



**Particle Physics Division  
Mechanical Department Engineering Note**

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Project Internal Reference: none.

Project: COUPP 1 Liter Bubble Chamber

Title: Coupp 1 liter chamber spacer flange

Author(s): Dave Pushka

Reviewer(s):

Key Words: ASME B31.3, ASME Boiler and Pressure Vessel Code VIII  
Division 1.

Applicable Codes: ASME

Abstract Summary:

The Coupp 1 liter bubble chamber vessel documented in FESHM pressure vessel engineering note PPD 10096 is being modified by the addition of a spacer flange to the 6 inch diameter port.

The spacer flange is an ANSI/ASME B16.5 class 300 flange in 304 stainless steel material and slip on style. To this flange, a short length (~5/8 of an inch) heavy wall stainless steel pipe is being welded. This pipe has been machined from a piece of A240 type 304 stainless steel plate material.

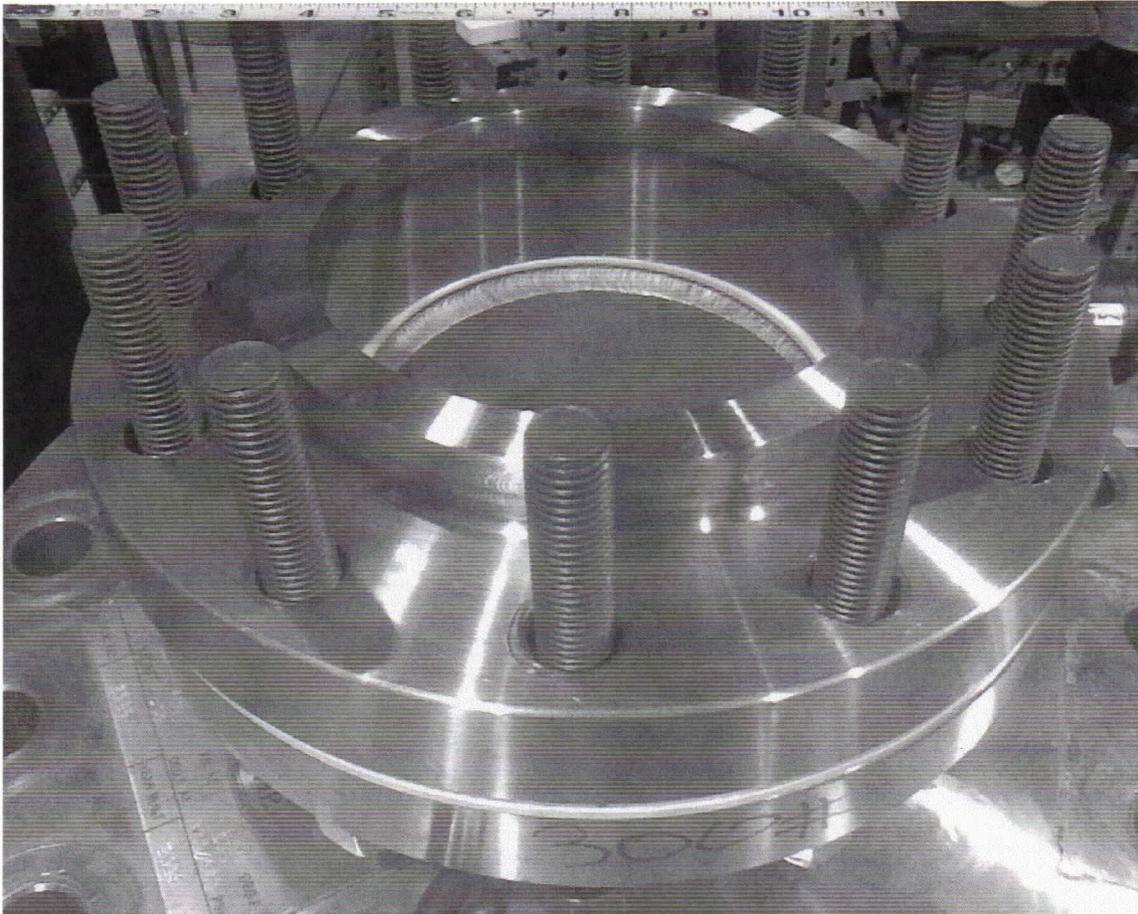
Short pipe length dimensions are 8.25 inch outside diameter, 6.75 inch inside diameter. Length (including weld prep on the B16.5 flange) is one (1)

inch from the back side of the B16.5 flange to the finished surface of the pipe.

Figure 1,  
Image of B16.5 class 300 slip on flange with short length of pipe welded on.



Figure 2, Spacer Flange installed on the pressure vessel.



Per ASME Boiler and Pressure vessel code Section VIII, Division 1, Part U-1(c) 2 e:

“Based on the Committee’s consideration, the following classes of vessels are not included in the scope of this Division; however, any pressure vessel which meets all the applicable requirements of this Division may be stamped with the Code symbol: [paragraphs a, b, c, and d omitted]...piping components such as pipe, flanges, bolting, gaskets, valves, expansion joints, fittings, and the pressure containing parts of other components, such as strainers and devices which serve such purposes of mixing, separating, snubbing, distributing, and metering or controlling flow, provided that pressure containing parts of such components are generally recognized as piping components or accessories.”

Therefore, this spacer flange is not considered a vessel nor a portion of the Coupp vessel documented in the engineering note.

Studs used to trap this spacer flange in place are the same material and graded used for the original vessel; SA 193 B8. Axial loads on the studs remain unchanged as the length increases. Therefore, these studs remain satisfactory.

Gasket sealing surfaces on the spacer flange are directly opposite; therefore, no bending moments are introduced to the spacer flange.

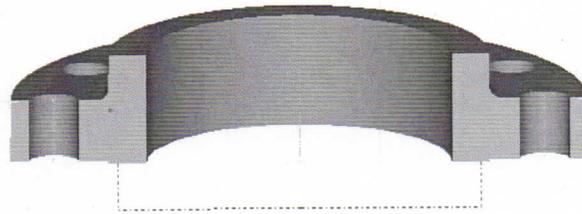


Figure 3, Section of Spacer Flange showing sealing surfaces

For a maximum allowable working pressure (MAWP) of 600 psig, the hoop stress on this thick wall ring (use the ring width of  $\frac{3}{4}$  inch in the radial direction, ignoring the contributions from the flange portions around the bolt holes, use formula (1) in UG-27:

Thickness,  $t = \frac{3}{4}$ "

Inside radius,  $R = 6.75"/2 = 3.375$  inches

$\frac{1}{2} R = 3.375/2 = 1.6875$

$t$  does not exceed  $\frac{1}{2} R$ , so formula (1) is applicable

Internal Design Pressure,  $P = (S \cdot E \cdot t) / (R + 0.6 \cdot t)$

$E$  is the joint efficiency,  $E = 1$  (this is not welded, rather forged from solid material).

S is the maximum allowable stress values for A240, type 304L plate (this has the lowest allowable stress value for all the 304 types) = 14.3 ksi

Substituting:

Internal Design Pressure,  $P = (14.3 * 1 * 3/4) / (1.6875 + 0.6 * 3/4) = 5.017$  ksi.  
= 5017 psi.

5017 psi >> 600 psi MAWP, therefore, the spacer flange is suitable for the vessel MAWP.