U.S. Department
of Transportation

**Research and
Special Programs
Administration**

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

MAR 3 1 2004

DOT-E 12741
(FIRST REVISION)

EXPIRATION DATE: February 28, 2006

(FOR RENEWAL, SEE 49 CFR § 107.109)

1. GRANTEE: Thunderbird Cylinder Inc. (TCI)
Phoenix, AZ

2. PURPOSE AND LIMITATION:

a. This exemption authorizes the use of certain DOT Specification 3A or 3AA cylinders for the transportation in commerce of the compressed gases listed in paragraph 6. The cylinders are retested by utilizing the 100 percent ultrasonic examination (UE) procedures described in paragraph 7 below in place of the internal visual inspection and the hydrostatic retest required in § 180.209. This exemption provides no relief from the 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.

c. Party status will not be granted to this exemption.

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

4. REGULATIONS FROM WHICH EXEMPTED: 49 CFR §§ 172.203(a) and 172.301(c) in that marking each shipping paper and cylinder with the exemption number is not required, §§ 180.209 and 173.302(c)(2), (c)(3), (c)(4), and (c)(5) in that the ultrasonic examination is performed in place of the hydrostatic pressure test and internal visual examination.

NOTE: This exemption does not relieve the holder from securing an approval for retesting cylinders from the Associate Administrator for Hazardous Materials Safety.

5. BASIS: This exemption is based on the application of TCI dated January 31, 2004, submitted in accordance with § 107.109.

6. HAZARDOUS MATERIALS (49 CFR § 172.101):

Hazardous Materials Description			
Proper shipping name	Hazard Class/ Division	Identi- fication Number	Packing Group
The appropriate proper shipping name listed in § 172.101/ Liquefied or nonliquefied compressed gases, or mixtures of such compressed gases which are authorized in the Hazardous Materials Regulations for transportation in DOT 3A and 3AA cylinders.	2.1, 2.2 or 2.3 as applicable	As listed in § 172.102 for the specific compressed gas or gas mixture.	N/A

7. SAFETY CONTROL MEASURES:

a. PACKAGING - Packaging prescribed is a DOT Specification 3A or 3AA cylinder that is subjected to periodic retesting, reinspection and marking prescribed in 49 CFR 180.209, except that the cylinder is examined by ultrasonic test in lieu of the hydrostatic pressure test and internal visual examination prescribed in 49 CFR 180.209. Each cylinder must be subjected to an external visual examination and retested in accordance with the procedure described in TCI's application for exemption on file with the Office of Hazardous Materials Exemption and Approvals (OHMEA) unless otherwise noted herein. A cylinder that has been exposed to fire or to excessive heat may not be retested under the terms of this exemption.

b. Ultrasonic equipment and Performance. The ultrasonic equipment performance must conform to the TCI application on file with OHMEA and as prescribed in this exemption.

The equipment will be a fully automated, pulse echo type, and incorporate multiple channel transducers, with interactive software. The UE channels must be arranged to perform straight and angle beam examinations. The ultrasonic pulses must enter into the cylinder wall in both longitudinal and circumferential directions and normal to the cylinder wall to ensure 100 percent coverage of the cylinder wall. All defects (such as isolated pits, line corrosion, sidewall defects (e.g. cracks, folds) and line corrosion inside-wall-to base transition area (SBT)) must be detected. The transducers or cylinder must be arranged so that the ultrasonic beams enter into the cylinder wall in x-y-z directions and measure thickness and detect the side wall flaws. Gain control accuracy must be checked every six months with equipment which is calibrated in accordance with a nationally recognized standard. Search units of 2.25 to 10 MHZ nominal frequency and 1/4" to a 1" diameter must be used during ultrasonic examination. This safety control measure must be an integral part of the test equipment design incorporating Lack-of-Expected-Response (L.E.R.) monitoring independent of operator actions.

c. Standard References (Calibration Standards).

(1) A cylinder or a cylinder section must be used as a standard reference and must have similar acoustic properties, surface finish, metallurgical condition as the cylinders under test. The standard reference cylinder must have a known minimum design wall thickness (t_m) which is less than or equal to the cylinder under test. The standard reference cylinder for cylinders less than or equal to 6-inches in diameter must have the same nominal diameter as the cylinder being tested. The standard reference cylinder for cylinders greater than 6-inches in diameter must conform to the allowable size ranges shown in the following table:

Standard Reference	Cylinder Size Ranges is being retested by UE	
Outside Diameter (OD-inches)	Minimum OD-inches	Maximum OD-Inches
7	6.30	10.50
7.50	6.75	11.25
9.00	8.10	13.50
9.25	8.33	13.88
10.00	9.00	15.00
12.00	10.80	18.00
14.00	12.60	21.00
14.25	12.83	21.38
18.00	16.20	27.00
22.00	19.80	33.00
24.00	21.60	36.00

Prior to machining for simulated defects such as minimum wall thickness, the average minimum wall thickness for the standard reference must be determined by means of an independent method.

(2) The standard reference (calibration cylinder) must be machined to include the following simulated defects:

(i) Simulated defect for reduction in wall thickness (area corrosion). A simulated defect for area corrosion must be achieved by a removal of an area from internal diameter of a reference cylinder. Dimensions for a simulated defect of area corrosion are as follow:

(A) Dimensions of area corrosion For DOT 3A and 3AA are as follow:

Area (A) <= 0.7 square inch (in^2)

depth (d) <= 1/20 of the design minimum wall thickness (t_m)

(B) The remaining wall thickness must be equal or greater than t_m.

(C) To achieve the reduction in wall thickness, a minimum of two different thickness steps must be machined in the cylinder wall.

(ii) Simulated defect for isolated pit. A flat bottom hole (FBH) must be machined into the inside surface of the cylinder to simulate an isolated pit.

(A) Dimensions of a FBH for DOT 3A and 3AA with diameter less than or equal to 4 inches are as follow:

diameter (D) = 1/8-inch

depth (d) = 1/3 of t_m

(B) Dimensions of a FBH For DOT 3A and 3AA with diameter greater than 4 inches are as follow:

diameter (D) = 1/4-inch

depth (d) = 1/3 of t_m

(iii) Simulated defect for line corrosion in the side wall to base transition (SBT). A circumferential notch must be machined into the surface of the cylinder to simulate SBT line corrosion.

(A) Dimensions of the SBT circumferential notch for DOT 3A and 3AA cylinders are as follow:

depth (d) = 0.10 of t_m

length (L) = 1 to 1.5 inch

Width (W) <= 0.02 inch

(3) A certification statement signed by Thunderbird Cylinder senior review engineer (SRE)or manager must be available for all standard references at each site where retesting is performed. The certification statement must include standard

reference drawing for each of cylinder that are being retested by UE. A standard reference drawing must include dimensions and the locations of each simulated defect.

d. Ultrasonic Examination (UE) System Standardization (Calibration). Prior to retesting a cylinder, the cylinder class (DOT specification or exemption) must be identified. The UE system must be standardized for testing the identified cylinder by using a standard reference. Standardization of the UE system must be performed by using a relevant reference cylinder that is described in paragraph 7.c. of this exemption. The standardization of the UE system is as follows:

(1) A reference cylinder with a machined simulated defect made to represent area corrosion must be placed in the UE system. The UE system must be standardized to indicate rejection for an area equal or greater than the machined surface for that class of cylinder (e.g. 0.70 in^2 for DOT 3A and 3AA). Where the wall thickness is reduced below t_m, a straight ultrasound beam must be used to measure the wall thickness of the machined area.

(2) A reference cylinder with a machined FBH made to represent an isolated pit must be placed in the UE system. The FBH must be detected by a minimum of two shear wave beams that strike the FBH from opposite sides (e.g. the first shear wave direction is from top to bottom of the cylinder and the second shear wave direction is from the bottom to top). The UE gain must be increased until the signal from FBH is maximized at 80 percent of the screen height.

(3) A reference cylinder with a machined notch made to represent SBT line corrosion must be placed in the UE system. The notch must be detected by a minimum of one shear wave beam. The UE gain must be increased until the signal from the notch is maximized at 80 percent of the screen height.

e. Examination Procedures.

(1) A written procedure for performing ultrasonic examination of cylinders under the terms of this exemption must be at each facility performing ultrasonic examination. At a minimum, this procedure must include:

(i) A description of the test set-up; test parameters; transducer model number, frequency, and size; transducer assembly used; system standardization procedures and threshold gain used during the test; and other pertinent information.

(ii) Requirement for the equipment standardization to be performed at the end of the test interval (cal-out), after 200 cylinders or four hours, which ever occurs first. This cal-out can be considered the cal-in for the next interval during continuous operation. Cylinders examined during the interval between cal-in and cal-out must be quarantined until an acceptable cal-out has been performed. An acceptable cal-out occurs when the calibration cylinder is examined and all required features are revealed without changing examination settings. If an acceptable cal-out does not occur, if any equipment that affects the UE results are replaced or altered (such as a search unit or coaxial cable etc.) or when a loss of power occurs, all cylinders examined since the last successful calibration must be re-examined. Additionally, standardization of test equipment shall be performed at the beginning of each work shift, when the cylinder under test has dimensions that exceed the allowable ranges of the reference cylinder, when there is a change of operator(s), if any equipment that affects the UE results are replaced or altered (such as a search unit or coaxial cable etc.) or when a loss of power occurs, and at the end of each work shift.

(2) The examination procedure must be available to a DOT official when requested. Any change to the written procedure must be submitted to OHMEA as soon as practicable.

(3) The equipment may not allow testing of a cylinder unless the system has been properly standardized (calibrated).

(4) The rotational speed of a standard reference cylinder must be such that all simulated defects are adequately detected, measured and recorded.

(5) The area of ultrasonic examination (UE) coverage must be 100% of the cylindrical section. The coverage must extend three inches into the sidewall-to-base transition taper.

(6) The external surface of the cylinder to be examined must be free of loose material such as scale and dirt.

(7) The rotational speed of the cylinder under UE must not exceed the rotational speed used during the standardization.

(8) A manual contact shear or longitudinal search units may be used for confirmation and sizing of an indicated defect. If manual UE is used, it must be performed under direct supervision of the Senior Review Technologist (SRT) by a minimum Level II operator and in accordance with American Society of Testing Materials (ASTM) practice E 213.

f. UE Acceptance/Rejection Criteria. A cylinder must be rejected based on any of the following:

(1) Wall thickness less than the design minimum wall thickness for the area described in the standardization section (paragraph 7.d.)

(2) If any of the flaws such as the isolated pit or SBT line corrosion which meet the rejection criteria and produces a signal with an amplitude which crosses the reference threshold set in standardization section (paragraph 7.d.).

g. Rejected cylinders. When a cylinder is rejected, the retester must stamp a series of X's over the DOT specification number and marked service pressure, or stamp "CONDEMNED" on the shoulder, top head, or neck using a steel stamp, and must notify the cylinder owner, in writing, that the cylinder is rejected and may not be filled with hazardous material for transportation in commerce.

(1) Alternatively, at the direction of the owner, the retester may render the cylinder incapable of holding pressure.

(2) If a condemned cylinder contains hazardous materials and the testing facility does not have the capability of safely removing the hazardous material, the retester must stamp the cylinder

"CONDEMNED" and affix conspicuous labels on the cylinder(s) stating: "UE REJECTED DOT-E 12741. RETURNING TO ORIGIN FOR PROPER DISPOSITION". The retester may only offer the condemned cylinders for transportation by a motor vehicle operated by a private carrier to a facility, identified to, and acknowledged in writing with OHMEA, that is capable of safely removing the hazardous material. A current copy of this exemption must accompany each shipment of condemned cylinders transported for the disposal of hazardous material.

h. Marking. Each cylinder passing retests under the provisions of this exemption must be marked as prescribed in § 173.34(e)(6). In addition, each cylinder must be marked UE, in characters not less than 1/4 high at a location close to the retester's marking.

i. UE Report. A report must be generated for each cylinder that is examined. The UE report must include the following:

(1) UE equipment, model and serial number
(2) Transducer specification, size, frequency and manufacturer
(3) Specification of each standard reference used to complete UE
(4) Cylinder serial no. and type
(5) UE technicians' name and certification level
(6) Date of the UE
(7) All recorded defects (pitting, corrosion, etc.)

(8) Brief description of the UE acceptance/rejection result

(9) The UE report must be on file at the test site, and made available to a DOT official when requested.

j. A cylinder 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 exemption.

k. Personnel Qualification: Each person who performs retesting, and evaluates and certifies retest results must meet the following qualification requirements:

(1) Project Manager/Director of Product Technology- is the senior manager of TCI responsible for compliance with DOT regulations including this exemption.

(2) The personnel responsible for performing cylinder retesting under this exemption must be qualified to an appropriate Ultrasonic Testing Certification Level (Level I, II or III) in accordance with the American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1A depending upon the assigned responsibility as described below:

(i) System startup and calibration must be performed by a Level II operator. A Level II operator may review and certify test results when a written acceptance and rejection criteria for cylinders has been provided by a Senior Review Technologist. Based upon written criteria, the Level II Operator may authorize cylinders that pass the retest to be marked in accordance with paragraph 7.h. of this exemption. However, a person with Level I certification may perform a system startup, check calibration, and perform ultrasonic testing 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 testing conducted under this exemption.

(ii) Senior Review Technologist (SRT) - is a person who reviews overall test results, provides

supervisory training and technical guidance to Operators, and reviews and verifies the retest results. A SRT must have a Level III Certification in UE, and a thorough understanding of the HMR (49 CFR) pertaining to the re-qualification and reuse of the DOT cylinders authorized under this exemption. 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 exemption.

1. OPERATIONAL CONTROLS.

(1) No person may perform inspection and testing of cylinders subject to this exemption unless -

(i) that person is an employee or agent of Thunderbird Cylinder and has a current copy of this exemption at the location of such inspection and testing, and

(ii) complies with all the terms and conditions of this exemption.

(2) The marking of the retester's symbol on the cylinders certifies compliance with all of the terms and conditions of this exemption.

(3) Each facility approved by OHMEA to test cylinders under the terms of this exemption must have a resident operator with at least a Level II Certification in UE.

8. SPECIAL PROVISIONS:

a. Prior to requalification of each package described in paragraph 7.a. of this exemption, TCI must provide a certification of the standard reference which is used to UE that package. The certification must meet all of the requirement described in paragraph 7.c. of this exemption.

b. During the initial use of the exemption, the test data, results, and additional technical information deemed pertinent in successful application of the retest procedure must be reported to OHMEA. The purpose of this information is to determine whether certain testing procedures and criteria require modification. In particular, special attention should be paid to evaluating and compiling

information on cylinders rejected by the ultrasonic examination procedure. For these rejected cylinder, the defect causing the rejection must be fully characterized and profiled. That is, the specific type of defect should be identified (e.g. pit or general corrosion etc.) and the specific size of the defect should be determined (i.e. length, depth, width, diameter, area, etc.). Cylinder type, size, minimum design wall thickness, age, etc. of the rejected cylinder must be reported. The ultrasonic signal profile should be reported for any defect causing the cylinder to be rejected. These results must be summarized and reported to OHMEA on an annual basis. SCC must submit to DOT an evaluation of the effectiveness of the ultrasonic testing program authorized by this exemption as part of any request to renew the exemption submitted in accordance with § 107.109.

c. The total number of cylinders tested and rejected under this exemption must be reported to OHMEA by cylinder class and age. These results must be summarized and reported on an annual basis.

d. A cylinder that meets the requirements of this exemption and the introductory text and paragraph (1) of § 173.302(c) may be marked with a plus sign (+) following the test date marking on the cylinder. In addition, a cylinder that meets the requirements of this exemption and of § 173.34(e)(16) may be marked with a "star".

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

f. Each facility approved by the Department to test cylinders under the terms of this exemption must have a resident operator with at least a Level II certification.

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

h. Transportation of Division 2.1 (flammable gases) and Division 2.3 (gases which are poisonous by inhalation) are not authorized aboard cargo vessel or aircraft unless specifically authorized in the Hazardous Materials Table (§ 172.101).

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

j. The marking of requirements of §§ 172.203(a) and 172.301(c) are waived.

9. MODES OF TRANSPORTATION AUTHORIZED: Motor vehicle, rail freight, cargo vessel, cargo aircraft only and passenger-carrying aircraft, as currently authorized by the HMR for the hazardous materials being transported.

10. MODAL REQUIREMENTS: None, other than as required by the HMR.

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, 49 CFR Parts 171-180.
- Persons operating under the terms of this exemption 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 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 this 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 inform the AAHMS, in writing, of any incident involving the package and shipments made under the terms of this exemption.

Issued in Washington, D.C.:

MAR 3 1 2004
(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.

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