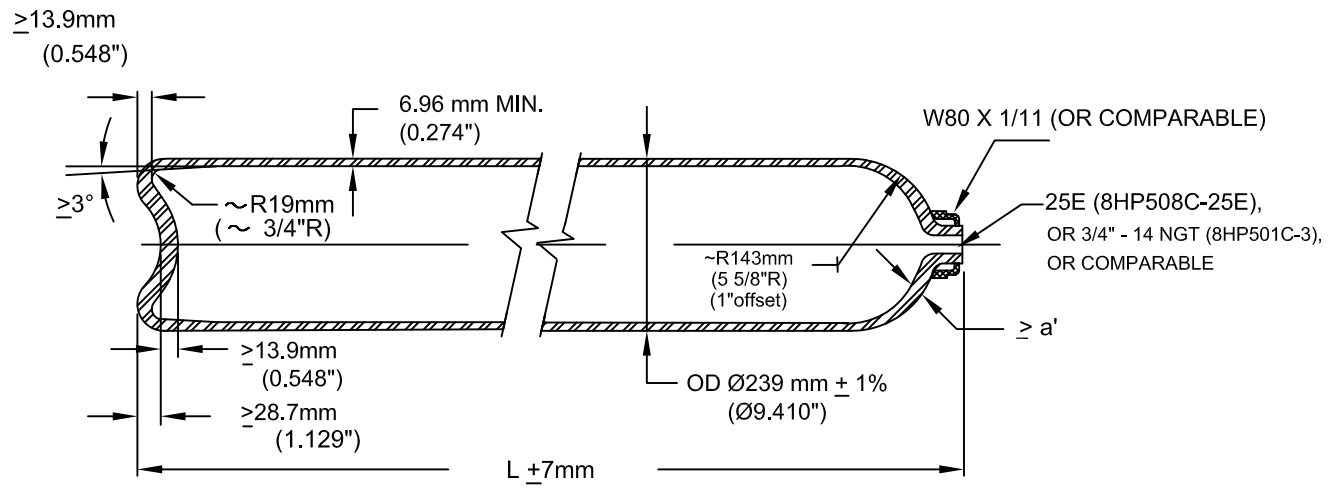

REV.	ECN - DESCRIP.	DATE	DRAWN	APP
01	2939	2/3/10	JJM	SAM
02	2977	7/14/10	JJM	SAM
03	Requaliification	11/29/2012	SAM	FG
04	3155	2/28/2013	SAM	SAM
05	3276	10/09/14	LJI	SAM

DRAWING FOR REFERENCE ONLY

SPECIFICATION: ISO 9809-2: 2000

1. Service Conditions:
   - Working pressure: 310 bar (4500 psi)
   - Hydraulic test pressure: 465 bar (6743 psi)
   (1 bar = 14.5 psi)

2. Material:
   Cr-Mo-steel complying with the requirements. of clause 6.2 of ISO 9809-2. (Norris' 4133M4)

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: ~573°C (1065°F) (Min. 30 minutes at temp.)

5. Mechanical Properties: (at room temperature)
   - Tensile (Rg): 1100 - 1220 MPa (159.6 - 177 ksi)
   - Yield (Re): ≥ 935 MPa (135.6 ksi)
   - Elong (A): ≥ 12% (ON $5.65\sqrt{S_o}$)
   - Out-of-roundness per ISO 9809-2 8.5 : <2%
   - Straightness per ISO 9809-2 8.7: 3 mm per m
   - Verticality per ISO 9809-2 8.8: 10 mm per m
   - Hardness test: Each cylinder - HB313 - 368
   - Flattening test: Flatten to 10 x t_m without cracks
   - Charpy test (-50°C, Trans): ≥ 35 J/cm^2(avg.)
   - UT flaw detection: Each cylinder per ISO 9809-2
   - Batch burst test: Pb ≥ 744 bar (10,788 psi)

6(a). Thickness Calculations: (ISO 9809-2: 2000)

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

Where:

Ph= Test Pressure (bar) = 465 bar

D = External diameter of container =Ø239 mm

F = Lesser of 0.65/(Re/Rg) or 0.77; where Re/Rg ≤0.9

= Lesser of 0.65/(935/1100) = 0.765 OR 0.77

$$a = 0.5x239\left(1-\sqrt{\frac{(10 \times 0.765 \times 935-\sqrt{3} \times 465)}{(10 \times 0.765 \times 935)}}\right) = 6.93mm\ (0.273")$$

NOTE: a', the guaranteed min thickness = 6.95 mm (0.274") exceeds calculated min thickness, a.

MODEL	LENGTH 'L'		Min WATER CAPACITY		APPROX. WGT. W/O FITTINGS	
	MM	IN	LITERS	IN^3	KG	LBS
8HP508C	1330	52.37	46.6	2844	68	150
8HP501C	1282	50.5	45	2750	63.5	140
*Vmin	698	27.5	21.3	1300	40.3	89
*Vmax	1930	76	71.0	4333	100.3	221

*Note: Vmin and Vmax represent the range covered by the same design family. Model 8HP501C is the current design qualification test cylinder. For actual values for max ovality, max verticality deviation, and max Straightness deviation see Norris document: 363-00

NORRIS CYLINDER COMPANY
4818 W. LOOP 281 LONGVIEW, TEXAS 75603 USA

ISO 9809-2 / 239mm OD / 310 BAR
REFILLABLE SEAMLESS STEEL CYLINDER FOR NON-EMBRITTLING GASES PER ISO 11114-1

SCALE	NOT TO SCALE		DRAWING NO.	REV.
DWN. BY	JJM	03/19/09	901A-A-9766	05
CHK'D BY	JJM	04/15/09		
APP'D BY	SAM	04/17/09	SHEET NO. 1	OF 1 SHEETS