The special stress limits of NG-3227 do not apply to threaded structural fasteners. For connections joining parts of pressure-retaining boundaries see Section III Appendices, Mandatory Appendix XIII, Article XIII-4000.

NG-3232 Level A Service Limits

The number and cross-sectional area of threaded structural fasteners shall be such that the stress intensity limits of this paragraph are satisfied for the Service Loadings for which Level A Limits are designated in the Design Specifications. The stress intensity limits are summarized in Figure NG-3232-1. Any deformation limit prescribed in the Design Specifications shall be considered. The total axial load transferred through the fastener threads shall not go to or through zero during the specified Service Loadings.

NG-3232.1 Average Stress. Elastic analysis of specified conditions shall show that the average primary plus secondary membrane stress including stress from preload meets the following requirements:

(a) The maximum value of the membrane stress intensity averaged across either the area of the fastener shank or the tensile stress area of the threads shall be no greater than the lesser of either $0.9S_y$ or $\frac{2}{3}S_u$, where $S_y$ and $S_u$ are determined at service temperature.

(b) The average shear stress across the threads when loaded in pure shear shall be no greater than $0.6S_y$, where $S_y$ is determined at service temperature.

(c) The average value of bearing stress under the fastener head shall be no greater than $2.7S_y$, where $S_y$ is determined at service temperature.

(d) The primary membrane stress intensity $P_m$ due only to Design Mechanical Loads applied to the fastener shall be no greater than $S_m$, where $S_m$ is determined at service temperature.

(e) If a tight joint is required, the stress due to preload shall be greater than that due to primary and secondary membrane stress excluding preload.

(f) The primary shear stress across the threads when loaded in pure shear due only to Design Mechanical Loads applied to the fastener shall be no greater than $0.6S_m$, where $S_m$ is determined at service temperature.

\[ P_m + Q_m + P_b + Q_b \leq 1.2S_y \]
\[ \text{Lesser of these in shank or threads} \]
\[ \text{NG-3232.2} \]
\[ (NG-3232.3) \]

\[ S_m \]
\[ \text{Shank or threads} \]
\[ \text{NG-3232.1d(i)} \]

\[ P_m + Q_m + P_b + Q_b + F \]
\[ \text{Lesser of these in shank or threads} \]
\[ \text{NG-3232.2} \]
\[ (NG-3232.3) \]

\[ S_y \]
\[ \text{Thread shear} \]
\[ \text{NG-3232.1b(i)} \]

\[ S_m \]
\[ \text{Bearing under head} \]
\[ \text{NG-3232.1c(i)} \]

\[ P_m + Q_m \]
\[ \text{or} \]
\[ 2/3S_m \]
\[ \text{or} \]
\[ 0.6S_y \]
\[ \text{Lesser of these in shank or threads} \]
\[ \text{NG-3232.1a(i)} \]
\[ (Notes 4 and 5) \]

\[ P_m \]
\[ \text{Shank or threads} \]
\[ \text{NG-3232.1d(i)} \]

NOTES:

(1) If a tight joint is required, the stress due to preload should exceed that due to primary plus secondary membrane stress other than preload.

(2) $Q_m$ are secondary membrane stresses.

(3) $Q_b$ are secondary bending stresses.

(4) For torquing during installation, the maximum membrane stress intensity shall not exceed 1.2 times these values at installation temperature.

(5) For threaded structural fasteners, in lieu of satisfying these primary plus secondary stress limits, a limit analysis using the methods of NG-3228.2, or experimental analysis using the methods of NG-3228.4, may be performed. These alternate analyses do not apply for torquing during installation.