

CHAPTER 6

MISCELLANEOUS METALS AND ALLOYS

MISCELLANEOUS METALS AND ALLOYS

6.0

GENERAL PROPERTIES

6.00 The general strength properties and related characteristics of various metals and alloys are listed in the tables which follow. Particular attention should be paid to the detailed notes at the bottom of each table and to the general explanatory notes in Chapter 3. These tables will be revised and amplified from time to time as found necessary and to include new materials of construction.

TABLE 6 - 1 (Revised Oct 46)
MECHANICAL PROPERTIES OF MATERIALS

MAGNESIUM ALLOY

CONDITION			① SHEET (CONDITION A)	② SHEET (CONDITION B)	③ ROUND SEAMLESS TUBING	④ ROUND SEAMLESS TUBING	
SPECIFICATION			ARMY	11317	11317	11318 (Grade 1)	11318 (Grade 2)
			NAVY			M-366 (Alloy 8)	M-366 (Alloy 11)
			FEDERAL				
			SAE				
TENSION	1	F_{tu}	Ultimate Stress, psi	28 000	32 000	36 000	32 000
	2	F_{ty}	Yield Stress, psi		24 000	17 000	17 000
	3	F_{tp}	Proportional Limit, psi				
	4	E	Modulus of Elasticity, psi	6 500 000	6 500 000	6 500 000	6 500 000
	5		Elongation in 2 in., %	12	4	7	3
COMPRESSION	6	F_{cu}	Ultimate (block) Stress, psi				
	7	F_{cy}	Yield Stress, psi				
	8	F_{cp}	Proportional Limit, psi				
	9	F_{co}	Column Yield Stress, psi				
	10	E_c	Modulus of Elasticity, psi				
SHEAR	11	F_{su}	Ultimate Stress, psi				
	12	F_{st}	Torsional Modulus of Rupture, psi				
	13	F_{sp}	Proportional Limit (torsion), psi				
	14	G	Modulus of Rigidity (torsion), psi				
BEARING	15	F_{br}	Ultimate Stress, psi				
	16		Rockwell Number				
	17		Brinell Number				
FATIGUE	18	F_{be}	Bending Endurance Limit, psi (300,000,000 cycles of completely reversed stress)				
	19	F_{se}	Torsional Endurance Limit, psi (20,000,000 cycles of completely reversed stress)				
20	w	Specific Weight, lb/cu in.		lb/cu ft.			
21		Nominal Chemical Composition					
22	REMARKS 1. See notes in Chapter 3.						

TABLE 6 - 2 (revised Oct 60)
MECHANICAL PROPERTIES OF MATERIALS

MAGNESIUM ALLOY

CONDITION		① ROUND AND SQUARE SHAPES UP TO 1-1/2"	② STRUCTURAL SHAPES	③ ROUND AND SQUARE SHAPES UP TO 1-1/2"	④ STRUCTURAL SHAPES	
SPECIFICATION		ARMY	11320 (Grade 1)	11320 (Grade 1)	11320 (Grade 2)	11320 (Grade 2)
		NAVY				
		FEDERAL				
		SAR				
TENSION	1	F_{tu} Ultimate Stress, psi	40 000	38 000	32 000	30 000
	2	F_{ty} Yield Stress, psi	26 000	23 000	20 000	16 000
	3	F_{tp} Proportional Limit, psi				
	4	E Modulus of Elasticity, psi	6 500 000	6 500 000	6 500 000	6 500 000
	5	Elongation in 2 in., %	12	10	5	3
COMPRESSION	6	F_{cu} Ultimate (block) Stress, psi				
	7	F_{cy} Yield Stress, psi				
	8	F_{cp} Proportional Limit, psi				
	9	F_{co} Column Yield Stress, psi				
	10	E_c Modulus of Elasticity, psi				
SHEAR	11	F_{su} Ultimate Stress, psi				
	12	F_{st} Torsional Modulus of Rupture, psi				
	13	F_{sp} Proportional Limit (torsion), psi				
	14	G Modulus of Rigidity (torsion), psi				
BEARING	15	F_{br} Ultimate Stress, psi				
	16	Rockwell Number				
	17	Brinell Number				
FATIGUE	18	F_{be} Bending Endurance Limit, psi (300,000,000 cycles of completely reversed stress)				
	19	F_{se} Torsional Endurance Limit, psi (20,000,000 cycles of completely reversed stress)				
20	w	Specific Weight, lb/cu in.		lb/cu ft.		
21		Nominal Chemical Composition				
22		REMARKS 1. See notes in Chapter 3.				

TABLE 6 - 3 (REVISED OCT '40)
MECHANICAL PROPERTIES OF MATERIALS

MAGNESIUM ALLOY
FORGINGS

CONDITION			①	②	③	④
SPECIFICATION			ARMY	11321		
			NAVY			
			FEDERAL			
			SAE			
TENSION	1	F_{tu} Ultimate Stress, psi	42 000			
	2	F_{ty} Yield Stress, psi	24 000			
	3	F_{tp} Proportional Limit, psi				
	4	E Modulus of Elasticity, psi				
	5	Elongation in 2 in., %	5			
COMPRESSION	6	F_{cu} Ultimate (block) Stress, psi				
	7	F_{cy} Yield Stress, psi				
	8	F_{cp} Proportional Limit, psi				
	9	F_{co} Column Yield Stress, psi				
	10	E_c Modulus of Elasticity, psi				
SHEAR	11	F_{su} Ultimate Stress, psi				
	12	F_{st} Torsional Modulus of Rupture, psi				
	13	F_{sp} Proportional Limit (torsion), psi				
	14	G Modulus of Rigidity (torsion), psi				
BEARING	15	F_{br} Ultimate Stress, psi				
	16	Rockwell Number				
	17	Brinell Number				
FATIGUE	18	F_{be} Bending Endurance Limit, psi (300,000,000 cycles of completely reversed stress)				
	19	F_{se} Torsional Endurance Limit, psi (20,000,000 cycles of completely reversed stress)				
20	w	Specific Weight, lb/cu in. lb/cu ft.				
21		Nominal Chemical Composition				
22		REMARKS 1. See notes in Chapter 3.				

TABLE 6 - 4 (REVISED OCT 40)
MECHANICAL PROPERTIES OF MATERIALS

MAGNESIUM
CASTING ALLOYS²

CONDITION		①	②	③	④		
		SAND CASTING CONDITION HT	SAND CASTING CONDITION HTA	SAND CASTING AS CAST	DIE CASTING		
SPECIFICATION		ARMY	57-74-1 (Grade 1)	57-74-1 (Grade 1)	57-74-1 (Grade 2)	113119	
		NAVY	M-112 (Alloy 4)	M-112 (Alloy 4)	M-112 (Alloy 11)		
		FEDERAL					
		SAE					
TENSION	1	F_{tu}	Ultimate Stress, psi	32 000	34 000	12 000	31 000
	2	F_{ty}	Yield Stress, psi	10 000	16 000		
	3	F_{tp}	Proportional Limit, psi				
	4	E	Modulus of Elasticity, psi	6 000 000	6 000 000	6 000 000	
	5		Elongation in 2 in., %	7	3	3	2
COMPRESSION	6	F_{cu}	Ultimate (block) Stress, psi				
	7	F_{cy}	Yield Stress, psi				
	8	F_{cp}	Proportional Limit, psi				
	9	F_{co}	Column Yield Stress, psi				
	10	E_o	Modulus of Elasticity, psi				
SHEAR	11	F_{su}	Ultimate Stress, psi				
	12	F_{st}	Torsional Modulus of Rupture, psi				
	13	F_{sp}	Proportional Limit (torsion), psi				
	14	G	Modulus of Rigidity (torsion), psi				
BEARING	16	F_{br}	Ultimate Stress, psi				
	16		Rockwell Number				
	17		Brinell Number	51	65	33	
FATIGUE	18	F_{be}	Bending Endurance Limit, psi (300,000,000 cycles of completely reversed stress)				
	19	F_{se}	Torsional Endurance Limit, psi (20,000,000 cycles of completely reversed stress)				
20	w	Specific Weight, lb/cu in.		lb/cu ft.			
21		Nominal Chemical Composition					
22	REMARKS						
	<ol style="list-style-type: none"> See notes in Chapter 3. The above values are minimum values obtained from cast test bars. Due to the differences between the actual casting and the test bars, these values should be reduced by 50 percent when used for determining allowable stresses. 						

TABLE 6-5
MECHANICAL PROPERTIES OF MATERIALS

MISCELLANEOUS
CASTING ALLOYS²

CONDITION			① ALUMINUM BRONZE	② MANGANESE BRONZE	③ BRONZE	④ BRONZE	
SPECIFICATION	ARMY						
	NAVY		46B18	49B3	46B23	46B6	
	FEDERAL		QQ-B-671	QQ-B-726	QQ-B-691 Grade 2	QQ-B-691 Grade 6	
	SAE						
TENSION	1	F_{tu}	Ultimate Stress, psi	65 000	65 000	27 000	35 000
	2	F_{ty}	Yield Stress, psi	30 000	30 000		
	3	F_{tp}	Proportional Limit, psi	12 000	12 000		
	4	E	Modulus of Elasticity, psi	14 000 000	14 000 000		
	5		Elongation in 2 in., %				
COMPRESSION	6	F_{cu}	Ultimate (block) Stress, psi	50 000	50 000		
	7	F_{cy}	Yield Stress, psi				
	8	F_{cp}	Proportional Limit, psi				
	9	F_{co}	Column Yield Stress, psi				
	10	E_c	Modulus of Elasticity, psi				
SHEAR	11	F_{su}	Ultimate Stress, psi	40 000	40 000		
	12	F_{st}	Torsional Modulus of Rupture, psi	60 000	60 000		
	13	F_{sp}	Proportional Limit (torsion), psi				
	14	G	Modulus of Rigidity (torsion), psi	4 500 000	4 500 000		
BEARING	15	F_{br}	Ultimate Stress, psi	80 000	80 000		
	16		Rockwell Number				
	17		Brinell Number				
FATIGUE	18	F_{be}	Bending Endurance Limit, psi (300,000,000 cycles of completely reversed stress)	14 000	14 000		
	19	F_{se}	Torsional Endurance Limit, psi (20,000,000 cycles of completely reversed stress)				
20	w	Specific Weight, lb/cu in.		lb/cu ft.			
21		Nominal Chemical Composition					
22	REMARKS						
	<p>1. See notes in Chapter 3.</p> <p>2. The above values are minimum values obtained from cast test bars. Due to the differences between the actual casting and the test bars, these values should be reduced by 50 percent when used for determining allowable stresses.</p>						

CHAPTER 7

NON-METALLIC MATERIALS

NON-METALLIC MATERIALS

7.0

GENERAL PROPERTIES

7.00 Although no attempt has been made to include the strength properties and related characteristics of non-metallic materials in this issue of the handbook, it is anticipated that such material will eventually be issued as supplements.

CHAPTER 8

APPENDIX

TABLE 8-2

AREAS AND MOMENTS OF INERTIA OF SOLID
CIRCULAR SECTIONS

Size of rivet, bolt or pin	Machine screw size	Area of solid section sq. in.	Moment of inertia of solid section, sq. in.
1/16		.003068	.00000075
3/32		.006902	.00000379
.112	No. 4	.009852	.00000772
1/8		.012272	.00001198
.138	No. 6	.014957	.00001781
5/32		.01918	.00002926
.164	No. 8	.02112	.00003549
3/16		.02761	.00006066
.190	No. 10	.02835	.00006399
.216	No. 12	.03664	.0001069
7/32		.03758	.0001125
1/4		.04908	.0001918
5/16		.07669	.0004682
3/8		.1105	.0009710
7/16		.1503	.001797
1/2		.1963	.003069
9/16		.2485	.004914
5/8		.3068	.007492
3/4		.4418	.01553
7/8		.6013	.02878
1		.7854	.04908

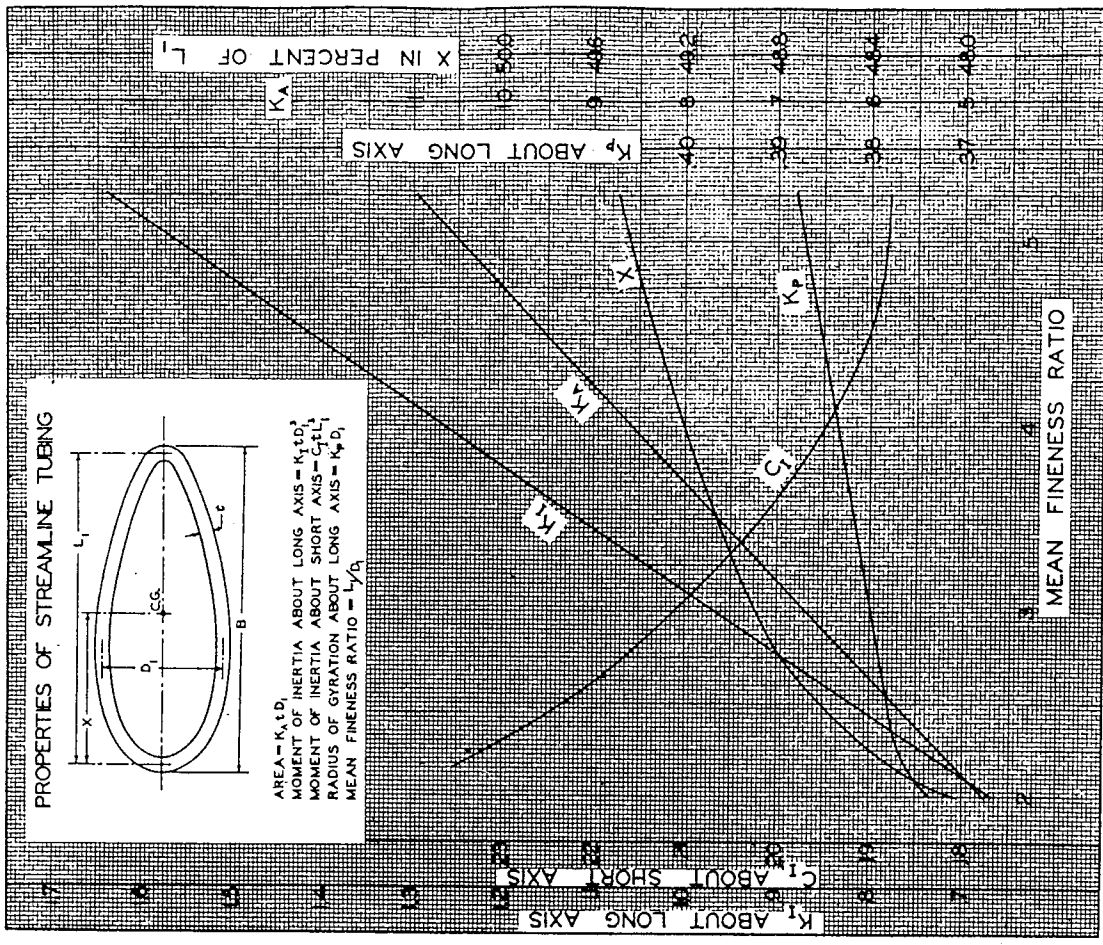


FIG. 8-2. PROPERTIES OF STREAMLINE TUBING

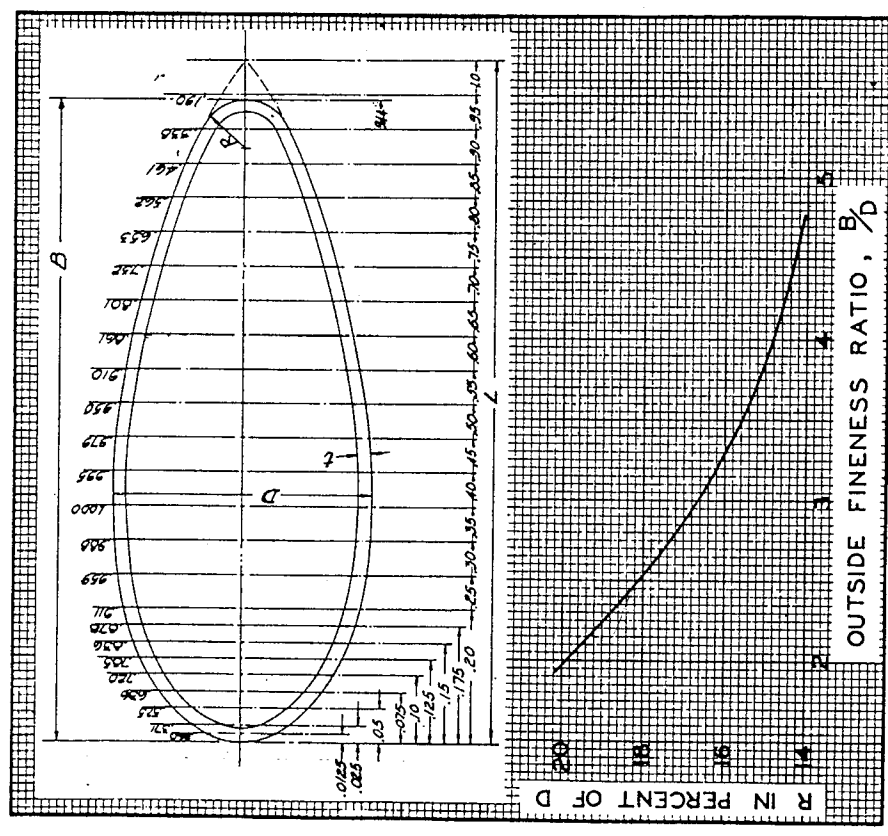


FIG. 8-1. SECTION OF STREAMLINE TUBING