



6511 Mapleridge • Houston, TX 77081

ASME Storage Cylinder – Model 8BA513

Specification:

2004 ASME Section VIII, Div 1, Appendix 22, U-Stamp Vessel

Manufacturer – Norris Cylinder Company, Dwg. 901A-A-9669 Rev-01

Sec VIII – MAWP 4165 PSI (287 Bar)

Appendix 22 – MAWP 5000 PSI (345 Bar)

Hydrostatic Test Pressure – 6696 PSI (462 Bar)

Material – CRO-MO Steel, SA 372, Grade F, Class 70

Minimum wall – 0.548", Tensile – 120 – 140 KSI

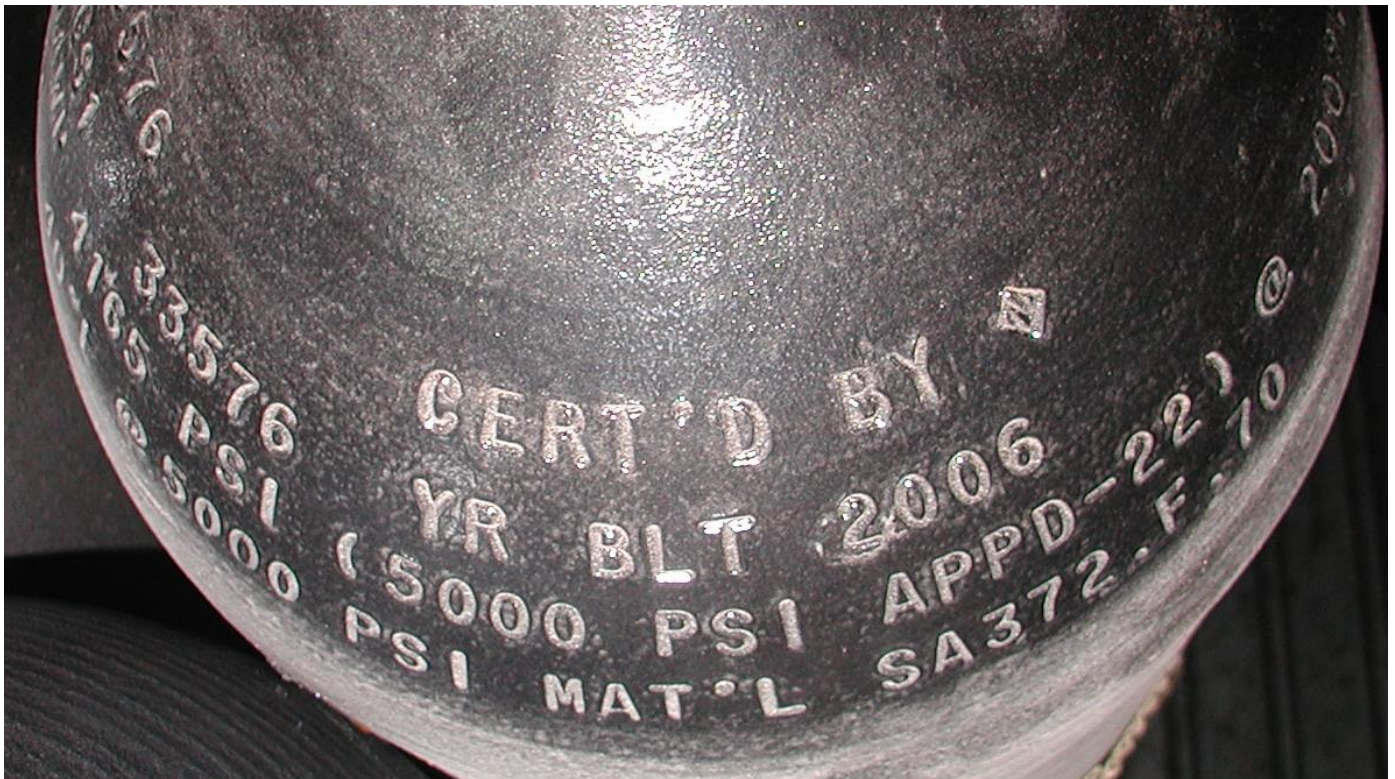
Ports - #12 SAE, Straight O ring Seal, Both ends

Dimensions – 64.5" (1638 MM) Long x 9 1/4" OD,

Weight – 300 Pounds (136 Kg)

Water Volume – 2952 Cu. In. (48.4 Liters)

Air Volume: 507 Cu. Ft. (14.3 M³) @ 5000 PSI (345 Bar)



SPECIFICATION: 2004 ASME SECTION VIII, DIV. 1, APPENDIX 22, U-STAMP VESSEL

1. TYPE OF SERVICE:

NON-CORROSIVE GAS
 MIN. DESIGN METAL TEMP.: -40°F
 MAX. DESIGN METAL TEMP.: 200°F
 SEC VIII MAWP = 4165 psi
 APPD.-22: MAWP = 5000 psi
 HYDROSTATIC TEST PRES. = 6696 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 (☉ -40°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

2. MATERIAL:

CR-MO STEEL, SA 372
 GRADE F, CLASS 70

4. HEAT TREATMENT: Q&T

- AUSTENITIZE: ~1650° F
- TEMPER: ~1200° F
- QUENCHANT: WATER BASED POLYMER

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

I. REQ'D MIN. WALL, APPENDIX-22 CALCULATIONS

(a) Cylindrical Shell: [Per UG-27 C(1) & Appd. 22]

$$t = \frac{PR}{SE-0.6P} = \frac{5000 \times 4.05}{40,000 \times 1 - 0.6 \times 5000} = 0.548"$$

(b) Hemispherical Ends: [Per UG-32(f) & Appd. 22]

$$t = \frac{PL}{2SE-0.2P} = \frac{5000 \times 4.05}{2 \times 40,000 \times 1 - 0.2 \times 5000} = 0.257"$$

II. Sec. VIII, Div. I, M.A.W.P. Calculations

(a) Cylindrical Shell: [UG-27 C(1)]

$$P = \frac{SEt}{R+0.6t} = \frac{33,300 \times 1 \times 0.548}{4.05 + 0.6 \times 0.548} = 4167 \text{ psi}$$

(b) Hemispherical Ends: [Per UG-32(f)]

$$P = \frac{2SEt}{L+0.2t} = \frac{2 \times 33,300 \times 1 \times 0.257}{4.05 + 0.2 \times 0.257} = 4173 \text{ psi}$$

•• SEC VIII MAWP = 4165 psi is OK

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:

$$S = \frac{P(L+0.2t)}{2tE} = \frac{5000(4.05+0.2 \times 0.548)}{2 \times 0.548 \times 28,000} = 18,977 \text{ psi}$$

(which is < 1/6 x specified min. tensile in the cylinder head.)

i.e., 1/6 x 120,000 = 20,000 psi

•• Valve & drain openings can be placed in the cylinder head w/o violating Appd-22, 22-3d(2).

IV. Reinforcement Calc's, head openings: [UG-37]

A. Port Option N (SAE 12) Reinforcement Calc's.

(a) Required min. thickness for the neck: [UG-27 C(1) & Appd. 22, 22-3 C(2)]

$$t_{rn} = \frac{PR_n}{SE-0.6P} = \frac{5000 \times 0.5765}{20,000 \times 1 - 0.6 \times 5000} = 0.1696"$$

(b) Required Area, A per UG-37 (C):

$$A = dt_r F + 2t_n t_r F(1-f_r)$$

$$= 1.1530 \times 0.257 \times 1 + 0 = 0.2963 \text{ in}^2$$

(c) Available area without reinforcement (per fig. UG-37.1) = A1 + A2

$$A1 = d(E_1 t - Ft_r) - 2t_n(E_1 t - Ft_r)(1-f_r) = 1.1530(1 \times 0.548 - 1 \times 0.257) - 0 = 0.3355 \text{ in}^2$$

$$OR \ A1 = 2(t+t_n)(E_1 t - Ft_r) - 2t_n(E_1 t - Ft_r)(1-f_r) = 2(0.548+0.25)(1 \times 0.548 - 1 \times 0.257) - 0 = 0.4644 \text{ in}^2$$

Choose larger value, **A1 = 0.4644 in²**

$$A2 = 5(t_n - t_{rn})f_r t_n \quad OR \ 5(t_n - t_{rn})f_r t_n = 5(.25 - .1696) \times 1 \times 0.548 \quad OR \ 5(.25 - .1696) \times 1 \times .25 = 0.2203 \text{ in}^2 \quad OR \ 0.1005 \text{ in}^2$$

Choose lower value, **A2 = 0.1005 in²**

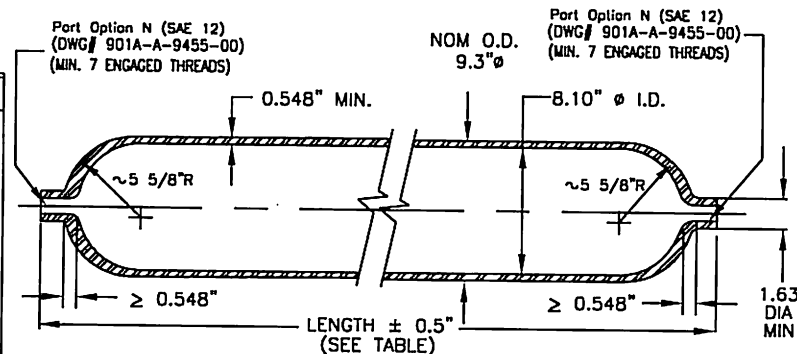
(d) Available area = A1 + A2 = 0.4644 + 0.1005 = **0.5649 in²**

Avail. Area, 0.5649 in² > Req'd. Area, 0.2963 in²

•• Option N opening is adequately reinforced

REV.	ECN - DESCIP.	DATE	DRWN.	APP.

DRAFT: 2/13/06



Note: Customer limit for max OD is 9.50"

CYLINDER MODEL	CYLINDER LENGTH in (mm)	MINIMUM WATER CAPACITY in ³ (liter)	APPROXIMATE CYLINDER WT. lbs (kg)	APPROX. AIR CAP. (● 5000 PSI, 70°F) ft ³ (m ³)
8BA513	64.5 (1638)	2952 (48.4)	300 (136)	507 (14.3)



NORRIS CYLINDER COMPANY

P.O. BOX 7486 LONGVIEW, TEXAS 75607

SEAMLESS STEEL ASME CYLINDER, MODEL 8BA513 FOR ACTIVE POWER

SCALE	NOT TO SCALE	DRAWING NO.	REV.
DWN. BY	RS	10/26/05	901A-A-9669 01
CHK'D BY			
APP'D BY		SHEET NO. 1	OF 1 SHEETS