

December 9, 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 15536
(SECOND REVISION)

EXPIRATION DATE: November 30, 2017

(FOR RENEWAL, SEE 49 CFR 107.109)

1. GRANTEE: TechKnowServ Corp.
(Former Grantee: WavesinSolids LLC)
State College, PA
2. PURPOSE AND LIMITATION:
 - a. This special permit authorizes the transportation in commerce of certain gases in DOT-107A tank car tanks (tubes). The tubes are retested by acoustic emission and ultrasonic examination (AE/UE) described in paragraph 7 below in place of the required internal visual inspection and the hydrostatic retest. The tubes authorized under this special permit are retested once every ten years instead of every five years. 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 the development of this special permit only considered the hazards and risks associated with the transportation in commerce.
 - c. No party status will 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 §§ 180.507, 180.509, and 180.519(a) and (b) in that AE and UE testing are performed in place of the hydrostatic pressure test and the internal visual inspection.

December 9, 2015

5. BASIS: This special permit is based on the application of TechKnowServ Corp. dated September 28, 2014 submitted in accordance with § 107.105.
6. HAZARDOUS MATERIALS (49 CFR 172.101):

| Hazardous Materials Description | | | |
|---|-------------------------------|------------------------------|----------------------|
| Proper Shipping Name | Hazard Class/ Division | Identification Number | Packing Group |
| Liquefied or non-liquefied compressed gases, or mixtures of such compressed gases, classed as Division 2.2, which are authorized for transportation in DOT Specification 107A tanks.* | 2.2 | As Appropriate | N/A |
| Compressed gas, oxidizing, n.o.s. (Up to 50% oxygen) | 2.2 | UN3156 | N/A |

* Oxygen, compressed UN1072 is not authorized in these tubes.

7. SAFETY CONTROL MEASURES:

a. PACKAGING - Prescribed packagings are DOT 107A seamless steel tank car tanks (flanged-end tubes) (§ 179.500). The tubes have been removed from the trucks and are framed, manifolded and mounted on a trailer. The packaging must meet the following:

(1) Each tube must be equipped with one shut-off valve that is rated for the test pressure of the tube.

(2) Each flange gasket must be leak tight and must not be prone to cold flow for the maximum operating pressure at 149°F (65°C) temperature when the tube is filled with compressed gas.

(3) Each tube must be equipped with two safety relief devices, one at each end. The discharge of each safety relief device must be connected to a single header (pipe) having non-obstructed passage, pointed upward and extended to the top of the trailer.

December 9, 2015

b. TESTING - Each tube must be requalified every ten (10) years as prescribed in § 180.205 for DOT-3AAX tubes, except that the tube is examined by the acoustic emission (AE) and ultrasonic examination (UE) method described below in place of the hydrostatic pressure test and internal visual inspection. A tube that has been exposed to fire or to excessive heat (temperatures of 1000°F. or greater) must not be retested under the terms of this Special Permit.

(1) Visual Examination: Every five (5) years each tube, including the tube neck and flange/sleeve, must receive an external visual examination (without disassembly) in accordance with CGA Pamphlet C-6. A cylinder with excessive corrosion around the neck or under the flange/sleeve must be removed and examined in accordance with the DOT procedure for the inspection of DOT/TC tube mounting threads listed on PHMSA website at: <http://www.phmsa.dot.gov/hazmat/library/reports>.

WavesinSolids must record the results of the visual inspection for each tube and submit the report to the Approvals and Permits Division (APD) upon request.

(2) Acoustic Emission (AE) Equipment: The AE equipment must be in accordance with the specification described in WavesinSolids special permit application SP14584, on file with (APD) and as prescribed in this Special Permit.

- i. Power supply, signal cable, signal processor and couplant must meet all requirements of the American Society for Testing and Materials (ASTM), 1419-02b Standard Test Method for Examination of Seamless, Gas-Filled, Pressure Vessels Using Acoustic Emission.

(3) AE Calibration and Standardization: Calibration of AE equipment performance and test procedure must be in accordance with ASTM E 1419-02b and WavesinSolids test method on file with APD, except as specifically stated herein.

(4) AE Test Pressurization:

- i. The test pressure must equal 1.1 times the highest fill pressure experienced by any individual tube in the unit for the last 12 months prior to requalification. If the highest fill pressure is not available the AE test pressure must be 0.77 times the lowest test pressure stamped on each tube (107A Tank) in the unit.
- ii. The data collection must begin at a pressure less than or equal to 50% of the AE test pressure. The rate of pressurization must be such that the saturation of electronic circuitry does not occur.

NOTE: AE retest per this Special Permit may not be used to requalify a tube that had been hydrotested within the last 1 year

(5) AE Test Evaluation & Markup:

- i. Each acoustic emission (AE) site on the cylindrical portion of each tube that produces 5 or more events within an 8-inch (204mm) axial distance must be marked for the follow up ultrasonic examination (UE) as prescribed herein.
- ii. Each AE site on the tube ends (i.e. sections of the tube that lie outboard of the sensors) which produces five or more events which hit both sensors and which had 43 dB or greater peak amplitude at the "first hit" sensor, must be subjected to UE by using shear wave.

(6) Ultrasonic Examination (UE) Equipment (Apparatus):

The UE equipment must be in accordance with the specification described in ASTM E-2223-02 "Examination of Seamless, Gas Filled, Steel Pressure Vessels, Using Angle Beam Ultrasonics".

- i. Each search unit used must have the appropriate frequencies (1-5 MHz) and refracted angle (45-75°) for the material and geometry of the tube that is being examined. Other angles and frequency combinations as found appropriate may be used for flaw sizing.

December 9, 2015

- ii. Each search unit must detect and display the indication from the notch on the reference ring at the maximum distance to be used during the examination.
 - iii. The search unit must be comprised of a transducer mounted on a plastic wedge that is designed to have continuous acoustic coupling between the search unit and the tube wall.
- (7) UE Standardization Ring With Reference Notches (Reference Ring): The reference ring must be fabricated from the same type of tube that is being examined. The reference ring must have the same diameter, minimum design wall thickness with a tolerance of +/- 10%, material, heat treatment, and surface condition as the tube to be examined. Reference notches will be placed into both internal and external surfaces of the reference ring. Notches must be made by EDM process. One or more notches may be placed into a single reference ring. Each circumferential notch must have a depth of less than or equal to 25 percent of t_m or 0.060" (1.53 mm) whichever is smaller, a width of less than or equal to 0.020" (0.5 mm), and a length of 1" (25.4 mm).

A certification statement signed by a WavesinSolids Senior Review Technologist (SRT) must be available for all standard references at each site where retesting is performed. The certification statement must include a standard reference drawing for each size and type of tube. A standard reference drawing must include dimensions and the locations of each simulated defect.

- (8) UE Standardization Procedure: The UE equipment must be standardized for each tube type by using the Standardization Ring and in accordance with the procedure described in ASTM E 2223-02.
- (9) UE Procedure:
- i. The UE of each tube must be in accordance with the ultrasonic examination described in ASTM E 2223-02 except that:
 - 1. The extent of the examination shall be 18 inches on either side of the axial location (on the cylindrical portion) as determined through AE.

December 9, 2015

2. The examination shall be performed within a single "V-path" if any flaw indication exceeds 20% of distance amplitude curve (DAC). For indications exceeding 20% of DAC, flaw characterization & sizing shall be performed using a suitable technique (e.g. crack tip diffraction).
 - ii. A copy of the most recent approved operating test procedure must be at each facility performing ultrasonic examination and be made available to a DOT representative when requested. Any change to the written procedures or in UE equipment (software or hardware), other than as supplied by the original equipment manufacturer, must be submitted to and approved by AAHMS prior to implementation.
- (10) Rejection criteria: rejection criteria as established by fracture mechanics for the tube retested under this Special Permit is a flaw with a maximum depth less than or equal to 25% of the minimum design wall thickness or any crack with a maximum depth of 0.060" (1.53 mm). When a tube is rejected, the retester must stamp a series of X's over the Special Permit or DOT specification number and marked test pressure, or stamp "CONDEMNED" on the shoulder, or neck using a steel stamp, and must notify the tube owner, in writing, that the tube is rejected and may not be filled with hazardous material for transportation in commerce. Alternatively, at the direction of the owner, the retester may render the tube incapable of holding pressure.
- c. MARKING: Each tube must be marked "DOT-SP 15536" in characters not less than 1/2" high in addition to the DOT 107A specification marking. Each tube that passes requalification under the provisions of this Special Permit must be marked as prescribed in § 180.213(d). In addition, each tube must be marked AE/UE, in characters not less than 1/4 inch high at a location close to the retester's marking.
- d. REPORT: A report must be generated for each unit listing all tubes that were examined. The AE and UE reports must include the following:

- (1) Unit/Module/Batch control identification
- (2) AE and UE equipment, model and serial No.
- (3) Specification of the standard reference used to UE the tube. Standard reference (calibration ring) must be identified by serial number or other stamped identification marking
- (4) Tube serial number, type and stamped pressure
- (5) Maximum allowable filling pressure
- (6) Minimum prescribed sidewall
- (7) Number of events at each location
- (8) Description of each AE event (amplitude, duration, energy, etc.)
- (9) Size of each defect measured (length and depth)
- (10) Type of each defect measured (crack, pitting, etc.)
- (11) Defect location relative to each sensor
- (12) Defect angular location defined by clock direction (3, 5, or 9 O'clock)
- (13) Defect location relative to sidewall (interior, outer surface, inner surface)
- (14) AE and UE technicians' name and certification level
- (15) Test Date
- (16) Thread inspection results (passed/failed/NA)
- (17) Internal inspection results (passed/failed/NA)
- (18) Acceptance/rejection results.

The AE and UE reports must be on file at the test site, and made available to a DOT official when requested.

e. PERSONNEL QUALIFICATION: Each person who performs retesting or who evaluates or certifies retest results must meet the following requirements:

- (1) Project Manager - is the senior manager of WavesinSolids responsible for compliance with DOT regulations including this special permit. Additionally, the project manager must ensure that each operator and senior review technologist maintain the required certifications described herein.

December 9, 2015

(2) The personnel responsible for performing tube retesting under this special permit shall be qualified to an appropriate Level (Level I, II or III)- acoustic emission and ultrasonic examination (AE/UE) in accordance with the American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1A-1996 depending upon the assigned responsibility as described below:

- i. As a minimum, a Level II Operator must perform system startup, calibrate the system, and review and certify the test results when written acceptance and rejection criteria for tubes has been provided by a Senior Review Technologist. Based upon written criteria, the Level II Operator may authorize tubes that pass the retest to be marked in accordance with paragraph 7(c) of this special permit. However, a person with Level I certification may perform a system startup, check calibration, and perform AE/UE under the direct guidance and supervision of a Senior Review Technologist or a Level II Operator, either of whom must be physically present at the test site so as to be able to observe examination conducted under this special permit.
- ii. Senior Review Technologist (SRT) - is a person who provides written AE/UE procedure, supervisory training and examinations (level I and II), technical guidance to operators and reviews and verifies the retest results. A SRT must have a thorough understanding of the DOT Regulations (49 CFR) pertaining to the requalification and reuse of DOT tubes authorized under this special permit and ASNT Recommended Practice SNT-TC-1A and possess either:
 1. A Professional Engineer (PE) License with documented experience for a minimum of 2 years in Non-Destructive Evaluation (NDE) of pressure vessels or pipelines using the Acoustic Emission and ultrasonic examination techniques; or,
 2. A PhD degree in Engineering/Physics with
- iii. A Level III certification from ASNT in Acoustic Emission and Ultrasonic Testing; or,
 1. A Professional Engineer (PE) License with documented experience for a minimum of 2 years in Non-Destructive Evaluation (NDE) of pressure vessels or pipelines using the Acoustic Emission and ultrasonic examination techniques; or,
 2. A PhD degree in Engineering/Physics with

December 9, 2015

documented evidence of experience in Non-Destructive Evaluation (NDE) of pressure vessels or pipelines using the ultrasonic examination technique or research/thesis work and authoring/co-authoring of technical papers published in recognized technical journals, in the fields of Acoustic Emission and ultrasonic testing methods.

3. The SRT must prepare and submit the reports required in paragraphs 7.i. and annually verify that the UE program is being operated in accordance with the requirements of this special permit.

The most recent copies of certification (e.g. ASNT Level III or P.E. license) must be available for inspection at each requalification facility.

f. OPERATIONAL CONTROLS -

(1) The maximum fill pressure for any tube may not exceed 7/10 of the marked test pressure for that tube. The maximum fill pressure for any tube covered by this Special Permit may not exceed 4000 psi.

(2) The maximum fill pressure for any tube in the frame assembly is limited by the tube with the lowest marked test pressure in that assembly.

(3) No person may perform inspection and testing of tubes subject to this Special Permit unless that person is an employee of WavesinSolids, meets personnel qualification of section (e) of this Special Permit, and complies with all the terms and conditions of this special permit.

(4) The marking of the retester's symbol along with the letters AE on the tubes (when individually tested) and/or affixing a data plate certifies compliance with all of the terms and conditions of this Special Permit. The data plate should at minimum include the following:

- i. Retesting company name
- ii. RIN
- iii. DOT Special Permit number
- iv. Trailer/Module's identification

December 9, 2015

- v. Filling pressure (lowest stamped working pressure) at 70°F
- vi. Maximum allowed filling pressure including overfill if applicable at 70°F
- vii. Test date
- viii. Retest date
- ix. Water capacity

(5) Each facility approved by the APD to test tubes under the terms of this Special Permit must have a resident operator with at least a Level II Certification in AE/UE.

(6) The dew point of the gases must be maintained at a temperature no greater than -52°F.

(7) For shipboard storage, these tanks must be kept on deck or in a ventilated hold.

8. SPECIAL PROVISIONS:

a. A person who is not a holder of this special permit who 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 reoffered for transportation in conformance with this special permit and the HMR.

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

9. MODES OF TRANSPORTATION AUTHORIZED: Motor Vehicle, Rail Freight, Cargo Vessel.

10. MODAL REQUIREMENTS: A current copy of this special permit must be carried aboard each cargo vessel, or motor vehicle used to transport packages covered by this special permit. The shipper must furnish a copy of this special permit 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 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.

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 notices of certain hazardous materials incidents, and 171.16 Detailed hazardous materials

December 9, 2015

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

PO: BrMoore/TG