

ASME BPVC.III.1.NB-2017

(2) The design of the welded joints shall be such that the stresses will not exceed the limits described in Section III Appendices, Mandatory Appendix XIII, Article XIII-3000 and tabulated in Section II, Part D, Subpart 1, Tables 2A and 2B.

(3) A fatigue strength reduction factor of 4 shall be used in the fatigue analysis of the joints.

(4) The requirements of NB-4440 and NB-5260 shall be satisfied.

**NB-3137 Reinforcement for Openings**

The requirements applicable to vessels and piping are contained in NB-3330 and NB-3643, respectively.

Add the following terms to the NB-3324 Nomenclature list:

$L$  = inside crown center radius of curvature  
 $r$  = inside knuckle radius  
 $D$  = inside diameter of a head skirt or the attached cylinder.  $D$  is also equal to the length of the major axis of an ellipsoidal head.

(1) performing an evaluation of service and test conditions by methods similar to those contained in Section III Appendices, Nonmandatory Appendix G; or

(2) for piping, pump, and valve material thickness greater than 2 1/2 in. (64 mm) establishing a lowest service

**NB-3324.3 Ellipsoidal and Torispherical Heads**

For heads where,  $t/L > 0.002$  and  $r/D > 0.06$ , use the equation in NB-3324.2 and substitute  $L$  for  $R$ .  $L$  is not permitted to be larger than  $D$ . For an ellipsoidal head  $L = (1/2 \text{ major axis of the ellipse})^2 / (1/2 \text{ minor axis of the ellipse})$ . For heads outside of these limits, tentative thickness may be determined using the stress analysis methods of NB-3200 with consideration of buckling.

**NB-3320 DESIGN CONSIDERATIONS**

**NB-3321 Design and Service Loadings**

The provisions of NB-3110 apply.

**NB-3322 Special Considerations**

The provisions of NB-3120 apply.

**NB-3323 General Design Rules**

The provisions of NB-3130 apply except when they conflict with rules of this subarticle. In case of conflict, this subarticle governs in the design of vessels.

**NB-3324 Tentative Pressure Thickness**

(17)

The following equations are given as an aid to the designer for determining a tentative thickness for use in the design. They are not to be construed as equations for acceptable thicknesses. However, except in local regions (Section III Appendices, Mandatory Appendix XIII, XIII-3120), the wall thickness of a vessel shall never be less than that obtained from the equations in NB-3324.1 and NB-3324.2, in which:

- $P$  = Design Pressure
- $R$  = inside radius of shell or head
- $R_o$  = outside radius of shell or head
- $S_m$  = design stress intensity values (Section II, Part D, Subpart 1, Tables 2A and 2B)
- $t$  = thickness of shell or head

**NB-3324.1 Cylindrical Shells.**

$$t = \frac{PR}{S_m - 0.5P} \text{ or } t = \frac{PR_o}{S_m + 0.5P}$$

**NB-3324.2 Spherical Shells.**

$$t = \frac{PR}{2S_m - P} \text{ or } t = \frac{PR_o}{2S_m}$$

**NB-3330 OPENINGS AND REINFORCEMENT**

**NB-3331 General Requirements for Openings**

(17)

(a) For vessels or parts thereof which meet the requirements of Section III Appendices, Mandatory Appendix XIII, XIII-3510, analysis showing satisfaction of the requirements of Section III Appendices, Mandatory Appendix XIII, XIII-3100 and XIII-3400 in the immediate vicinity of the openings is not required for pressure loading if the rules of NB-3330 are met.

(b) For vessels or parts thereof that do not meet the requirements of Section III Appendices, Mandatory Appendix XIII, XIII-3510 so that a fatigue analysis is required, the rules contained in NB-3330 ensure satisfaction of the requirements of Section III Appendices, Mandatory Appendix XIII, XIII-3100 in the vicinity of openings, and no specific analysis showing satisfaction of those stress limits is required for pressure loading. The requirements