U.S. Department
of Transportation
**Research and
Special Programs
Administration**

400 Seventh St., S.W.
Washington, D.C. 20590

APR 2 4 2003

DOT-E 8487
(FOURTH REVISION)

EXPIRATION DATE: March 31, 2005

(FOR RENEWAL, SEE 49 CFR § 107.109)

1. GRANTEE: General Dynamics Armament and Technical Products (Former Grantee: Lincoln Composites)
Lincoln, Nebraska

2. PURPOSE AND LIMITATIONS:

a. This exemption authorizes the manufacture, mark, sale and use of non-DOT specification cylinders conforming with all regulations applicable to DOT specification FRP-1 standard, except as specified herein, for filling Division 2.2 gases and for use as equipment components aboard aircraft. This exemption provides no relief from any Hazardous Materials Regulations (HMR) other than as specifically stated herein.

b. The safety analyses performed in development of this exemption only considered the hazards and risks associated with transportation in commerce.

3. REGULATORY SYSTEM AFFECTED: 49 CFR Parts 106, 107 and 171-180.

4. REGULATIONS FROM WHICH EXEMPTED: 49 CFR §§ 173.302a(a)(1), 173.304a(a)(2) and 175.3 in that non-DOT specification cylinders are not authorized, except as specified herein.

5. BASIS: This exemption is based on the application of Lincoln Composites dated March 17, 2003, submitted in accordance with § 107.109.

6. HAZARDOUS MATERIALS (49 CFR § 172.101):

Proper Shipping Name/ Hazardous Material Description	Hazard Class/ Division	Identi-fication Number	Packing Group
The specific commodity name or generic description for non-flammable gases, as appropriate	2.2	As appro-priate	n/a

7. SAFETY CONTROL MEASURES:

a. PACKAGING - Prescribed packagings are non-DOT specification fiber reinforced plastic (FRP) aluminum lined full composite (FC) cylinders made in full compliance with Lincoln Composites' (Formerly Brunswick Corporation) specification submitted with the September 11, 1980 application. The cylinders must conform to DOT FRP-1 Standard, revision 2 dated February 15, 1987 (§ 178.AA) except as follows:

§ 178.AA-2 Type, size and service pressure.

Type 3FC cylinder consisting of resin impregnated continuous filament winding in both longitudinal and circumferential directions over a welded aluminum liner; not over 44 pounds (1200 cubic inches) water capacity; and service pressure at least 1000 psi and not over 4500 psi. Liner must consist of 2 circumferentially welded shells with end fittings adhesively bonded to the liner.

§ 178.AA-4 Duties of inspector.

(a) thru (c) * * *

(d) Verify compliance of liners with all requirements including markings; inspect inside for defects prior to welding; inspect inside after autofrettage for signs of possible buckling; verify heat treatment as proper; verify threads by gage; report minimum thickness of liner wall noted; verify fitting bond integrity.

(e) thru (g) * * *

§ 178.AA-5 Authorized material and identification of material.

(a) Aluminum liner must be fully annealed 5086-0 alloy and temper. End fittings must be 2024 T850 aluminum alloy and temper or 17-4 PH corrosion resistant steel. Biasable seal material for end fittings must be as specified in the application.

(b) thru (e) * * *

§ 178.AA-6 Manufacture.

(a) Liner. * * * (Added) Liner must consist of 2 circumferentially welded aluminum shells having end fitting bonded with chlorobutyl rubber to inner surface of liner.

(b) * * *

(c) Welding or brazing.

(1) Brazing for any purpose whatsoever is prohibited.

(2) Liner welding is permitted and must be per automatic process-no hand welds permitted. Location is restricted to circumferential welds in the cylindrical section. Backing strips that remain in place are prohibited.

(d) and (e) * * *

§ 178.AA-7 Wall thickness.

(a) Thickness of the liner must be determined in accordance with the buckling analysis report, and must be such that after autofrettage, the compressive stress in the sidewall of the liner at zero pressure will not cause buckling of the liner. The liner load must not exceed 20 percent of the total structure load at burst pressure.

(b) thru (d) * * *

§ 178.AA-9 Thermal treatment.

(a) The aluminum liner does not require reannealing after welding.

(b) * * *

§ 178.AA-10 Pressure relief devices and protection for valves, pressure relief devices and other connections.

(a) Pressure relief devices and protection for valves and other connections must be in compliance with §§ 173.301(f) and 173.301(h), except that the adequacy of the pressure relieving device for each design must be verified in accordance with 178.AA-18(g) notwithstanding the requirement of CGA Pamphlet C-14.

§ 178.AA-12 Destructive tests.

(a) Physical tests. Determination of mechanical properties of liner material is not required.

* * * * *

§ 178.AA-13 Acceptable results of tests.

(a) * * *

(b) Not required.

(c) * * *

(1) The test cylinder must withstand at least 500 pressurizations between approximately zero and service pressure followed by at least 30 pressurizations between zero and test pressure, without evidence of distortion or failure. All cylinders used in cycle tests must be destroyed.

(2) * * *

(d) * * *

§ 178.AA-14 Rejected liners and cylinders

(a) Not applicable

(b) thru (d) * * *

§ 178.AA-15 Marking.

(a) thru (c) * * *

(d) (Added). Each cylinder must be marked "Must not be used after 15 years or 300 pressurizations (including topping off) whichever comes first".

§ 178.AA-16 Inspector's report.

(a) The inspector must prepare a report that is clear, legible and in accordance with the following form:

REPORT OF MANUFACTURE OF FIBER REINFORCED PLASTIC (FRP) TYPE 3FC FULL COMPOSITE (FC) WELDED ALUMINUM-LINED COMPRESSED GAS CYLINDERS.

Place:_____

Date:_____

Exemption Number:
_____

Manufactured
For_____

Location:_____

Manufactured
by_____

Location:_____

Consigned to _____

Location:_____

Quantity _____ Size _____ inches outside diameter by _____ inches long

Marks placed on _____of the cylinder are:

DOT-E 8487_____

Serial Numbers _____ to _____ inclusive _____
Identifying Symbol(Register)_____

Inspector's Mark_____

Test Date_____

Other Marks (if any)____

Each composite cylinder was made by completely overwrapping a welded aluminum liner with resin impregnated filament reinforcement. Liners were made by circumferentially welding 2 shells. End fittings on open ends of the shell were adhesively bonded as prescribed in the application. Composite overwrap was made by winding resin impregnated _____continuous filament over this liner in both longitudinal and circumferential directions followed by curing the resin at controlled temperature.

Aluminum was identified by heat numbers and verified as to chemical analysis, record thereof, is attached hereto.

Each liner was inspected both before and after closing. All that were inspected were found to be free from seams, cracks, laminations and other defects which might prove injurious to the strength of the cylinder.

Liner walls were measured and the minimum thickness noted was at least equal to the minimum design thickness. The outside diameter was found by a close approximation to be _____inches.

Filament and resin were certified by the manufacturers, identified by package number. Filament was verified as to strand strength. Composite was verified as to shear strength. Record thereof is attached hereto. After wrapping composite was cured as prescribed in the manufacturer's specification.

Processes of manufacture were supervised and found to be efficient and satisfactory.

Filament stresses are calculated to be _____ PSI in hoop direction and _____ PSI in longitudinal direction at service pressure. Tensile stress on the aluminum liner is calculated to be _____ PSI at service pressure.

Autofrettage and hydrostatic test, as prescribed were made in the presence of the Inspector. All cylinders accepted are in compliance with requirements. Results of autofrettage and test pressurizations are attached hereto.

I hereby certify that all of the cylinders proved satisfactory in every way and comply with the requirements of DOT-E 8487.

Signed: _____
(Inspector)

* * * * *

§ 178.AA-18 Design Qualification tests

(a) thru (c) * * *

(d) Pressure cycling test. * * *

(1) Cycling test at ambient temperature - Two representative cylinders shall be cycle tested at ambient temperature as follows without showing evidence of distortion, deterioration or failure:

Pressurize from 0 to service pressure for 500 cycles; then pressurize from 0 to test pressure for 30 cycles.

After successfully passing this test one cylinder must be pressurized to burst in accordance with (e)(1) of this paragraph and the burst pressure recorded. The other cylinder must be cycled to failure from 0 to service pressure. Total number of cycles must be recorded.

(2) Environmental cycling test. * * *

(i) Pressurize from 0 to service pressure for 250 cycles in an environment of 140°F or higher temperature and 95 percent or greater relative humidity.

(ii) * * *

(iii) Then pressurize from 0 to service pressure for 250 cycles in an environment of -60°F or lower temperature.

* * * * *

(3) Thermal cycling test. * * *

(i) Cycle test at ambient temperature by performing 500 pressurizations from zero to service pressure and 30 pressurizations from zero to test pressure.

(ii) * * *

(e) to (h) * * *

b. TESTING - Each cylinder must be reinspected and hydrostatically retested every three years in accordance with 49 CFR § 180.205 as prescribed for DOT 3HT cylinders, except that permanent volumetric expansion must not exceed 5 percent of the total volumetric expansion at test pressure and rejection elastic expansion does not apply. Retest dates must be imbedded in the epoxy coating in a permanent manner other than stamping or steel stamped on the outer exposed metallic surface of the cylinder neck. Reheat treatment or repair of rejected cylinders is not authorized.

c. OPERATIONAL CONTROLS - A cylinder is not authorized 15 years after the date of manufacture or after 300 pressurizations (including topping off), whichever comes first.

8. SPECIAL PROVISIONS:

a. In accordance with the provisions of Paragraph (b) of § 173.22a, persons may use the packaging authorized by this exemption for the transportation of the hazardous materials specified in paragraph 6, only in conformance with the terms of this exemption.

b. A person who is not a holder of this exemption, but receives a package covered by this exemption, may reoffer it for transportation provided no modifications or changes are made to the package and it is offered for transportation in conformance with this exemption and the HMR.

c. A current copy of this exemption must be maintained at each facility where the package is offered or reoffered for transportation.

d. Each packaging manufactured under the authority of this exemption must be marked with a registration symbol designated by the Office of Hazardous Materials Exemptions and Approvals for a specific manufacturing facility.

e. A current copy of this exemption must be maintained at each facility where the package is manufactured under this exemption. It must be made available to a DOT representative upon request.

f. Cylinder must be shipped in strong outer packagings in accordance with § 173.301(k).

g. Cylinders subjected to action of fire must be removed from service.

h. Cylinders manufactured under this exemption are for use as equipment component aboard aircraft only.

i. Maximum filling density for carbon dioxide must be such that the pressure in the cylinder at 130°F does not exceed 5/4 of the marked service pressure.

j. Transportation of oxygen is only authorized when in accordance with § 172.102(c)(2) Special Provision A52 and §§ 175.85(h) and (i).

9. MODES OF TRANSPORTATION AUTHORIZED: Motor vehicle, rail freight, cargo vessel, cargo aircraft only, and passenger-carrying aircraft.

10. MODAL REQUIREMENTS: A current copy of this exemption must be carried aboard each cargo vessel or aircraft used to transport packages covered by this exemption. The shipper must furnish a copy of this exemption to the air carrier before or at the time the shipment is tendered.

11. COMPLIANCE: Failure by a person to comply with any of the following may result in suspension or revocation of this exemption and penalties prescribed by the Federal hazardous materials transportation law, 49 U.S.C. 5101 et seq:

- All terms and conditions prescribed in this exemption and the Hazardous Materials Regulations, Parts 171-180.

- Registration required by § 107.601 et seq., when applicable.

Each "Hazmat employee", as defined in § 171.8, who performs a function subject to this exemption must receive training on the requirements and conditions of this exemption in addition to the training required by §§ 172.700 through 172.704.

No person may use or apply this exemption, including display of its number, when the exemption has expired or is otherwise no longer in effect.

12. REPORTING REQUIREMENTS: The carrier is required to report any incident involving loss of packaging contents or packaging failure to the Associate Administrator for Hazardous Materials Safety (AAHMS) as soon as practicable. (Sections 171.15 and 171.16 apply to any activity undertaken under the authority of this exemption.) In addition, the holder(s) of this exemption must also inform the AAHMS, in writing, as soon as practicable of any incidents involving the package and shipments made under this exemption.

Issued at Washington, D.C.

APR 2 4 2003

(DATE)

Robert A. McGuire
for Associate Administrator for
Hazardous Materials Safety

Address all inquiries to: Associate Administrator for Hazardous Materials Safety, Research and Special Programs Administration, Department of Transportation, Washington, D.C. 20590. Attention: DHM-31.

Copies of this exemption may be obtained by accessing the Hazardous Materials Safety Homepage at http://hazmat.dot.gov/exemptions Photo reproductions and legible reductions of this exemption are permitted. Any alteration of this exemption is prohibited.

PO: sdc