

## STRUCTURAL COMPOSITES INDUSTRIES - TECHNICAL BULLETIN

SUBJECT: INSPECTION AND REQUALIFICATION OF DOT EXEMPTION AND TRANSPORT CANADA APPROVED CYLINDERS MANUFACTURED BY STRUCTURAL COMPOSITES INDUSTRIES, (SCI).

### 1.0 INTRODUCTION

Under NASA sponsorship, Structural Composite Industries developed the technology to produce fiber reinforced plastic (composite) high pressure gas cylinders and introduced the world's first commercial composite cylinders in 1976. Since this time composite cylinders have demonstrated their safety and durability in a wide variety of commercial, military and aerospace applications.

This Technical Bulletin describes the proper techniques and references for inspection and requalification of SCI's commercial composite cylinders.

In the United States, inspection and requalification of DOT Exemption cylinders must be performed by a facility holding a current Retester's Identification Number issued by the Research and Special Programs Administration of the DOT. The retest facility must also comply with other administrative DOT requirements in order to retest Exemption cylinders.

### 2.0 DE-VALVE

Safely vent the cylinder. Refer to CGA Pamphlet C-2, "Recommendations for the Disposition of Unserviceable Compressed Gas Cylinders with Known Contents", for venting procedures.

Remove the valve using the proper tools and a holding fixture so that the cylinders exterior and valve are not damaged. Do not use a pipe wrench on the cylinder neck. Do not use heat to loosen the valve.

### 3.0 EXTERIOR INSPECTION

The cylinder should be clean and free from dirt and any attachment that would interfere with visual inspection. Soap and water, Windex or equivalent, may be used to remove oil and grease from the cylinder exterior.

Inspect for damage. Refer to CGA Pamphlet C-6.2.1988, "Guidelines for Visual Inspection and Requalification of Fiber Reinforced High Pressure Cylinders'.

Damage beyond Level 1 in C-6.2 is not field refurbishable. Cylinders with questionable damage should be returned to SCI for evaluation. Call SCI to obtain a return authorization number prior to returning the cylinder.



#### 4.0 INTERIOR INSPECTION

Inspect the cylinder threads for nicks, cuts, cracks and other damage. See CGA C-6 or CGA C-6.I.

All SCI cylinders have straight threads with O-ring seals. Make sure the O-ring gland is clean and free from damage. See CGA C-6.I.

Inspect the interior with a high-intensity light. Normal interior inspection procedures are found in CGA C-6 and C-6. I. Cylinders with dents visible on the interior must be condemned.

#### 5.0 HYDROSTATIC TESTING

SCI's composite cylinders shall be hydrostatically tested in accordance with their DOT Exemptions or TC approvals. They require the cylinders to be retested every three years. A maximum permanent volumetric expansion of five percent of the total expansion is allowed. There is no rejection criteria for elastic expansion.

The elastic expansion data printed on some cylinder labels is to be used as a guide to determine the size of the burette for hydrotesting and is not the rejection criteria for elastic expansion.

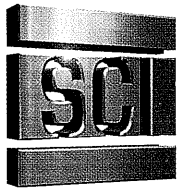
The following hydrostatic test procedure is recommended in order to stabilize the cylinder and test equipment. The "A"(pre-test) and "B"(test) pressures for specific cylinder service pressures are shown in Table 1.

Zero the burette/scale and observe the water level for thirty seconds to ensure there are no temperature variations. Apply "**A**" pressure (90% of Test Pressure – 100psi) to the cylinder at a rate not to exceed 3,000 psi per minute, lock off and check for leaks. If the water level falls in the burette/weigh bowl, check the system for leaks. If the water rises in the burette/weigh bowl, water is leaking into the jacket. Repair system as necessary.

If the water level is constant, release the pressure and re-zero the burette. Pressurize to the "**B**" (Test) pressure at a rate not to exceed 3,000 psi per minute and maintain pressure for 60 seconds or sufficiently longer to ensure complete expansion of the cylinder. Read and record the total expansion.

**TABLE 1**

SERVICE PRESSURE psi	DOT Pre-Test – psi "A" Pressure	DOT Test – psi		TC Pre-Test – psi "A" Pressure	TC Test – psi (1.5 * SP) "B" Pressure
		(5/3 * SP) "B" Pressure	"B" Pressure		
1,850	2,681	3,090	3,090	2,400	2,775
2,216	3,230	3,700	3,700	2,890	3,324
3,000 (Except E7218)	4,400	5,000	5,000	3,950	4,500
3,000 (E7218 Only)	5,300	6,000	6,000	3,950	4,500
3,295	4,850	5,500	5,500	4,340	4,942
3,360	4,940	5,600	5,600	4,436	5,040
3,500	5,151	5,835	5,835	4,625	5,250
4,500	6,650	7,500	7,500	5,975	6,750
5,000	7,401	8,335	8,335	6,650	7,500



Depressurize the cylinder and adjust the burette to bring the water level to the zero- reference point. Wait 60 seconds, or longer if the volume in the burette is still falling, then read and record the permanent expansion. The permanent expansion must not exceed 5% of the total expansion.

Note: When using computer controlled test equipment, make sure that the 60 second (minimum) wait period is entered into the software. Failure to do so will often result in a false high permanent reading, because composite cylinders do not immediately return to their original shape like metal cylinders. Hold time at Zero Pressure may be extended to six (6) minutes or longer, to allow for complete contraction, prior to recording permanent expansion values

Dry the internal surface of the cylinder with forced hot air for a minimum of 30 minutes or until completely dry. Verify dryness by using an internal drop light. The temperature of the hot air should be from 120°F to a maximum of 150°F. (49-65C).

## 6.0 RE-TEST MARKING

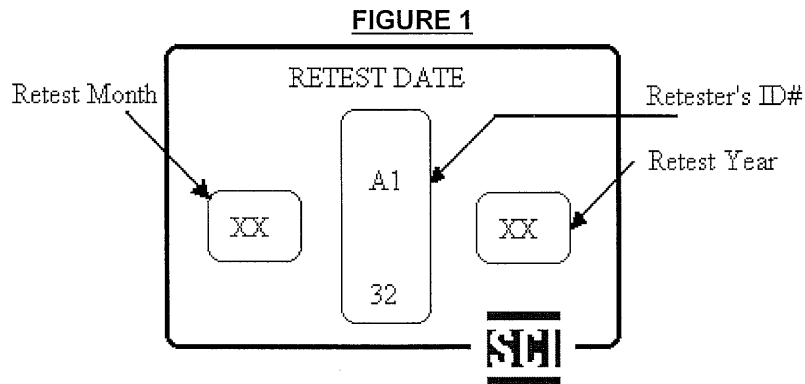
Retest dates may be steel stamped on the outer exposed surface of the aluminum cylinder neck or marked on a label securely affixed to the cylinder. SCI recommends use of an aluminum foil label as shown in Figure 1. The labels may be ordered through SCI.

### CAUTION

DO NOT ATTEMPT TO STAMP RETEST MARKINGS IN THE COMPOSITE. ANY CYLINDER WITH STAMPED MARKINGS IN THE COMPOSITE MUST BE CONDEMNED!

Title 49 CFR, Chapter 1, Paragraph 173.34(e) (6) requires as of April 15, 1986 that the retester's identification number be set between the month and year of the retest date. The retest date and retester's identification number may be typewritten or metal stamped on the foil label. For this example the retester's number is A123.

Note: The numbers are read in a clockwise manner.





The retest label is to be attached near the manufacturers label. First, clean the surface where the label is to be attached. Ammoniated water, "Windex", or equivalent window cleaner may be used. Dry the surface thoroughly before applying the label.

Mark the retest label with the month, year and retester's identification number using either a typewriter or metal stamp.

Peel the label from the paper backing. The label has a pressure sensitive adhesive surface on the back.

Apply label flat on the clean surface. Work out folds and any air pockets.

Overcoat the label and edges with a thin epoxy coating. Use any commercial epoxy glue such as Devcon 5 minute clear epoxy or equivalent. Air dry.

## 7.0 RE-VALVING

Use new O-rings compatible with the cylinder contents.

### CAUTION

ONLY O-RING MATERIALS COMPATIBLE WITH HIGH PRESSURE OXYGEN SHOULD BE USED ON CYLINDERS IN OXYGEN SERVICE.

Make sure O-ring and cylinder gland are clean.

Make sure cylinder and valve threads are clean.

Lubricate O-ring with a light coat of Dow Coming M-55 grease.

### CAUTION

FOR OXYGEN CYLINDERS USE NO LUBRICANTS, SEALANTS, GREASE, ANTI-SEIZE COMPOUNDS OR TEFLON TAPE ON THREADS OR O-RINGS.

Recommend O-rings sizes are shown in Table 2.



TABLE 2

<b>MS 33649 Dash#</b>	<b>CYLINDER THREAD</b>	<b>PARKER - O-ring Side#</b>
04	.4375-20 UNF-2B	3-904
05	.5000-20 UNF-2B	3-905
07	.6250-18 UNF-2B	3-907
08	.7500-16 UNF-2B	3-908 (Note 1)
10	.8750-14 UNF-2B	3-910 (Note 2)
11	1.000-12 UNF-2B	3-911
12	1.0625-12 UN-2B	3-912
14	1.1875-12 UN-28	3-914
16	1.3125-12 UN-28	3-916 (Note 3)
18	1.5000-12 UN-2B	3-918
20	1.6250-12 UN-2B	3-920
24	1.8750-12 UN-2B	3-924
28	2.2500-12 UN-2B	3-928
32	2.5000-12 UN-2B	3-932

- Note 1 Models ALT 545A, 665, and 665P do not have MS ports and require Parker O-ring size 2-210. Model ALT 545 has the MS33649-08 port and takes the 3-908 O-ring.
- Note 2 Models ALT-294, 294S, 295, 295S, 671, 683, 684, 685 and 708 have thread sizes .875-14 UNF-2B and require Parker O-ring size number 2-212. They do not have MS ports.
- Note 3 Model ALT-358 has a port conforming to MS 16142 with 1.3125-12 UN-2B threads. The required O-ring size is 3-916.