NB-3512 Acceptability of Large Valves

Valve designs having an inlet piping connection larger than NPS 4 (DN 100) are acceptable when they satisfy either the standard design rules or one of the alternative design rules.

NB-3512.1 Standard Design Rules. The design shall be such that requirements of this subarticle are met. The requirements of NB-3530 through NB-3550 apply to valves of conventional shape having generally cylindrical or spherical bodies with a single neck of a diameter commensurate with that of the main body portion, such as having a neck inside diameter less than twice the main run inside diameter in the neck region.

NB-3512.2 Alternative Design Rules. A valve design may not satisfy all of the requirements of NB-3512.1. A design may be accepted provided it meets one of the alternatives listed in (a), (b), (c), or (d) below.

(a) When the valve design satisfies the rules of NB-3530 through NB-3546.2 with thermal stresses neglected, the rules of Section III Appendices, Mandatory Appendix XIII relative to accounting for thermal secondary stresses and fatigue analysis (Section III Appendices, Mandatory Appendix XIII, XIII-3410, XIII-3420, and XIII-3500) shall also be satisfied.

(b) When a valve is exempted from fatigue analysis by the rules of Section III Appendices, Mandatory Appendix XIII, XIII-3510, the design is acceptable, provided that the requirements of (1) or (2) below are met.

(1) The rules of NB-3530 through NB-3546 shall be met. The rules of Section III Appendices, Mandatory Appendix XIII may be substituted for those of NB-3545.2 for evaluating secondary stresses, and NB-3545.3 need not be considered.

(2) The rules of NB-3530 and NB-3541 shall be met. An experimental stress analysis is performed in accordance with Section III Appendices, Mandatory Appendix II, and the rules of Section III Appendices, Mandatory Appendix XIII with respect to primary and secondary stresses resulting from pressure and mechanical loads shall be met. Unless otherwise specified in the Design Specifications, the pipe reactions shall be taken as those parts defined by NB-3546.3(a), and shall also meet all of the following requirements.

(1) Pressure, thermal, and mechanical effects, such as those resulting from earthquake, maximum stem force, closure force, assembly forces, and others that may be defined in the Design Specification, shall be included in the design analysis. For Level A Service Limits, the pipe reaction effects are to be determined by considering that the maximum fiber stress in the connected pipe is at one-half of its yield strength in direct tension and at its yield strength in torsion and in bending in the plane of the neck and run, and at its yield strength in direct tension in the plane of the neck. No pipe reaction effects shall be accounted for in the extrapolation stress analysis. The analytical procedure shall have verified capability of providing this extrapolation.

(2) In place of using the values of $S_m$ to satisfy the rules of Section III Appendices, Mandatory Appendix XIII, the allowable stress intensity values for ferritic valve body and bonnet materials shall be those allowable stress values given in Section II, Part D, Subpart 1, Table 1A. For materials in Section II, Part D, Subpart 1, Tables 2A and 2B, a reduced allowable stress intensity based on applying a factor of 0.67 to the yield strengths listed in Section II, Part D, Subpart 1, Table Y-1 shall be used.

(3) The adequacy of the stress analysis of the body and bonnet shall be verified by experimental stress analysis conducted in accordance with the requirements of Section III Appendices, Mandatory Appendix II, II-1100 through II-1400. Individual tests shall be made to verify the adequacy of the stress analysis of internal pressure effects and pipe reaction effects. Tests shall be made on at least one valve model of a given configuration, but a verified analytical procedure may then be applied to other valves of the same configuration, although they may be of different size or pressure rating. The geometrical differences shall be accounted for in the extrapolation stress analysis. The analytical procedure shall have verified capability of providing this extrapolation.

(4) A Design Report shall be prepared in sufficient detail to show that the valve satisfies all applicable requirements.
ENDNOTES

1 Any postweld heat treatment time that is anticipated to be applied to the material or item after it is completed shall be specified in the Design Specification. The Certificate Holder shall include this time in the total time at temperature specified to be applied to the test specimens.

2 In addition to providing a basis for acceptance standards for material, the test data are designated to be used as a basis for establishing inservice operation and for use in fracture prevention evaluation [NB-3210(d) and Section III Appendices, Nonmandatory Appendix G].

3 The requirements for impact testing of the heat-affected zone [NB-4335.2] may result in reduced test temperatures or increased toughness requirements for the base material.

4 The methods given in the Appendix of SFA-5.9, Specification for Corrosion Resisting Chromium and Chromium-Nickel Steel Welding Rods and Bare Electrodes, shall be used to establish a welding and sampling method for the pad, groove, or other test weld to ensure that the weld deposit being sampled will be substantially free of base metal dilution.

5 The volumetric examinations required by this paragraph need only be conducted from one surface.

6 The direction of ultrasonic examinations referenced is the direction of sound propagation.

7 Lowest service temperature is the minimum temperature of the fluid retained by the component or, alternatively, the calculated volumetric average metal temperature expected during normal operation, whenever pressure within the component exceeds 20% of the preoperational system hydrostatic test pressure.

8 Communicating chambers are defined as portions of the vessel which intersect the shell or heads of a vessel and form an integral part of the pressure-retaining closure, e.g., sumps.

9 Side plates of a flat-sided vessel are defined as any of the flat plates forming an integral part of the pressure-retaining enclosure.

10 The severity and frequency of specified fluid temperature variations may be such that the period of calculated pressure integrity is less than plant design life. In such cases it is the responsibility of the Certificate Holder to state these conditions in the Design Report [NB-3560].

11 Special features such as wear surfaces or seating surfaces may demand special alloys or proprietary treatments. The absence of such materials from Section II, Part D, Subpart 1, Tables 2A and 2B shall not be construed to prohibit their use and such materials do not require approval under Section III Appendices, Mandatory Appendix IV [NB-2121].

12 Normal service is defined as service, other than startup and shutdown, resulting in specified Service Loadings for which Level A Limits, Level B Limits, or Testing Limits are designated.

13 t equals nominal wall thickness.

14 Welds that are exposed to corrosive action should have a resistance to corrosion that is not substantially less than that of the cladding. The use of filler metal that will deposit weld metal which is similar to the composition of the cladding material is recommended. If weld metal of different composition is used, it should have properties compatible with the application.

15 An intermediate postweld heat treatment for this purpose is defined as a postweld heat treatment performed on a weld within a temperature range not lower than the minimum holding temperature range to which the weld shall be subjected during the final postweld heat treatment.

16 A radiographic examination [NB-5111(a)] is required; a preservice examination [NB-5111(b)] may or may not be required for compliance to the Design Specification [NCA-3252(e)].
methods. Such temporary piping shall be designed to safeguard against rupture or other failure which could become a hazard to health or safety.

**NC-3690 DIMENSIONAL REQUIREMENTS FOR PIPING PRODUCTS**

**NC-3691 Standard Piping Products**

Dimensions of standard piping products shall comply with the standards and specifications listed in Table NCA-7100-1.

**NC-3692 Nonstandard Piping Products**

The dimensions of nonstandard piping products shall be such as to provide strength and performance equivalent to standard products, except as permitted in NC-3641.

**NC-3700 ELECTRICAL AND MECHANICAL PENETRATION ASSEMBLIES**

**NC-3720 DESIGN RULES**

(a) The design of the pressure-retaining portion of electrical and mechanical penetration assemblies shall be the same as for vessels (NC-3300).

(b) For closing seams in electrical and mechanical penetration assemblies meeting the requirements of NC-4730(c), the closure head shall meet the requirements of NC-3325 using a factor \( C = 0.20 \). The fillet weld shall be designed using an allowable stress of 0.5\( S \).

**NC-3800 DESIGN OF ATMOSPHERIC STORAGE TANKS**

**NC-3810 GENERAL REQUIREMENTS**

**NC-3811 Acceptability**

The requirements for acceptability of atmospheric storage tanks are given in the following subparagraphs.

**NC-3811.1 Scope.** The design rules for atmospheric storage tanks cover vertical cylindrical flat bottom above ground welded tanks at atmospheric pressure. These tanks may contain liquids such as refueling water, condensate, borated reactor coolant, or liquid radioactive waste. Such tanks may be within building structures, depending upon the liquid to be contained, or they may be above grade exposed to atmospheric conditions.

NOTE: These rules do not limit storage tanks from being installed below grade or below ground, provided the tanks are not subject to external pressure resulting from earth or fill.

**NC-3811.2 Design Requirements.** The design rules for atmospheric storage tanks shall conform to the design requirements of NC-3100 and NC-3300 except as they may be modified by the requirements of this subarticle. As an alternative, the design rules of NC-3200 may be used as a replacement of the requirements of NC-3800. The specific design requirements shall be stipulated in the Design Specifications.

**NC-3812 Design Report**

The Certificate Holder manufacturing a design conforming to the design requirements is required to provide a Design Report as part of his responsibility for achieving structural integrity of the tank. The Design Report shall be certified when required by NCA-3350.

**NC-3820 DESIGN CONSIDERATIONS**

**NC-3821 Design and Service Loadings**

(a) Loadings shall be identified as Design or Service, and if Service, they shall have Level A, B, C, or D Service Limits designated (NCA-2142).

(b) The provisions of NC-3110 shall apply.

(c) The stress limits given in NC-3821.5 shall be met.

**NC-3821.1 Design Pressure.** The Design Pressure shall be atmospheric.

The limitation of the Design Pressure to atmospheric is not intended to preclude the use of these tanks at vapor pressure slightly above or below atmospheric within the range normally required to operate vent valves. If these pressures or vacuums exceed 0.03 psig (0.2 kPa gage), especially in combination with large diameter tanks, the forces involved may require special consideration in the design.

**NC-3821.2 Design Temperature.** The Design Temperature shall not be greater than 200°F (95°C).

**NC-3821.3 Loadings.** The requirements of NC-3111 shall be met.

**NC-3821.4 Welded Joint Restrictions.** The restrictions given in (a) through (c) below on type and size of joints or welds shall apply.

(a) Tack welds shall not be considered as having any strength value in the finished structure.

(b) The minimum size of fillet welds shall be in accordance with NC-4246.6.

(c) All nozzle welds shall be in accordance with NC-4246.5.

**NC-3821.5 Limits of Calculated Stresses for Design and Service Loadings.** Stress limits for Design and Service Loadings are specified in Table NC-3821.5-1. The symbols used in Table NC-3821.5-1 are defined as follows:

\[ S = \text{allowable stress value given in Section II, Part D, Subpart 1, Tables 1A, 1B, and 3, psi (MPa).}\]