H.1 Members Subject to Flexure and Axial Force

Use of the interaction equation given in H.1 is predicated on a stability analysis performed in accordance with Chapter C. If the analysis is not performed in accordance with Chapter C, using the interaction equation given in Section H.1 can be unconservative.

H.2 Members Subject to Torsion

H.2.1 Round or Oval Tubes

The equation for equivalent h/t is based on the theoretical elastic buckling strength of cylinders in torsion. Tubes loaded in torsion are not as sensitive to the effect of initial imperfections in the geometry as are tubes loaded in axial compression. Battdorf, et. al. (1947) showed this gives good agreement with the results of tests on thin cylinders that fail in the elastic range, and Clark and Rolf (1964) showed this agrees well with experimental results in the inelastic stress range. The elastic buckling strength of cylinders in torsion matches AISC (2005) Specification Section H.3.1, since

$$\frac{\pi^2 E}{(1.25\lambda_t)^2} = \frac{1.23E}{\sqrt{L/D}(D/t)^{5/4}}$$

where $\lambda_t = 2.9(R/t)^{5/8}(L/R)^{1/4}$ and $R = D/2$

Sharp (1993) noted that the equivalent slenderness ratio for tubes can give very conservative results for long tubes with both longitudinal and circumferential stiffeners. Figure CH.2.1 shows the change in the coefficient in Equation H.2-2 with length of tube. A coefficient of 2.9 is specified for all cases (solid line in Figure CH.2.1). A more accurate and less conservative value for long tubes is less than 2.9 as illustrated by the dashed line in Figure CH.2.1. The ordinate in this figure is a rearrangement of Equation H.2-2. The addition of longitudinal stiffeners as well as circumferential stiffeners usually increases the shear strength of a tube compared to a tube with circumferential stiffeners only.

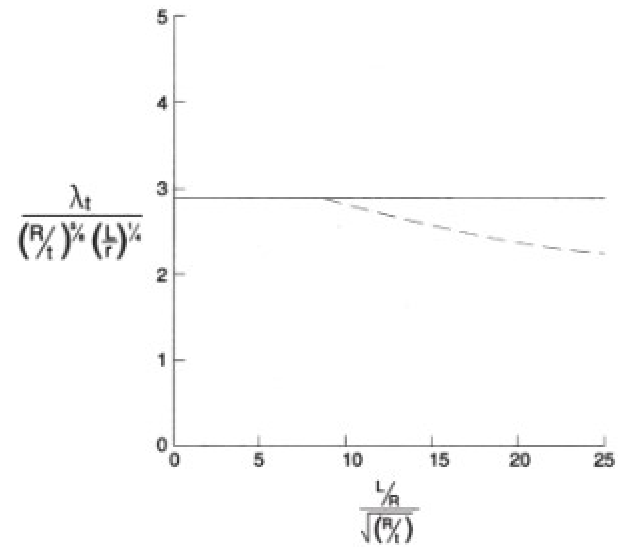

Figure CH.2.1
SHEAR BUCKLING OF TUBES WITH CIRCUMFERENTIAL STIFFENERS

H.2.2 Rectangular Tubes

Rectangular tubes were not specifically addressed before the 2010 *Specification*. The 2005 AISC *Specification* section H3.1(b) addresses rectangular tubes with equations that give the same limit state shear stress as the equations given in AISC *Specification* section G2.1(b)(i). H.2.2 matches the AISC approach, but uses the limit state shear stresses for aluminum webs given in the 2010 SAS Section G.2.1.

The torsion constant C for rectangular tubes of constant wall thickness t may be conservatively taken as

$$C = 2(b - t)(d - t)t - 4.5(4 - \pi)t^3$$

where

b = width of the tube
d = depth of the tube.

H.2.3 Rods

Since shear buckling cannot occur in a rod, Section H.2.3 simply uses shear yielding as the limit state shear stress for a rod.

H.3 Members Subject to Torsion, Flexure, Shear, and/or Axial Compression

H.3.1 Flat Elements

Equations H.3-1 and H.3-2 are documented in Galambos (1998) (equation 4.32).

H.3.2 Curved Elements

Equations H.3-3 and H.3-4 are documented in Galambos (1998) (equation 14.57), which is based on work by Schilling (1965).