

8.D6 We are asked in this problem to calculate the stress levels at which the rupture lifetime will be 1 year and 15 years when an 18-8 Mo stainless steel component is subjected to a temperature of 650°C (923 K). It first becomes necessary to calculate the value of the Larson-Miller parameter for each time. The values of t_r corresponding to 1 and 15 years are 8.76×10^3 h and 1.31×10^5 h, respectively. Hence, for a lifetime of 1 year

$$T(20 + \log t_r) = 923 \left[20 + \log (8.76 \times 10^3) \right] = 22.10 \times 10^3$$

And for $t_r = 15$ years

$$T(20 + \log t_r) = 923 \left[20 + \log (1.31 \times 10^5) \right] = 23.18 \times 10^3$$

Using the curve shown in Figure 8.35, the stress values corresponding to the one- and fifteen-year lifetimes are approximately 110 MPa (16,000 psi) and 80 MPa (11,600 psi), respectively.