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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 11526
(TWENTY-SECOND REVISION)

EXPIRATION DATE: 2017-10-31

(FOR RENEWAL, SEE 49 CFR 107.109)

1. GRANTEE: Linde Gas North America LLC
Murray Hill, NJ
2. PURPOSE AND LIMITATION:
 - a. This special permit authorizes the use of certain DOT Specification 3A, 3AA, cylinders and cylinders manufactured under DOT-SP 9370 and DOT-SP 9909 for the transportation in commerce of the compressed gases described in paragraph 6 below, when retested by a one hundred percent (100%) ultrasonic examination (UE) of the sidewall in lieu of the internal visual and the hydrostatic retest. 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.
 - 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 §172.203(a) in that marking the special permit number on shipping papers is waived; § 173.302a(b) in that the plus marking is authorized; § 180.205(a), (c), (f), (g); and § 180.209(a), (b), (g) in that the ultrasonic inspection is performed in lieu of the internal visual examination and hydrostatic pressure test and that cylinders used for Division 2.1 & 2.2

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materials may be requalified every ten years and are not required to be hammer tested prior to each refill.

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

5. This special permit is based on the application of Linde Gas North America LLC, dated July 25, 2016, submitted in accordance with § 107.109.
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, which are authorized in the Hazardous Materials Regulations for transportation in DOT specification 3A & 3AA cylinders and commodities authorized in DOT-SP 9370 and DOT-SP 9909.	2.1, 2.2, or 2.3*	As appropriate	N/A

*Note: Cylinders containing Division 2.3 gases must be requalified once every 5 years.

7. SAFETY CONTROL MEASURES:

a. PACKAGING - Prescribed packaging is a DOT Specification 3A or 3AA, 3AA cylinder or cylinder manufactured under special permits DOT-SP 9370 or DOT-SP 9909 that is subjected to periodic retesting, reinspection and marking prescribed in §§ 180.205 and 180.209, except that:

- (1) The cylinder is examined by ultrasonic examination (UE) in lieu of the hydrostatic pressure test and internal visual inspection prescribed in § 180.205. Each cylinder must be subjected to an external visual examination and retested in accordance with the procedure described in Linde

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Gas North America, LLC's (formerly BOC) application for special permit on file with the Approvals and Permits Division (APD) 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 special permit.

- (2) Hammer test is not required.

- (3) Each cylinder that is used to transport Division 2.1 or 2.2 materials must be retested at least once every 10 years. The 10-year requalification period is not authorized for cylinders used to transport Division 2.3 materials.

b. ULTRASONIC EQUIPMENT & PERFORMANCE - The ultrasonic equipment performance must conform to the Linde Gas North America, LLC, application on file with APD and as prescribed in this special permit. The UE equipment must be 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, both circumferential directions and normal to the cylinder wall to ensure 100 percent coverage of the cylinder wall. The system must be set-up to perform longitudinal ultrasonic angle beams from the cylinder shoulder down to the cylinder base that includes sidewall-to-base transition (SBT) area and from the cylinder base up to the cylinder shoulder. Also the system must be set-up to perform circumferential ultrasonic angle beams in both clockwise and counterclockwise rotation around the cylinder. All flaws (such as isolated pits, sidewall cracks and flaws inside the sidewall-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 and measure thickness and detect the sidewall flaws. Gain control accuracy must be checked annually with equipment that is calibrated in accordance with industry standards for checking gain linearity accuracy, as published in ASTM-E317. Search units of 2.25 to 10 MHz nominal frequency and 1/4" to a 1" diameter must be used during ultrasonic examination. A manual contact shear or longitudinal search unit may be used for confirmation and sizing of an indicated flaw. If manual UE is used, it must be performed under direct supervision of a Senior Review Technologist by a minimum Level II operator

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and in accordance with American Society of Testing & Materials (ASTM) practice E-213 and this special permit. This safety control measure must be an integral part of the test equipment design incorporating Lack-of-Expected-Response (LER) monitoring independent of operator actions.

c. Standard References

(1) UE Reference Cylinder - A cylinder or cylinder section must be used as a standard reference and must have similar acoustic properties, surface finish and metallurgical condition as the cylinders under test. The standard reference, (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.

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
7.00	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 placing the 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 (reference cylinder) must be prepared to include the following artificial defects:

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(i) Simulated defect for reduction in wall thickness (area corrosion). A simulated defect for area corrosion must be machined into the inside surface of the cylinder. A minimum of two different thickness steps must be machined into the inside cylinder wall. Dimensions must be as follows:

(A) For DOT 3A and 3AA, the simulated defect must be less than or equal to 0.7 square inches (in^2) and less than or equal to $1/20$ of the design minimum wall thickness (t_m) deep. The remaining wall thickness is equal or greater than t_m .

(B) For cylinders manufactured under DOT-SP 9370 and DOT-SP 9909 the simulated defect must be less than or equal to 0.25 square inch (in^2) and less than or equal to $1/20$ of the minimum design wall thickness (t_m) deep. The remaining wall thickness is equal or greater than t_m .

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

- (A) For DOT 3A and 3AA with diameter less than or equal to 4 inches the FBH must be $1/8$ -inch diameter and $1/3$ of t_m depth.
- (B) For DOT 3A and 3AA with diameter greater than 4 inches the FBH must be $1/4$ -inch diameter and $1/3$ of t_m depth.
- (C) For DOT 3A and 3AA with diameter greater than 24 inches (tonner) the FBH must be $1/2$ -inch diameter and $1/3$ of t_m depth.
- (D) For cylinders manufactured under DOT-SP 9370 and DOT-SP 9909 the FBH must be $1/4$ -inch diameter and $1/4$ of t_m depth.

(iii) Simulated defect for line corrosion in the sidewall-to-base transition (SBT). A circumferential notch must be machined into the surface of the cylinder to simulate SBT line corrosion. The notch must be 0.10 of t_m depth, 1 inch long and less than or equal to 0.02 inch with.

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(iv) Simulated defect for longitudinal sidewall crack (LSC). A longitudinal notch must be machined into the surface of the cylinder to simulate LSC line corrosion. Dimensions of the LSC notch for cylinders manufactured under DOT-SP 9370 and DOT-SP 9909 must be 0.06 of t_m depth, 1 inch long and less than or equal to 0.02 inches in width. DOT 3A and 3AA specification cylinders are not required to be standardized for LSC.

(3) A certification statement signed by a Linde Gas North America, LLC's (formerly BOC) 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 cylinder. 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 special permit) 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 using a relevant reference cylinder (as described in paragraph 7.c. of this special permit). The standardization of the UE system is as follows:

(1) A reference cylinder with a machined simulated flaw 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 to or greater than the machined surface for that class of cylinder (e.g., 0.70 in² 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 the FBH is maximized

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at 80% of the screen height.

- (2) 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% of the screen height.

e. Test Procedures.

- (1) A copy of the operating test procedure (as approved and acknowledged in writing by APD) for performing ultrasonic examination of cylinders under the terms of this special permit 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, whichever 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

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occurs, and at the end of each work shift.

(2) A copy of the most recent approved operating test procedure must 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.

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

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

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

(6) The pulse rate must be adjusted to ensure a minimum of 10% over-lapped for each helix.

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

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

f. ACCEPTANCE/REJECTION CRITERIA. A cylinder must be rejected based on any of the following:

(1) The measured wall thickness is less than the calculated design minimum wall thickness using a maximum allowable stress of 58,000 psi for 3A cylinders and 73,000 psi for 3AA cylinders for the area described in the standardization section herein, (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.).

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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-SP 11526. 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 APD, that is capable of safely removing the hazardous material. A current copy of this special permit must accompany each shipment of condemned cylinders transported for the disposal of hazardous material.

h. Marking. Each cylinder passing retest under the provisions of this special permit must be marked as prescribed in § 180.213. Cylinders that are less than 5 inches in diameter may be marked as prescribed in § 180.213 in characters at least 1/8" high. In addition, each cylinder must be marked UE, in characters not less than 1/4" high for a cylinder with a diameter equal to or greater than 5 inches and 1/8" high for a cylinder with a diameter less than 5".

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 perform UE. Standard reference must be identified by serial number or other stamped identification marking.
- (4) Cylinder serial number and type

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- (5) UE technician's name and certification level
- (6) Examination Date
- (7) Location and type of each defect on the cylinder (e.g. longitudinal line corrosion 5 inches from base)
- (8) Dimensions (area, depth and remaining wall thickness) and brief description of each defect
- (9) Acceptance/rejection results
- (10) The UE report must be on file at each test facility, and copies made available to a DOT official when requested.

j. 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 BOC responsible for compliance with DOT regulations including this special permit. Additionally, the project manager must ensure that each operator and senior review technologist maintains the required certifications described herein.

(2) The personnel responsible for performing cylinder retesting under this special permit 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. However, written procedures for accepting/rejecting a cylinder must be provided by the 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 special permit. 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 special permit.

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(ii) Senior Review Technologist (SRT) - is a person who provides written UE procedure, supervisory training, examinations (Level I and II) and 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 cylinders that are authorized under both this special permit and ASNT Recommended Practice SNT-TC-1A and must possess either:

(A) Level III certification from ASNT in Ultrasonic Testing; or

(B) Professional Engineer (PE) License with a documented experience for a minimum of 2 years experience in Non-Destructive Evaluation (NDE) of pressure vessels or pipelines using the ultrasonic examination technique; or,

(C) PhD degree in a discipline of Engineering/Physics with 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 ultrasonic testing methods.

(D) 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, P.E.) must be available for inspection at each requalification facility.

k. OPERATIONAL CONTROLS.

(1) No person may perform inspection and testing of cylinders subject to this special permit unless:

(i) that person is an employee or agent of Linde Gas North America, LLC, and has a current copy of this special permit at the location of such inspection and testing;

(ii) that person complies with all the terms and conditions of this special permit; and

(iii) that person is listed on Attachment 1 of this special permit.

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

(3) Each facility approved by APD to test cylinders under the terms of this special permit must have a resident operator with at least an ASNT Level II Certification in UT.

(4) The UE equipment and operating procedures identified in this special permit are only authorized for use when the approved SRT is available (or alternatively available by telephone or other electronic means) at each facility operating under the special permit.

(5) Notwithstanding the requirements of a RIN Approval for notification of address and personnel changes, any change in Project manager or SRT, with appropriate documentation (i.e. ANST certification), must be submitted to and acknowledged in writing by APD immediately.

(6) Prior to each filling, the company filling the cylinder must ensure that:

(i) Gas mixtures are chemically compatible with the cylinder material and do not have an adverse effect on the cylinder's strength.

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(ii) The quality of the gas or gaseous mixture meets the requirements of § 180.209(b)(ii) and has a dew point below minus 52 °F at 1 atmosphere;

(7) Prior to each fill the cylinder under this special permit must be externally inspected in accordance with CGA Pamphlet 6.1.

(8) Any cylinder exhibiting evidence of fire or excessive heat damage may not be retested under the terms of this special permit.

8. SPECIAL PROVISIONS:

a. The ultrasonic examination (UE) data, results, and additional technical information deemed pertinent in successful application of the UE must be recorded and kept at each facility for a minimum of 5 years after completion of UE. For any rejected cylinder, the defect causing the rejection must be fully characterized and profiled. That is, the specific type of defect should be identified (i.e. isolated pits, line corrosion or SBT crack) and the specific size of the defect should be determined (i.e. length, depth, width, diameter, area, etc.). The record includes cylinder type, size, minimum design wall thickness, age, etc. of the rejected cylinder.

b. Shippers (offerors) may use the cylinders specified and tested in accordance with the provisions of this special permit for the transportation in commerce of those hazardous materials specified herein, provided no modifications or changes are made to the cylinders. All terms of this special permit and other applicable requirements contained in 49 CFR Parts 100-185 must be met.

c. In order to authorize a cylinder for a special filling limit (+ marking) stated in § 173.302a(b) the cylinder must meet the following:

(1) The cylinder must meet the requirement of § 173.302a(b)(1).

(2) The wall thickness of the cylinder is equal to or greater than the design minimum wall thickness as it is described in the accept/reject criteria of this special permit for each cylinder type.

- d. 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).
- e. Transportation of oxygen is only authorized aboard aircraft when in accordance with § 175.501.
- f. 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.
- g. A current copy of this special permit must be maintained at each facility where the package is offered or reoffered for transportation.
- h. The marking requirements of §172.203(a) 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 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

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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, in writing, of any incident involving a package, shipment or operation conducted under terms of this special permit.

Issued in Washington, D.C.:



for William Schoonover
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: AS/TG

ATTACHMENT 1

Only the following locations have been authorized by APD to perform requalification functions described in the special permit. Each authorization is valid only when the associated RIN approval and this special permit remain current. As acknowledged by the list of names and locations below, the grantee of this special permit must notify APD of any change in approval status, company name, address, or new test facility additions within 20 days of that change.

H241 Linde North America, LLC
P.O. Box 12338
11 Triangle Drive
Research Triangle Park, NC 27709

H283 Linde North America, LLC (Mobile Unit)
P.O. Box 12338
11 Triangle Drive
Research Triangle Park, NC 27709

H616 Linde Gas North America LLC
10 Arrowhead Lane
Cohoes, NY 12047

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