

SPECIFICATION: 2013 ASME B&PV CODE SECTION VIII, DIV. 1, APPENDIX-22, U-STAMP VESSEL

1. SERVICE CONDITIONS: NON-CORROSIVE SERVICE MIN. DESIGN METAL TEMP.: -50°F MAX. DESIGN METAL TEMP.: 200°F MAWP = 5250 psi APPD.-22: MAWP = 7000 psi HYDROSTATIC TEST PRES. = 9375 psi	3. MANUFACTURE: HOT BILLET PIERCED FOLLOWED BY HOT DRAWING	5. MECHANICAL PROPERTIES - TENSILE: 120-140 KSI - YIELD: ≥70 KSI - ELONG.: ≥ 18% (2" GAUGE) - FLATTENING TO 0.8xD, NO CRACKS - CHARPY (@ -50°F): LAT EXPN ≥.015" (3 LONG SPECIMEN) - HARDNESS: 216-300 BHN, (HIGHEST AVG. BHN < LOWEST AVG. BHN+40) - EACH CYLINDER TO BE MAGNETIC PARTICLE INSPECTED
	4. HEAT TREATMENT: Q&T - AUSTENITIZE: ~1650° F - TEMPER: ~1200° F - QUENCHANT: WATER BASED POLYMER	
2. MATERIAL: CR-MD STEEL, SA 372 GRADE F, CLASS 70		

DESIGN CALCULATIONS: MATERIAL: SA 372 GRADE F, CLASS 70

I. APPDX-22 MIN WALL CALC'S FOR MAWP = 7000 PSI
 (Based on design stress = 1/3 x min. tensile)

(a) Cylindrical Shell: [UG-27 C(1) & App.- 22]
 $t = \frac{PR}{SE-0.6P} = \frac{7000 \times 4.0}{40,000 \times 1 - 0.6 \times 7000} = 0.783"$

(b) Hemispherical Ends: [Per UG-32(f) & App.- 22]
 $t = \frac{PL}{2SE-0.2P} = \frac{7000 \times 4.0}{2 \times 40,000 \times 1 - 0.2 \times 7000} = 0.357"$

II. SECTION VIII MAWP CALCULATIONS:
 (Design stress per 2013 ASME CODE Sec II/D, table 1A)

(a) Cylindrical Shell: [Per UG-27 C(1)]
 $P = \frac{SEt}{R+0.6t} = \frac{33,300 \times 1 \times 0.783}{4.0 + 0.6 \times 0.783} = 5833 \text{ psi}$

(b) Hemispherical Ends: [Per UG-32(f)]
 $P = \frac{2SEt}{L+0.2t} = \frac{2 \times 33,300 \times 1 \times 0.357}{4.0 + 0.2 \times 0.357} = 5839 \text{ psi}$

∴ SECTION VIII MAWP ≤ 5833 psi

∴ SEC-VIII MAWP = 5250 psi IS OKAY

III. Membrane Stress Calculations for Cylinder Head:
 Using UG-32(f), the formula for hemispherical head thickness can be written in terms of stress as follows:
 $S = \frac{P(L+0.2t)}{2tE} = \frac{7000(4.0+0.2 \times 0.735)}{2 \times 0.735 \times 1} = 19,748 \text{ psi}$
 (which is < 1/6 x specified min. tensile in the cylinder head.)
 i.e. , 1/6 x 120,000 = 20,000 psi

∴ Openings may be placed in the cylinder head where $t \geq 0.735"$ (Appd-22, 22-3d(2)).

IV. Head Opening Reinforcement Calc. : [UG-37]
 Port Size: 3.507"φ
 Port wall thickness $tp \geq 0.735"$

(a) Required Area, A [UG-37.1]:
 $A = dtrF + 2t_n r F(1-f_r) = 3.507" \times 0.357 \times 1 + 0 = 1.2520 \text{ in}^2$

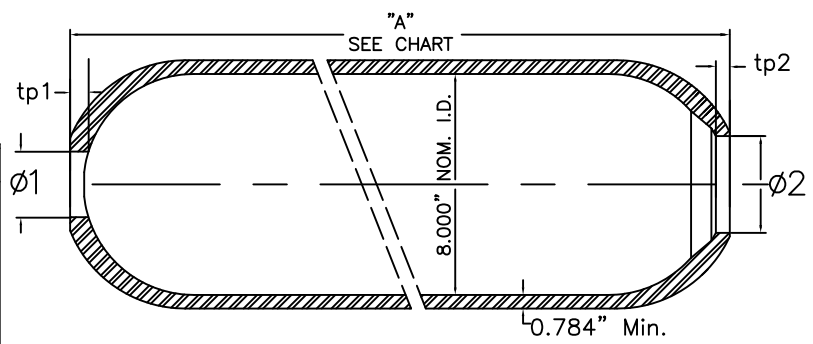
(b) Available area, A1 [UG-37.1]
 $A_1 = d(E_1 t - F_{tr}) - 2t_n(E_1 t - F_{tr})(1-f_r) = 3.507 (1 \times 0.735 - 1 \times 0.357) - 0 = 1.3256 \text{ in}^2$

OR $A_1 = 2(t+t_n)(E_1 t - F_{tr}) - 2t_n(E_1 t - F_{tr})(1-f_r) = 2(0.735+0) (1 \times 0.735 - 1 \times 0.357) - 0 = 0.5557 \text{ in}^2$

Choose larger, ∴ $A_1 = 1.3256 \text{ in}^2 > \text{Req'd Area } 1.2520 \text{ in}^2$

∴ A center head opening of up to φ3.507" is adequately reinforced for port wall thickness $tp \geq 0.735"$ in SA 372, Grade F, Class 70 material.

REV.	ECN - DESCRIP.	DATE	DRWN.	APP.
24	3333	2/11/15	LJI	SAM



MODEL	NOM. VOL. (Gallons)	*"A" DIM.(NOM.) (inches)	APPROX. WT. (lbs.)
8BA711	11	54	400

* The actual accumulator length will vary depending on choice of the end ports. Refer to drawing No. 901A-B-9436 for true 'A' dimensions.

Notes:
 - No fatigue issues related to design
 - For Canadian Registration Approval, refer to dwg #901B-B-9432-16 for models 8BA711 and 8BA713 only.

DRAWING FOR REFERENCE ONLY

N NORRIS CYLINDER COMPANY
 4818 WEST LOOP 281 LONGVIEW, TEXAS 75603 USA

ASME ACCUMULATOR
 MAWP = 5250 PSI
 APPENDIX - 22 MAWP = 7000 PSI

SCALE	NOT TO SCALE	DRAWING NO.	REV.
DWN. BY	TC	1/28/97	901B-B-9432 24
CHK'D BY	RS	1/28/97	
APP'D BY	BA	1/28/97	SHEET NO. 1 OF 1 SHEETS