



REV.	ECN - DESCRIPT.	DATE	DRWN.	CHKD.
01	3385	04/29/15	LJI	SAM
02	3435	07/20/15	LJI	

DRAWING FOR REFERENCE ONLY

D.O.T. Wall Stress Calculations: $S = P(1.3D^2 + 0.4d^2)/(D^2 - d^2)$

S = Maximum wall stress, psi $s = \frac{4000 [1.3 (9.183)^2 + 0.4 (8.735)^2]}{(9.183)^2 - (8.735)^2}$
P = Test pressure, psi
D = Outside diameter, inch $s = 69,835 \text{ psi (481.5 MPa)}$
d = Inside diameter, inch

Required Minimum tensile: $= \frac{69,835}{0.67} = 104,231 \text{ psi (718.7 MPa)}$

Note that the DOT Wall Stress Calculation is theoretically based on Norris Drawing 901A-B-9106 - Model 8BC300.

SPECIFICATION: ISO 9809/1: 1999
DOT 3AA 2400

1. Service Conditions:
- DOT rated service pressure: 165 bar (2400 psi)
- ISO rated working pressure: 184 bar (2666 psi)
- Hydraulic test pressure: 275.8 bar (4000 psi)

2. Material:
Cr-Mo-Steel, Fully killed and made to fine grain practice by basic oxygen or electric furnace process

Chemical Composition (%)

	C	Si	Mn	P	S	Cr	Mo
Min.	0.28	0.15	0.40	--	--	0.80	0.15
Max.	0.33	0.30	0.60	0.020	0.020	1.10	0.25

Note: S+P < 0.030

3. Manufacture:
Hot billet extrusion followed by hot drawing

4. Heat Treatment: Quenched and Tempered
-Austenitize: ~899°C (1650°F)
-Quenchant: Water based polymer: (temperature ≤ 60°C(140°F))
-Temper: ~627°C(1160°F) (Min. 30 minutes at temp.)

5. Mechanical Properties: (at room temperature)

- Tensile (Rg): 775 - 930 MPa (112.4 - 134.8 ksi)
- Yield (Re): ≥ 604.5 MPa (87.675 ksi)
- Elong (A): ≥ 14% (ON 5.65 √S₀)
≥ 20% on 2" G.L. for DOT
- Hardness: 225-270 BHN
- Flattening test: Flatten to ø6 x t without cracks
- Alternative Bend Test: Bend to 4-6 x t (based on actual tensile value) without visible cracks
- Charpy test (-50°C, Trans): ≥ 35 J/cm² (avg.)
- UT flaw detection: Each cyld. per ISO 9809-1
- Batch burst test: Pb ≥ 441.3 bar (6400psi)

6(a). Thickness Calculations: (ISO 9809/1: 1999)

$$a = 0.5 \times D \left(1 - \sqrt{\frac{(10FRe - \sqrt{3} Ph)}{(10FRe)}} \right)$$

Where:
Ph = Test Pressure (bar) = 275.8 bar (4000psi)
D = External diameter of container = ø235.2mm
F = Lesser of 0.65/(Re/Rg) or 0.85; Re/Rg ≤ 0.9
= Lesser of 0.65/0.78 or 0.85 = 0.833 (for Re/Rg = 0.78)

$$a = 0.5 \times 235.2 \left(1 - \sqrt{\frac{(10 \times 0.833 \times 604.5 - \sqrt{3} \times 275.8)}{(10 \times 0.833 \times 604.5)}} \right) = 5.714 \text{ mm (0.2249")}$$

NOTE: a', the guaranteed min thickness = 5.72mm (0.225") exceeds/equals calculated min thickness, a.

MODEL	LENGTH 'L'		Min WATER CAPACITY		APPROX. WGT. W/O FITTINGS	
	MM	IN	LITERS	IN ³	KG	LBS
8BC300P	1410	55.5	49	2995	60.8	134
*Vmin	708	27.9	21.7	1325	34	75
*Vmax	1727	68	TBD	TBD	TBD	TBD

*Note: Model 8BC300P is the design qualification test cylinder. Vmin and Vmax represent the range covered by the same design family.

NORRIS CYLINDER COMPANY
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REFILLABLE SEAMLESS STEEL CYLINDER FOR PERMANENT AND LIQUEFIED GASES - ø235mm/275.8 Bar TP

SCALE	NOT TO SCALE	DRAWING NO.	REV.
DWN. BY	R.S.	5/20/04	901A-A-9643
CHK'D BY	SAM	5/20/04	
APP'D BY		SHEET NO. 1	OF 1 SHEETS