XIII-3140 PRIMARY STRESS LIMITS FOR PIPING

For Class 1 piping components operating within the temperature limits of the applicable Subsection, the requirements of XIII-3141 through XIII-3144 shall apply.

XIII-3141 Design Limits

The stress intensity limits for Class 1 components in Table XIII-3110-1 shall be satisfied.

XIII-3142 Level B Service Limits

(a) For Service Loadings for which Level B Service Limits are designated that do not include reversing dynamic loads [see XIII-1300(aa)] or that have reversing dynamic loads combined with nonreversing dynamic loads [see XIII-1300(q)], the stress intensity limits for Class 1 components in Table XIII-3110-1 shall be satisfied.

(b) For Service Loadings for which Level B Service Limits are designated that include reversing dynamic loads that are not required to be combined with nonreversing dynamic loads, the nonreversing dynamic loads shall meet the requirements of (a) above. The reversing dynamic loads shall meet the requirements of XIII-3420 and XIII-3520 as a unique load set. The reversing dynamic loads are not required to meet (a) above.

XIII-3143 Level C Service Limits

(a) For Service Loadings for which Level C Service Limits are designated that do not include reversing dynamic loads or that have reversing dynamic loads combined with nonreversing dynamic loads, the requirements of XIII-3110, XIII-3120, XIII-3130, XIII-3300, and XII-3740 shall be satisfied. If the effects of anchor motion due to reversing dynamic loads are not considered in XIII-31421(b), then they shall satisfy the requirements of (b)(5) and (b)(6) below.

(b) As an alternative to (a) above, for piping fabricated from material designated P-No. 1 through P-No. 9 in Section II, Part D, Subpart 1, Table 2A and limited to $D_o/t \leq 40$ for Level C Service Limits, that include reversing dynamic loads that are not required to be combined with nonreversing dynamic loads, the requirements of (1) through (6) below shall apply.

(1) The pressure coincident with the reversing dynamic load shall not exceed the Design Pressure.

(2) The requirements of XIII-3110, XIII-3120, XIII-3130, XIII-3300 and XIII-3740 shall be satisfied for all nonreversing dynamic load combinations provided in the Design Specifications.

(3) The stress intensity for primary membrane plus bending stresses, $(P_m + P_b)$, due to weight loads shall not exceed $0.5S_m$.

(4) The stress intensity for primary membrane plus bending stresses, $(P_m + P_b)$, resulting from the combination of pressure, weight, and reversing dynamic loads shall not exceed the following:

(-a) in elbows and bends: $3.1S_m$

(-b) in tees and branches: $3.1S_m$

(-c) in all other components: $2.1S_m$

(5) The stress intensity range of secondary stresses, $Q$, resulting from anchor motion effects due to reversing dynamic loads shall not exceed $4.2S_m$.

(6) The use of the $4.2S_m$ limit in (5) assumes essentially linear behavior of the entire piping system. This assumption is sufficiently accurate for systems where plastic straining occurs at many points or over relatively wide regions, but fails to reflect the actual strain
distribution in unbalanced systems where only a small portion of the piping undergoes plastic strain. In these cases, the weaker or higher-stressed portions will be subjected to strain concentration due to elastic follow-up of the stiffer or lower-stressed portions. Unbalance can be produced by

(-a) the use of small pipe runs in series with larger or stiffer pipe, with the small lines relatively highly stressed

(-b) local reduction in size or cross section, or local use of weaker material.

In the case of unbalanced systems, the design shall be modified to eliminate the unbalance, or the stress intensity range of secondary stresses, \( Q \), shall be limited to \( 2.1 S_m \).
for the material, the latter value shall be used if there is to be a large number of cycles because strain softening may occur.

**NB-3224.2 External Pressure.** The permissible external pressure shall be taken as 120% of that given by the rules of NB-3133.

**NB-3224.3 Special Stress Limits.** The permissible values for special stress limit shall be taken as 120% of the values given in NB-3227.4, NB-3228.1, NB-3228.2, and NB-3228.3.

**NB-3224.4 Secondary and Peak Stresses.** The requirements of NB-3222.2, NB-3222.4, NB-3222.5, and NB-3227.3 need not be satisfied.

**NB-3224.5 Fatigue Requirements.** Service Loadings for which Level C Service Limits are designated need not be considered when applying the procedures of NB-3222.4(a) to determine whether or not a fatigue analysis is required.

**NB-3224.6 Deformation Limits.** Any deformation limits prescribed by the Design Specifications shall be considered.

**NB-3224.7 Piping Requirements.**

(a) For Level C Service Limits which do not include reversing dynamic loads or have reversing dynamic load combined with nonreversing dynamic loads, the requirements of NB-3224.1 through NB-3224.6 above shall be satisfied. If the effects of anchor motion due to reversing dynamic loads are not considered in NB-3223(b)(2), then they shall satisfy the requirements of (b)(5) and (b)(6) below.

(b) As an alternative to (a) above, for piping fabricated from material designated P-No. 1 through P-No. 9 in Section II, Part D, Subpart 1, Table 2A and limited to \( D_{p}/t \leq 40 \) for Level C Service Limits, which include reversing dynamic loads that are not required to be combined with nonreversing dynamic loads, the requirements of (1) through (6) below shall apply.

1. The pressure coincident with the reversing dynamic load shall not exceed the Design Pressure.
2. The requirements of NB-3224.1 through NB-3224.6 shall be satisfied for all nonreversing dynamic load combinations provided in the Design Specifications.
3. The primary membrane plus bending stress \((P_m + P_b)\) or the local membrane plus bending stress \((P_L + P_b)\) due to weight loads shall not exceed 0.5\(S_m\).
4. The primary membrane plus bending stress \((P_m + P_b)\) or the local membrane plus bending stress \((P_L + P_b)\) resulting from the combination of pressure, weight, and reversing dynamic loads shall not exceed the following:
   - (a) in elbows and bends: 3.1\(S_m\)
   - (b) in tees and branches: 3.1\(S_m\)
   - (c) in all other components: 2.1\(S_m\)
5. The range of secondary stress, \(Q\), resulting from anchor motion effects due to reversing dynamic loads shall not exceed 4.2\(S_m\).