Fermilab

SDC SOLENOID DESIGN NOTE #144

TITLE: Thickness of Solid Aluminum Outer Vacuum Shell using CGA-341 and ASME Pressure Vessel Code

AUTHOR: R.W. Fast

DATE: May 16, 1991

ABSTRACT: The thickness calculated using the ASME PV Code is greater than that calculated using CGA-341.

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1. Dimensions and parameters

   OD of shell = 160" Length of shell = 360"
   Aluminum: 5083-0, with a modulus E = 10 Msi
   Design pressure: 30 psi using CGA-341; 15 psi using PV Code

2. Calculation using CGA-341

$$t = [P_c D^{2.5}(L/D)/2.6E]^{0.4}$$

$$= \{[(30)(160)^{2.5}(360/160)]/(2.6)(10 \times 10^6)]\}0^{.4}$$

$$= (0.8407)^{0.4}$$

$$= 0.933 \text{ inches}$$

3. Calculation using ASME Pressure Vessel Code, Section VIII, Div 1, UG-28

   Using trial and error method, P_c = 14.7 psi for t = 1.067", L/D = 2.25, D/t = 150, A = 0.0032, B = 1650

4. Summary

   Thickness per CGA-341: 0.933 inches

   Thickness per ASME PV Code: 1.067 inches