

BEVEL SEAT FITTINGS																				
SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	SIZE	
1	2 3/16	2 3/16	5/16	2 1/8	1 13/16	3 5/8	1 1/2	2 3/8	1 1/2	-	1 13/16	1 5/8	1 11/16	3	1 3/8	2 7/8	1	1/2	3 1/2	
1 1/2	2 15/16	3	1 3/4	2 1/8	2 3/8	4 3/4	1 1/2	2 9/16	1 5/8	2 3/4	-	2 7/16	1	1 7/8	3	1 3/4	3 1/8	1 1/2	3 1/4	
2	4 1/16	3 3/4	2 1/8	2 5/16	2 13/16	5 9/16	1 1/2	2 13/16	1 3/4	4 1/4	3 1/16	1 7/8	3	1 1/16	1 7/8	3	1 3/4	3 3/8	2	4 1/2
2 1/2	5 3/16	4 5/8	2 3/8	2 9/16	3 3/16	6 3/8	1 3/4	3 1/16	1 3/4	4 1/4	4 5/8	3 5/8	1 3/16	1 7/8	3 1/2	1 11/16	1 7/8	3 1/2	1 1/2	4 1/2
3	6 5/16	5 7/16	3 1/8	2 7/8	3 9/16	7	1 3/4	3 1/2	1 13/16	5	5 7/16	4 3/16	1 5/16	1 5/16	3 3/4	1 13/16	3 7/8	3	2	5 1/2
4	-	7 1/4	4 1/4	3 7/8	4 11/16	9 5/16	1 3/4	4 5/16	2 1/8	6 5/8	7 1/4	5 7/16	1 1/2	2 3/8	4	2 7/16	4 5/8	4	3	6 1/2

TRI-WELD FITTINGS																			
SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	SIZE
1	2 1/16	3	-	-	3	3 1/2	-	-	-	2 1/4	2 1/4	2 3/4	-	2 7/8	4 1/4	-	1 1/2	1 1/2	3 1/4
1 1/2	-	3	-	-	3	3 1/2	-	-	-	2 1/4	2 1/4	2 3/4	-	2 7/8	4 1/4	-	1 1/2	1 1/2	3 1/4
2	2 1/16	3	-	-	3	3 1/2	-	-	-	1 3/16	2 1/4	2 3/4	1 1/8	2 1/4	2 7/8	4 1/4	-	1 1/2	3 1/4
2 1/2	2 15/16	4 1/2	1 5/16	3 7/16	4 1/2	5	2 15/16	3 11/16	2 5/16	3	3 1/2	1 11/16	2 5/16	2 3/8	4 3/4	2 3/16	1 1/2	2 1/2	4 1/2
3	4 1/16	5 3/4	4 1/16	4 9/16	5 3/4	6 1/4	4 1/16	4 3/16	2 5/16	3 1/4	3 3/4	2 1/16	4 1/8	3 7/8	6 1/4	2 9/16	1 1/2	2 1/2	5 1/2
3 1/2	5 3/16	6 1/2	5 3/16	5 11/16	6 3/4	7 1/4	5 3/16	5 3/8	3 5/8	4 1/8	2 3/8	4 5/16	3 7/8	6 3/4	2 7/8	2 1/2	2 1/2	2 1/2	5 1/2
4	-	8 1/2	8 5/16	8 15/16	8 1/2	9 1/8	8 5/16	9 9/16	-	5	5 5/8	3 7/16	6 7/8	4 5/8	9 1/4	4 1/16	4	4	6 1/2

TRI-CLAMP FITTINGS																			
SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	SIZE
1	2 1/16	3	-	-	3	3 1/2	-	-	-	2 1/4	2 1/4	2 3/4	-	2 7/8	4 1/4	-	1 1/2	1 1/2	3 1/4
1 1/2	-	3	-	-	3	3 1/2	-	-	-	2 1/4	2 1/4	2 3/4	-	2 7/8	4 1/4	-	1 1/2	1 1/2	3 1/4
2	2 1/16	3	-	-	3	3 1/2	-	-	-	1 3/16	2 1/4	2 3/4	1 1/8	2 1/4	2 7/8	4 1/4	-	1 1/2	3 1/4
2 1/2	2 15/16	4 1/2	1 5/16	3 7/16	4 1/2	5	2 15/16	3 11/16	2 5/16	3	3 1/2	1 11/16	2 5/16	2 3/8	4 3/4	2 3/16	1 1/2	2 1/2	4 1/2
3	4 1/16	5 3/4	4 1/16	4 9/16	5 3/4	6 1/4	4 1/16	4 3/16	2 5/16	3 1/4	3 3/4	2 1/16	4 1/8	3 7/8	6 1/4	2 9/16	1 1/2	2 1/2	5 1/2
3 1/2	5 3/16	6 1/2	5 3/16	5 11/16	6 3/4	7 1/4	5 3/16	5 3/8	3 5/8	4 1/8	2 3/8	4 5/16	3 7/8	6 3/4	2 7/8	2 1/2	2 1/2	2 1/2	5 1/2
4	-	8 1/2	8 5/16	8 15/16	8 1/2	9 1/8	8 5/16	9 9/16	-	5	5 5/8	3 7/16	6 7/8	4 5/8	9 1/4	4 1/16	4	4	6 1/2

ORIFICE RUN LENGTHS																			
SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	SIZE
1	2 1/16	3	-	-	3	3 1/2	-	-	-	2 1/4	2 1/4	2 3/4	-	2 7/8	4 1/4	-	1 1/2	1 1/2	3 1/4
1 1/2	-	3	-	-	3	3 1/2	-	-	-	2 1/4	2 1/4	2 3/4	-	2 7/8	4 1/4	-	1 1/2	1 1/2	3 1/4
2	2 1/16	3	-	-	3	3 1/2	-	-	-	1 3/16	2 1/4	2 3/4	1 1/8	2 1/4	2 7/8	4 1/4	-	1 1/2	3 1/4
2 1/2	2 15/16	4 1/2	1 5/16	3 7/16	4 1/2	5	2 15/16	3 11/16	2 5/16	3	3 1/2	1 11/16	2 5/16	2 3/8	4 3/4	2 3/16	1 1/2	2 1/2	4 1/2
3	4 1/16	5 3/4	4 1/16	4 9/16	5 3/4	6 1/4	4 1/16	4 3/16	2 5/16	3 1/4	3 3/4	2 1/16	4 1/8	3 7/8	6 1/4	2 9/16	1 1/2	2 1/2	5 1/2
3 1/2	5 3/16	6 1/2	5 3/16	5 11/16	6 3/4	7 1/4	5 3/16	5 3/8	3 5/8	4 1/8	2 3/8	4 5/16	3 7/8	6 3/4	2 7/8	2 1/2	2 1/2	2 1/2	5 1/2
4	-	8 1/2	8 5/16	8 15/16	8 1/2	9 1/8	8 5/16	9 9/16	-	5	5 5/8	3 7/16	6 7/8	4 5/8	9 1/4	4 1/16	4	4	6 1/2

ZEPHYRWELD FITTINGS																			
SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	SIZE
1	2 1/16	3	-	-	3	3 1/2	-	-	-	2 1/4	2 1/4	2 3/4	-	2 7/8	4 1/4	-	1 1/2	1 1/2	3 1/4
1 1/2	-	3	-	-	3	3 1/2	-	-	-	2 1/4	2 1/4	2 3/4	-	2 7/8	4 1/4	-	1 1/2	1 1/2	3 1/4
2	2 1/16	3	-	-	3	3 1/2	-	-	-	1 3/16	2 1/4	2 3/4	1 1/8	2 1/4	2 7/8	4 1/4	-	1 1/2	3 1/4
2 1/2	2 15/16	4 1/2	1 5/16	3 7/16	4 1/2	5	2 15/16	3 11/16	2 5/16	3	3 1/2	1 11/16	2 5/16	2 3/8	4 3/4	2 3/16	1 1/2	2 1/2	4 1/2
3	4 1/16	5 3/4	4 1/16	4 9/16	5 3/4	6 1/4	4 1/16	4 3/16	2 5/16	3 1/4	3 3/4	2 1/16	4 1/8	3 7/8	6 1/4	2 9/16	1 1/2	2 1/2	5 1/2
3 1/2	5 3/16	6 1/2	5 3/16	5 11/16	6 3/4	7 1/4	5 3/16	5 3/8	3 5/8	4 1/8	2 3/8	4 5/16	3 7/8	6 3/4	2 7/8	2 1/2	2 1/2	2 1/2	5 1/2
4	-	8 1/2	8 5/16	8 15/16	8 1/2	9 1/8	8 5/16	9 9/16	-	5	5 5/8	3 7/16	6 7/8	4 5/8	9 1/4	4 1/16	4	4	6 1/2

TRIGONOMETRIC SOLUTIONS OF OBLIQUE-ANGLE TRIANGLES

FORMULA

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
 $\cos^2 A = \frac{b^2 + c^2 - a^2}{2bc}$
 $\cos^2 B = \frac{a^2 + c^2 - b^2}{2ac}$
 $\cos^2 C = \frac{a^2 + b^2 - c^2}{2ab}$
 $\sin^2 A = \frac{a^2 - (b^2 + c^2 - a^2) \cos C}{2bc}$
 $\sin^2 B = \frac{b^2 - (a^2 + c^2 - b^2) \cos C}{2ac}$
 $\sin^2 C = \frac{c^2 - (a^2 + b^2 - c^2) \cos C}{2ab}$

KNOWN **SOUGHT**

A, B, C a, b, c
 a, b, c A, B, C
 A, B, a c
 A, B, c a
 a, b, c A, B, C

FORMULA

$\tan \frac{A}{2} = \frac{a \sin \frac{B-C}{2}}{b \cos \frac{B-C}{2} - c \sin \frac{B-C}{2}}$
 $\tan \frac{B}{2} = \frac{b \sin \frac{A-C}{2}}{a \cos \frac{A-C}{2} - c \sin \frac{A-C}{2}}$
 $\tan \frac{C}{2} = \frac{c \sin \frac{A-B}{2}}{a \cos \frac{A-B}{2} - b \sin \frac{A-B}{2}}$

C = $180^\circ - (A+B)$
 $a = \frac{b \sin A}{\sin B}$
 $c = \frac{b \sin C}{\sin B}$
 $C = \sqrt{A^2 + B^2 - 2AB \cos c}$
 $b = 180^\circ - (A+B)$

TERMAL EXPANSION - INCHES PER FOOT

F	CS	SS	Cr-Mo	COPPER	BRASS	ALUM	PSG	F
-50	-0.0087	-0.014	-0.0132	-0.0137	-0.0176	0	212	212
0	-0.0051	-0.0078	-0.0079	-0.0081	-0.0104	5	227	227
50	-0.0015	-0.0022	-0.0022	-0.0023	-0.0030	10	239	239
70	0	0	0	0	0	15	250	250
100	0.0023	0.0034	0.0022	0.0034	0.0035	20	266	266
150	0.0061	0.0090	0.0058	0.0091	0.0093	30	298	298
200	0.0099	0.0146	0.0094	0.0151	0.0152	40	320	320
250	0.0141	0.0203	0.0132	0.0208	0.0214	50	338	338
300	0.0182	0.0261	0.0171	0.0267	0.0276	60	366	366
350	0.0226	0.0321	0.0210	0.0327	0.0340	70	388	388
400	0.0270	0.0380	0.0250	0.0386	0.0405	80	406	406
450	0.0316	0.0440	0.0292	0.0449	0.0472	90	422	422
500	0.0362	0.0501	0.0335	0.0512	0.0540	100	436	436
550	0.0411	0.0562	0.0379	0.0574	0.0610	110	448	448
600	0.0460	0.0624	0.0424	0.0639	0.0680	120	460	460
650	0.0512	0.0687	0.0469	0.0703	0.0753	130	470	470
700	0.0563	0.0750	0.0514	0.0768	0.0826	140	480	480
800	0.0670	0.0890	0.0610	0.0900	0.0978	160	499	499
1000	0.0899	0.1148	0.0866	0.1175	0.1298	200	505	505

C = $\sqrt{A^2 + B^2 - 2AB \cos c}$
 $a = \sqrt{b^2 + c^2 - 2bc \cos A}$
 $b = \sqrt{a^2 + c^2 - 2ac \cos B}$

TRICONOMETRIC SOLUTIONS OF OBLIQUE-ANGLE TRIANGLES

FORMULA

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 $\cos^2 A = \frac{b^2 + c^2 - a^2}{2bc}$
 $\cos^2 B = \frac{a^2 + c^2 - b^2}{2ac}$
 $\cos^2 C = \frac{a^2 + b^2 - c^2}{2ab}$
 $\sin^2 A = \frac{a^2 - (b^2 + c^2 - a^2) \cos C}{2bc}$
 $\sin^2 B = \frac{b^2 - (a^2 + c^2 - b^2) \cos C}{2ac}$
 $\sin^2 C = \frac{c^2 - (a^2 + b^2 - c^2) \cos C}{2ab}$

KNOWN **SOUGHT**

A, B, C a, b, c
 a, b, c A, B, C
 A, B, a c
 A, B, c a
 a, b, c A, B, C

FORMULA

$\tan \frac{A}{2} = \frac{a \sin \frac{B-C}{2}}{b \cos \frac{B-C}{2} - c \sin \frac{B-C}{2}}$
 $\tan \frac{B}{2} = \frac{b \sin \frac{A-C}{2}}{a \cos \frac{A-C}{2} - c \sin \frac{A-C}{2}}$
 $\tan \frac{C}{2} = \frac{c \sin \frac{A-B}{2}}{a \cos \frac{A-B}{2} - b \sin \frac{A-B}{2}}$

C = $180^\circ - (A+B)$
 $a = \frac{b \sin A}{\sin B}$
 $c = \frac{b \sin C}{\sin B}$
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