

COLUMN STRENGTH - THOUSANDS OF POUNDS

C-2
C-1

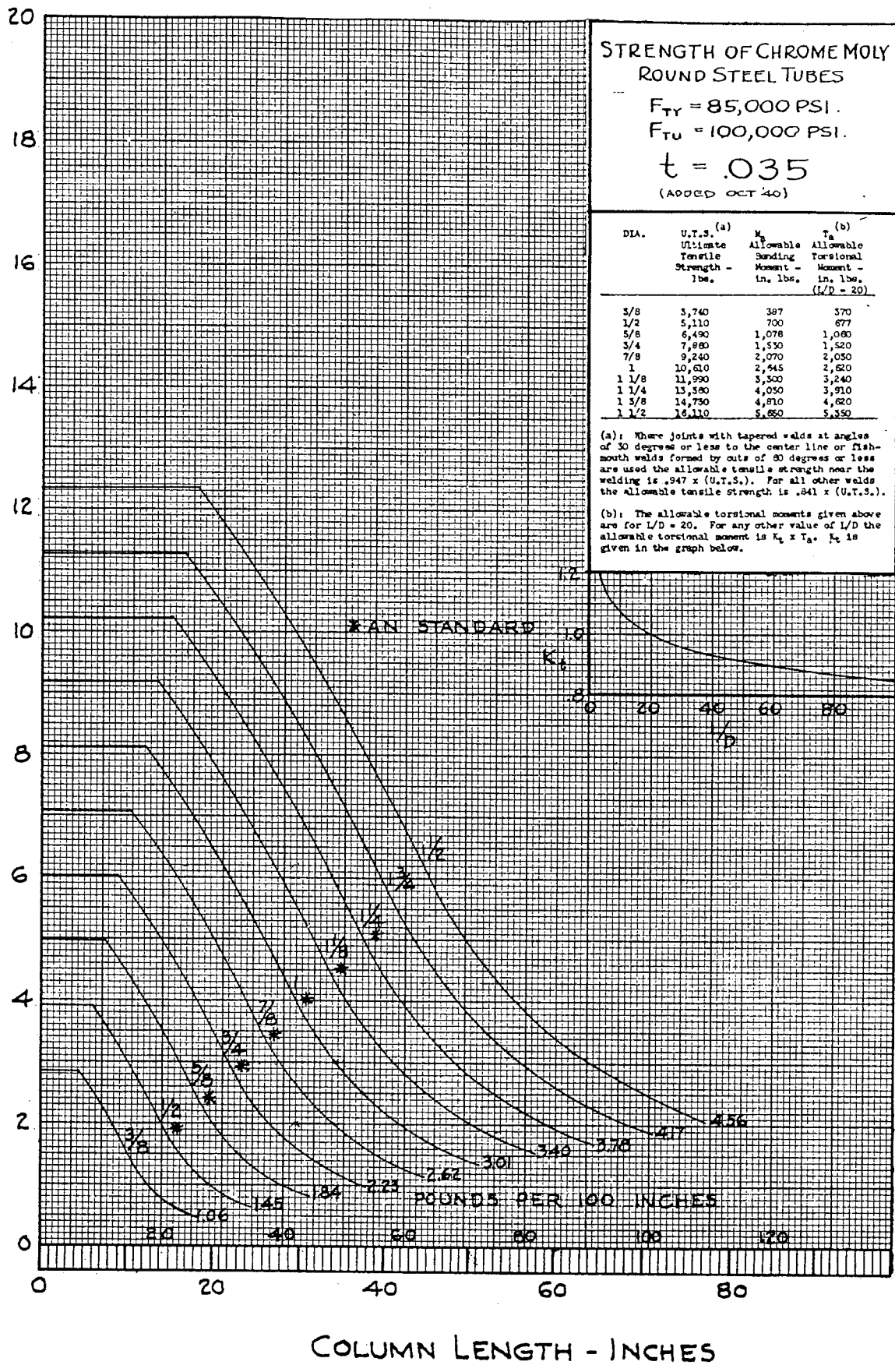


FIG 4-14

COLUMN STRENGTH - THOUSANDS OF POUNDS

C_c = 2
C_c = 1

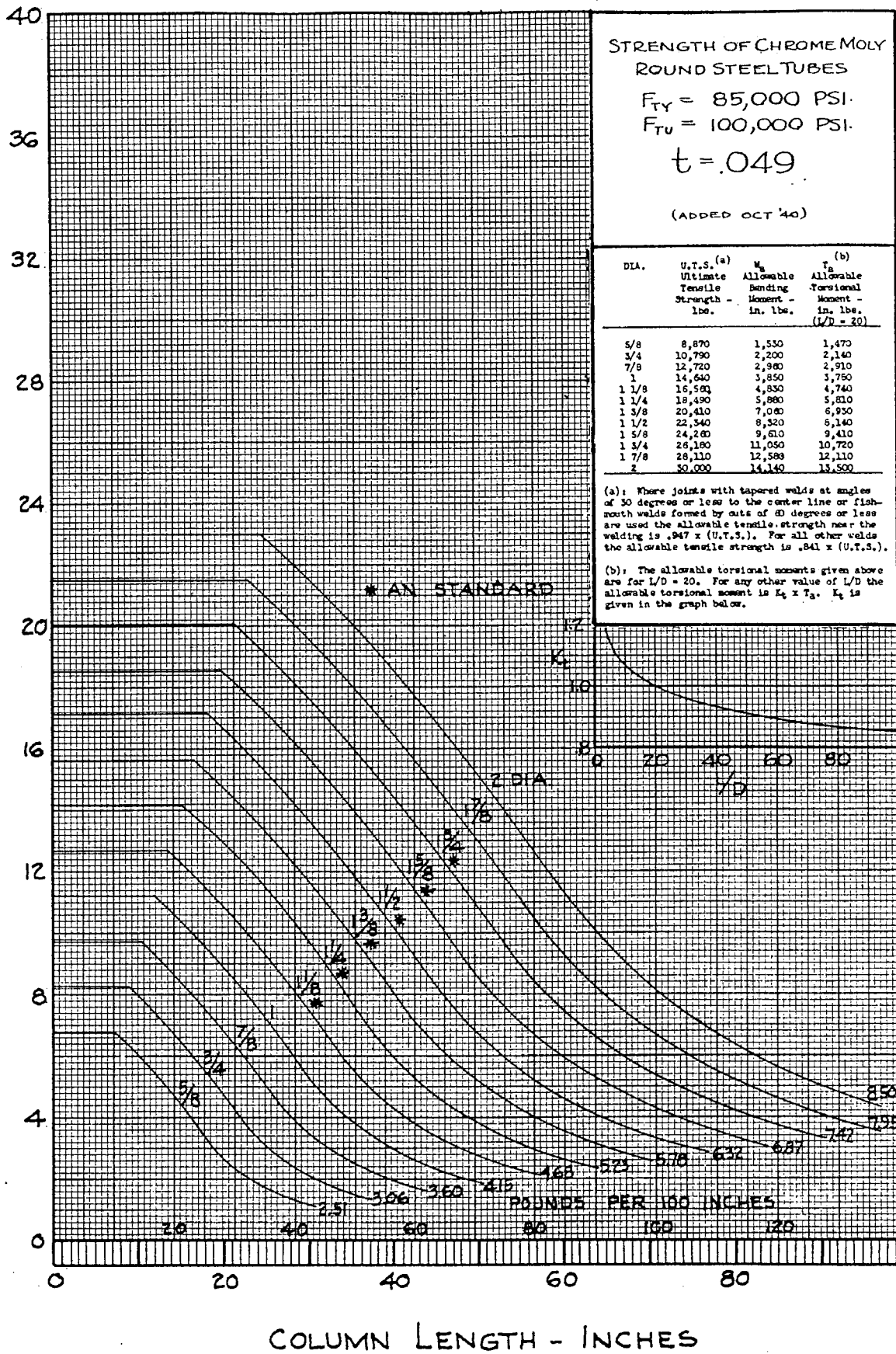


FIG. 4-15

COLUMN STRENGTH - THOUSANDS OF POUNDS

STRENGTH OF CHROME MOLY ROUND STEEL TUBES

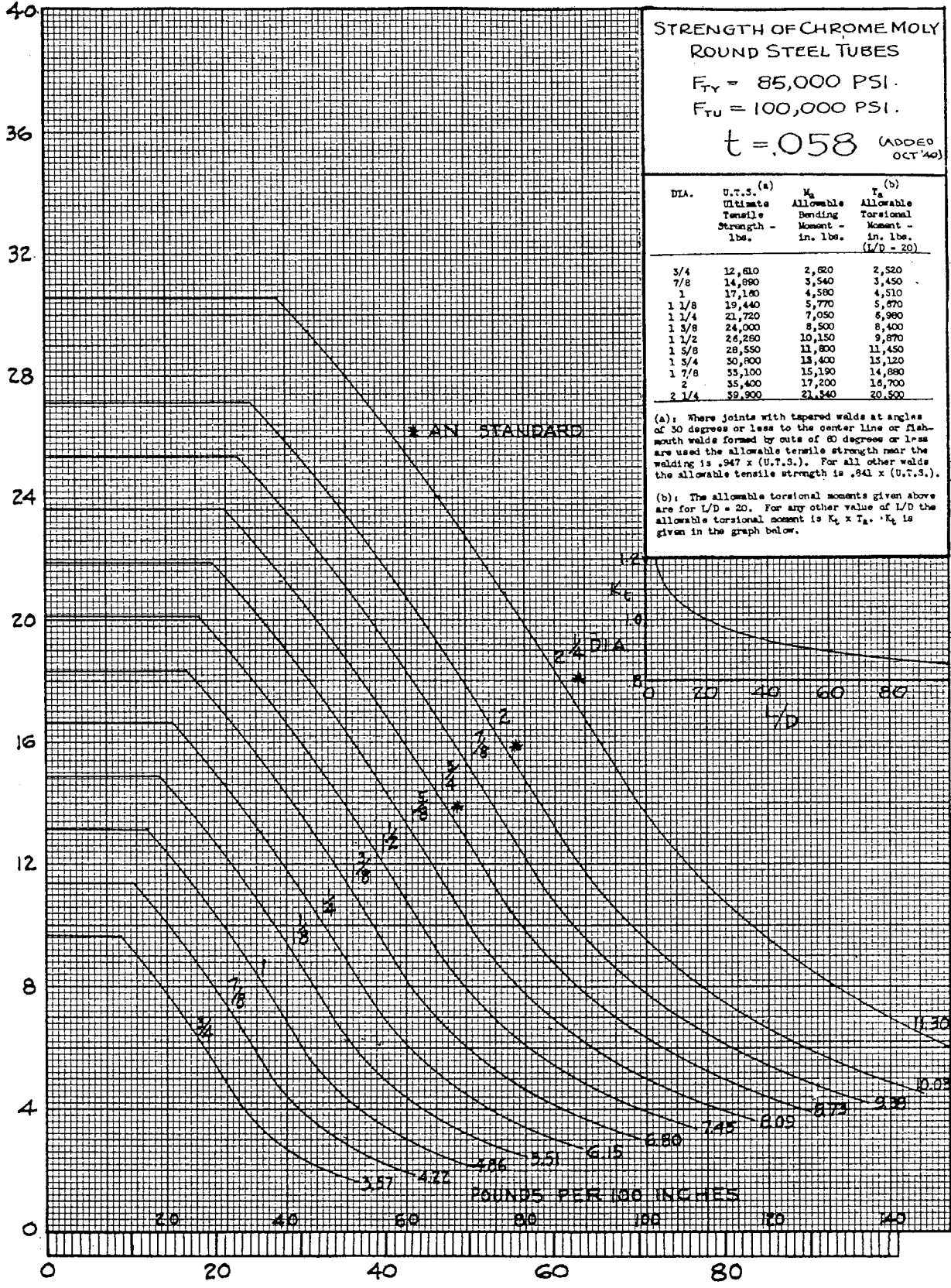
$F_{TY} = 85,000 \text{ PSI}$
 $F_{TU} = 100,000 \text{ PSI}$

$t = .058$ (ADDED OCT '40)

DIA.	U.T.S. (a) Ultimate Tensile Strength - lbs.	K_b Allowable Bending Moment - in. lbs.	T_a (b) Allowable Torsional Moment - in. lbs. (L/D = 20)
3/4	12,610	2,620	2,520
7/8	14,890	3,540	3,450
1	17,160	4,580	4,510
1 1/8	19,440	5,770	5,670
1 1/4	21,720	7,050	6,980
1 3/8	24,000	8,500	8,400
1 1/2	26,280	10,150	9,970
1 5/8	28,560	11,800	11,450
1 3/4	30,840	13,400	13,120
1 7/8	33,120	15,150	14,880
2	35,400	17,200	16,700
2 1/4	39,900	21,340	20,500

(a): Where joints with tapered welds at angles of 30 degrees or less to the center line or flash-mouth welds formed by cuts of 80 degrees or less are used the allowable tensile strength near the welding is .947 x (U.T.S.). For all other welds the allowable tensile strength is .941 x (U.T.S.).

(b): The allowable torsional moments given above are for L/D = 20. For any other value of L/D the allowable torsional moment is $K_t \times T_a$. K_t is given in the graph below.



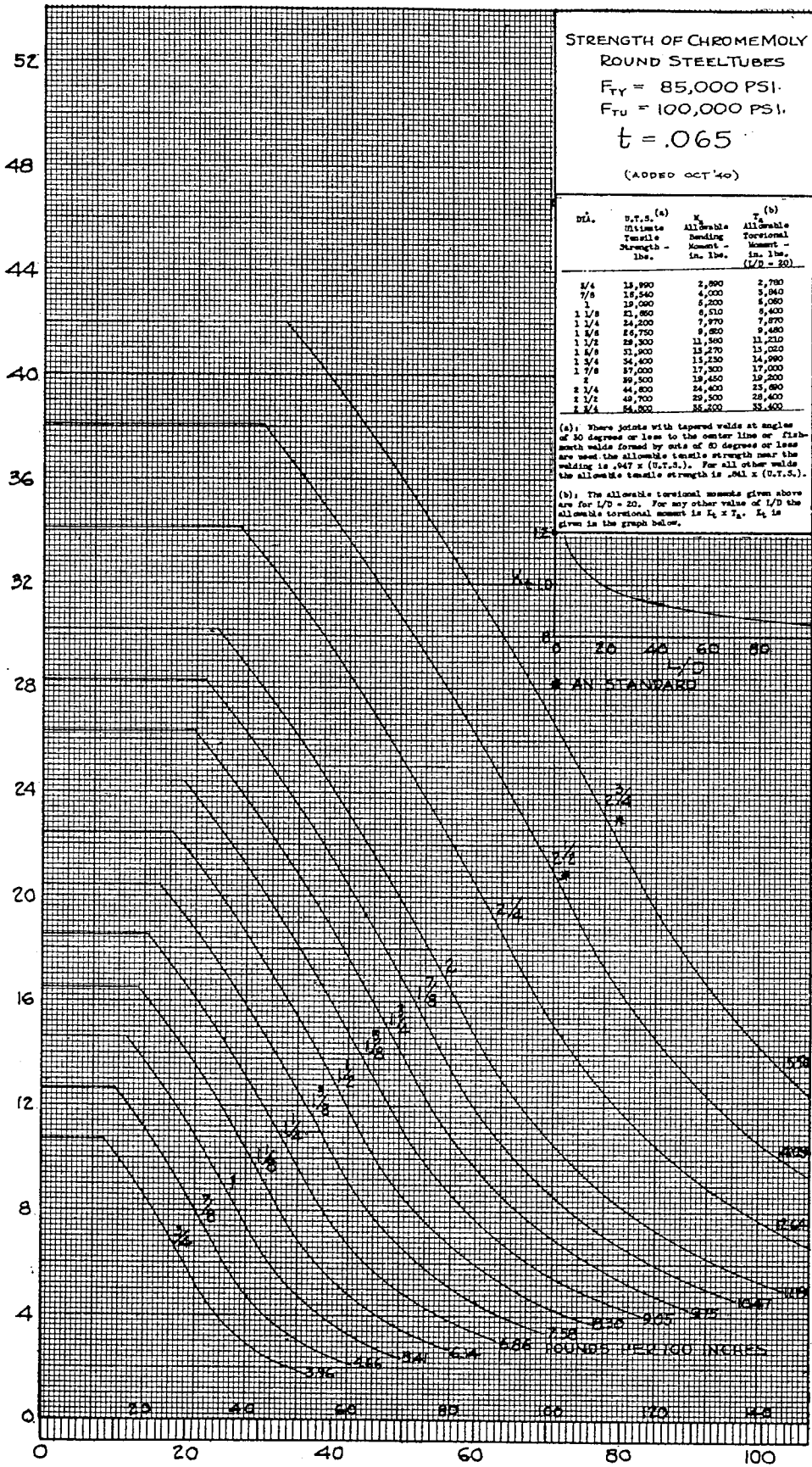
C = 2
C = 1

COLUMN LENGTH - INCHES

FIG. 4-16

COLUMN STRENGTH - THOUSANDS OF POUNDS

C=2
C=1



COLUMN LENGTH-INCHES

FIG. 4-17

COLUMN STRENGTH - THOUSANDS OF POUNDS

STRENGTH OF CHROME MOLY ROUND STEEL TUBES

$F_{TY} = 85,000 \text{ PSI.}$

$F_{TU} = 100,000 \text{ PSI.}$

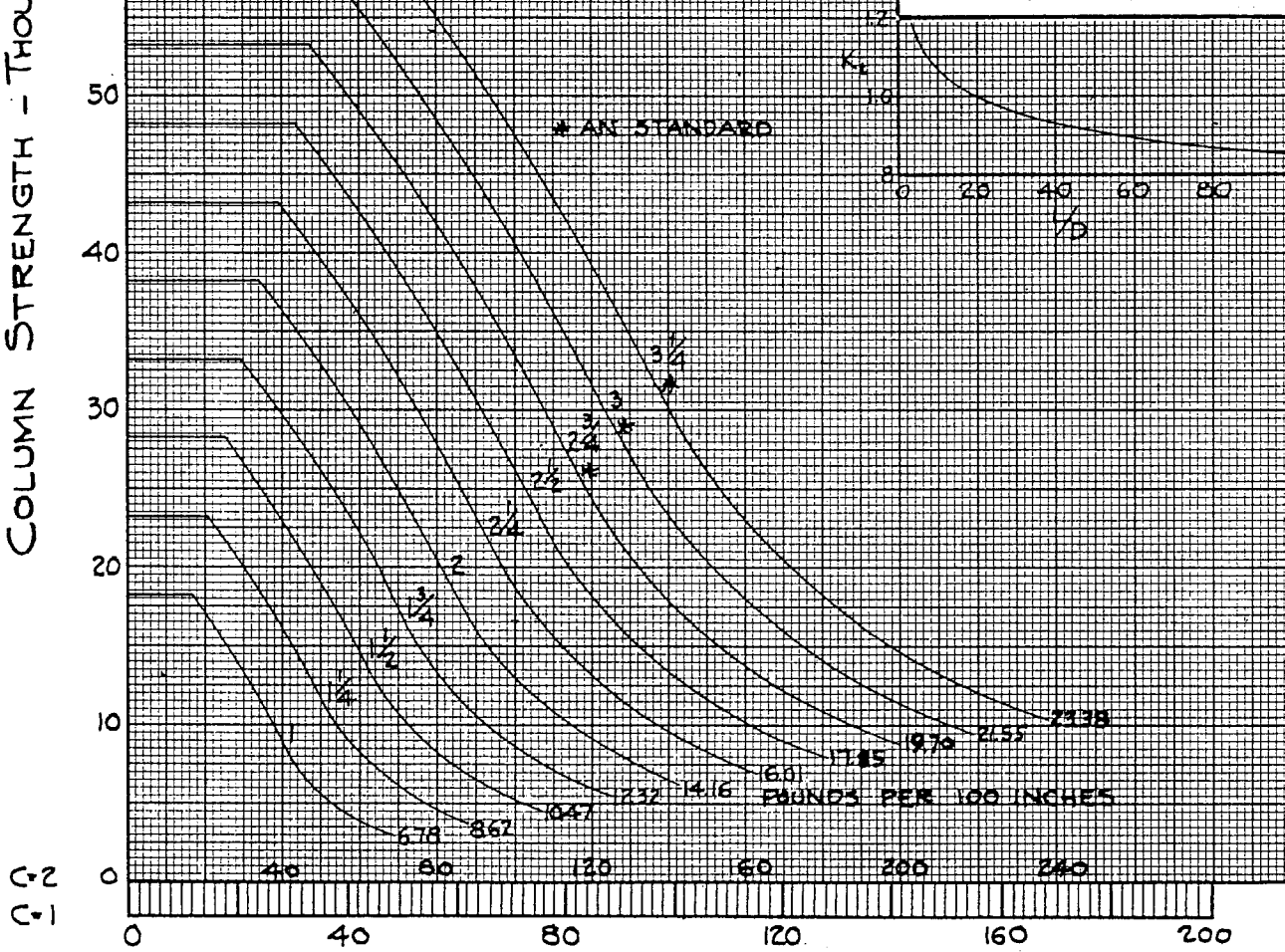
$t = .083$

(ADDED OCT '40)

DIA.	(a)		(b)	
	U.T.S. Ultimate Tensile Strength - lbs.	K_b Allowable Bending Moment - in. lbs.	K_t Allowable Torsional Moment - in. lbs. (L/D = 20)	
1	25,910	6,820	6,580	
1 1/4	50,430	10,530	10,050	
1 1/2	36,950	14,780	14,500	
1 3/4	43,470	19,900	19,600	
2	49,990	25,680	25,400	
2 1/4	56,510	32,000	31,600	
2 1/2	63,030	38,100	37,500	
2 3/4	69,550	44,200	43,700	
3	76,070	50,300	49,200	
3 1/4	82,590	56,400	55,200	

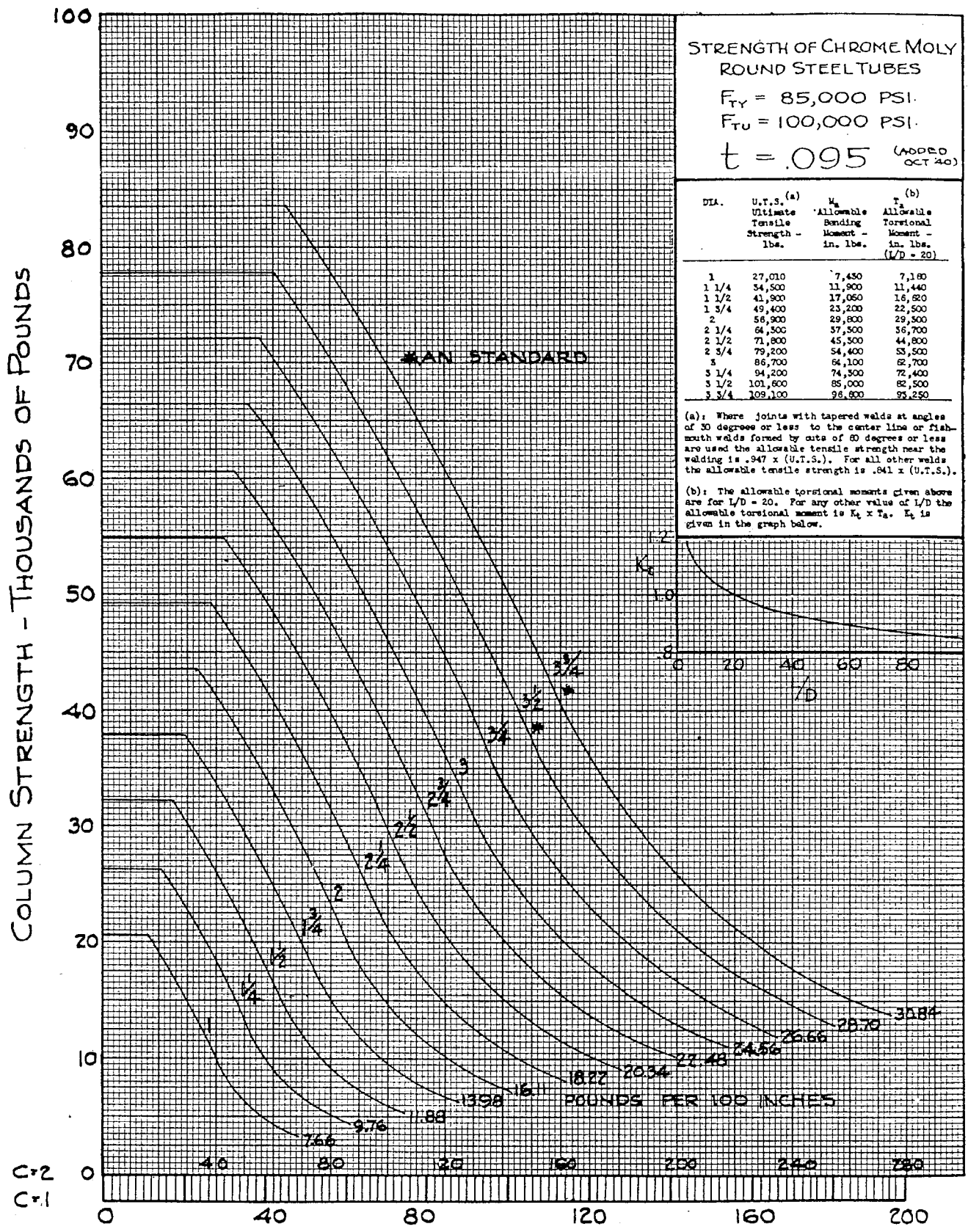
(a): Where joints with tapered welds at angles of 30 degrees or less to the center line or fish-mouth welds formed by cuts of 30 degrees or less are used the allowable tensile strength near the welding is .947 x (U.T.S.). For all other welds the allowable tensile strength is .841 x (U.T.S.).

(b): The allowable torsional moments given above are for L/D = 20. For any other value of L/D the allowable torsional moment is $K_t \times T_a$. K_t is given in the graph below.



COLUMN LENGTH - INCHES

FIG. 4-18



COLUMN LENGTH - INCHES

FIG. 4 - 19

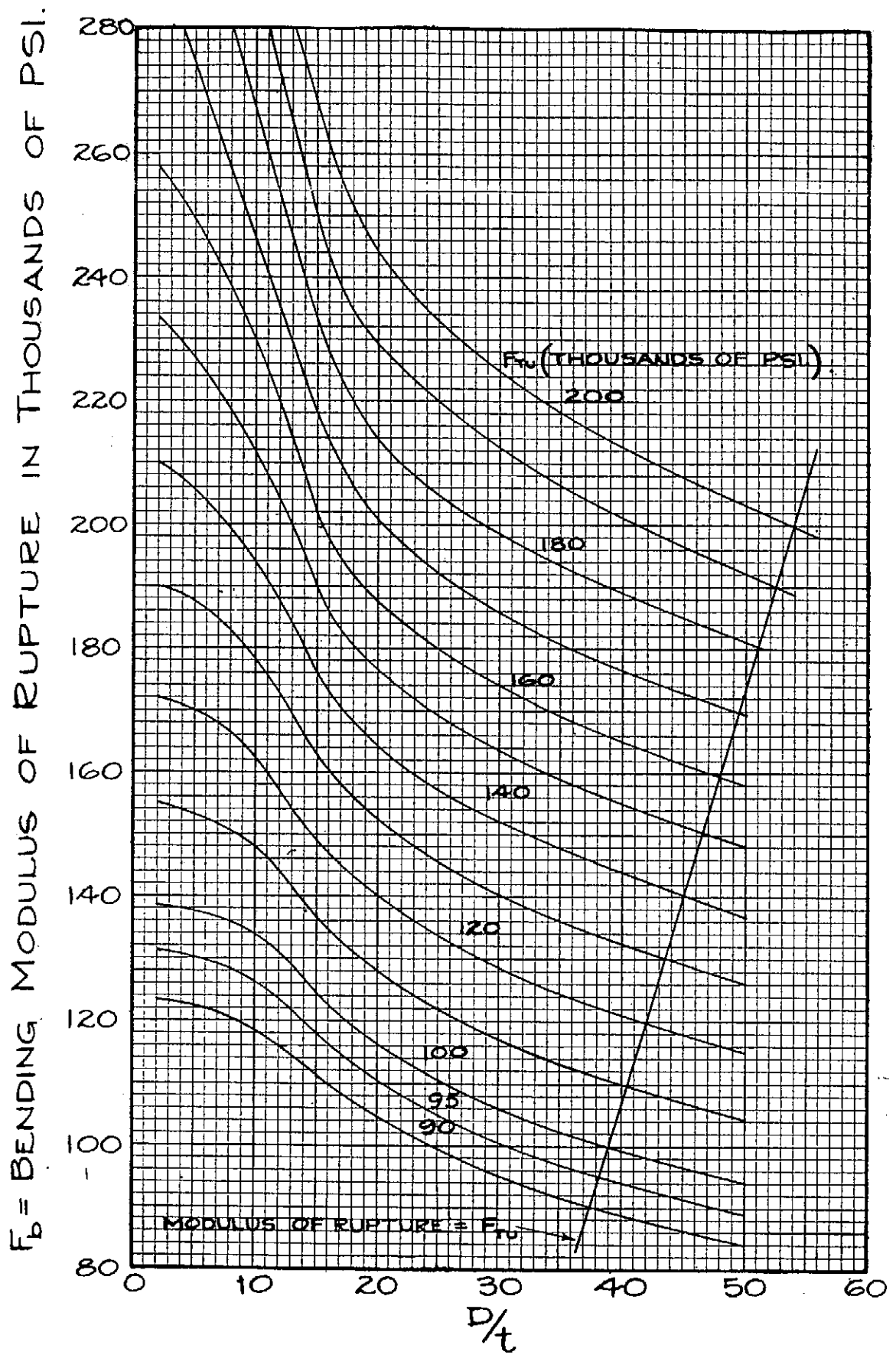


FIG.4-20 BENDING MODULUS OF RUPTURE
CHROME MOLYBDENUM STEEL TUBING

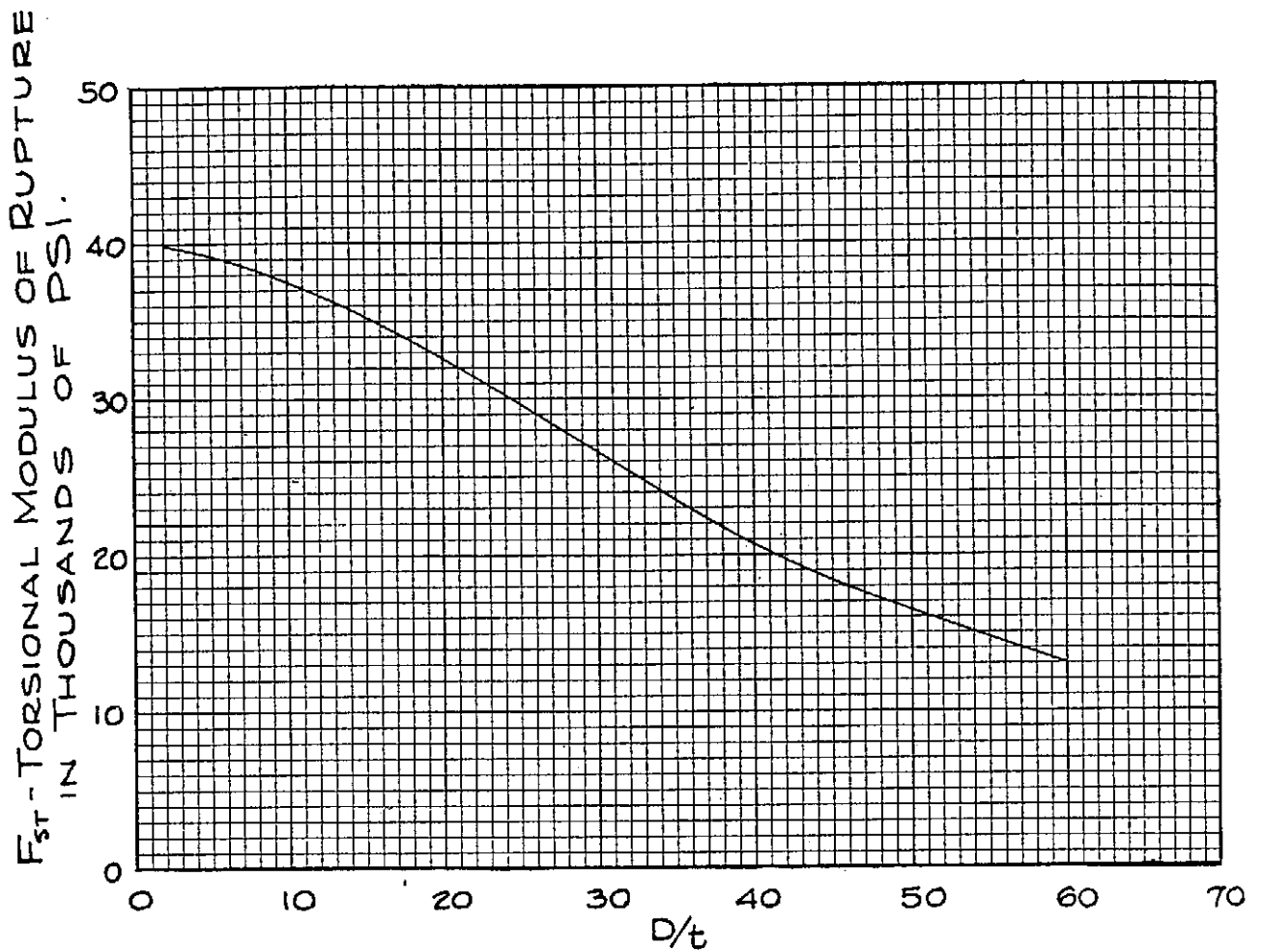


FIG. 4-21 TORSIONAL MODULUS OF RUPTURE OF 1025 STEEL ROUND TUBING

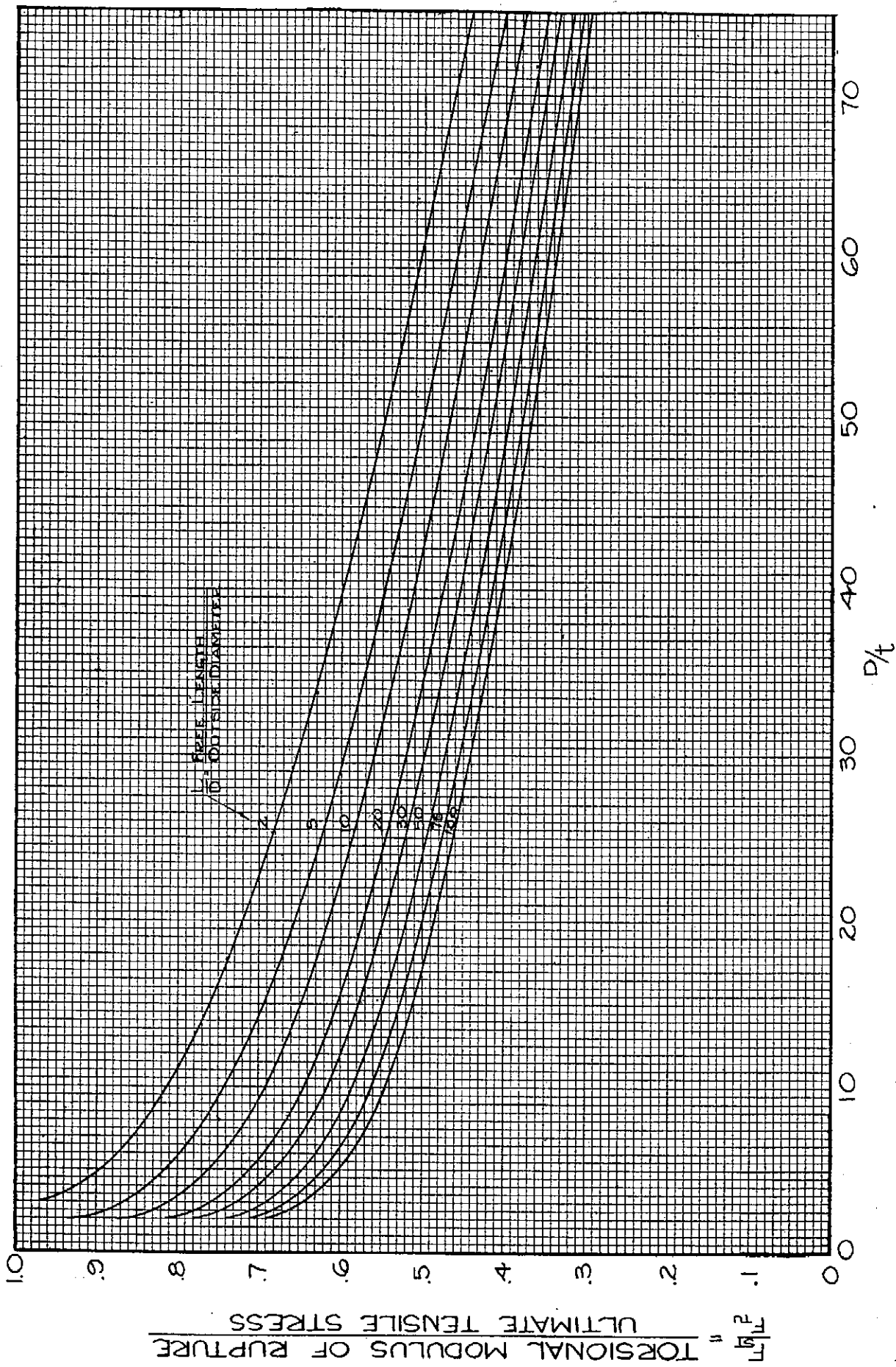


FIG. 4-22. TORSIONAL MODULUS OF RUPTURE OF ROUND ALLOY STEEL TUBING

TABLE 4-11
SHEARING STRENGTH, AREAS, AND MOMENTS OF INERTIA OF STEEL RIVETS, BOLTS, AND PINS

Material				Low carbon steel	Heat treated alloy steel	Heat treated alloy steel
Tensile strength, lb. per sq. in.				55,000	100,000	125,000
Shear strength, lb. per sq. in.				35,000	65,000	75,000
Size of rivet, bolt or pin	Machine screw size	Area of solid section, sq. in.	Moment of inertia of solid section, sq. in.	Allowable single shear strength, lb.		
1/16		.003068	.00000075	107	199	230
3/32		.006902	.00000379	242	449	518
.112	No. 4	.009852	.00000772	345	640	739
1/8		.012272	.00001198	430	798	920
.138	No. 6	.014957	.00001781	523	972	1122
5/32		.01918	.00002926	671	1247	1438
.164	No. 8	.02112	.00003549	739	1372	1584
3/16		.02761	.00006066	966	1794	2070
.190	No. 10	.02835	.00006399	992	1842	2126
.216	No. 12	.03664	.0001069	1252	2381	2748
7/32		.03758	.0001125	1315	2442	2818
1/4		.04908	.0001918	1717	3190	3681
5/16		.07669	.0004682	2684	4984	5751
3/8		.1105	.0009710	3868	7183	8287
7/16		.1503	.001797	5261	9770	11272
1/2		.1963	.003069	6871	12760	14722
9/16		.2485	.004914	8697	16152	18637
5/8		.3068	.007492	10738	19942	23010
3/4		.4418	.01553	15463	28717	33135
7/8		.6013	.02878	21046	39085	45097
1		.7854	.04908	27489	51051	58905

TABLE 4-12 (REVISED OCT '40)
BEARING STRENGTH* OF STEEL SHEETS ON RIVETS, BOLTS, AND PINS
NORMALIZED X-4130 SHEET ($F_{br} = 140,000$ PSI)

Size of Rivets	1/16	3/32	1/8	5/32	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Plate Sizes	Bearing Strength of Plate												
.028	245	368	490										
.035	306	459	612	765	918								
.049	429	643	857	1072	1286	1714							
.058	507	761	1015	1269	1522	2030	2537						
.065	569	853	1137	1422	1706	2275	2844						
.072	630	945	1260	1575	1890	2520	3150	3780					
.083	726	1089	1452	1815	2173	2904	3630	4356					
.095	831	1247	1662	2078	2494	3325	4156	4988	6650				
.120	1050	1575	2100	2625	3150	4200	5250	6300	8400	10500			
3/16	1640	2460	3280	4100	4920	6560	8200	9840	13120	16400	19680	22960	26240
1/4	2188	3281	4375	5469	6563	8750	10938	13125	17500	21875	26250	30625	35000

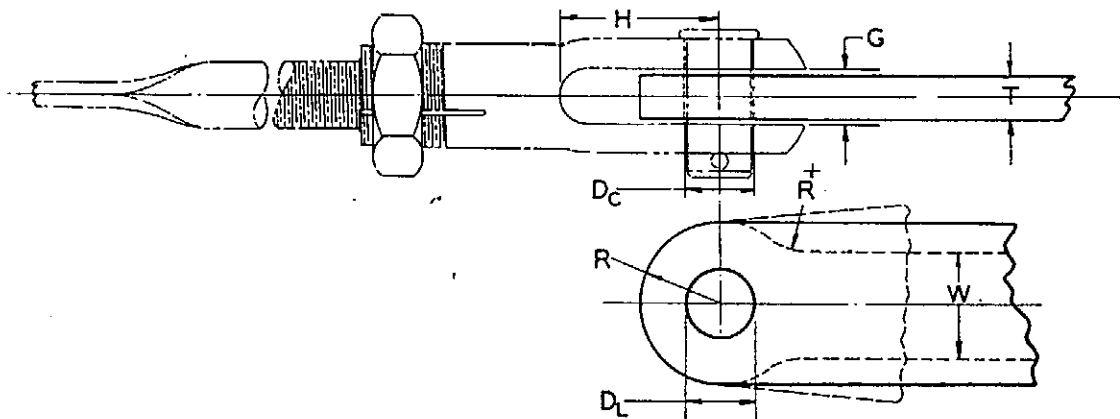
$F_{br} = 100,000$ PSI. (FOR USE IN COMPUTING BEARING STRENGTH AT OTHER VALUES OF ALLOWABLE BEARING STRESS)

Size of Rivets	1/16	3/32	1/8	5/32	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Plate Sizes	Bearing Strength of Plate												
.028	175	263	350										
.035	219	328	438	547	656								
.049	306	459	612	766	919	1225							
.058	362	544	725	906	1087	1450	1812						
.065	406	609	812	1016	1219	1625	2031						
.072	450	675	900	1125	1350	1800	2250	2700					
.083	519	778	1038	1297	1556	2075	2594	3113					
.095	594	891	1185	1484	1781	2376	2969	3563	4750	7500			
.120	750	1125	1500	1875	2250	3000	3750	4500	6000	7500	10000	12500	15000
3/16	1172	1758	2344	2930	3516	4688	5859	7031	9375	11719	14063	16406	18750
1/4	1563	2344	3125	3906	4688	6250	7813	9375	12500	15625	18750	21875	25000

*FOR d/t VALUES ≥ 5.5 THE ALLOWABLE BEARING STRENGTHS MUST BE SUBSTANTIATED BY TESTS COVERING BOTH YIELD AND ULTIMATE OF THE JOINT.

TABLE 4-13
STEEL TIE RODS AND TENSION LUGS

Tie rods			Clevis			Lug (See Sec. 4.53)					
1 Size	2a Strength-lb. Stainless Steel Internal and High Carbon Steel Streamline and Internal	2b Strength-lb. Stainless Steel Streamline	3 Gap G	4 Throat H	5 Hole D _c	6 Thick- ness T	7 Hole D ₁	8 90000 lb. U. T. S. Alloy Steel		10 125000 lb. U. T. S. H. T. Alloy Steel	
	R	W						R	W		
			+ .010 - .000		- .000 + .010	+ .006 - .006	+ .003 - .003	- .000	- .000	- .000	- .000
No. 6	1000	1200	.109	3/8	.188	3/32	13/64	9/32	5/16	7/32	1/4
No. 10	2100	2400	.150	15/32	.188	1/8	13/64	3/8	3/8	9/32	3/8
1/4	3400	4200	.203	5/8	.250	3/16	17/64	13/32	9/16	3/8	1/2
5/16	6100	6900	.203	27/32	.375	3/16	25/64	23/32	13/16	9/16	5/8
3/8	8000	10000	.266	7/8	.375	1/4	25/64	23/32	7/8	9/16	5/8
7/16	11500	13700	.344	1	.438	5/16	29/64	13/16	1	5/8	7/8
1/2	15500	18500	.406	1-3/16	.500	3/8	33/64	15/16	1-1/8	3/4	1
9/16	20200	24000	.453	1-3/8	.563	3/8	37/64	1-1/8	1-1/4	7/8	1-1/16
5/8	24700	29500	.516	1-1/2	.625	7/16	41/64	1-1/8	1-1/2	15/16	1-1/8
3/4	43000	42000	.656	1-15/16	.750	1/2	25/32	1-1/2	2	1-1/8	1-3/8
7/8		58000	.781	2-5/16	.875	5/8	29/32	1-7/8	2-1/2	1-1/4	1-3/4
1		76000	.906	2-11/16	1.00	3/4	1.31	2-3/16	3	1-1/2	2



TIE ROD LUG

TABLE 4-14
STRENGTH OF STEEL CABLE

Diameter in Inches	(Army Spec. 48-21) 19 Strands non-flex.			(Army Spec. 48-22) 7x7 Flexible			(Army Spec. 48-35) 7x19 Extra-Flexible		
	Approx. Wt. in lb. per 100 ft.	Breaking strength in lb. minimum	E A	Approx. Wt. in lb. per 100 ft.	Breaking strength in lb. minimum	E A	Approx. wt. in lb. per 100 ft.	Breaking strength in lb. minimum	E A
0.031	1/32	0.30	185						
0.062	1/16	0.78	500	0.81	480	47,990			
0.078	5/64	1.21	780	0.83	650	54,990*			
0.094	3/32	1.75	1100	1.46	920	83,900			
0.109	7/64	2.60	1600						
0.125	1/8	3.50	2100	2.45	1350	123,110*	2.88	2000	155,020
0.156	5/32	5.50	3200	4.67	2600	270,700	4.44	2800	255,230
0.187	3/16	7.70	4600	5.80	3200	333,240*	6.47	4200	374,760
0.218	7/32	10.00	6100	8.30	4800	479,140*	9.50	5600	500,500*
0.250	1/4	13.50	8000	10.50	5800	603,670*	12.00	7000	643,500*
0.281	9/32						14.56	8000	813,510
0.312	5/16	20.65	12500	16.70	9200	958,290*	17.71	9800	1,026,230*
0.344	11/32						22.53	12500	1,309,140
0.375	3/8						26.45	14400	1,625,570*

*Computed using estimated values of A.

STAINLESS STEEL CABLE (Army Spec. 48-36)		
6x7 Flexible		
6x19 Extra-Flexible		
Diameter in inches	Approx. wt. in lb. per 100 ft.	Breaking strength in lb. minimum
6x7 Flexible		
1/16	0.75	480
3/32	1.35	920
6x19 Extra-Flexible		
1/8	2.9	1900
5/32	4.1	2600
3/16	5.8	3900
7/32	7.8	5200
1/4	10.4	6600
9/32	13.0	8000
5/16	16.2	9600
3/8	23.0	13000