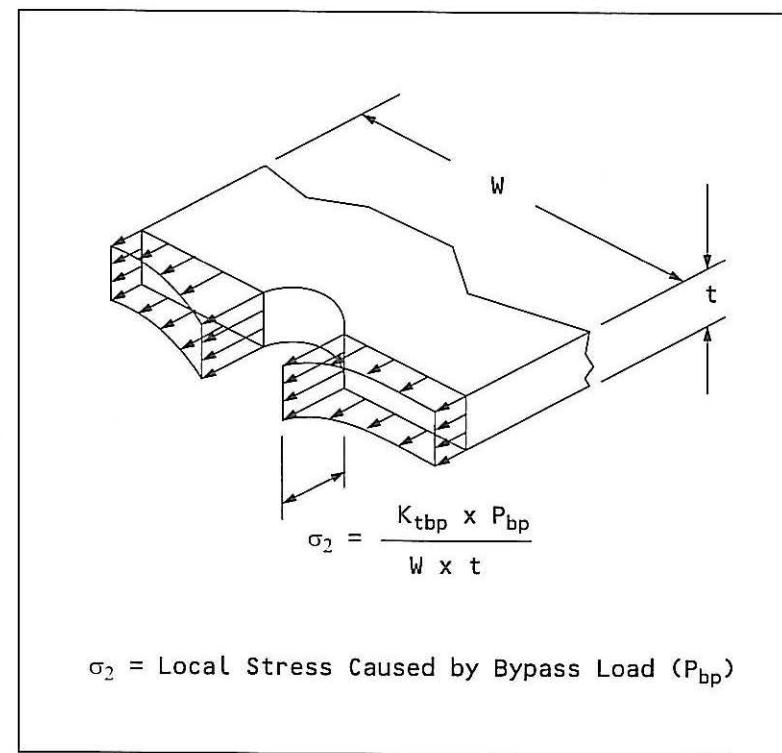
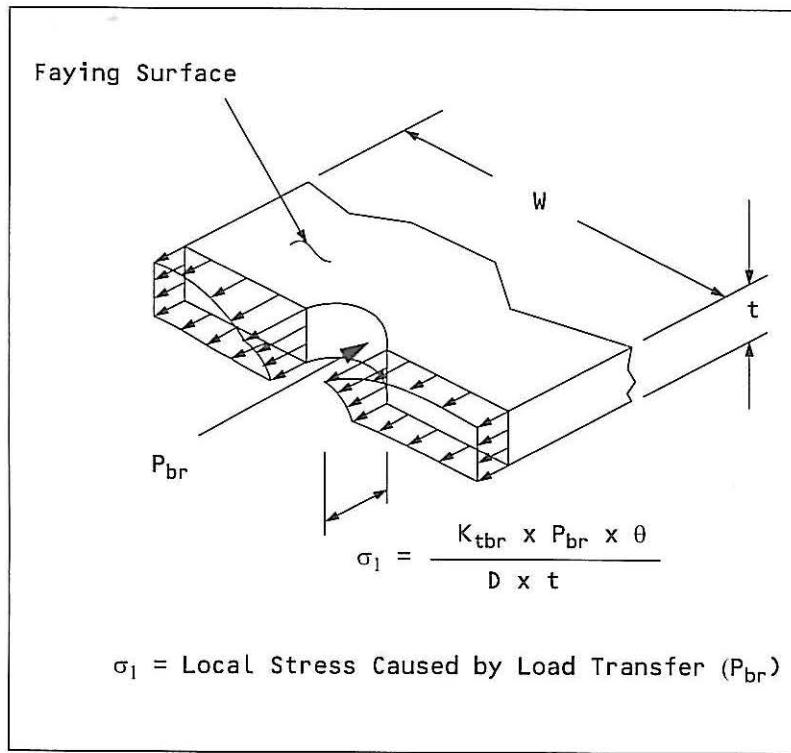
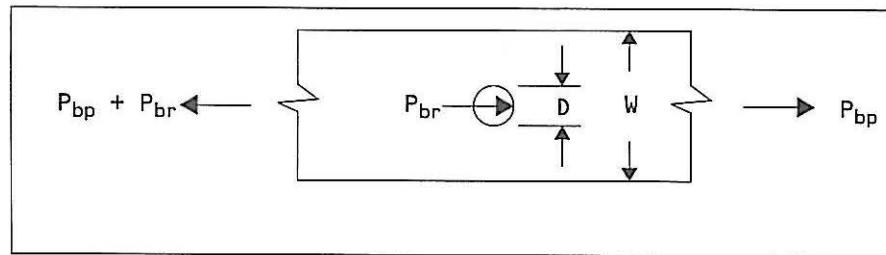
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MATERIAL CURVES -- STRESS SEVERITY FACTORS

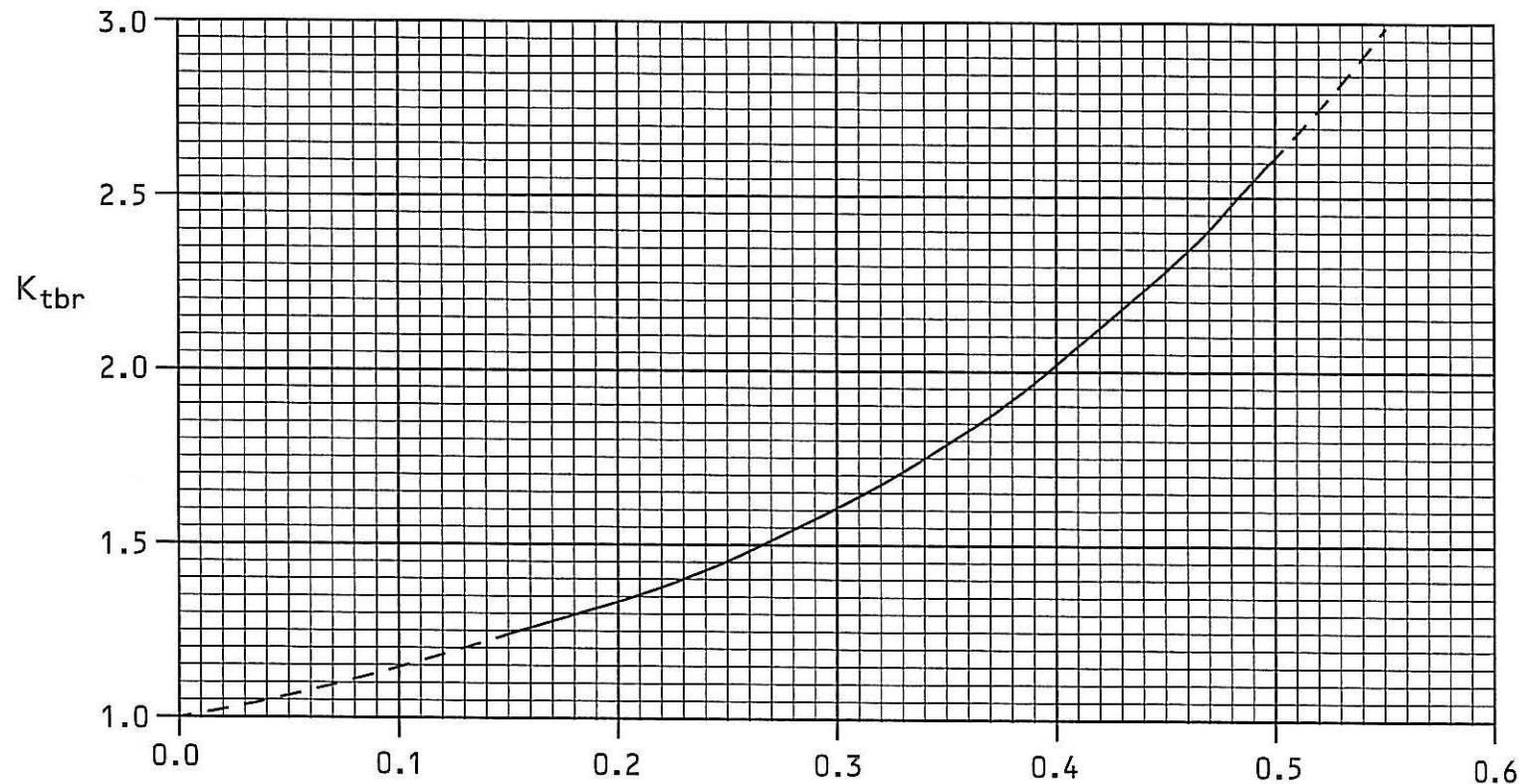
Stress Severity Factors

The following charts are copies of those discussed in section 72-07. For students use when solving in-class problems.



MATERIAL CURVES - STRESS SEVERITY FACTORS

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$$\sigma_{\text{ref}} = P_{\text{br}} / (D \times t)$$

$$\sigma_{\text{peak}} = K_{\text{tbr}} \times \sigma_{\text{ref}}$$

Note: Valid for standard
SRM edge margins

D/W (Diameter/Width)
BEARING STRESS DISTRIBUTION FACTOR

Figure 1
MATERIAL CURVES - STRESS SEVERITY FACTORS

Source: Peterson Stress Concentration
Factors, 3rd Edition, Chart 4.67

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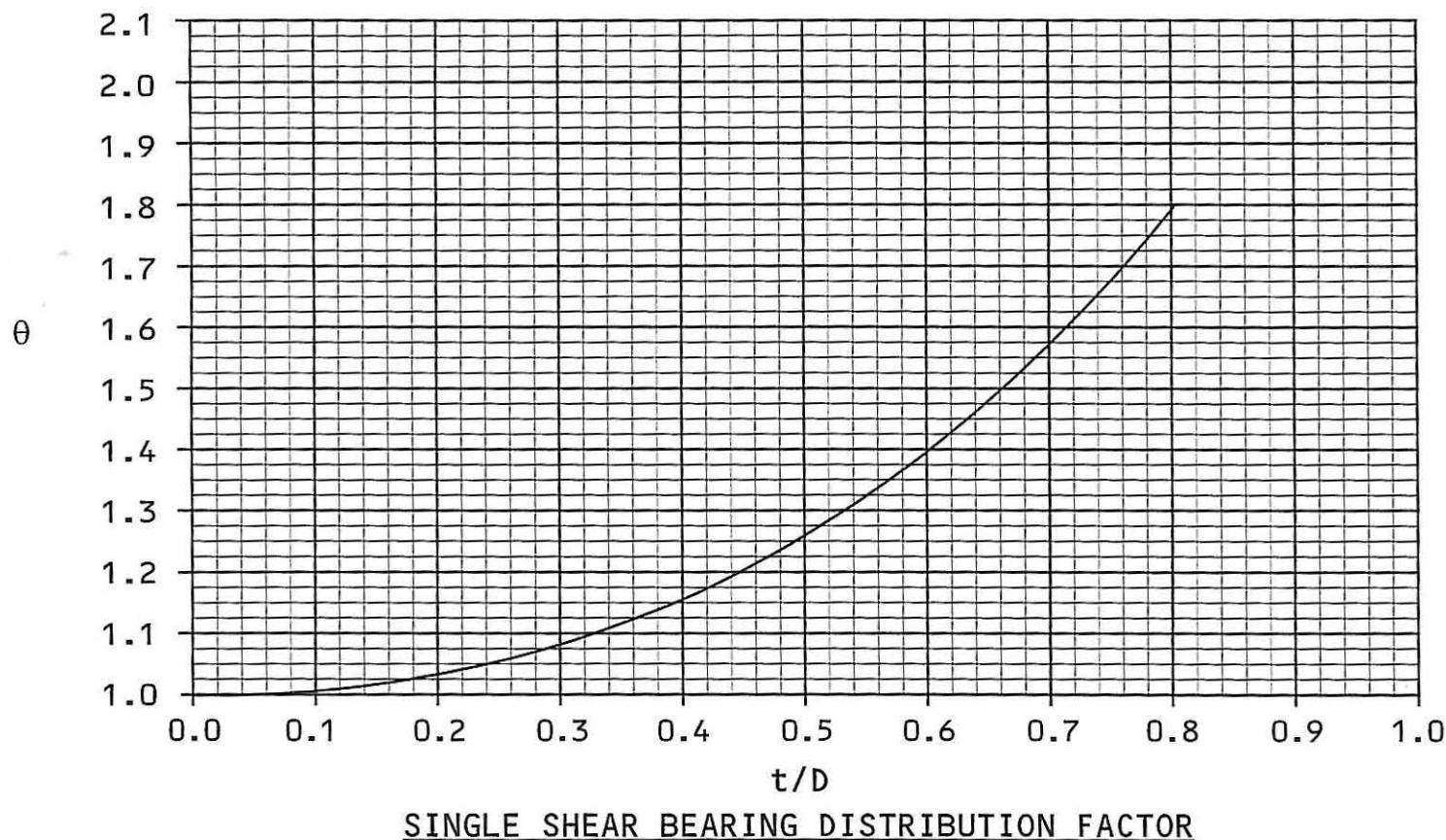
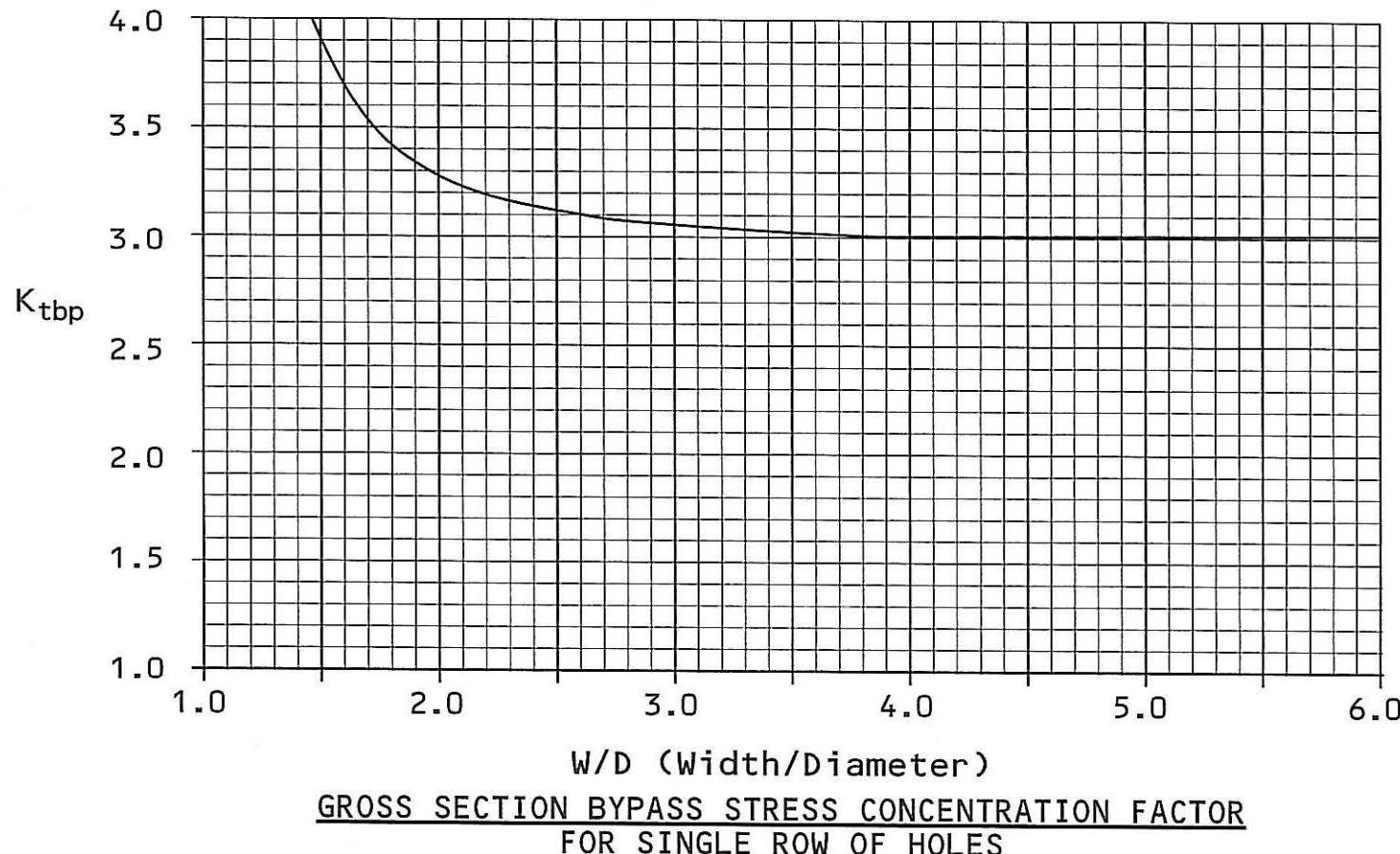


Figure 2
MATERIAL CURVES - STRESS SEVERITY FACTORS

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Source: D6-29942, Figure F-3

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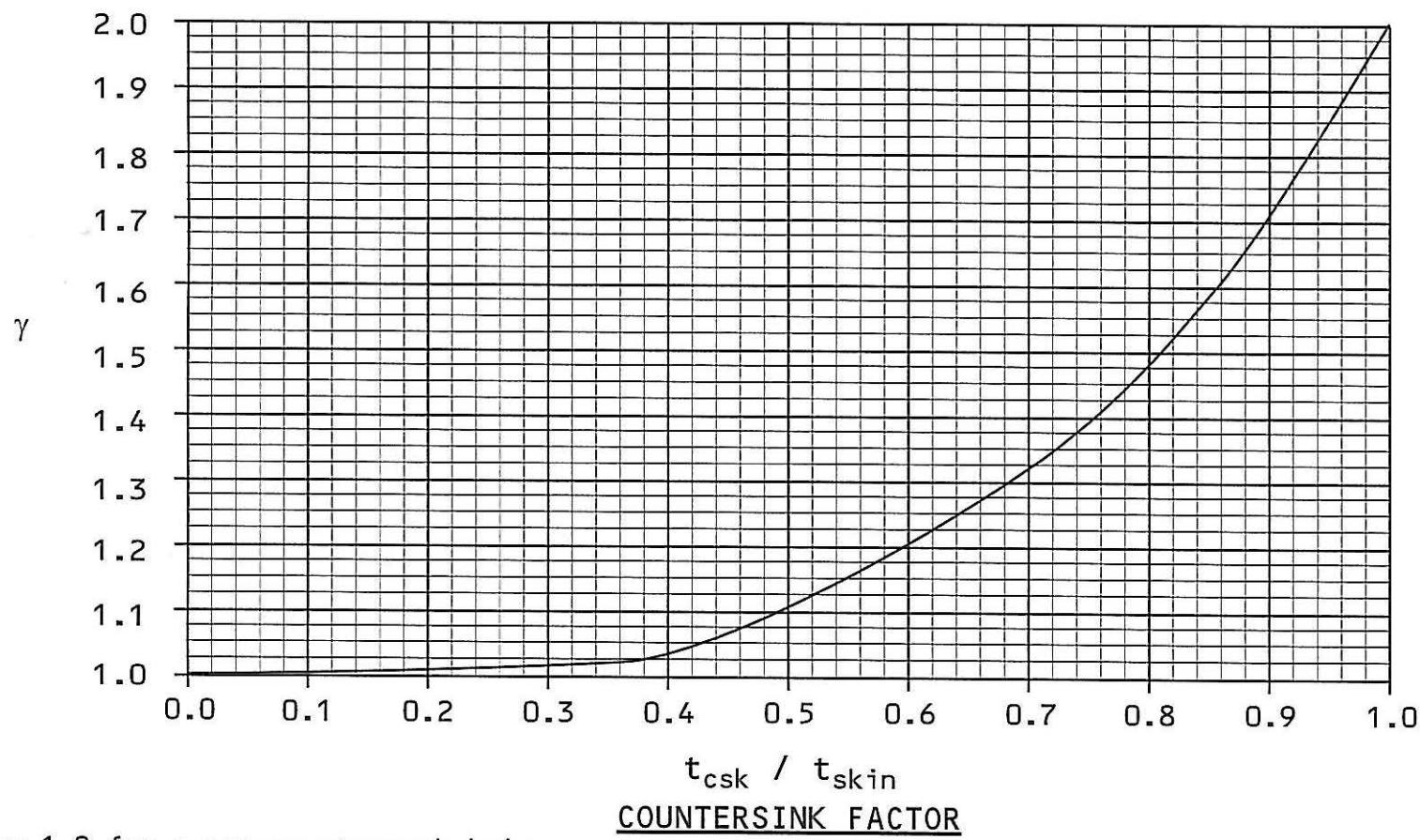
$$K_{tbp}\sigma_{ref} = \sigma_{peak}$$

Figure 3

Source: BDM 6040 Figure 3-1

MATERIAL CURVES - STRESS SEVERITY FACTORS

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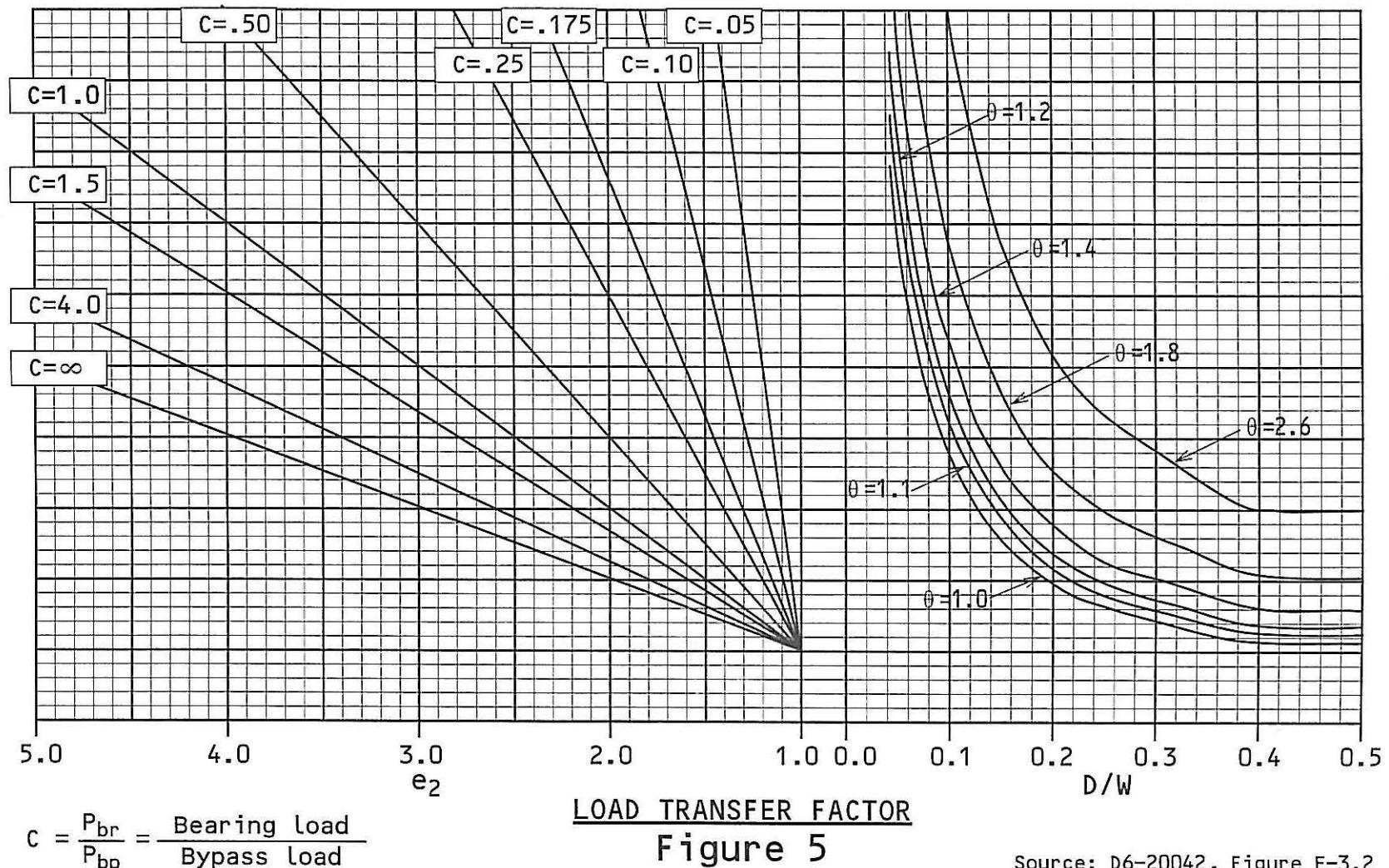


$\gamma = 1.0$ for a non-countersunk hole
 $\gamma = .88$ for a cold-worked hole

Figure 4
 MATERIAL CURVES – STRESS SEVERITY FACTORS

Source: D6-29942, Figure E-3.1

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Source: D6-20042, Figure E-3.2

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MATERIAL CURVES - STRESS CONCENTRATION FOR HOLE

NOTES:

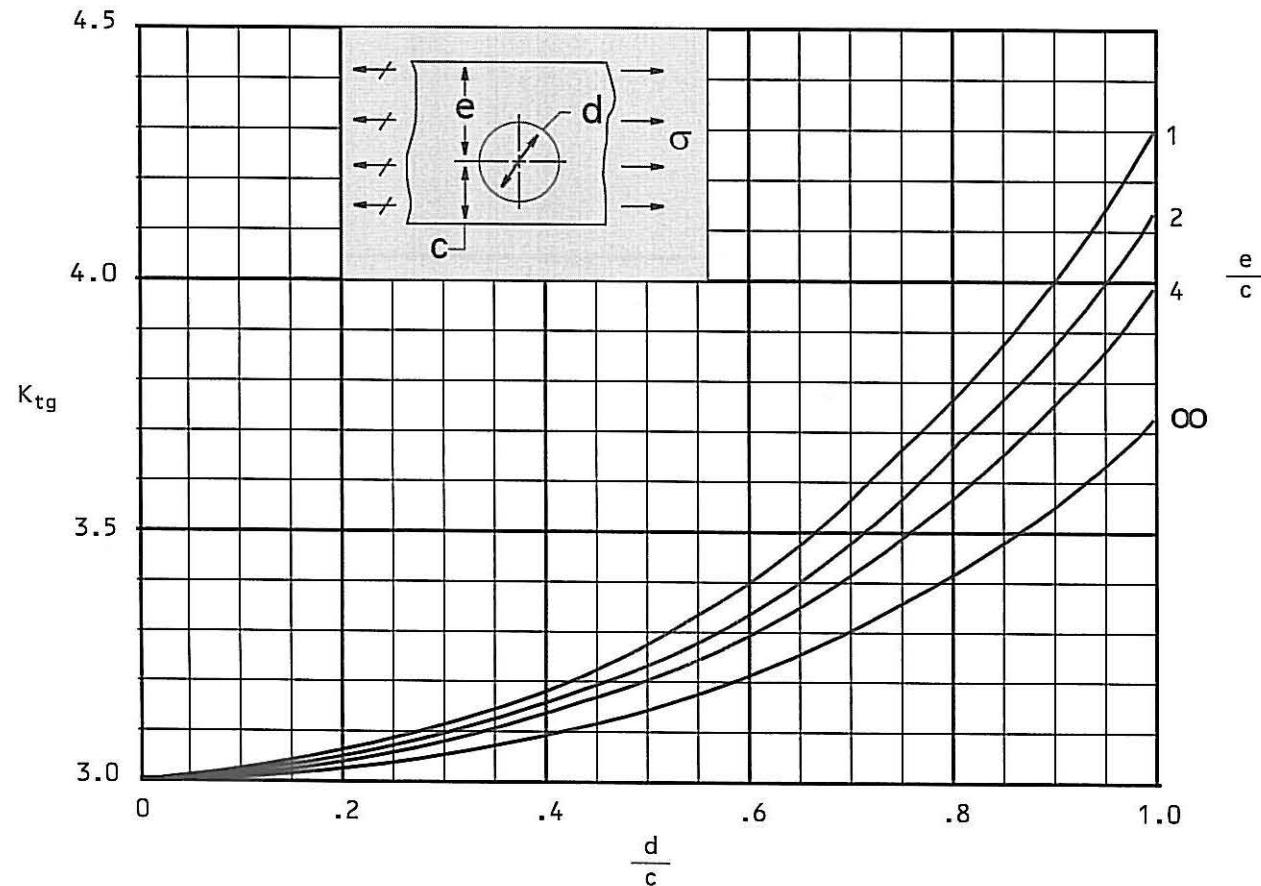
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MATERIAL CURVES - STRESS CONCENTRATION FOR HOLE

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MATERIAL TABLES - RAMSBERG-OSGOOD PARAMETERS

NOTES:

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MATERIAL	THICKNESS	F _{0.70} ksi	F _{0.85} ksi	η
2024-T3 BARE SHEET & PLATE	≤.250	39.0	36.0	11.5
2024-T4 BARE SHEET & PLATE	≤.500	36.7	34.5	15.6
2024-T3 CLAD SHEET & PLATE	.020 - .062	35.7	33.0	12.0
2024-T6 CLAD SHEET & PLATE	<.062	49.0	45.0	11.0
2024-T6 CLAD SHEET & PLATE	≥.063	47.0	43.0	10.6
7075-T6 BARE SHEET & PLATE	≤.500	70.0	63.0	9.2
7075-T6 CLAD SHEET & PLATE	≤.500	64.5	61.6	19.5
7075-T6 EXTRUSION	≤.250	72.0	68.0	16.6

EXTRACT FROM BRUHN, TABLE B1.1

MATERIAL TABLES - RAMSBERG-OSGOOD PARAMETERS

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MATERIAL TABLES - PLANE-STRAIN FRACTURE TOUGHNESS

NOTES:

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Maintenance Training Manual

ALLOY	FORM	THICKNESS in	AVERAGE K _{IC} ksi
D6AC	PLATE	0.6-0.8	64
AERMET 100	BAR	1.0	121
9NI-4CO-.20C	FORGING	1.5-2.0	134
CUSTOM 465	BAR	1.0-1.5	89
HSL180	BAR	0.6	122
2024-T351	PLATE	0.8-2.0	31
7050-T7351	PLATE	1.0-2.0	35
7050-T76511	EXTRUSION	0.6-2.0	31
7075-T651	PLATE	0.5-2.0	26
7075-T7651	CLAD PLATE	0.5-0.6	25

REF: MMPDS-03, TABLES 2.1.2.1.3 AND 3.1.2.1.6

MATERIAL TABLES - PLANE-STRAIN FRACTURE TOUGHNESS

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