

April 10, 2015



U.S. Department  
of Transportation

East Building, PHH-30  
1200 New Jersey Avenue S.E.  
Washington, D.C. 20590

Pipeline and Hazardous  
Materials Safety Administration

DOT-SP 14402  
(SECOND REVISION)

**EXPIRATION DATE: January 31, 2019**

(FOR RENEWAL, SEE 49 CFR § 107.109)

1. GRANTEE: Hexagon Lincoln, Inc.  
Lincoln, NE
2. PURPOSE AND LIMITATIONS:
  - a. This special permit authorizes the manufacture, marking, sale, and use of a non-DOT specification fully wrapped fiber reinforced composite gas cylinder with a non-load sharing plastic liner that meets the ISO 11119 - 3 standard except for the design water capacity and service pressure. This special permit provides no relief from the Hazardous Materials Regulations (HMR) other than as specifically stated herein. The most recent revision supersedes all previous revisions.
  - b. The safety analyses performed in development of this special permit only considered the hazards and risks associated with transportation in commerce. The safety analyses did not consider the hazards and risks associated with consumer use, use as a component of a transport vehicle or other device, or other uses not associated with transportation in commerce.
  - c. Party status will not be granted to this special permit.
3. REGULATORY SYSTEM AFFECTED: 49 CFR Parts 106, 107 and 171-180.
4. REGULATIONS FROM WHICH EXEMPTED: 49 CFR § 173.302a in that the use of a non-DOT specification or UN cylinder is not authorized except as specified herein.

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5. BASIS: This special permit is based on the application of Hexagon Lincoln dated August 7, 2014, submitted in accordance with § 107.109.
6. HAZARDOUS MATERIALS (49 CFR § 172.101):

<b>Hazardous Materials Description</b>			
<b>Proper Shipping Name</b>	<b>Hazard Class/ Division</b>	<b>Identification Number</b>	<b>Packing Group</b>
Argon, compressed	2.2	UN1006	N/A
Helium, compressed	2.2	UN1046	N/A
Hydrogen, compressed	2.1	UN1049	N/A
Neon, compressed	2.2	UN1065	N/A
Nitrogen, compressed	2.2	UN1066	N/A
Methane, compressed or Natural gas, compressed ( <i>with high methane content</i> )	2.1	UN1971	N/A

7. SAFETY CONTROL MEASURES:

a. PACKAGING - Packaging prescribed is a non-DOT specification fully wrapped fiber reinforced composite gas cylinder with a non-metallic and non-load sharing plastic liner as described in Hexagon Lincoln's application on file with the Office of Hazardous Materials Special Permits and Approvals (OHMSPA). Each cylinder must meet all the design and construction requirements for UN composite cylinders specified in § 178.71(1) and of ISO Standard 11119-3 (Gas Cylinders of Composite Construction-Specification and Test Methods - Part 3: Fully wrapped fiber reinforced composite gas cylinders with non-metallic and non-load-sharing metallic liners) except as described following:

- (1) Cylinders made under this special permit are limited to a maximum water volume and service pressure of 550 liters and 507 bar (7352 psig) respectively.

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(2) Each cylinder must be designed to have the ratio of burst pressure ( $P_b$ ) over test pressure ( $P_h$ ) greater than or equal to 2 ( $P_b/P_h = 2$ ).

(3) All of the batch inspection and testing must be performed to meet the 12,000 cycle pressure cycling test using test pressure,  $P_h$ , as described in § 8.5 of ISO 11119-3.

(4) Cylinders with water volume and test pressure greater than or equal to 450 liters and 450 bar (6,525 psig) are authorized the following exception from the requirement of ISO 11119-3:

(i) § 8.1 - The DOT Independent Inspection Agency (IIA) may accept the results of qualification testing that was conducted or witnessed by another IIA. The IIA must evaluate and confirm that the testing met the requirement of this special permit.

(ii) § 8.2.1 - The number of cylinders required to be manufactured for prototype testing must be greater than or equal to the number of cylinders required for testing, plus four (4) for "new designs", or plus two (2) for "design variants". Following successful testing and approval of the new design or design variant. Upon successful result of the prototype testing, the remaining cylinders that were not subjected to design testing may be use as allowed by this special permit.

(iii) § 8.2.7 - The IIA must supervise all testing as specified in this special permit (see Table 2).

(iv) § 8.3.2(d) - a minor change to a resin component that is within the same specification (i.e. from one epoxy to another) may be qualified as a design variant.

(v) § 8.4 - Attached Table 2 (qualification tests) may be used in lieu of Table 2 of ISO 11119-3.

Table 2. Qualification tests for cylinders with water volume and test pressure greater than or equal to 450 liters and 450 bars.

Test no.	Qualification for Design Variants														
		New Design	Length <= 50%	Length >50%	Diameter <=20%	Diameter >20% <= 50%	Liner thickness >20% or manufacture	Liner material	Equivalent fiber	Test Pressure <=20%	Test pressure >20% <=60%	Composite thickness or pattern	Boss-to-liner interface	Equivalent resin matrix	Resin Matrix
9.1	Liner material test							X							
9.3	Composite material test								X			X <sup>1</sup>		X <sup>1</sup>	
8.5.1/2	Hydraulic pressure	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8.5.3	Hydraulic burst	X	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>	X	X <sup>1</sup>	X <sup>1</sup>	X	X <sup>1</sup>	X	X	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>
8.5.4	Ambient cycle	X			X <sup>1</sup>	X		X	X <sup>1</sup>	X <sup>1</sup>	X	X	X <sup>1</sup>		
8.5.6	Environmental cycle	X													X
8.5.7	High temperature creep <sup>1</sup>	X				X <sup>1</sup>		X			X <sup>1a</sup>	X <sup>1a</sup>	X <sub>a</sub>	X <sub>a</sub>	X <sub>a</sub>
8.5.8	Flaw tolerance <sup>1</sup>	X				X									X
8.5.9	Drop	X		X		X		X	X		X				X
8.5.10	High velocity impact (gunfire)	X				X <sup>2</sup>				X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>			X
8.5.11	Fire resistance	X		X <sup>1b</sup>		X <sup>1b</sup>					X				
8.5.12	Permeability	X				X <sup>1</sup>	X	X			X <sup>1</sup>				
8.5.13	Torque	X						X					X		X
8.5.15	Leak	X			X	X		X		X	X		X		
8.5.16	Pneumatic cycle	X				X <sup>1</sup>	X <sup>1</sup>	X					X		

**Notes:**

- For a new design of a cylinder with water volume larger than 450 L, a minimum of 1 cylinder may be used for each design change. For a change of boss-liner interface column, a leak check of the liner interface would be accepted. The pneumatic cycle test is not required if the boss-liner interface does not change.
  - Where the design variant's burst pressure to test pressure ratio is over 20% greater than the same ratio for the approved design.
  - When length increases up to than 50% and/or diameter increases up to 20%, Bonfire test may not be required if the volume stays the same or decreases and the same PRD and number of PRDs are used.
- Test to be conducted for reduction in diameter only

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(vi) § 8.5.8.2 - Temperature monitoring of cylinder not required if temperature is maintained below 85°C.

(vii) § 8.5.6.2 - All new designs must be performed in accordance with ISO 11119-3. Testing that has been performed in the past at a temperature of 40°C for the same type of cylinder with water volume greater than 450 liters may be sent to OHMSPA for consideration.

(viii) § 8.5.10.1 - High velocity impact (gunfire) test - One representative tube charged to service pressure shall be impacted. The cylinder (tube) shall be positioned so that the projectile impact point is in the tube sidewall. During the gunfire test distance from the firing location to test tube must not exceed 50 yards. If the wall is not penetrated, it is also permissible to fire additional bullets into the same area until the wall is penetrated. Tested tubes shall reveal no evidence of a fragmentation failure. Results of the tests must be recorded. Temperature monitoring of cylinder not required if temperature is maintained below 85°C.

(ix) § 8.5.11.1: Pressure relief devices must be in accordance with CGA S-1.1, except that they may be qualified for service pressures up to 507 bar (7,352 psig).

(x) § 8.5.11.2: fire resistance test - the fire resistance test, allowing partial exposure to the cylinder in the horizontal position, may be performed in accordance with ISO 11439 in lieu of vertical fire testing.

(xi) § 8.5.16.1 - Temperature monitoring of cylinder not required if temperature is maintained below 85°C.

(xii) § 9.3 - Certification of fiber strength by the fiber manufacturer is acceptable.

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(xiii) §§ 10.1 & 10.2 - marking must contain the following:

(A) DOT special permit number followed by service pressure expressed in bar (psig). Marking may be on label permanently attached to the outside of the cylinder.

(B) A serial number and the manufacturer's identification number or a symbol as obtained from the Associate Administrator for Hazardous Materials Safety, located just below or immediately following the DOT marking. The serial number and the manufacturer's identification number may be placed on the boss provided the markings are accessible for inspection.

(C) The DOT inspector's official mark must be placed near the serial number. The marking must contain date the (month and year) of the initial hydraulic proof pressure test for that cylinder.

(D) The size of the letters and numbers used must be at least 0.64 cm (1/4 inch) high if space permits.

(E) The following are examples of an authorized format for marking:

DOT-SP AAAAA-YYYY

(where AAAAA is the special permit number and YYYY is the service pressure)

CCCC MMI

(where CCCC is the serial number and MMI is the manufacturer's mark or symbol)

DDD - MM/YY

(where DDD is the inspectors mark and MM/YY is the month and year of the hydraulic proof pressure test).

(5) Additional markings are permitted, provided the additional markings do not obscure the required marking and are not detrimental to the integrity of the cylinder. Provisions for marking of the required requalification dates and RIN information must be made near the cylinder markings.

b. Requalification -

(1) Each cylinder must be requalified once every 5 years by a qualified person holding a valid DOT RIN using a hydraulic proof pressure test equal to 1.5 times the marked service pressure and hold the pressure for a minimum of 3 minutes without a loss of pressure. Each cylinder must visually be inspected in accordance with CGA Pamphlet C-6.2 Guidelines for Visual Inspection and Re-qualification of Fiber Reinforced High Pressure Cylinders, except as specifically noted herein:

(i) Cylinders with fiber damage (cuts, abrasions, etc.) that exceeds Level 1 type damage as defined in CGA Pamphlet C-6.2 and meet the following depth and length criteria are considered to have Level 2 damage:

(A) Depth - Damage that upon visual inspection is seen to penetrate the outer fiberglass layer but does not expose the carbon layer beneath, or that has a measured depth of greater than 0.005 inch and less than 0.045 inch for cylinders with an outside diameter greater than 7.5 inches or less than 0.035 inch for cylinders 7.5 inches or less in outside diameter;

(B) Length - Damage that has a maximum allowable length of:

Region	Direction of fiber damage	Maximum length of damage
Cylinder sidewall and domes	Transverse to fiber direction (longitudinal direction)	20% of the straight sidewall section length
Cylinder sidewall and domes	In fiber direction (circumferential direction)	20% of the straight sidewall section length

(ii) Cylinders with damage that meet the Level 2 criteria must be rejected. Requalifiers must contact the cylinder manufacturer in the event

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that the damage cannot be clearly interpreted based on these criteria. Repair of rejected cylinders is authorized for Level 2 type damage. Repairs must be made in accordance with CGA Pamphlet C-6.2, prior to the hydrostatic pressure test. Repairs must be evaluated after the hydrostatic test.

(iii) Cylinders that have direct fiber damage that penetrates through the outer fiberglass layer and into the carbon layer, or that have a measured damage depth of greater than the Level 2 maximum are considered to have Level 3 type damage. Cylinders that have damage with depth meeting Level 2, but length exceeding the Level 2 maximum are considered to have Level 3 type damage. Cylinders with Level 3 type damage are not authorized to be repaired, and must be condemned.

(iv) A hydrostatic requalification may be repeated as provided in § 180.205(g); only two such tests are permitted. Pressurization prior to the official hydrostatic test for the purpose of a systems check may not exceed 85% of the minimum required test pressure.

(2) Persons who perform inspection and testing of cylinders subject to this special permit must comply with § 180.205(b) and with all the terms and conditions of this special permit.

(3) Requalification date (month/year) must be permanently marked on the cylinder as specified in paragraph § 180.213. The marking of the RIN symbol on the cylinder certifies compliance with all of the terms and conditions of this special permit.

c. OPERATIONAL CONTROLS -

(1) Cylinders manufactured under this special permit are not authorized for use 15 years from the date of manufacture, except as specified under paragraph 8.a. of this special permit.

(2) Cylinders may not be used for underwater breathing purposes.

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(3) A cylinder that has been subjected to fire may not be returned to service.

(4) Cylinders with water volume larger than 450 l are permanently mounted inside of framing or modules during transportation. Structural framework that is intended for transportation of the cylinders under this special permit must have a Finite Element Analysis (FEA) on file with the Office of Hazardous Materials Special Permits and Approvals. The FEA must demonstrate the framework's ability to protect the cylinders from damage due to front, rear, or side impact, and rollover. As a minimum, the frame must be designed to meet the following:

- a. All requirement of § 173.301(i);
- b. The frame design must withstand a static force of eight times the weight of the assembly along the three principle axes, applied individually; and

The frame design must withstand a static force of seven times longitudinally, three times laterally, and three times vertically, the weight of the structure applied simultaneously.

8. SPECIAL PROVISIONS:

a. Service Life Extension Program.

(1) Hexagon Lincoln must formulate a service life extension program within 12 months of the issuance of this special permit for consideration. If Hexagon Lincoln life extension program is accepted by OHMSPA and acknowledged in writing, then the program must be successfully completed for each design type prior to extending cylinder service life from 15 years to 30 years.

(2) Hexagon Lincoln must randomly recall a minimum of thirty cylinders of each design type which have been in service for 10 and 13 years. Cylinders recalled after 10 years shall be designated "Group A" and cylinders recalled after 13 years shall be designated "Group B".

All recalled cylinders must be requalified as specified in ISO 11119-3, Section 8. All cylinders that fail to meet the requalification requirements must

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be condemned, removed from service and rendered incapable of retaining pressure. In the case that some units from the initial minimum lot size are condemned, an additional 30 cylinders must be selected and requalified as specified in paragraph 7.b. These 30 cylinders constitute a batch for additional testing. The cylinders must be tested in accordance with Sections 8.5.4, 8.5.5, 8.5.7 and 8.5.8 of ISO 11119-3. An Independent Inspector must witness all tests. Acceptance criteria shall be as defined in ISO 11119-3 except  $P_b = 1.8P_h$  and the design life (y) must be greater than or equal to 20 years.

(3) The complete test report including original test data must be submitted to the Associate Administrator for Hazardous Materials Safety for assessment within 30 days of completion. Failure to meet the acceptance criteria specified in this section shall result in the design being restricted to a maximum life of 15 years.

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

c. A person who is not a holder of this special permit, but receives a package covered by this special permit, may reoffer it for transportation provided no modification or change is made to the package and it is offered for transportation in conformance with this special permit and the HMR.

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

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

f. Each packaging manufactured under the authority of this special permit must be either (1) marked with the name of the manufacturer and location (city and state) of the facility at which it is manufactured or (2) marked with a registration symbol designated for a specific manufacturing

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facility by the Office of Hazardous Materials Special permits and Approvals for a specific manufacturing facility.

g. The cylinders described in this special permit are authorized only for normal transportation as an article of commerce i.e., the movement of hazardous materials packages from consignor to consignee.

h. When authorized for transportation by cargo vessel as prescribed in § 172.101, Hazardous Materials Table, flammable gases covered by this special permit must be packed within a closed freight container of steel construction.

9. MODES OF TRANSPORTATION AUTHORIZED: Motor vehicle, cargo vessel, and rail freight.
10. MODAL REQUIREMENTS: A current copy of this special permit must be carried aboard each cargo vessel and motor vehicle used to transport packages covered by this special permit.
11. COMPLIANCE: Failure by a person to comply with any of the following may result in suspension or revocation of this special permit and penalties prescribed by the Federal hazardous materials transportation law, 49 U.S.C. 5101 et seq:
  - o All terms and conditions prescribed in this special permit and the Hazardous Materials Regulations, 49 CFR Parts 171-180.
  - o Persons operating under the terms of this special permit must comply with the security plan requirement in Subpart I of Part 172 of the HMR, when applicable.
  - o Registration required by § 107.601 et seq., when applicable.

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

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

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Under Title VII of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)–“The Hazardous Materials Safety and Security Reauthorization Act of 2005” (Pub. L. 109-59), 119 Stat. 1144 (August 10, 2005), amended the Federal hazardous materials transportation law by changing the term “exemption” to “special permit” and authorizes a special permit to be granted up to two years for new special permits and up to four years for renewals.

12. REPORTING REQUIREMENTS: Shipments or operations conducted under this special permit are subject to the Hazardous Materials Incident Reporting requirements specified in 49 CFR §§ 171.15 - Immediate notice of certain hazardous materials incidents, and 171.16 - Detailed hazardous materials incident reports. In addition, the grantee(s) of this special permit must notify the Associate Administrator for Hazardous Materials Safety, in writing, of any incident involving a package, shipment or operation conducted under terms of this special permit.

Issued in Washington, D.C.:



for Dr. Magdy El-Sibaie

Associate Administrator for Hazardous Materials Safety  
Address all inquiries to: Associate Administrator for Hazardous Materials Safety, Pipeline and Hazardous Material Safety Administration, U.S. Department of Transportation, East Building PHH-30, 1200 New Jersey Avenue, Southeast, Washington, D.C. 20590.

Copies of this special permit may be obtained by accessing the Hazardous Materials Safety Homepage at [http://hazmat.dot.gov/sp\\_app/special\\_permits/spec\\_perm\\_index.htm](http://hazmat.dot.gov/sp_app/special_permits/spec_perm_index.htm)  
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