NC-3646 Closures

(a) Closures in piping systems shall be made by use of closure fittings, such as blind flanges or threaded or welded plugs or caps, either manufactured in accordance with standards listed in Table NCA-7100-1 and used within the specified pressure-temperature ratings, or made in accordance with (b) below.

(b) Closures not manufactured in accordance with the standards listed in Table NCA-7100-1 may be made in accordance with the rules contained in NC-3300 of this Subsection using the equation

\[ t_m = t + A \]

where

\[ A = \text{sum of mechanical allowances (NC-3613), in. (mm)} \]
\[ t = \text{pressure design thickness, calculated for the given closure shape and direction of loading using appropriate equations and procedures in NC-3000, in. (mm)} \]
\[ t_m = \text{minimum required thickness, in. (mm)} \]

(c) Connections to closures may be made by welding, extruding, or threading. Connections to the closure shall be in accordance with the limitations provided in NC-3643 for branch connections. If the size of the opening is greater than one-half the inside diameter of the closure, the opening shall be designed as a reducer in accordance with NC-3648.

(d) Other openings in closures shall be reinforced in accordance with the requirements of reinforcement for a branch connection. The total cross-sectional area required for reinforcement in any plane passing through the center of the opening and normal to the surface of the closure shall not be less than the quantity of \( d_s \), where

\[ d_s = \text{diameter of the finished opening, in. (mm)} \]
\[ t = \text{pressure design thickness for the closure, in. (mm)} \]

NC-3647 Pressure Design of Flanged Joints and Blanks

NC-3647.1 Flanged Joints.

(a) Flanged joints manufactured in accordance with the standards listed in Table NCA-7100-1, as limited by NC-3612.1, shall be considered as meeting the requirements of NC-3640.

(b) Flanged joints not included in Table NCA-7100-1 shall be designed in accordance with XI-3000.

NC-3647.2 Permanent Blanks. The minimum required thickness of permanent blanks (Fig. NC-3647.2-1) shall be calculated from the following equations:

\[ t_m = t + A \]

where

\[ A = \text{the sum of the mechanical allowances, in. (mm)} \]
\[ (NC-3613) \]
\[ t = d_s \left( \frac{3P}{165} \right)^{1/2} \]

where

\[ t = \text{the pressure design thickness calculated from the equation below, in. (mm)} \]
\[ t_m = \text{the minimum required thickness, in. (mm)} \]
\[ d_s = \text{the inside diameter of the gasket for raised or flat face flanges or the pitch diameter of the gasket for retained gasketed flanges, in. (mm)} \]
\[ P = \text{Design Pressure, psi (MPa)} \]
\[ S = \text{the allowable stress in accordance with Section II, Part D, Subpart 1, Tables 1A and 1B, psi (MPa)} \]

NC-3647.3 Temporary Blanks. Blanks to be used for test purposes only shall have a minimum thickness not less than the pressure design thickness \( t \) calculated as in NC-3647.2 above, except that \( P \) shall not be less than the test pressure and the allowable stress \( S \) may be taken as 95% of the specified minimum yield strength of the blank material (Section II, Part D, Subpart 1, Table Y-1).

NC-3647.4 Flanges. Flanges shall be integral or be attached to pipe by welding, braising, threading, or other means within the applicable standards specified in Table NCA-7100-1.

NC-3647.5 Gaskets.

(a) Gaskets shall be made of materials which are not injuriously affected by the fluid or by temperatures within the design temperature range.

(b) Only metallic or asbestos metallic gaskets may be used on flat or raised face flanges if the expected normal service pressure exceeds 720 psi (5 MPa) or the temperature exceeds 750°F (400°C). However, compressed sheet asbestos confined gaskets are not limited as to pressures, provided the gasket material is suitable for the temperatures.

(c) The use of metal or metal asbestos gaskets is not limited as to pressure, provided the gasket materials are suitable for the fluid Design Temperature.

NC-3647.6 Bolting.

(a) Bolts, stud bolts, nuts, and washers shall comply with applicable standards and specifications listed in Table NCA-7100-1. Unless otherwise specified, bolting shall be in accordance with the latest edition of ASME B16.5. Bolts and stud bolts shall extend completely through the nuts.

(b) Studs shall be threaded full length or shall be machined down to the root diameter of the thread in the unthreaded portion, provided that the threaded portions are at least 1-1/2 diameters in length. Studs greater than 8 diameters in length may have an unthreaded portion which has the nominal diameter of the thread, provided the following requirements are met:

(1) the threaded portions shall be at least 1-1/2 diameters in length;

(2) the stud shall be machined down to the root diameter of the thread for a minimum distance of 0.5 diameters adjacent to the threaded portion; and