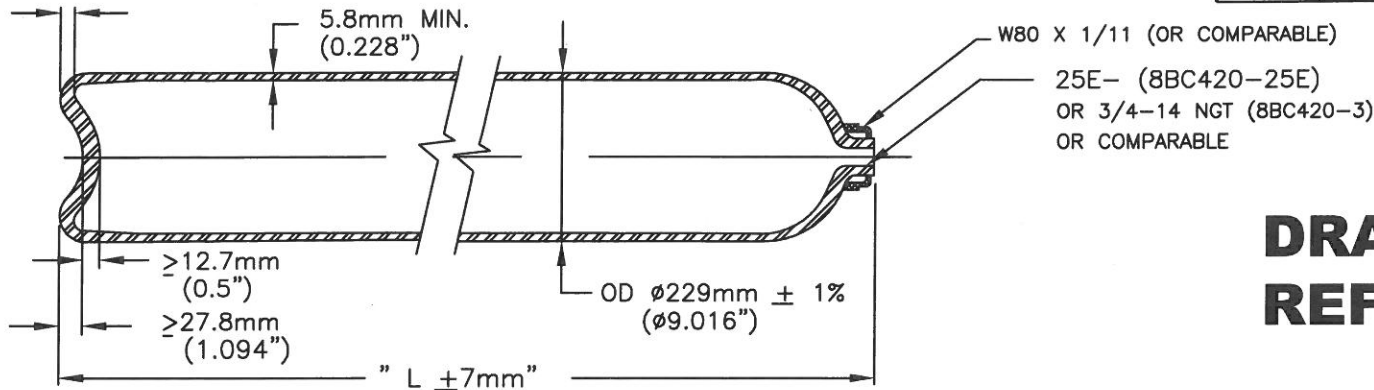


≥12.7mm
(0.5")



| REV. | ECN - DESCRIP. | DATE | DRWN. | CHKD. | APP. |
|------|----------------|----------|-------|-------|------|
| 01 | 2868 | 06/05/09 | JJM | | |
| 02 | 2890 | 07/31/09 | JJM | | |

DRAWING FOR REFERENCE ONLY

SPECIFICATION: ISO 9809/1: 1999

1. Service Conditions:

- Working pressure: 230 bar (3335 psi)
- Hydraulic test pressure: 345 bar (5004 psi)
(14.5 PSI = 1 bar)

2. Material:

Cr-Mo-steel (4137) complying with the requirements of clause 6.2 of ISO 9809-1
See Norris' 4137 SPEC.

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: ~615°C (1140°F) (Min. 30 minutes at temp.)

5. Mechanical Properties: (at room temperature)

- Tensile (Rg): 945 - 1075 MPa (137 - 156 ksi)
- Yield (Re): ≥ 803 MPa (116.5 ksi)
- Elong (A): ≥ 14% (ON 5.65 √S₀)
- Out-of-roundness per ISO 9809-1 8.5 - <2%
- Straightness per ISO 9809-1 8.7 - 3 mm per m
- Verticality per ISO 9809-1 8.8 - 10 mm per m
- Hardness test: Each end of every cylinder
- Flattening test: Flatten to 8 x t_m without cracks
- Charpy test (-50°C, Trans): ≥ 35 J/cm² (avg.)
- UT flaw detection: Each cyld. per ISO 9809-1
- Batch burst test: Pb ≥ 552 bar (8007psi)

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

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

Where:

Ph = Test Pressure (bar) = 345 bar (5004psi)

D = External diameter of container = ø231.3mm Max

F = Lesser of 0.65/(Re/Rg) or 0.85; Re/Rg ≤ 0.9
= Lesser of 0.65/0.85 or 0.85 = 0.765 (for Re/Rg = 0.85)

$$a = 0.5 \times 231.3 \left(1 - \sqrt{\frac{(10 \times 0.765 \times 803 - \sqrt{3} \times 345)}{(10 \times 0.765 \times 803)}} \right) = 5.77 \text{mm} \quad (0.227")$$

NOTE: a', the guaranteed min thickness = 5.8mm (0.228") equals or exceeds the calculated min thickness, a.

| MODEL | LENGTH 'L' | | Min WATER CAPACITY | | APPROX. WGT. W/O FITTINGS | |
|--------|------------|--------|--------------------|-----------------|---------------------------|-----|
| | MM | IN | LITERS | IN ³ | KG | LBS |
| 8BC420 | 1499 | 59.0 | 50.0 | 3051 | 64.4 | 142 |
| 8BC335 | 1229 | 48.375 | 40.0 | 2441 | 54.0 | 119 |
| 8BC253 | 960 | 37.8 | 30.0 | 1831 | 43.5 | 96 |
| *Vmin | 699 | 27.5 | 20.5 | 1251 | 33.6 | 74 |
| *Vmax | 2235 | 88 | 77.3 | 4717 | 93.4 | 206 |

*Note: Model 8BC420 is the design qualification test cylinder. Vmin and Vmax represent the range covered by the same design family. 14.5 PSI = 1 bar.



NORRIS CYLINDER COMPANY

4818 WEST LOOP 281 LONGVIEW, TEXAS 75603

REFILLABLE SEAMLESS STEEL CYLINDER FOR COMPRESSED GASES EXCEPT HYDROGEN AND METHANE PER ISO 11114-1

| SCALE | NOT TO SCALE | DRAWING NO. | | REV. |
|----------|--------------|-------------|-------------|-------------|
| DWN. BY | R.S. | 11/1/06 | 901A-A-9695 | 02 |
| CHK'D BY | JJM | 02/25/09 | | |
| APP'D BY | | | SHEET NO. 1 | OF 1 SHEETS |