CHAPTER 3

METALS - GENERAL

3.0   EXPLANATION OF MECHANICAL PROPERTIES TABLES

3.00   The general allowable strength properties of various metals are given in the tables at the end of each chapter. In general, these properties correspond to the specification values and are the minimum which will be accepted under the given specification. Conversely, they represent the maximum values which are acceptable for strength calculations. In connection with these tables the following notes apply to the various items, the numbers below corresponding to the numbers on the tables:

(1) F_{tu} - Ultimate tensile stress. (From tests of standard specimens).

(2) F_{ty} - Tensile stress at which the permanent strain equals 0.002. (From tests of standard specimens).

(3) F_{tp} - Tensile stress at which the permanent strain equals 0.0001. (From tests of standard specimens).

(4)   E   - Average ratio of stress to strain for stress below proportional limit.

(5)   Elongation - This factor is a measure of the ductility of the material and is based on a tension test.

(6) F_{cu} - Ultimate (block) compressive stress. (Obtained from flat end compression tests of specimens having an L/ρ of approximately 12).

(7) F_{cy} - Same as (3), but obtained from a compression test.

(8) F_{cp} - Same as (2), but obtained from a compression test.

(9) F_{co} - Column yield stress. Upper limit of the allowable column stress for primary failure. (See Sec. 1.513).

(10) E_c - Same as (4), but obtained from a compression test.

(11) F_{su} - Ultimate stress in pure shear. This value represents the average shearing stress over the cross section and applies to cases in which an actual shear failure takes place. (Such as the shear failure of rivets or bolts).

(12) F_{st} - Modulus of rupture in torsion. This value applies only to solid cylindrical specimens having a length to diameter ratio of approximately 19.

(13) F_{sp} - Proportional limit in torsion. This represents the shearing stress at which the permanent strain equals 0.0001, as obtained from torsion tests.

(14)   G   - Modulus of rigidity in shear. This corresponds to the value E for tensile stresses. It will apply in calculating the shear deflection of webs, provided that no wrinkling occurs.

(15) F_{br} - Ultimate bearing stress. This value may be used for the design of the connecting elements of rigid joints only when there is no possibility of relative movement between the parts joined, without deformation of these parts.

(16) Rockwell Number - These values are useful as a means of checking the uniformity of a material and as an approximate means of determining the ultimate tensile stress of wrought materials.

(17) Brinell Number - These values serve the same purposes as item (16) above.

(17a) Vickers Numbers - Similar to Brinell.

(18) F_{be} - Endurance limit in bending. This value is the maximum alternating bending stress which a polished specimen can withstand for a given number of cycles of completely reversed stress. Based on rotating-beam tests. The value may be lowered by stress concentration, surface roughness, corrosion, and overstraining. (See Sec. 1.416).

(19) F_{se} - Endurance limit in torsion. This value is the maximum alternating stress that the material can withstand for a specified number of complete reversale.

(20) w - Specific weight. Values given are average values.

(21) The nominal chemical composition is given for reference purposes only. See the corresponding Army, Navy, Federal, or SAE specification for details as to chemical composition.

3.01 The methods of using the materials and their allowable strength properties will be specified by the procuring or licensing agency. That is, additional factors of safety or arbitrary reductions in allowable stresses may be considered necessary in particular cases. In general, the values listed represent "safe" values for materials conforming to the specifications given.