

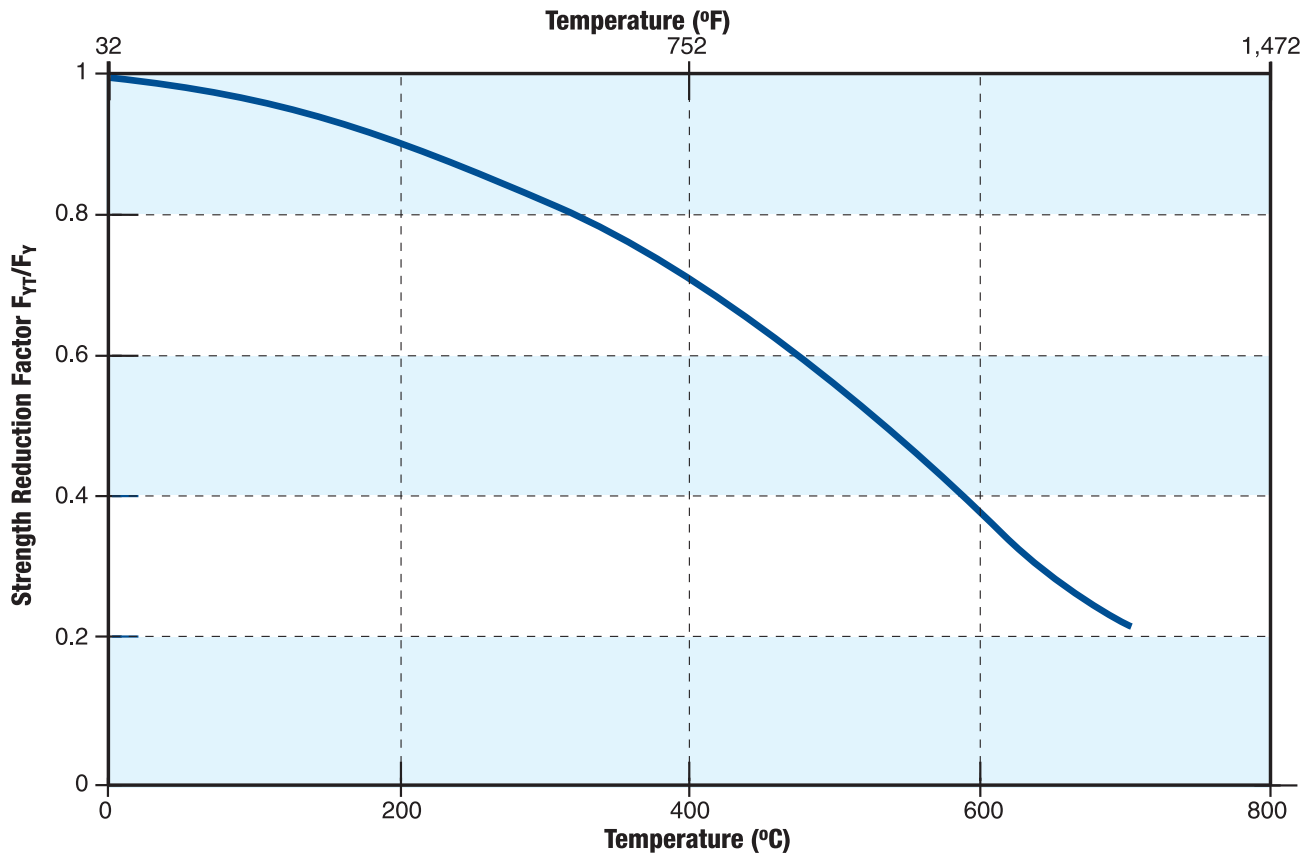


Figure A-6 Strength of steel at elevated temperatures (Lie 1992).

The modulus of elasticity, E_0 , is about 210×10^3 MPa for a variety of common steels at room temperature. The variation of the modulus of elasticity with temperature for structural steels and steel reinforcing bars is presented in Figure A-7. As in the case of strength, if the steel attains a temperature of 550 °C (1,022 °F), the modulus of elasticity is reduced to approximately half of the value at ambient temperature.

Figure A-8 shows the variation of yield strength of light gauge steel at elevated temperatures, corresponding to 0.5 percent, 1.5 percent, and 2 percent strains based on the relationships in Gerlich (1995), Makelainen and Miller (1983), and BSI (2000).

In addition to the changes in the properties with increasing temperature, steel expands with increasing temperature. The coefficient of thermal expansion for structural steel is approximately 11×10^{-6} mm/mm-°C. Consequently, an unrestrained, 20-meter-long steel member that experiences a temperature increase of 500 °C (1,022 °F) will expand approximately 110 mm. WTC 5 had many buckled girders and beams on the burned-out fire floors where the expansion was restrained.

An approximate melting point for steel is 1,400 °C (2,500 °F); however, the melting temperature for a particular steel component varies with the steel alloy used.