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GUIDELINE FOR DETERMINING THE EXTENT OF EXTERNAL VESSEL CORROSION ON FOAM INSULATED MC-331 CARBON DIOXIDE AND NITROUS OXIDE TANK TRAILERS

FIRST EDITION

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Work Item 18-095

Bulk Distribution Equipment and Standards Committee

NOTE—Appendices A and B (Informative) are for information only.

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1 Introduction

Some carbon dioxide and nitrous oxide trailers have been in service for 40 and 50 years without having had the foam removed for inspection of the vessel exterior. When these units are removed from service for refurbishment, extreme surface corrosion can be discovered, including areas that are pitted, corroded, or rusted. This corrosion is caused by water condensing between the foam and the tank surface as the tank cools and warms during filling and emptying. The corrosion and subsequent loss of pressure vessel shell thickness is a safety issue and is a primary reason for removing these tanks from service. See Figure 1 for an example of a tank trailer with the insulation removed.



Figure 1—Example of trailer with insulation removed

2 Scope

This publication establishes guidelines for the removal of insulation and the inspection of the vessel exterior on foam insulated carbon steel MC-331 carbon dioxide and nitrous oxide tank trailers.

It is recommended that any time a trailer is reinsulated, the pressure vessel be inspected for corrosion so problems can be identified, prevented, and/or repaired before the shell thickness is less than the minimum required thickness.

3 Definitions

3.1 Publication terminology

3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

3.1.2 Should

Indicates that a procedure is recommended.

3.1.3 May

Indicates that the procedure is optional.

3.1.4 Will

Is used only to indicate the future, not a degree of requirement.

3.1.5 Can

Indicates a possibility or ability.

3.2 Technical definitions

3.2.1 Design certifying engineer (DCE)

Person registered with the DOT in accordance with Title 49 of the U.S. *Code of Federal Regulations* (49 CFR) Subpart F of Part 107 who has the knowledge and ability to perform stress analysis of pressure vessels and otherwise determine whether a cargo tank design and construction meets the applicable DOT specification [1].¹

4 Safety considerations

The vessel should be emptied and cleaned before inspection begins. For safety considerations for handling carbon dioxide and nitrous oxide, see CGA G-6, *Carbon Dioxide* and CGA G-8.3, *Safe Practices for Storage and Handling of Nitrous Oxide* [2, 3].

4.1 Confined space

Work shall not be performed inside a vessel or confined area until the vessel or confined area has been properly prepared and work procedures are established that ensure the safety of workers. Potential hazards of confined space entry include asphyxiation and flammability and toxicity of chemicals. See Title 29 of the *U.S. Code of Federal Regulations* (29 CFR) Part 1910.146 for guidance on confined space entry [4].

4.2 Low temperature

4.2.1 Frostbite

Skin contact with spilled or spraying refrigerated liquid or with uninsulated surfaces containing refrigerated liquid can cause severe frostbite. Seek prompt medical treatment for frostbite injuries.

4.2.2 Ice

Moisture condenses and freezes on exposed cold surfaces causing valves, couplings, and safety devices to freeze open or shut, preventing normal operation. Ice can also form on nearby walking surfaces and create a slipping hazard. Ice buildup should be monitored and corrected to minimize the potential for incidents.

4.3 Carbonic acid

Carbon dioxide in the presence of water creates carbonic acid that can cause corrosion. Corrosion and rust can lead to particulate formation and contamination. It is important to follow proper procedures to prevent contaminants from being introduced as well as potential failure of the vessel.

Carbonic acid is relatively weak but can irritate the eyes or respiratory tract.

4.4 Contamination

Personnel working on or handling parts or equipment that can come into contact with nitrous oxide shall wear clean gloves and clothing and shall use clean handling equipment.

4.4.1 Stability

Nitrous oxide can exothermically decompose into nitrogen and oxygen that can result in fire or personal injury.

4.4.2 Flammability

Materials that burn in air burn much more vigorously in the presence of nitrous oxide or in the presence of oxygen and heat produced by nitrous oxide decomposition.

¹ References are shown by bracketed numbers and are listed in order of appearance in the reference section.

4.4.3 Ignition temperatures

Ignition temperatures are reduced in the presence of nitrous oxide or in the presence of oxygen and heat produced by nitrous oxide decomposition. Some materials that do not burn in air readily burn in an oxidizer-enriched environment.

4.4.4 Clothing

Absorbent material such as clothing can become saturated with nitrous oxide (or oxygen resulting from decomposition) and readily ignite and burn rapidly. The hazard can continue for some time after exposure. If exposed to oxidizer vapors, bulky clothing should be removed or the individual should stand in an open area or otherwise avoid ignition sources for 30 minutes to allow gas to desorb from the clothing.

4.4.5 Ground service

Stepping on nitrous oxide spill areas or rolling equipment across them can result in ignition.

4.5 Personal protective equipment

Safety glasses with side protection shall be used for protection from injuries due to flying particles. Goggles should be used when cutting through insulation.

A dust mask should be worn when cutting through insulation.

When working with nitrous oxide, fire-resistant clothing and leather gloves shall be worn.

When working with carbon dioxide, a long-sleeved shirt and long pants with cuffless bottoms (with pant legs worn outside of boots) should be worn. Leather gloves should be used.

Self-contained breathing apparatus (SCBA) shall be used wherever there is a possibility of an oxygen deficiency or when carbon dioxide or nitrous oxide can be greater than the permissible exposure limits. See ANSI/ASSP Z88.2, *Practices for Respiratory Protection* [5].

For more information on personal protective equipment (PPE), see CGA P-44, *Selection of Personal Protective Equipment* [6].

5 Inspection

5.1 Qualifications

5.1.1 Facility

The testing facility shall be registered with DOT per Title 49 of the *U.S. Code of Federal Regulations* (49 CFR) Part 107.501 as a repair facility and have a valid cargo tank (CT) registration [1]. For Canadian registrations, refer to CSA B620, *Highway tanks and TC portable tanks for the transportation of dangerous goods* [7].

5.1.2 Inspector qualifications

Thickness inspections shall be performed by a DOT registered inspector, per 49 CFR 180.409, trained in the use of the ultrasonic thickness tester and depth micrometer [1]. For a definition of a registered inspector, see 49 CFR 171.8 [1].

5.1.3 Design certifying engineer

A design certifying engineer (DCE) shall meet the knowledge and ability requirements by meeting any one of the following requirements:

- has an engineering degree and one year of work experience in cargo tank structural or mechanical design;