December 14, 2009

U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety Administration**

East Building, PHH – 30
1200 New Jersey Avenue, Southeast
Washington, D.C. 20590

DOT-SP 14867

EXPIRATION DATE: October 31, 2011

(FOR RENEWAL, SEE 49 CFR § 107.109)

1. GRANTEE: GTM Manufacturing, LLC
Amarillo, TX

2. PURPOSE AND LIMITATIONS:

a. This special permit authorizes the manufacture, marking, sale and use of non-DOT specification hoop-wrapped fiber reinforced welded steel lined tubes with water capacities of up to 2525 gallons (9560L), enclosed and secured within an ISO freight container for the transportation in commerce of the materials authorized by this special permit. 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.

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

4. REGULATIONS FROM WHICH EXEMPTED: 49 CFR §§ 173.302a and 173.304 in that the use of a non-DOT specification packaging is not authorized except as specified herein.

5. BASIS: This special permit is based on the application of GTM Manufacturing, LLC dated May 21, 2009, submitted in accordance with § 107.105 and the public proceeding thereon.

6. HAZARDOUS MATERIALS (49 CFR § 172.101):

Hazardous Material Description			
Proper Shipping Name	**Hazard Class/ Division**	**Identi- fication Number**	**Packing Group**
Methane, compressed or Natural gas, compressed (with high methane content)	2.1	UN1971	N/A
Air, compressed; Oxygen, compressed; Helium, compressed; Nitric oxide; Argon, compressed; Nitrogen, compressed; and mixtures, thereof.	Division 2.1 or 2.2, as appro- priate	As listed in § 172.101 for specific compressed gases or gas mixtures	N/A
Hydrogen, compressed; Methane, compressed; Natural gas, compressed; Ethane, compressed; Propane; Silane; and mixtures thereof; and mixtures of these Division 2.1 gases with Helium compressed; Argon, compressed or Nitrogen, compressed.	Division 2.1 or 2.2, as appro- priate	As listed in § 172.101 for specific compressed gases or gas mixtures	N/A

7. SAFETY CONTROL MEASURES:

a. PACKAGING - Prescribed packaging is a non-DOT specification fiber reinforced plastic (FRP), hoop-wrapped (HW), API-5LX High Strength Low Alloy (HSLA) electric resistance welded (ERW) steel pipe with hot formed API-5LX-70 HSLA or SA-516-70 steel heads fabricated in accordance with GTM Manufacturing, LLC data presented with their original application and additional information on file with the Office of Hazardous Materials Special Permits and

Approvals (OHMSPA), and in full conformance with DOT FRP-2 Standard Revision 1 dated January 4, 1987 (§ 178.BB), except as follows:

§ 178.BB-2 Type size and service pressure.

Type 3HW tube consisting of resin impregnated continuous filament windings in the circumferential direction only over an API-5LX electric resistance welded (ERW) steel pipe made in compliance with § 178.BB-6(a) of this special permit; not over 2,525 gallons nominal water capacity; and service pressure at least 900 psi but not greater than 4,000 psi.

§ 178.BB-3 Inspection by whom and where.

Inspection and verification must be performed by an independent inspection agency approved in writing by the Associate Administrator for Hazardous Material Safety, in accordance with 49 CFR Subpart I. Chemical analysis and tests must be made in the United States, unless otherwise approved in writing by the Associate Administrator, in accordance with 49 CFR Subpart I.

§ 178.BB-4 Duties of the Inspector.

(a) Determine that all materials conform to the requirements in this special permit.

(b) Verify compliance of the ERW steel pipe liner and heads with § 178.BB-6(a) of this special permit. Verify compliance of filament and resin system components with the requirements specified in § 178.BB-5 of this special permit.

(c) Prior to initial shipment of any specific composite tube design, verify acceptable results of the design and qualification tests prescribed in § 178.BB-18.

(d) Verify that each completed tube conforms to all requirements, including markings.

(e) Verify the winding process is to ensure that the composite material is uniform, of required thickness and pattern, and in accordance with the composite design and the structure present in the tubes subjected to the design qualification tests.

(f) Witness all tests and pressurizations; obtain copies of all test results and certifications; and report volumetric capacity, permanent expansion and completed composite tube weight.

(g) Furnish completed inspector's report (§ 178.BB-16) to the manufacturer and upon request, to the customer or representative of the DOT. (See § 178.BB-17).

§ 178.BB-5 Authorized Materials and Identification of material.

(a) ERW steel liner must be ASTM SA 516-70 or API 5L-X70 HSLA. The steel analysis must conform to the following:

Material Composition	*ASTM 841 Grade F / API 5LX70		*ASTM SA516-70	
	Percent minimum	Percent maximum	Percent minimum	Percent maximum
Carbon		0.10		0.18
Manganese	1.10	1.70	0.85	1.20
Phosphorus		0.020		0.020
Sulphur		0.008		0.010
Silicon	0.05	0.45	0.05	0.40
Copper		0.40		0.40
Nickel		0.85		0.40
Chromium		0.60		0.50
Molybdenum		0.50		0.125
Niobium		0.11		0.04
Vanadium		0.09		0.03
Titanium		0.025		0.03
Boron		0.0005		0.0005
Aluminum	0.020 total or 0.015 acid soluble		0.020 total or 0.015 acid soluble	

* The check analysis must be within the tolerances stated for the respective material.

(b) Heads must be ASTM SA 516-70 or API 5L-X70 HSLA hot-formed steel and air cooled. Only open hearth, basic oxygen or electric furnace process

of uniform quality is authorized. The steel analysis must conform to SA 516-70 or ASTM A 841, Grade F. and the following:

Material Composition	*ASTM 841 Grade F / API 5LX70		*ASTM SA516-70	
	Percent minimum	Percent maximum	Percent minimum	Percent maximum
Carbon		0.10		0.18
Manganese	1.10	1.70	0.85	1.20
Phosphorus		0.020		0.020
Sulphur		0.008		0.010
Silicon	0.05	0.45	0.05	0.40
Copper		0.40		0.40
Nickel		0.85		0.40
Chromium		0.60		0.50
Molybdenum		0.50		0.125
Niobium		0.11		0.04
Vanadium		0.09		0.03
Titanium		0.025		0.03
Boron		0.0005		0.0005
Aluminum	0.020 total or 0.015 acid soluble		0.020 total or 0.015 acid soluble	

* The check analysis must be within the tolerances stated for the respective material.

(c) A heat of steel made under these specifications, the ladle analysis of which is slightly out of the specified range, is acceptable if satisfactory in all other aspects. The check analysis tolerances may not be exceeded without prior written approval of the Associate Administrator.

(d) Materials with seams, cracks, laminations, or other injurious defects are not permitted.

(e) Materials used must be identified by any suitable method to ensure traceability.

(f) Filament materials must be commercial Type E fiberglass. Filaments must be tested in

accordance with ASTM D-2343-67 and have minimum strand strength of 200,000 psi.

(g) Resin system must be flexible isothalic polyester type with at least 2 percent elongation (at break, and at least 7,500 psi tensile strength). Resin system must be neat resin with no fibers tested on a sample coupon representative of the composite overwrap in accordance with ASTM D-2344-84(89) and have minimum shear strength of 2,000 psi.

(h) Materials used must be identified by any suitable method to ensure traceability.

(i) Materials must be of uniform quality and contain no injurious defects.

§ 178.BB-6 Manufacture.

(a) Liner. ERW steel liner with overwrap must be designed for a service pressure of at least 50 percent of the service pressure marked on the composite reinforced tube, and must conform with 49 CFR 190.53 DOT API 5L-X70, PLS2 specification for steel pipe, with yield strength of 70,000 psi to 90,000 psi, and tensile strength of 82,000 psi to 102,000 psi except:

(1) Dirt and scale must be removed prior to inspection and processing into the finished tube.

(2) Surface finish must be uniform and reasonably smooth.

(3) No defect of any kind is permitted if it is likely to appreciably weaken the finished tube.

(4) Minimum wall thickness shall be maintained after any surface defect removal or abatement is performed on the liner.

(5) No marking is to be applied to the finished tube except as specified in § 178.BB-15.

(6) Hydrostatic testing of any tube prior to application of filament is authorized up to 100 percent of SYMS of the API 5L-X70 specified value and shall not exceed 95 percent (2850 psi) of the marked service pressure of the finished composite reinforced tube.

b. COMPOSITE REINFORCED TUBE. The composite reinforced tube must be made from an API 5L—X70 steel pipe liner circumferentially wrapped with resin impregnated continuous filament winding. The winding pattern must be "hoop" wrapped, applied under controlled tension to develop the required composite thickness. After winding is complete, the composite must be cured by a controlled temperature profile, and auto-frettaged by pressurizing the tube to not less than 105% and not greater than 116% of the prescribed minimum test pressure. Pressure shall be rounded up to determine the appropriate values. No defect is acceptable that is likely to weaken the finished composite tube.

c. WELDING. Welding is authorized. The attachment of heads to the steel liner is authorized provided that they are of weldable quality steel with a carbon content not to exceed 0.25%, and are done with the same controlled process variables used for the successful design qualification tests. Weld filler material strength must equal or exceed that of the parent material.

d. Circumferential Seams by Welding. Heads attached by welding must have an open root as specified in the weld procedures or alternatively be driven fit with the flange of the head thoroughly welded with complete penetration of the pipe liner to head joint or welded with line up clamps to ensure proper fit up to ensure complete penetration of the pipe to head weld joint.

(1) Weld Testing. Guided bend test. A root bend test specimen shall be cut from the pipe liner to head joint or a welded test plate shall be used for the tensile test specimen. A specimen must be taken across the major seam and must be prepared and tested in accordance with the requirements of CGA Pamphlet C-3.

(2) Alternatively, a reduced section tensile test shall be made transverse to the weld seam. The tensile test shall not be less than 100% of the minimum specified tensile strength of the base materials. If the specimen

tested fails, up to two additional specimens from the same tube may be tested to qualify the lot. Failure of the additional specimens shall constitute failure of the entire lot.

(3) Ultrasonic Examination. The ultrasonic examination shall be made by "Phased Array" inspection technique, capable of detecting a rejectable flaw size of 2mm in depth and 5mm long. 100% of the circumferential weld of each shell to head joint shall be ultrasonically examined in accordance with the requirements of ASME Section V.

(4) Longitudinal Weld Joints in Shell: Only High frequency electric resistance welded joints are authorized. All welding and inspection shall meet API 5L X70 PSL2 criteria. Welded repairs are not authorized. Weld joints must be annealed at a minimum or 1600 F.

(5) Ultrasonic Inspection of Longitudinal Weld Joints shall be in accordance with the requirements of API 5L-X PSL2.

e. Lot Size.

(1) Liner lot size means a group of tubes successively produced from a heat of steel having the same:

(i) size and configuration;

(ii) specified material of construction;

(iii) process of manufacture including ERW welding, post weld annealing and thermal treatment;

(iv) equipment of manufacture; and

(v) conditions of time, temperature and atmosphere during thermal treatment.

(2) Heads shall have the same:

(i) size and configuration;

(ii) specified materials of construction;

(iii) process of manufacture, including forming and preheating;

(iv) equipment of manufacture and thermal treatment and;

(v) conditions of time, temperature and atmosphere during thermal treatment.

(3) Composite reinforced tube lot size means a group of tubes successively produced from qualified liners having:

(i) the same size and configuration;

(ii) the same specified materials of construction;

(iii) the same process of manufacture with the same tube specification (steel pipe liner, head) specification;

(iv) auto-frettaged and hydro-testing under the same conditions of time, temperature and pressure;

(v) In no case may the lot size exceed 200; however, any composite reinforced tube processed for use in the required destructive tests need not be counted as one of the 200, but must be processed with the lot.

f. Design Qualification Test. Prior to initial shipment of any specific tube design, qualification tests as prescribed in § 178.BB-18 must have been performed with satisfactory results.

§ 178.BB-7 Wall thickness.

(a) Minimum thickness of the liner must be at least equal to the minimum design thickness and be such that after auto-frettage, the compressive stress in the sidewall of the liner at zero pressure will not exceed 95 percent of the minimum design yield strength shown in § 178.BB-18(j). The maximum tensile stress of the liner at operating pressure must not exceed 60 percent of its yield strength.

(b) The maximum filament stress at service pressure must not exceed 40 percent of the filament stress.

(c) The head design must incorporate added materials to ensure the stresses in the areas not supported by the hoop wrap are less than the stresses in the cylindrical portion of the tubes.

(d) Stresses shall be computed by analysis techniques, such as NASA CF-72124, "Computer Program for the Analysis of Filament Wound Reinforced Metal Shell Pressure Vessels", May 1966.

§ 178.BB-8 Openings.

(a) Openings are permitted only on heads. The centerline of openings must coincide with the longitudinal axis of the tube.

(1) The size of any opening in a head may not exceed 15% the outside diameter of the pipe liner.

(2) All openings must be circular.

(b) All openings must be threaded.

(1) Thread openings must be clean cut, even, without checks and to gauge.

(2) Tapered threads are authorized, and when used must conform to:

(i) American Standard Pipe thread (NPT) type, and must be in compliance with the requirements of NBS Handbook H-28, Part II, Section VII; or

(ii) National Gas Taper thread (NGT) meeting the requirements of NBS Handbook H-28, Part II, Sections VII and IX.

(3) Straight threads conforming to the requirements of Federal Standard (FED-STD) H28-1978, Natural Gas Straight (NGS) thread, or other straight threads having at least 6

engaged threads are authorized provided the minimum calculated shear strength is ten times the test pressure of the tube.

§ 178.BB-9 Curing of the Finished Composite Reinforced Tube.

The resin must be cured at the temperature and process specified by the manufacturer and noted in the Inspector's report, and shall not exceed 400°F. Curing temperature and process must correspond with that of the specific design qualification test tube.

§ 178.BB-10 Pressure Relief Devices and Protection for Valves, Relief Devices, and other connections.

(a) Pressure relief devices and protection for valves and other connections must conform with the requirements of §§ 173.301(g) and 173.301(i), be secured in the container and withstand the rollover and fire test described in the application on file, except that the adequacy of the pressure relief devices for each design may be verified in accordance with the design qualification bonfire test detailed in 178.BB-18(g) of this special permit.

(b) No pressure relief device will be required if:

(1) The gas is a permanent gas (non-liquefied) (see § 173.302).

(2) The completed GTM with tubes pressurized to the marked service pressure shall pass a "pan fire test" using a pan at least 8" deep and extending beyond the GTM on all sides 12 to 24 inches. One hundred fifty (150) gallons minimum of diesel fuel or JP-4 shall be ignited and allowed to burn out. The pressure in any tube shall be monitored and shall at no time exceed the test pressure of the finished composite reinforced tube.

§ 178.BB-11 Non-Destructive tests.

(a) Hydrostatic test

(1) By water jacket or direct expansion method, operated so as to obtain accurate data. Pressure gauge must permit reading to an accuracy of 1 percent in the range of 80 percent to 100 percent of test pressure. Expansion gauge must permit reading of total expansion to accuracy of either plus or minus 0.05 percent.

(2) The accuracy of the test equipment must be maintained by periodic recalibration. Records must be maintained to verify that the test equipment is calibrated on a regular basis. A calibration tube capable of verifying the equipment accuracy for the material, size and test pressure of tested tube, must be used for checking the equipment at the beginning of each day.

(3) Pressure must be maintained for a minimum of 3 minutes at auto-frettage pressure or longer to insure complete expansion. Any internal pressure applied after auto-frettage and prior to the official test must not exceed 95 percent of the test pressure. If, due to failure of the test apparatus, the test pressure can not be maintained, the test may be repeated at a pressure increased by 10 percent or 100 psi, whichever is lower. Not more than 2 such repeated tests are allowed.

(4) Each tube must be tested to at least 5/3 times the service pressure. In no case may the test pressure exceed the auto-frettage pressure.

§ 178.BB-12 Destructive tests.

(a) Cycling test: One tube taken at random out of each lot of 200 tubes or less must be subjected to a cyclic pressurization test by hydrostatically pressurizing the tube between approximately zero

psi and the designated pressure at a rate not to exceed 4 cycles per minute. Adequate recording instrumentation must be provided if the equipment is to be left unattended for periods of time. All tubes used in the cycle test must be destroyed.

(b) Burst test: One tube taken at random out of each lot of 200 tubes or less shall be hydrostatically pressurized to failure as follows: pressure shall be increased at a uniform rate up to the minimum prescribed burst pressure; this pressure must be held for at least 60 seconds; then the pressure shall be increased to failure at a rate not to exceed 200 psi per second. The tube cycle tested in (a) above may be used for this burst test.

§ 178.BB-13 Acceptable results of tests.

(a) Hydrostatic test.

(1) The permanent volumetric expansion of the tube must not exceed 5 percent of the total volumetric expansion at test pressure.

(2) All tubes failing to pass the hydrostatic test must be rejected.

(b) Liner test. Applies to the steel liner only.

(1) Elongation must be at least 20 percent; except that an elongation of 10 percent is acceptable when authorized specimen size is 24t x 6t in accordance with API 5L-X70 PSL2 specification requirements.

(2) When the test results fail to meet requirements, the lot must be rejected.

(3) A retest of a rejected lot is authorized if an improper test was made due to the presence of a defect in the specimen or if the equipment of procedure was faulty. The retest must be performed on specimens taken from the same tube liner.

(c) Cycling test.

(1) Each tube tested at a minimum must withstand 10,000 pressurizations between approximately zero and service pressure, followed by at least 30 pressurizations between zero and test pressure, without evidence of distortion or failure.

(2) If the tube fails to meet the cycle test and the failure can be related to an anomaly, then two more tests may be taken from the same lot and subjected to the same test, both tubes must pass.

(3) When 2 of the 3 tubes tested fail the cycle test, the lot represented must be rejected.

(d) Burst Test.

(1) Burst pressure shall be at least 2.4 times the service pressure and in no case less than the value necessary to meet the stress criteria of 178.BB-7(a). Failure must initiate in the tube sidewall. Tubes with marked service pressure not exceeding 2,200 psi must remain in one piece. Burst pressure and failure mode must be recorded.

(2) If the tube should fail to meet the required burst pressure and the failure can be related to an anomaly, then two more tests may be taken from the same lot and subjected to the same test. Both tubes must pass the test for acceptance of the lot.

(3) When 2 of the 3 tubes tested fail to withstand the minimum prescribed burst pressure, the lot must be rejected.

§ 178.BB-14 Rejected Liners and Tubes.

(a) Physical Test. Reheat treatment of the API 5L-X70 pipe liner is not authorized. Subsequent thereto, acceptable liners must pass all prescribed tests.

(b) Hydrostatic Test. Tubes rejected by the hydrostatic test must not be placed in service.

(c) Cycle Test. Tube lots rejected by the cycle test must not be placed in service.

(d) Burst Test. Tube lots rejected by the cycle test must not be placed in service.

§ 178.BB-15 Marking.

(a) Each tube must be permanently marked by a method other than stamping in the composite reinforced wrap, on the side near the end of the tube containing the valve outlet.

(b) Required markings are as follows:

(i) DOT-SP***-YYYY (where ***** = Special Permit number and YYYY=service pressure in psig (bar).

(ii) A serial number and an identifying symbol (letters); the location of the symbol shall be just below or immediately following the serial number. The symbol and serial number must be those registered with the Associate Administrator of Hazardous Material Safety; duplication of the symbol is not authorized.

(iii) The inspector's official mark must be placed near the serial number.

(iv) Date of original test (month and year).

(v) Examples of tube marking:

DOT-SP***-2005 or DOT-SP***-2005-1234-XX-AA-3-811234-XY AB 3-81

(c) Size of marks on the heads must be at least ¼ inch high, using low stress steel stamps.

(d) Additional markings are permitted in the head opposite the valve end, and/or composite, provided the markings are not of a size and depth that will create harmful stress concentrations.

(e) Retest dates may be stamped in low stress area of both heads.

§ 178.BB-16 Inspector's report.

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

Each composite reinforced steel tube was made by circumferentially overwrappping an API 5L-X70 ERW steel liner with resin impregnated continuous filament reinforcement. Composite over wrap was made by winding resin impregnated continuous filament over this liner in circumferential direction only, followed by curing the resin at controlled temperature. The liner conforms to 178-BB-6 for API 5L-X70 ERW steel pipe having a service pressure of 1500 psig. Conformance of the liner with 178-BB-6 was verified by performance of the prescribed tests or by obtaining the report of the inspector performing the tests.

Filament and resin were certified by the manufacturer and identified by package number. Strand strength of filament was verified. Shear strength of composite was verified. After wrapping, composite was cured per manufacturer's specification.

Prescribed auto-frettage and hydrostatic tests were made in the presence of the inspector. All tubes conform to specification requirements and the applicable terms of this special permit.

Tensile stress on the ERW steel liner is calculated to be_____ psi at the service pressure of _____ psi.
Filament stress is calculated to be _____ at service pressure.

I hereby certify that all of these tubes proved satisfactory in every way and conform to the requirements for DOT-SP 14867; except as follows:

Exceptions taken to any of the reporting or testing requirements of this special permit are:

(Signed)_____ Date _____

(Inspector)

Record of Chemical Analysis of Material for Liner:
Place: Date: Special Permit #
Serial #'s Size: O.D. Length
Manufacturer Name:
Customer:
Material Description:
Note: Any omission of analysis by heats, must be accounted for by notation herein reading, "The prescribed certificate of the manufacturer of the material has been secured, found satisfactory, and placed on file" or by attaching a copy of the certificate.

Alloy Designation & Tube represented (serial nos.)
Chemical Analysis:
Material manufacturer and mill analysis made by:
Whether of not certified mill reports are on file with the material manufacturer.

Inspector Signature: Date:

Record of Physical Tests of Material for Liner:
Place: Date: Special Permit #
Serial #'s Size: O.D. Length
Manufacturer Name:
Customer:
Test specimen description:
Lot Code: Serial #'s:
Yield: Tensile: % Elongation:

Inspector Signature: Date:

Report of Composite Analysis:
Place: Date: Special Permit #
Serial #'s Size: O.D. Length
Manufacturer Name:

Customer:
Filament specification and designation details:
Filament manufacturer:
Manufacturers package number:
Tensile:
Inter-laminar shear strength:

Inspector Signature: Date:

Resin System Components Manufacturing Batch Numbers:

Place: Date: Special Permit #
Serial #'s Size: O.D. Length
Manufacturer Name:
Customer:
Resin type: Batch #:
Curing agent: Batch #:
Accelerator: Batch #:
Other if applicable: Batch #:

Inspector Signature: Date:

Report of Hydrostatic Test for Composite Re-enforced Steel Tubes:

Place: Date: Special Permit #
Serial #'s Size: O.D. Length
Manufacturer Name:
Customer:
Customer location:
Minimum prescribed test pressure:
Weight (without valve):
Hydrostatic test:
Serial #: Liner: Composite: Volume:
Autofrettage pressure:
Total expansion (TE):
Permanent expansion(PE):
Ratio PE to TW in % :
Test Pressure:

Inspector Signature: Date:

Lot Cycling and Burst Tests:

Place: Date: Special Permit #
Size: O.D. Length
Manufacturer Name:
Customer:

Test Type	Serial Number of Tube	Number of pressurizations		Burst Pressure
		To service pressure	To test pressure	
Cycling				
Virgin Burst				

Inspector Signature: Date:

§ 178.BB-17 Retention of Inspector's report.

The inspector's report must be retained for 15 years from the original test date on the tube by the manufacturer and inspector.

§ 178.BB-18 Design qualification tests.

(a) General. Except as authorized in writing by the Associate Administrator for Hazardous Material Safety, qualification tests as prescribed in this paragraph must be performed on representative tubes of each specific design prior to any initial shipment. All tubes used for design qualification tests must be fabricated on the same equipment and subjected to the same processes as is used to produce the tubes intended for filling and shipment. All tests must be witnessed by an independent inspector. Test reports must be kept on file by the tube manufacturer and made available to the independent inspector and any representative of the Office of Hazardous Materials Safety upon request.

(b) Design Changes. For the purposes of this special permit, a design change is:

(1) any change in manufacturer
(2) any change in material;
(3) a 20 percent or greater change in diameter or service pressure;
(4) a 50 percent or greater change in water capacity

(c) Test requirements. Each tube design or any design change to an approved design must be

qualified by subjecting representative tubes to the tests prescribed in the following table:

	Original Design	Design Change		
Test Type		Material	Diameter or Service Pressure	Water Capacity
		Any Change	Greater than 20% Change	Greater than 50% Change
Cycling Ambient	X	X	X	X
Cycling Environmental	X	X	X	
Cycling Thermal	X	X	X	
Hydraulic Burst	X	X	X	X
Gunfire	X	X		
Bonfire	X	X	X	X

Instead of applying the "change in water capacity", shown in this subparagraph, to design qualification test requirements for environmental cycling and thermal cycling, the following is authorized for tubes greater than 42 inches in length:

(1) When a design has been qualified by environmental cycling and thermal cycling design qualification tests performed on test tubes at least 42 inches long, further tests are not required unless the change in length exceeds 100 percent.

(d) Pressure cycling tests.

All cycling tests shall be performed by hydrostatically pressurizing the tube between zero and the designated pressure at a rate not to exceed 4 cycles per minute. Adequate recording instrumentation must be provided if the equipment is to be left unattended for periods of time. All tubes used in the cycle test must be destroyed.

Note: 24” diameter, 60” length test specimens for Hot/Cold/Environmental vs 24” diameter, 20 feet length due to constraint of testing facilities is authorized.

(1) Ambient Temperature: A representative tube shall be tested at ambient temperature without showing visible evidence of distortion, deterioration or failure as follows: Each tube tested at a minimum must withstand 10,000 pressurizations between approximately zero and service pressure, followed by at least 30 pressurizations between zero and test pressure. After completion of the test, the tube shall be pressurized to burst in accordance with the following paragraph, and the burst pressure recorded.

(2) Environmental test: A representative tube shall be tested without showing visible evidence of distortion, deterioration or failure as follows:

(i) The tube shall be conditioned for 48 hours at zero pressure, a minimum 140F, and a minimum 95% relative humidity.

(ii) Pressurize from zero to service pressure for 5,000 cycles a minimum 140F, and a minimum 95% relative humidity.

(iii) Stabilize at zero pressure and ambient conditions.

(iv) Pressurize from zero to service pressure for 5,000 cycles at minus 60F or lower.

(v) Stabilize at zero pressure and ambient conditions.

(vi) Pressurize form zero to test pressure for 30 cycles at ambient temperature.

(3) Thermal test: A representative tube shall be tested without showing visible evidence of distortion, deterioration or failure as follows:

(i) At ambient temperature from zero to service pressure, cycle 10,000 times followed by 30 cycles from zero to test pressure.

(ii) Hydrostatically pressurize to service pressure and submerge and hold tube for 10 minutes in 200F fluid; transfer the tube and submerge for 10 minutes into minus 60°F fluid. Transfer time shall be between one and three minutes, with the pressure in the tube controlled within the range of service to test pressure. Repeat 20 times.

(4) After passing this test, the tube must be burst-tested and the pressure recorded.

(e) Hydraulic burst test. One representative tube shall be hydrostatically pressurized to failure as follows:

(1) Pressure shall be applied at a uniform rate not to exceed 200 psi per second, up to the designated burst pressure, and held for a minimum of 60 seconds; the pressure shall be increased to failure and the burst pressure recorded.

(2) The burst pressure of the tube must be at least 2.4 times the marked service pressure. Failure must initiate in the sidewall and the tube must remain in one piece. The burst pressure and failure must be recorded.

(f) Gunfire test. One representative tube charged with air or nitrogen to service pressure shall be impacted by a 0.50 caliber armor piercing projectile and a 0.50 caliber "tumbled" armor piercing projectile. The composite tube shall be positioned so that the projectile impact point is in the tube sidewall having hoop winding. The

distance from the firing location to test tube must not exceed 50 yards. Tested tubes shall reveal no evidence of a fragmentation failure. Results of the tests must be recorded.

(g) Fire Engulfment test. The composite tubes tested must be fitted with pressure relief devices in accordance with § 178.BB-10 and charged with the intended lading to the prescribed filling pressure or density. Charging with nitrogen or air is authorized only if the subject tubes will be in non-liquefied gas service. A single tube and the completed assembly shall pass a "pan fire test" using a pan at least 8" deep and extending beyond the GTM on all sides 12 to 24 inches. 150 gallons minimum of diesel fuel or JP-4 shall be ignited and allowed to burn out. The pressure in any tube shall be monitored and shall at no time exceed the test pressure of the finished composite reinforced tube. Results are acceptable if the contents do not vent or vent through the PRD. After successfully passing the fire test, the single tube must be pressurized to burst as required in § 178.BB-18(g) above, and the pressure recorded.

(h) Rollover test. The complete assembly, charged to service pressure shall be rolled or dropped from a height representing the actual configuration during transportation. The assembly shall be robust enough to withstand a minimum 8g load as evidenced by typical shock load indicators. Results are acceptable if there is no apparent damage to the piping, valves, or fittings resulting in loss of contents.

(i) Forklift Puncture test. The complete assembly shall be puncture tested as described in the application. As a minimum any tube within the assembly shall be capable of withstanding level 2 damage as defined in paragraph 7.B above.

(j) Qualification test results. A report of all tests for each design qualification, describing test setup, procedure and results must be submitted to the OHMSPA prior to production of the design. The report as a minimum must include the following for each design tested.

BASIC TUBE DESIGN DATA:

Date: _____
Special Permit number: _____
Service Pressure: _____
Auto-frettage pressure (Note 1): _____
Test pressure: _____
Minimum burst pressure: _____
Calculated burst pressure: _____
Volume: _____
Inside diameter: _____
Outside diameter: _____
Liner material: _____
Filament material: _____
Resin material: _____
Total weight of tube: _____
Weight of liner: _____
Weight of composite material: _____
Minimum wall thickness of liner
of Design Qualified tube: _____
Minimum design wall thickness of liner: _____
Yield strength of liner
of Design Qualified tube: _____
Minimum design yield strength of liner: _____
Nominal thickness of overwrap: _____
Minimum strand strength of filament: _____
Minimum shear strength of resin: _____

Note: For each tube qualification, the total and permanent volumetric expansion readings obtained in the auto-frettage pressurizations must be recorded.

DESIGN STRESSES AND LOAD DISTRIBUTION

STRESS					LOAD	
Direction			Distribution		Distribution (%)	
Pressure	Longitudinal	Circumferential	Liner	Overwrap	Liner	Overwrap
Zero	X					
		X				
Service	X					
		X				
Test	X					
		X				
*Min. Burst	X					
		X				

* Based on § 178.BB-7.

g. TESTING (Continued Service)-

Tubes must be reinspected and hydrostatically retested at least once every five years. Testing must be performed in accordance with DOT-FRP-2, tested to 5/3 of the marked service pressure, 49 CFR 180.205, and the latest edition of CGA pamphlet C-6.2 "Guidelines for Visual Inspection and Re-qualification of Fiber Reinforced High Pressure Cylinders", except as specifically noted herein:

(1) Tubes must be volumetrically tested by the water jacket method suitable for the determination of the tube expansion for a minimum test time of one minute.

(2) A maximum permanent expansion to total expansion ratio does not apply. The tube must be condemned if the elastic expansion exceeds the rejection elastic expansion (REE) as marked on the tube.

(3) Retest markings must be applied on a label securely affixed to the tube and over coated with epoxy, near the original test date. Metal stamping of the composite surface is prohibited. Reheat treatment of rejected tubes is not authorized.

(4) Tubes with fiber damage (cuts, abrasions, etc.) that exceed 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:

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

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

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

(5) Tubes with damage that meet the Level 2 criteria must be rejected. Retesters must contact the tube manufacturer in the event that damage is questionable based on this criteria. Repair of rejected tubes is authorized for Level 2 type damage. Repairs must be made in accordance with CGA pamphlet C-6.2 or the manufacture’s requirements, prior to the hydrostatic pressure test. Repairs must be evaluated after the hydrostatic test.

(6) Tubes that have direct fiber damage that penetrates through the outer cosmetic surface(resin rich)

fiberglass layer and into the fiberglass layer, or that have a measured damage depth of greater than the Level 2 maximum stated in (5)(a) above are considered to have Level 3 type damage. Tubes that have damage with depth meeting Level 2, but length exceeding the Level 2 maximum is considered to have Level 3 type damage. Tubes with Level 3 type damage are not authorized to be repaired, and must be condemned.

(7) A hydrostatic retest may be repeated as provided for in § 180.205(g), however, only two such retests are permitted. Pressurization prior to the official hydrostatic test for the purpose of a systems check must not exceed 85% of the required test pressure.

h. OPERATIONAL CONTROLS -

(1) Tubes manufactured under this special permit are not authorized for use fifteen (15) years after the date of manufacture. In service testing reports are required to be submitted to the OHMSPA starting within 24 months from date of manufacture for review.

(2) A tube that has been subjected to fire may not be returned to service.

(3) Tubes must be manifolded in accordance with the requirements of § 173.301(g).

(4) All tubes must be operated and maintained in accordance with GTM Manufacturing, LLC Operations Manual.

(5) Tubes shall be permanently mounted within a high strength structural framework that safely secures the tubes, components, and manifolding. The frame must be designed in accordance with § 173.301(i), and the manufacturers criteria to withstand the rollover, impact and other tests specified in the special permit.

(6) If tubes are not fitted with pressure relief devices:

(i) The driver of the transport vehicle must be instructed that when the vehicle is in an accident involving spilled fuel or fire, the vehicle must be move to a safe location unless moving the vehicle would directly endanger others.

(ii) Emergency response information provided with the shipment and available via an emergency response telephone number must indicate that the receptacles are not fitted with pressure relief devices and provide appropriate guidance for explosive fire.

8. SPECIAL PROVISIONS:

a. 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.

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

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

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

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

f. The following documentation must be submitted to and acknowledged in writing by OHMSPA prior to the first shipment:

(1) Suitable calculations to show that the actual venting capacity of the pressure relief devices provided for the commodity transported, exceeds the

capacity required as calculated in accordance with § 173.301.

(2) The GTM Technical/operations manual shall be revised to reflect the specific hazards of Silane (i.e. packless valves, measures to prevent back diffusion, grounding) and gas purity standards (i.e. record keeping).

9. MODES OF TRANSPORTATION AUTHORIZED: Motor Vehicle.

10. MODAL REQUIREMENTS: A current copy of this special permit must be carried aboard each 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:

- All terms and conditions prescribed in this special permit and the Hazardous Materials Regulations, 49 CFR Parts 171-180.

- 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.

- 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.

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 -- OHMSPA, 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
Acting 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 Photo reproductions and legible reductions of this special permit are permitted. Any alteration of this special permit is prohibited.

PO: SStaniszewski