SUPPLEMENT 6
CONTINUED SERVICE AND INSPECTION OF DOT TRANSPORT TANKS

S6.1 SCOPE

This Supplement provides rules for continued service inspections of transport tanks, i.e., cargo tanks, rail tanks, portable tanks, and ton tanks that transport dangerous goods as required in the Code of Federal Regulations, Title 49, Parts 100 through 185, and the United Nations Recommendations for Transport of Dangerous Goods-Model Regulations. This Supplement, where applicable, shall be used in conjunction with other applicable Parts of the *National Board Inspection Code* (NBIC) and Section XII, *Transport Tanks*, of the *ASME Boiler and Pressure Vessel Code*.

S6.2 TERMINOLOGY

a) The terminology used in this Supplement in some cases may be in conflict with terms and definitions normally used in the repair and alteration of pressure-retaining items. Considering these differences, this supplement in the Definition Section has incorporated definitions and terms specified in CFR 49, Parts 100 through 185.

b) When conflicts are identified between this part and the regulations of the competent authority regarding the examination, inspection, testing, repair, and maintenance for the continued qualification of transport tanks, the regulations of the Competent Authority take precedence.

c) Rules for repairs and modifications of transport tanks are provided in NBIC Part 3, *Repairs and Alterations*, Supplement 6.

S6.3 ADMINISTRATION

a) The competent authority's requirements describe the frequency, scope, type of inspection (internal, external, or both), type of examination (nondestructive, spark test, etc.), and the documentation requirements for the inspection.

b) For transport tanks under the Jurisdiction of the Department of Transportation, the Registered Inspector shall have a thorough knowledge of the Code of Federal Regulations, Title 49, Parts 100 through 185.

S6.4 INSPECTION

This Section will establish the appropriate methods to be used for continued service inspections. Inspections for repairs and modifications of transport tanks is located in NBIC Part 3, *Repairs and Alterations*, Supplement 6.

S6.4.1 SCOPE

This Section describes the duties, qualifications, and responsibilities of the Registered Inspector, and the scope of inspection activities permitted.

S6.4.2 GENERAL REQUIREMENTS FOR INSPECTORS

a) The Inspector shall be a National Board recognized Inspector, i.e., Authorized Inspector (AI), Qualified Inspector (QI), Certified Individual (CI), or a Registered Inspector (RI). The Registered Inspector is a position established by CFR 49 Parts 100 through 185 for Continued Service Inspections. This individual's duties and responsibilities are subject to DOT and not ASME QAI-1.

b) For continued service inspections, the Owner-user's Registered Inspector can be used to perform inspections and testing in accordance with the Code of Federal Regulations, Title 49, Parts 100 through 185, Transportation.

S6.4.3 REGISTRATION OF INSPECTORS

Each Registered Inspector performing duties and responsibilities for continued service inspections or inspections for repairs and modifications as specified in this Section and 49 CFR Part 180 is required to meet the qualification requirements of NBIC Part 2, S6.4.4, S6.4.6 and S6.4.7, as applicable to be registered with DOT.

S6.4.4 QUALIFICATIONS OF INSPECTORS

Registered Inspector (RI) means a person registered with the US Department of Transportation (DOT) in accordance with Subpart F of Part 107 of 49 CFR who has the knowledge and ability to determine whether a cargo tank conforms to the applicable DOT specification. A Registered Inspector may or may not be an employee of the approved facility. In addition, Registered Inspector means a person who meets, at a minimum, any one of the following:

a) Has an engineering degree and one year of work experience;

b) Has an associate degree in engineering and two years of work experience;

c) Has a high school diploma or GED and three years of work experience; and

d) Has at least three years experience in performing the duties of a Registered Inspector by September 1, 1991, and was registered with the DOT by December 31, 1995.

S6.4.5 CODES OF CONSTRUCTION

a) The Registered Inspector is responsible to ensure that all repairs or modifications (including re-rating) are performed in accordance with the original code of construction of the transport tank.

b) For repairs or modifications, the original code of construction for DOT vessels shall be either ASME Section VIII Division I or Section XII.

S6.4.6 INSPECTOR DUTIES FOR CONTINUED SERVICE INSPECTIONS

a) Inspectors performing Continued Service Inspections required by the Code of Federal Regulations (CFR), Title 49, Part 180 shall be a Registered Inspector. The Inspector shall satisfy the following requirements:

1) Has satisfied DOT requirements as a Registered Inspector;

2) Has successfully completed the National Board's web-based training program for Registered Inspectors and been issued a National Board certificate of completion;

3) Has received authorization from DOT as a Registered Inspector; and

4) Has been registered by DOT for the classification(s) of Transport Tanks to be inspected.

b) Inspectors performing Continued Service Inspections meeting the requirements of NBIC Part 2, S6.13 (Cargo Tanks), S6.14 (Portable Tanks), or S6.15 (Ton Tanks), and 49 CFR, Part 180 shall perform all inspections and tests required by this Section and any additional requirements, as applicable in 49CFR Part 180. The Inspections and tests shall be documented as follows:

1) All inspections and tests shall be conducted, as applicable, in accordance with NBIC Part 2, S6.13, S6.14, and S6.15;

2) All inspections and tests shall be documented in an Inspection Report as required by NBIC Part 2, S6.5;

3) All inspection and test reports shall be maintained by the Owner-User or Shipper of the transport tank in accordance with NBIC Part 2, S6.5;

4) All inspection and test reports shall be available for review by an authorized representative of the Department of Transportation; and

c) The requirements for inspections are provided for each classification of transport tanks as specified in NBIC Part 2, S6.4.6.1, Cargo Tanks, S6.4.6.2, Portable Tanks and S6.4.6.3, Ton Tanks.

S6.4.6.1 INSPECTOR DUTIES FOR CONTINUED SERVICE INSPECTION OF CARGO TANKS

a) Cargo tanks constructed in accordance with a DOT Specification that are required to be tested or inspected can not be used for transportation until the required test or inspection has been successfully completed.

1) The Registered Inspector shall inspect cargo tanks in accordance with S6.13, and in conjunction with the requirements of 49 CFR Parts180.401 through 180.417.

2) The Registered Inspector in the performance of their duties shall ensure that the following requirements for Periodic Inspection and test frequencies in S6.13 are properly satisfied as specified by:

a. Periodic Inspection and Test frequencies: NBIC Part 2, Table S6.13;

b. Pressure Test Requirements for Cargo Tank by specification: NBIC Part 2, Table S6.13.6.

b) Additional criteria for material thickness requirements for a cargo tank specification are listed, as applicable for material type (ferrous and non ferrous) in various tables in NBIC Part 2, S6.13.

S6.4.6.2 INSPECTOR DUTIES FOR CONTINUED SERVICE INSPECTION OF PORTABLE TANKS

a) Portable tanks constructed in accordance with DOT, United Nations (UN), or Inter Modal (IM) specifications that are required to be tested or inspected cannot be used for transportation until the required test or inspections have been successfully completed.

b) The Registered Inspector shall inspect portable tanks in accordance with NBIC Part 2, S6.14, in conjunction with the requirements of 49CFR, Parts 180.601 to 180.605.

c) The Registered Inspector in the performance of their duties shall ensure that the following requirements for Inspection Intervals and Pressure Test Requirements in NBIC Part 2, S6.14, are properly satisfied as specified by:

1) Inspection Intervals: NBIC Part 2, Table S6.14;

2) Pressure Testing Requirements: NBIC Part 2, Table S6.14.6.

S6.4.6.3 INSPECTOR DUTIES FOR CONTINUED SERVICE INSPECTIONS OF TON TANKS

a) Ton Tanks constructed in accordance with DOT 106A or DOT 110A requirements that are required to be tested and inspected cannot be used for transportation until the required test and inspection has been made.

b) The Registered Inspector, shall inspect ton tanks in accordance with NBIC Part 2, S6.15, in conjunction with the requirements of 49CFR, Part 180.519.

c) The Registered Inspector, in the performance of his or her duties, shall ensure that the requirements for Ton Tank Periodic Inspection and Test Frequencies in NBIC Part 2, Table S6.15.3 are properly satisfied.

d) Additional criteria for material thickness, safety valve, and acceptable material with acceptable tensile strength and elongation requirements for ton tanks, are listed in the following tables of NBIC Part 2, S6.15:

1) Thickness of Plate and Safety Valve Requirements: NBIC Part 2, Table S6.15.1-a;

2) Acceptable materials with acceptable tensile strength and elongation requirements: NBIC Part 2, Table S6.15.1-b.

S6.4.7 CONTINUED SERVICE, INSPECTION FOR DOT TRANSPORT TANKS SCOPE

This supplement details frequencies of testing requirements, type of tests required, acceptance criteria, and inspection reports of transport tanks.

S6.4.7.1 ADMINISTRATION

The Competent Authority's requirements describe the frequency, scope, type of inspection, and documentation requirements for the inspection and are noted in the US Code of Federal Regulations, Title 49 CFR, Parts 100 through 185.

S6.4.7.2 INSPECTION AND TEST REQUIRED FREQUENCIES

Inspection and frequencies for periodic testing of cargo tanks are found in NBIC Part 2, S6.13; portable tanks S6.14; and ton tanks S6.15.

S6.4.7.3 EXTERNAL VISUAL AND PRESSURE TESTS

External visual inspection tests shall be performed in accordance with NBIC Part 2, S6.13.1, for cargo tanks; S6.14.5 for portable tanks; and NBIC Part 2, S6.15.2, for ton tanks. The pressure tests for cargo tanks shall be as specified in S6.13.6; S6.14.6, for portable tanks; and NBIC Part 2, S6.15.3, for ton tanks.

S6.4.7.4 LEAK TIGHTNESS TESTING OF TRANSPORT TANKS

S6.4.7.4.1 CARGO TANKS

a) Each cargo tank must be tested for leaks in accordance with NBIC Part 2, Table S6.13, *Periodic Inspections and Tests,* and per the requirements in NBIC Part 2, S6.13.9. The minimum leakage test pressure of 80% of MAWP may be accepted by provisions of the Competent Authority (see 49 CFR 180.407[h]).

b) All external and accessible portions of piping up to the first closure when offered for transportation shall be tested for leak tightness.

   1) All closure fittings must be in place during the leak tightness test.

   2) The leak tightness test pressure must be maintained for at least 5 minutes.

   3) All sources of leakage must be properly repaired.

   4) A cargo tank that fails to retain leakage test pressure may not be returned to service as a specification cargo tank.

S6.4.7.4.2 PORTABLE TANKS

Each portable tank's piping must be tested for leaks in accordance with the inspection intervals in NBIC Part 2, Table S6.14, and per the procedures in NBIC Part 2, S6.14.6.

a) The minimum leakage test pressure is as specified in NBIC Part 2, Table S6.14.6.

b) All closure fittings must be in place during the leak tightness test.

c) The test pressure must be maintained for at least 5 minutes.

d) All sources of leakage must be properly repaired.

e) A portable tank that fails to retain leakage test pressure may not be returned to service as a specification portable tank.

S6.4.7.4.3 TON TANKS

Each ton tank shall be tested at intervals specified in NBIC Part 2, Table S6.15.3, by procedure at pressures specified for the classification of the tank.

S6.4.7.4.4 LEAK TIGHTNESS TESTING OF VALVES

S6.4.7.4.4.1 CARGO TANKS

Cargo tank valves shall be periodically visually inspected in accordance with the applicable provisions in NBIC Part 2, S6.13.2(e) and leak tested at time intervals specified in Table S6.13. This test should coincide with the leak test for piping as specified in NBIC Part 2, S6.4.7.4.1, and shall include:

a) All valves under pressure shall be leak tested at the pressure specified, for leakage through the valve, and externally (e.g., valve bonnet).

b) During the inspection a suitable method must be used for detecting the existence of leaks. This method must consist either of coating the entire surface of all joints under pressure with a solution of soap and water, or using other equally sensitive methods.

c) All emergency devices and valves including self-closing stop valves, excess flow valves and remote closure devices must be free from corrosion, distortion, erosion, and external damage that will prevent safe operation. Remote closure devices and self-closing stop valves must be functioned to demonstrate proper operation.

S6.4.7.4.4.2 PORTABLE TANKS

Portable tank valves shall be periodically visually inspected in accordance with the applicable provisions of NBIC Part 2, S6.14.3, and leak tested at time intervals specified in NBIC Part 2, S6.14. Leak tightness testing requirements are as specified in NBIC Part 2, Table S6.14.6, and shall include:

a) Piping, valves, and gaskets must be free from corroded areas, defects, and other conditions, including leakage, that might render the portable tank unsafe for filling, discharge, or transportation;

b) All emergency valves shall be free from corrosion, distortion, and any damage or defect that could prevent their normal operation;

c) Remote closure devices and self-closing stop valves must be operated to demonstrate proper function.

d) For testing of internal self-closing stop valves see Appendix A and B of 49CFR180; and

e) The intermediate periodic inspection and test shall include an internal and external inspection, unless exempted, and an external inspection of the portable tank and fittings, leakage test, and test for satisfactory operation of all service equipment.

S6.4.7.4.4.3 TON TANKS

Ton tank valves shall be periodically visually inspected in accordance with the applicable provisions of NBIC Part 2, S6.15.2 and leak tested in accordance with the provisions of NBIC Part 2, S6.15.3 and S6.15.3.1. This test should coincide with the tank retest intervals as stipulated in NBIC Part 2, Table S6.15.3.

S6.4.7.5 LEAK TIGHTNESS TESTING OF SAFETY RELIEF DEVICES

S6.4.7.5.1 CARGO TANKS

a) All re-closing pressure relief devices for cargo tanks shall be visually inspected per NBIC Part 2, S6.13.2(e) and pressure tested for leak tightness as stipulated in NBIC Part 2, S6.13.6(b) at frequencies specified in NBIC Part 2, Table S6.13.

Note: When performing this test, all re-closing pressure relief valves, including emergency relief vents, and normal vents shall be removed for inspection and tested as follows:

b) Leakage test for any venting device required for the interval specified in NBIC Part 2, Table S6.13, must include testing the device in place, except that any venting device set to discharge at less than the leakage pressure must be removed or rendered inoperative during the test.

c) Non-re-closing relief device discs should be evaluated for replacement at the time of the pressure test intervals.

S6.4.7.5.2 PORTABLE TANKS

Portable tanks subject to a five-year periodic inspection and leak tightness test, except for DOT Specification 56 and 57 Portable Tanks, shall include:

a) All re-closing pressure relief devices must be removed from the tank and tested separately unless they can be tested while installed on the portable tank.

b) If a leakage test is specified being less than the MAWP, the re-closing pressure relief valves can be tested in place.

c) Visual inspection shall include all emergency devices to ensure that they are free from corrosion, distortion, and any damage or defects that could prevent the devices from operating as designed.

d) For Specification 57 Portable Tanks, during the air test, the pressure relief device may be removed or left in place. If the relief device is left in place during the test, the device's discharge opening shall be plugged. (See Special Requirements for testing of pressure relief devices for Specifications 51 and 56 Portable Tanks in NBIC Part 2, S6.14.6.2.)

e) For Specification 60 Portable Tanks, re-closing pressure relief devices may be removed from the tank and tested separately unless they can be tested while installed in the portable tank.

f) If portable tanks are fitted with non-reclosing relieving devices, consideration for replacing the discs for these devices should be evaluated at the time of the leak tightness test interval.

S6.4.7.5.3 TON TANKS

Each ton tank designed to be removed from tank cars for filling and emptying shall have their safety relief devices, if fitted, tested and subjected to a periodic inspection and test at frequencies established in NBIC Part 2, Table S6.15.3.

a) All pressure relief devices shall be retested by air or gas for the start-to-discharge and vapor tightness requirements.

b) For ton tanks fitted with rupture discs and fusible plugs, the inspection of these devices and disposition must be as described in NBIC Part 2, S6.15.3.3.

S6.4.7.6 TESTING OF MISCELLANEOUS PRESSURE PARTS

S6.4.7.6.1 CARGO TANKS

Cargo tanks provided with manholes (or handholes) shall be inspected in accordance with NBIC Part 2, S6.13.2 and all major structural attachments as defined in CFR180.407(d)(2)(viii), including the upper coupler (fifth wheel) assembly and ring stiffeners shall be inspected in accordance with NBIC Part 2, S6.13.3. Other miscellaneous items shall comply with the following:

a) Cargo tanks equipped with linings that protect the cargo tank from the commodity being transported shall be inspected, unless exempted, in accordance with the provisions of NBIC Part 2, S6.13.5.

b) For cargo tanks equipped with a heating system, the heating system shall be pressure tested as required by NBIC Part 2, S6.13.6.4.

c) Delivery hoses for MC330 and MC331 cargo tanks shall be leak tightness tested. Any conditions as noted in NBIC Part 2, S6.13.9, which exist for the delivery hose, shall be unacceptable and prevent its continued use.

d) New or replaced delivery hose assemblies shall meet all of the requirements of NBIC Part 2, S6.13.10. In addition to this requirement, for commodities transported in MC330 and MC331, the delivery hose assemblies may be installed or carried on the cargo tank. The operator is required to perform inspections as required in 49CFR180.416.

S6.4.7.6.2 PORTABLE TANKS

For portable tanks, the periodic visual inspection shall include:

a) The operation of tightening devices for manhole and handhole covers, or the gaskets are operative and there is no leakage at the manhole or handhole cover or gasket at leakage pressure.

b) The framework structural supports and the lifting device located on the portable tank shall be in satisfactory condition.

S6.4.7.6.3 TON TANKS

Visual inspection of ton tanks shall include damaged chimes or protective rings, if so fitted.

S6.4.7.7 ACCEPTANCE CRITERIA

All defects or deficiencies discovered during the inspection process of a transport tank shall be documented in the Inspection Report and discussed with the Owner or user of the transport tank at the time of the inspection. Defects or deficiencies shall be corrected using appropriate methods, and tested prior to returning the transport tank to service. (See NBIC Part 2, S6.10.)

S6.4.7.8 INSPECTION REPORT

S6.4.7.8.1 CARGO TANKS

Cargo tank Inspection Reports, as a minimum, shall include the information specified in NBIC Part 2, S6.13.6.7 and S6.13.8 (as applicable) and 49 CFR 180.417.

S6.4.7.8.2 PORTABLE TANKS

Portable tank Inspection Reports shall satisfy the requirements of NBIC Part 2, S6.14.9, in addition to those of 49 CFR Part 180.605.

S6.4.7.8.3 TON TANKS

Ton tank Inspection Reports shall satisfy the requirements of NBIC Part 2, S6.15.3.6 in addition to those of 49 CFR Part 180.519.

S6.5 STAMPING AND RECORD REQUIREMENTS FOR DOT TRANSPORT TANKS IN CONTINUED SERVICE

This section provides for preparation, distribution and maintenance of inspection records and stamping requirements for Continued Service Inspections of Transport Tanks, i.e., cargo tanks, portable tanks, and ton tanks.

S6.5.1 GENERAL

To ensure that transport tanks can maintain their authorization to transport hazardous materials by the mode of transport permitted by the competent authority (DOT), the specification transport tank's Owner or user shall satisfy, as applicable, that the records and stamping requirements of this supplement and Code of Federal Regulations, Title 49, Part 180 (49 CFR 180) have been satisfied.

S6.5.2 STAMPING

a) Transport tanks represented as manufactured to a DOT specification or a United Nations (UN) standard shall be marked on a non-removable component of the transport tank with specification markings conforming to the applicable specification. The specification marking is required to be located in an unobstructed area with letters and numerals identifying the standard or specification. Unless otherwise specified by Part 178.3 of the Code of Federal Regulations, the markings must identify the name and address or symbol of the transport tank manufacturer or, where specifically authorized, the symbol of the approval agency certifying compliance with a UN standard.

b) Symbols required by the Department of Transportation (DOT) must be with the approval of the DOT Associate Administrator. Duplicative symbols are not authorized. Stamping and symbol requirements for transport tanks that are under different rules than CFR 49, Parts 100 through 185, shall comply with the applicable competent authority's rules and regulations.

c) The detailed markings, i.e., stamped, embossed, burned, printed, etc., size of the markings, capacities, etc., are specified in Part 178.3 of the Code of Federal Regulations, Title 49, as follows:

1) ASME-Stamped Transport Tanks

a. Transport tanks stamped with the ASME Section XII Code Symbol shall satisfy the applicable requirements of that Code. Transport tanks manufactured prior to the adoption of ASME Section XII by the Competent Authority were manufactured in accordance with ASME Section VIII, Div. 1. Stamping with the ASME Section VIII, Div. 1 "U" Code Symbol Stamp is dependent on pressure and/or media limitations.

b. When the stamping on a transport tank becomes indistinct or the nameplate is lost or illegible, but traceability to the original transport tank is still possible. To satisfy this requirement, as a minimum, original source data from the manufacturer of the vessel or records in possession of the tank Owner should be used to establish traceablity to the stamping with the concurrence of the Inspector, and approval of the Competent Authority, and if required the Jurisdiction. The Inspector shall instruct the Owner or user to have the stamped data replaced. All restamping shall be done in accordance with the original code of construction (ASME Section XII, or ASME Section VIII, Div. 1, as applicable). Request for permission to restamp or replace the nameplate shall be made to the Competent Authority and, if required, the Jurisdiction. Application must be made on the *Replacement of Stamped Data Form*, NB-136 (See NBIC Part 2, 5.5.2). Proof of the stamping and other such data, as is available, shall be furnished with the request. When traceability cannot be established, the Competent Authority shall be contacted.

2) Restamping or replacement of nameplates

Restamping or replacement of the nameplate as authorized by the Competent Authority shall only be done in the presence of the Inspector, i.e., AI, QI, CI, or National Board Commissioned Inspector, as required by ASME Section XII and the applicable Modal Appendix, or as required by the Competent Authority. For transport tanks manufactured to ASME Section VIII, Division 1, restamping or replacement shall only by done in the presence of an Authorized Inspector or a National Board Commissioned Inspector.

S6.5.3 OWNER OR USER REQUIRED RECORDS FOR CARGO TANKS

a) Each Owner or User of a DOT Specification cargo tank shall retain the appropriate ASME Manufacturer's Data Report, Form T-1, for Section XII Transport Tanks, or Form U-1A for Section VIII, Division 1 Pressure Vessels, and related papers certifying that the DOT Specification cargo tank identified in the documents was manufactured and tested in accordance with the applicable tank specification.

1) In addition to the appropriate ASME Manufacturer's Data Report, the required documents shall include any certification of emergency discharge control systems required by 49 CFR 173.315(n) or 49 CFR 180.405(m).

a. The Certificate of Compliance issued by the cargo tank motor vehicle manufacturer (CTMVM) and all preceding certificates issued by preceding manufacturers signed and dated by a Registered Inspector or Company Official or Design Certifying Engineer as required by 49 CFR 178.337-18(a)(1) or (a)(2) as appropriate. The certificate must contain a statement indicating whether or not the cargo tank was postweld heat treated for anhydrous ammonia service as specified in 49 CFR 178.337-1(f);

b. Cargo tank fabrication drawings;

c. Piping drawing that identifies the location, make, model, and size of each valve and the arrangement of all piping associated with the cargo tank motor vehicle;

d. Assembly drawing;

e. Pressure test report for the piping, valves and fittings;

f. Hose certification; and

g. Certification of emergency discharge control systems.

2) The documents required by 49 CFR shall be retained throughout Ownership of the cargo tank and for one year after relinquishing Ownership.

3) In the event of a change in Ownership, the prior Owner shall retain non-fading photocopies of these documents for one year.

4) Users of a cargo tank that are not the Owner shall retain a copy of the vehicle certification report as long as the cargo tank motor vehicle is used by the User and for one year thereafter.

5) The required documents specified in this Section shall be maintained at the Owner's or Users' principal place of business, or at a location where the cargo tank is housed or maintained.

6) Items (4) and (5) do not apply if the User leases the cargo tank for less than 30 days.

b) For DOT Specification cargo tanks that were manufactured prior to September 1, 1995, that were not constructed to ASME Section VIII, Division 1 (Non Code Pressure Vessels), but wishes to certify the cargo tank to a DOT Specification Cargo Tank, the following shall be complied with:

1) The Owner shall perform the appropriate tests and inspections as required by 49 CFR Part 178 under the direct supervision of a Registered Inspector to determine if the cargo tank conforms to the applicable specification.

2) Both the Owner and the Registered Inspector shall certify that the cargo tank fully conforms to the applicable specification.

3) The Owner shall maintain the certification as specified in this section.

c) For ASME stamped cargo tanks, the Owner must have the manufacturer's certification and the appropriate ASME Manufacturer's Data Report on file.

1) If the Owner does not have the manufacturer's certification and the appropriate ASME Manufacturer's Data Report, the following shall be satisfied:

a. If the pressure vessel of the cargo tank is registered with the National Board of Boiler and Pressure Vessel Inspectors (National Board), they shall obtain a copy of the Manufacturer's Data Report from the National Board.

b. If the pressure vessel of the cargo tank is not registered with the National Board, shall copy the cargo tank's identification and ASME Code nameplate information and retain this information in their files.

2) If the nameplate information is copied as identified in (c)(1)b., the Owner and the Registered Inspector shall certify that the pressure vessel of the cargo tank fully conforms to the DOT specification.

3) The Owner shall retain all certification documents in accordance with retention periods specified in this supplement.

S6.5.3.1 REPORTING REQUIREMENTS BY THE OWNER OR USER OF TESTS AND INSPECTIONS OF DOT SPECIFICATION CARGO TANKS

The Owner or User that performs the required Test and the Registered Inspector that performs the inspection as specified at frequencies established in NBIC Part 2, Table S6.13, shall prepare a written report in English that satisfies the requirements of NBIC Part 2, S6.13. Each test and inspection facility that fails a cargo tank based on a test or inspection report shall notify the Owner, register the report with the National Board, and provide a copy of the test report indicating the failure to the competent authority.

S6.5.3.2 DOT MARKING REQUIREMENTS FOR TESTS AND INSPECTIONS OF DOT SPECIFICATION CARGO TANKS

Each cargo tank that has successfully completed the test and inspection contained in NBIC Part 2, S6.13, shall be durably and legibly marked, in English. The markings shall comply with the following:

a) Date (month and year) of the type of test or inspection performed, subject to the following:

1) Date shall be readily identifiable with the applicable test or inspection;

2) Markings shall be 32 mm (1.25 in.) high, near the specification plate or anywhere on the front head of the cargo tank.

b) The type of test or inspection may be abbreviated as follows:

1) “V” for external visual inspection;

2) “I” for internal visual inspection;

3) “P” for pressure test;

4) “L” for lining inspection;

5) “T” for thickness inspection;

6) “K” for leakage test for a cargo tank tested to the requirements of NBIC Part 2, S6.13.9, except for cargo tanks subject to the requirements of NBIC Part 2, S6.13.9 (d)(10); or

7) “K-EPA27” for a cargo tank tested to the requirements of NBIC Part 2, S6.13.9(d)(10), that was manufactured after October 1, 2004.

c) For a cargo tank motor vehicle composed of multiple cargo tanks constructed to the same specification, which are tested and inspected at the same time, one set of test and inspection markings may be used to satisfy the requirements of NBIC Part 2, S6.5.3.2.

d) For a cargo tank motor vehicle composed of multiple cargo tanks constructed to different specifications, which are tested and inspected at different intervals, the test and inspection markings shall appear in the order of the cargo tank's corresponding location, from front to rear.

S6.5.4 OWNER OR USER REQUIRED RECORDS FOR PORTABLE TANKS

a) The Owner of each portable tank or their authorized agent shall retain a written record of the date and results of all required inspections and tests, including the ASME Manufacturer's Data Report.

b) The written record, if applicable, shall indicate the name and address of the person that performed the inspection or test. The inspection and test shall comply with the requirements of the portable tank's specification, as provided in 49 CFR, Part 178.

c) The Owner shall maintain a copy of the ASME Manufacturer's Data Report. He shall also maintain a certificate(s) that is signed by the manufacturer of the portable tank, and by the authorized design approval agency, as applicable indicating compliance with the applicable portable tank specification.

d) The signed certificate, including the ASME Manufacturer's Data Report, shall be maintained by the Owner or their authorized agent during the time that the portable tank is used for service. DOT Specifications 56 and 57 portable tanks are exempt from this requirement.

S6.5.4.1 REPORTING OF PERIODIC AND INTERMEDIATE PERIODIC INSPECTION AND TESTS OF DOT SPECIFICATION PORTABLE TANKS

a) The user of portable tanks shall satisfy the requirements for Periodic and Intermediate Periodic Inspection and Tests of portable tanks as specified in Table S6.14 of this Supplement and shall maintain the results of these tests as required in NBIC Part 2, S6.5.4.

b) The methods and procedures to be used in the performance of the required Intermediate Periodic and Inspections and Tests are specified in NBIC Part 2, S6.14.

S6.5.4.2 MARKING REQUIREMENTS FOR PERIODIC AND INTERMEDIATE INSPECTION AND TESTS FOR IM OR UN PORTABLE TANKS

Each IM or UN portable tank that has successfully completed the required Periodic or Intermediate Inspection and Test shall be durably and legibly marked, in English. The markings shall comply with the following:

a) Date (month and year) of the last pressure test;

b) Identification markings of the approval agency witnessing the test;

c) When required, the date (month and year) of the last visual inspection;

d) Markings shall be placed on or near the metal identification plate; and

e) Markings shall be 3 mm (0.118 in.) high when on the metal identification plate and 12 mm (0.47 in.) high when on the portable tank.

S6.5.4.3 DOT MARKING REQUIREMENTS FOR PERIODIC AND INTERMEDIATE INSPECTION AND TESTS OF DOT SPECIFICATION 51, 56, 57, OR 60 PORTABLE TANKS

Each DOT Specification 51, 56, 57, or 60 portable tank that has successfully completed the required Periodic or Intermediate Inspection and Test shall be durably and legibly marked, in English. The markings shall comply with the following:

a) Date (month and year) of the most recent test;

b) Markings shall be placed on or near the metal certification plate;

c) Markings shall be accordance with 49 CFR, Part 178.3; and

d) Letters and numerals shall not be less than 3 mm (0.118 in.) high, when on a metal certification plate and 12 mm (0.47 in.) on the portable tank, except that a portable tank manufactured under a previously authorized specification may continue to be marked with smaller markings if originally authorized under that specification (for example, DOT specification 57 portable tanks).

S6.5.5 OWNER OR USER REQUIRED REPORTS FOR DOT SPECIFICATION 106A AND DOT 110A TON TANKS

a) The Owner or User of a DOT Specification ton tank shall retain the certificate of construction (AAR-Form 4-2) and related papers certifying that the manufacturer of the specification tank identified in the documents is in accordance with the applicable specification.

b) The Owner or User shall retain the documents throughout the period of Ownership of the specification ton tank and for one year thereafter.

c) Upon a change in Ownership of the specification ton tank, the Owner shall satisfy the requirements of Section 1.3.15 of the ARR Specification.

S6.5.5.1 REPORTING OF INSPECTION AND TESTS FOR DOT SPECIFICATION 106A AND DOT 110A TON TANKS

a) The Owner or User shall inspect and test ton tanks at frequencies specified in NBIC Part 2, Table S6.15.3 and shall perform the inspections and tests in accordance with NBIC Part 2, S6.15.3.

b) The Owner or User is required to develop a written record of the results of the pressure test and visual inspection and shall record the information on a suitable data sheet. Completed copies of these reports shall be retained by the Owner and by the person performing the pressure test and visual inspection, as long as the ton tank is in service.

c) The required information to be recorded and checked on these data sheets is:

   1) Date of test and inspection;

   2) DOT Specification Number;

   3) Ton tank identification (registered symbol and serial number);

4) Date of manufacturer and Ownership symbol;

5) Type of protective coating (painted, etc.), and statement as to need for refinishing or recoating;

6) Conditions checked, i.e., leakage, corrosion, gouges, dents or digs, broken or damaged chime or protective ring, fire, fire damage, internal condition;

7) Test pressure;

8) Results of tests;

9) Disposition of ton tank (returned to service, returned to manufacturer for repair, or scraped); and

10) Identification of person conducting the retest or inspection.

d) If a Retest Inspection is required, the Owner or User shall prepare a written report in accordance with NBIC Part 2, S6.15.3.6, of this Supplement.

S6.5.5.2 DOT MARKING REQUIREMENTS FOR TESTS AND INSPECTION OF DOT SPECIFICATION 106A AND 110A TON TANKS

a) When a ton tank passes the required inspection and test with acceptable results, the tank car facility shall mark the following information on the ton tank:

1) Date of the inspection and test;

2) Due date of the next inspection and test;

3) The markings on the ton tank shall be in accordance with Appendix C of the ARR Specifications for Tank Cars.

b) When a tank car facility performs multiple inspections and tests at the same time, one date may be used to satisfy the requirements of NBIC Part 2, S6.5.5.2. Additionally, one date may be shown when multiple inspections and tests have the same due date.

S6.6 CORROSION AND FAILURE MECHANISMS IN TRANSPORT TANKS

An effective inspection and test program requires an understanding of the applicable potential failure mechanisms and the applicable inspection and test methods to ensure the continued structural integrity of a transport tank.

S6.6.1 SCOPE

This Section provides an overview of the causes of deterioration and failure mechanisms in transport tanks. As provided in this overview, some forms of deterioration and failure mechanisms may include stress corrosion cracking, fatigue, and temperature gradients (brittle fracture behavior) applicable to transport tanks during their normal operation.

S6.6.2 GENERAL

a) This Supplement includes a general discussion of mechanisms and effective inspection and test methods. Additionally, some specific guidance is given on how to evaluate the transport tanks for repairs, modifications, and continued service requirements.

b) There are a variety of inservice conditions that may cause deterioration of the materials used in the construction of transport tanks. These inservice conditions should be taken into consideration during any repair activity. Prior to any repair activity, it is important to identify the cause of the deterioration, and to prevent its recurrence.

S6.6.3 INTERNAL AND/OR EXTERNAL CORROSION

Internal and/or external wastage from corrosion is probably one of the most common causes of deterioration in transport tanks while in operation. All metals and alloys are susceptible to corrosion. Corrosion is deterioration that occurs when a metal reacts with its environment. Corrosion can be classified based on three factors. These factors are:

a) Nature

1) Wet — liquid or moisture present in the transport tank;

2) Dry — high temperatures that may be present in the transport tank;

b) Mechanism — electrochemical or direct chemical reactions; and

c) Appearance — either uniform or localized.

S6.6.3.1 TYPES OF CORROSION

To implement the proper corrective actions will depend on which factors caused the problems, making it important to diagnose the reason for failure. Early detection of corrosion problems are important to prevent failures and can be achieved by performing regular inspections and encouraging employees to be observant and communicate their observations. The following types of corrosion mechanisms are commonly found in transport tanks:

a) Pitting Corrosion

Pitting corrosion is the formation of holes in an otherwise relatively un-attacked surface. Some of the characteristics of pitting corrosion are:

1) Usually a slow process causing isolated, scattered pitting over a small area that does not substantially weaken the transport tank. It could, however, eventually cause leakage;

2) In some cases, local corrosion pits can be caused by microbiological activity, commonly known as MIC (microbiologically influenced corrosion) attack; or

3) Generally, the area of the steel surrounding a corrosion pit from MIC will exhibit discoloration or a ring as evidence of a thriving bacteria colony.

b) Line Corrosion

This is a condition where pits are connected; or nearly connected to each other in a narrow band or line. Line corrosion frequently occurs in the interior surfaces of a transport tank at the following locations:

1) The liquid-vapor interface in the transport tank, or

2) The bottom of the transport tank.

c) General Corrosion

This is corrosion that covers a considerable area of the vessel surface of the transport tank. When this condition occurs, the Owner-user of the transport tanks has to consider if this condition has compromised the continued safe operation of the transport tank. The following should be used in making this determination:

1) Inspect the affected area or areas to ensure that the required minimum thickness of the vessel is within acceptable limits; and

2) If the affected area's or areas' minimum thickness is below tolerance, depending on the degree of deterioration, restore the area or areas to the required thickness by using the weld buildup method or a flush patch.

d) Grooving Corrosion

This type of corrosion is a form of metal deterioration caused by localized corrosion, and may be accelerated by stress concentration. Grooving is generally noticed:

1) Adjacent to welded surfaces, and

2) On flange-mating surfaces.

e) Exfoliation and Selective Leaching

1) Exfoliation is a subsurface corrosion that begins on a clean surface, but spreads below the surface of the metal. This type of corrosion differs from pitting in that the damage to the metal exhibits a laminated appearance, recognized by a flaky and sometimes blistered surface.

2) Selective leaching results in the removal of one of the elements in an alloy material. This corrosion mechanism is detrimental because it yields a porous metal with poor mechanical properties.

f) Galvanic Corrosion

1) Occurs when two dissimilar metals come in contact with each other in the presence of an electrolyte (i.e., film of water containing dissolved oxygen, nitrogen, and carbon dioxide) constituting an electrolytic cell. The difference in galvanic potential between the two dissimilar materials creates a local electrical cell that may cause rapid corrosion of the less- noble metal. This corrosion mechanism becomes more active when there are large differences between the electrode potentials of the two metals.

2) Galvanic corrosion may also exist with relatively minor changes of alloy composition (i.e., between a weld metal and the base metal). Natural (i.e., an oxide coating on aluminum) or a protective coating may inhibit galvanic corrosion, but in most instances the metals or alloys must be selected on the basis of intrinsic resistance to corrosion.

3) In transport tanks, the effects of galvanic corrosion are most noticeable at welds or at flanged and bolted connections that have been exposed to contact with a fluid that is conductive.

g) Erosion/Corrosion

This type of damage mechanism is generally attributed to the movement of a corrodent over a metal surface that increases the rate of attack due to mechanical wear and corrosion. This type of damage mechanism is generally characterized as having an appearance of smooth bottomed shallow pit, and may also exhibit a directional pattern or surface texture related to the path taken by the corrodent. This deterioration would normally occur at locations where the transport tank is filled or emptied.

h) Crevice Corrosion

1) Environmental conditions in a crevice can, with time, become different from those on a nearby clean surface. A more aggressive environment may develop within the crevice and cause local corrosion. Crevice corrosion commonly can be found in:

a. Gasket surfaces;

b. Lap joints; and

c. Bolts and flanges.

2) Crevice corrosion can also be caused by dirt deposits, corrosion products, scratches in paint, etc.

3) To avoid or greatly reduce corrosion, the Owner-user of transport tanks, when having a transport tank manufactured, can specify materials and protection methods (such as coating). By implementing proper selection of materials and protection methods, corrosive attack in transport tanks can be predicted and controlled. However, there may be unexpected failures as a result of one or more of the following:

a. Poor choice of materials used in transport tank repairs or new construction;

b. Operating conditions different from those anticipated in service;

c. Defective fabrication;

d. Improper design;

e. Inadequate maintenance; and

f. Defective material.

S6.6.4 FAILURE MECHANISMS

There are various failure mechanisms that can result in cracks or loss of structural integrity to transport tanks. The more common failure mechanisms described below are fatigue, mechanical, thermal, and corrosion induced brittle fracture and hydrogen embrittlement, as a result of poor handling practices during welded repairs.

a) Fatigue — Stress reversals (such as cyclic loading) in parts of transport tank equipment are common, particularly at points of high secondary stress. These stresses can originate adjacent to locations of weld repairs and from over-the-road vibratory stresses. If stresses are high and reversals frequent, failure of parts may occur because of mechanical fatigue crack propagation. Fatigue failures in transport tanks may also result from exposure to cyclic temperature and pressure changes. Locations where metals having

different thermal coefficients of expansion that are joined by welding may be susceptible to thermal fatigue upon exposure to service temperature variations.

1) In specific cases where the combined effects of exposure to a corrosive environment and cyclic loading occur together in a transport tank, the damage mechanism that can occur is corrosion assisted fatigue or simply corrosion fatigue.

2) Corrosion fatigue crack propagation typically occurs along a straight direction, with minimal branching. Some sources of fatigue crack initiation are:

   a. At sharp corners;

   b. At openings in the transport tank; and

   c. At structural attachments.

b) Temperature — At subfreezing temperatures, water and some chemicals handled in transport tanks may freeze and cause failure. Carbon and low-alloy steels may be susceptible to brittle fracture, even at ambient temperatures. A number of failures have been attributed to brittle fracture of steels that were exposed to temperatures below their ductile-to-brittle transition temperature (DBTT) during a pressure test or hydrostatic test. However, most brittle fractures have occurred on the first application of a particular stress level (that is, the first hydrostatic test or overload).

   Special attention should be given to low-alloy steels because they are prone to temper embrittlement, which can result in a loss of toughness.

   Temper embrittlement is defined as a loss of ductility and notch toughness due to postweld heat treatment or high temperature service, above 370°C (700°F).

c) Hydrogen Embrittlement — A loss of strength and/or ductility in steels caused by atomic hydrogen dissolved in the steel. It is a low-temperature phenomenon, seldom encountered above 95°C (200°F), and most often occurs as a result of hydrogen evolved from aqueous corrosion reactions or hydrogen generated during welding. Weld underbead cracking (also know as delayed cracking and cold cracking) is also a form of hydrogen embrittlement; however, in this case, the hydrogen comes from the welding operation rather than from a corrosion reaction.

   1) Weld underbead cracking is caused by hydrogen dissolved in a hard, high-strength weld heat-affected zone. Use of low-hydrogen welding practices to minimize dissolved hydrogen, and/or use of high-preheat, and/or postweld heat treatment to reduce heat-affected zone hardness, will reduce the likelihood of weld underbead cracking in susceptible steel.

   2) Hydrogen embrittlement is reversible as long as no physical damage, e.g., cracking, has occurred in the steel. If the atomic hydrogen is removed from the steel before any damage occurs, for example by heating for a short time in the absence of hydrogen between 150°C (300°F) and 205°C (400°F), normal mechanical properties will be restored.

   3) Welding procedures, repair methods, and inspection procedures must include careful consideration of potential failure in corrosive environments, including the various forms of hydrogen embrittlement.

d) Stress Corrosion Cracking (SCC) — Cracking of a metal caused by the combined action of stress and a corrosive environment. SCC only occurs with specific combinations of metal and environment. The stress required may be either applied or residual. Examples of stress corrosion cracking include chloride stress

corrosion cracking of stainless steels in hot, aqueous chloride solutions; caustic cracking of carbon steel in hot sodium hydroxide solutions, and ammonia stress corrosion cracking of brass in ammonia solutions (season cracking).

1) Corrosivity alone is not a good indicator of the likelihood of a particular environment to cause SCC in a particular metal. Solutions that are highly corrosive to a material almost never promote SCC.

2) The principal variables affecting SCC are tensile stress, service temperature, solution chemistry, duration of exposure, and metal properties. Removing any one of these parameters sufficiently can reduce or eliminate the possibility of SCC occurring in service.

S6.7 CLASSIFICATION BOUNDARIES

Transport tanks are classified as Class 1, Class 2, and Class 3. The classification is established by the applicable Modal Appendix of ASME Section XII. Also contained in the Modal Appendix is the type of Inspector, i.e., Authorized Inspector, Qualified Inspector, and Certified Individual, that is permitted to perform the applicable fabrication inspection of the transport tank, i.e., cargo tank, tank car, portable tank, and ton tank. The classification of the transport tank, except for continued service inspections, determines the code of construction requirements for repairs or modifications.

S6.8 PRESSURE, TEMPERATURE, AND CAPACITY REQUIREMENTS FOR TRANSPORT TANKS

a) ASME Section XII has established pressure, temperature, and maximum thickness requirements for transport tanks as follows:

1) Pressure: full vacuum to 208 bar (full vacuum to 3,000 psia);

2) Temperature: -269°C to 343°C (-452°F to 650°F); and

3) Maximum material thickness: 38 mm (1-1/2 in.).

b) Transport tanks manufactured prior to the adoption of ASME Section XII by the Competent Authority were manufactured in accordance with ASME Section VIII, Div. 1. Transport tanks manufactured to this Code were required to be stamped with the “U” Code Symbol Stamp in accordance with Section VIII, Div. 1, if the design pressure of the transport tank was 241 kPa (35 psi) (depending on material being transported) and greater. If the design pressure was less than 241 kPa (35 psi) (depending on the media being transported), the transport tank was constructed in accordance with Section VIII, Div. 1, but not stamped with the “U” Code Symbol Stamp.

c) For these transport tanks, the requirements established in NBIC Part 2, for continued service inspection, repairs, or modifications shall apply, unless specifically exempted by the DOT.

S6.9 REFERENCES TO OTHER CODES AND STANDARDS

Other existing inspection codes, standards, and practices pertaining to the continued service inspection, i.e., CFR 49, Parts 100 through 185, ASME Section XII, etc., of transport tanks can provide useful information and references relative to the inspection techniques listed in this Appendix. Additionally, supplementary guidelines for assisting in the evaluation of inspection results and findings are also available. Some acceptable requirements and guidelines are as follows:

a) American Society of Mechanical Engineers — *ASME Boiler and Pressure Vessel Code*, Section VIII, Div. 1 (*Rules for Construction of Pressure Vessels*).

b) American Society of Mechanical Engineers:

1) ASME Section V (*Nondestructive Examination*)

2) ASME Section IX (*Welding and Brazing Qualifications*).

c) Code of Federal Regulations, Title 49, Parts 100 through 185, *Transportation*.

d) American Petroleum Institute — API 579, *Fitness for Service*.

e) ADR 2003, *European Agreement Concerning the International Carriage of Dangerous Goods by Road*. (Published by the UN Economic Commission for Europe, Information Service, Palais des Nations, C7-1211 Geneve, Suisse.)

f) CGA 6-4.1, *Cleaning Equipment for Oxygen Service*.

g) CGA S-1.2, *Pressure Relief Device Standard*, Part 2: *Cargo and Portable Tanks for Compressed Gases*. (Published by the Compressed Gas Association, Inc. [CGA], 4221 Walney Road, Chantilly, VA 20151.)

h) IMDG Code 2002, *International Maritime Dangerous Goods Code* (including Amendment 31-02. (Published by the International Maritime Organization [IMO], 4 Albert Embankment, London, SE1 7SR England.)

i) RID 2003, *Carriage of Dangerous Goods*. (Published by the Intergovernmental Organization for International Carriage by Rail [OTIF], Gyphenhubeliweg 30, C7-3006 Bern, Switzerland.)

j) *United Nations Recommendations on the Transport of Dangerous Goods – Modal Regulations*. (Published by the United Nations Publications, 2 UN Plaza, New York, New York 10017.)

k) SSPC Publication #91-12, *Coating and Lining Inspection Manual*. (Published by Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, PA 15212-2683.)

S6.10 CONCLUSION

a) During any continued service inspections or tests of transport tanks, performed by the Registered Inspector, the actual operating and maintenance requirements as specified in this Supplement shall be satisfied. The Registered Inspector shall determine, based on the applicable requirements of the *Code of Federal Regulations*, Title 49, Parts 100 through 185, and NBIC Part 2, Supplement 6, whether the transport tank can continue to be safely operated.

b) Defects or deficiencies in the condition, operation, and maintenance requirements of the transport tank, including piping, valves, fittings, etc., shall be discussed with the Owner or user of the transport tank at the time of inspection. Defects or deficiencies shall be corrected using the appropriate methods prior to returning the transport tank to service.

S6.11 PERSONNEL SAFETY AND INSPECTION ACTIVITIES

a) Proper inspection of transport tanks may require pre-inspection planning. This planning should include development of an inspection plan that will satisfy the applicable technical requirements of this Part, the

Code of Federal Regulations, Title 49, Parts 100 through 185, Transportation, and appropriate safety considerations. The inspection plan should also include the applicable failure and deterioration mechanisms, and inspection methods and the requirements of the applicable Competent Authority.

b) This Supplement describes pre-inspection and post-inspection activities applicable to all transport tanks. Specific inspection requirements for transport tanks are identified in NBIC Part 2, S6.13 for Cargo Tanks, S6.14 for Portable Tanks, NBIC Part 2, S6.15 for Ton Tanks.

c) Personnel safety is the joint responsibility of the Owner or user and the Registered Inspector. All applicable safety regulations shall be followed. This includes, if applicable, all governmental rules and regulations. Owner's or user's personnel safety programs and/or safety programs by the Inspector's employer or similar regulations such as confined space requirements also apply.

S6.12 TRANSPORT TANK ENTRY REQUIREMENTS

a) No transport tank shall be entered until it has been properly prepared for inspection. The Owner or user and the Inspector shall determine that the transport tank may be entered safely. This shall include:

1) Potential hazards associated with the entry into the transport tank have been identified by the Owner or user and are brought to the attention of the Inspector, along with acceptable means or methods for mitigating each of these hazards;

2) Coordination of entry into the transport tank by the Inspector and the Owner or user representative(s) working in or near the transport tanks;

3) If personal protective equipment is required to enter the transport tank, the necessary equipment is available, and the Inspector is properly trained in its use; and

4) An effective energy isolation program is in place and in effect that will prevent the unexpected release of energy or media to enter the transport tanks.

b) The Inspector shall be satisfied that a safe atmosphere exists before entering the transport tank. The oxygen content of breathable atmosphere shall be between 19.5% and 23.5%.

c) The Inspector shall not be permitted to enter an area if toxic, flammable, or inert gases or vapors are present and above acceptable limits without proper personal protective equipment. Protective equipment may include, among other items, protective outer clothing, gloves, eye protection, foot protection, and/or respirators.

d) The Inspector shall have proper training governing the selection and use of any personal protective clothing and equipment necessary, particularly related to respiratory protection if the testing of the atmosphere of the transport tank reveals any hazards. This requirement is to ensure that the inspection may be performed safely.

S6.12.1 PRE-INSPECTION ACTIVITIES

a) Prior to conducting the inspection, a review of the history of the transport tank and a general assessment of current conditions shall be performed. This shall include a review of information, such as:

1) Date of the last inspection;

2) Current Inspection Certificate;

3) ASME Code Name Plate and/or Specification;

4) If applicable, National Board registration number;

5) Serial number of identification marking of the transport tank;

6) Operating conditions and normal contents of the transport tank;

7) Previous inspection report or inspection certificates;

8) Records of wall thickness checks, especially where corrosion is a consideration; and

9) Observations of the condition of the complete transport tank, including, piping, fitting, valves, etc.

b) The following activities should be performed as required to support the inspection:

1) Verify the pressure gages, thermometers, and indicating devices are in proper calibration;

2) Ensure that all overpressure protection devices are in proper operation, and that they are operating as designed; and

3) Ensure that all structural attachments are free of defects and are operating as designed.

S6.12.2 PREPARATION FOR INTERNAL INSPECTION

The Owner or user has the responsibility to prepare a transport tank for internal inspection. Requirements for safety including occupational safety and health regulations (federal, state, local, or other), the Owner's or user's own safety program, and the safety programs of the Inspector's employer are applicable for inspections. The transport tank shall be prepared in the following manner or as deemed necessary by the Inspector.

a) When a transport tank is connected to a common header with other transport tanks or in a system where liquids or gases are present, the transport tank shall be isolated by closing, locking, and/or tagging stop valves in accordance with the Owner's or user's procedures.

b) When toxic or flammable materials are involved, additional safety precautions should require removing pipe sections or blanking pipelines before entering the transport tank. The means of isolating the transport tank shall be acceptable to the Inspector and in compliance with applicable occupational safety and health regulations.

c) The transport tank shall be allowed to cool or warm to ambient temperature at a rate to avoid damage to the transport tank.

d) The transport tank shall be drained of all liquid and shall be purged of any toxic or flammable gases or other contaminants that were contained in the transport tank. Mechanical ventilation using a fresh air blower or fan shall be started after the purging operation and maintained until all pockets of "dead air" that may contain toxic or flammable or inert gases are reduced to acceptable limits. During the air purging and ventilation of the transport tank involved with flammable gases, the concentration of the vapor in air should pass through the flammable range before a safe atmosphere is obtained. All necessary precautions shall be taken to eliminate the possibility of explosion or fire.

e) Manhole, if applicable, and handhole plates, washout plugs, inspection plugs, and any other item requested by the Inspector shall be removed.

f) The Inspector shall not enter a transport tank until all safety precautions have been taken. The temperature of the transport tank shall be such that the inspection personnel will not be exposed to excessive heat or cold. The transport tank should be cleaned as necessary.

g) A qualified person (attendant) shall remain outside the transport tank at the point of entry while the Inspector is inside and shall monitor activities inside and outside and communicate with the Inspector as necessary. The attendant shall have means of summoning rescue assistance, if needed, and to facilitate rescue procedures for those inside the transport tank without personally entering the transport tank.

Note: If a transport tank has not been properly prepared for an internal inspection, the Inspector shall decline to make the inspection.

S6.12.3 POST-INSPECTION ACTIVITIES

a) Any defects or deficiencies in the condition, operation, and maintenance practices of the transport tank and auxiliary equipment shall be reported to the Owner or user, including recommendations for correction.

b) Documentation of inspections shall contain pertinent data such as a description of the transport tank, classification (Class 1, 2, or 3), the transport tank identification number, inspection intervals, date of inspection, type of inspection, or type of test performed, and any other information required by the Competent Authority. The Inspector shall sign, date, and note any deficiencies, comments, or recommendations on the inspection report. The Inspector should retain and distribute copies of the inspection report as required.

S6.13 INSPECTION AND TESTS OF CARGO TANKS

All cargo tanks shall be examined and tested at frequencies specified in NBIC Part 2, Table S6.13. The examination and tests shall provide for a visual external, visual internal, leakage test, pressure test, thickness test, and lining test. It should be noted that the information in NBIC Part 2, Table S6.13 is a summary of United States Code of Federal Regulations, Title 49, Part 180. The user shall compare the requirements provided with Part 180 to ensure full compliance.

S6.13.1 VISUAL EXTERNAL INSPECTION

a) Visual inspections are required of the complete cargo tank as required in NBIC Part 2, Table S6.13. The visual inspection shall include the heads, shell, nozzle connections, support attachments, all welded seams (longitudinal and circumferential), nozzle attachment welds, support, piping, appurtenances, structural attachments, and any attachment welds for possible defects. The visual inspection shall include a thorough examination for scratches that affect the pressure-retaining capabilities of the cargo tank, dents, leaks, distortions, corroded or abraded areas, and any other condition that would affect the safe operation of the cargo tank. If the cargo tank is able to be externally inspected, this must be noted in the inspection report of the cargo tank.

b) If the cargo tank is insulated and equipped with an internal lining, the following inspections shall be performed:

1) Insulated cargo tanks — If the insulation on the cargo tank precludes a complete and thorough external visual inspection, the cargo tank shall be subjected to an internal visual inspection, if equipped with a manhole or inspection openings. This inspection shall include all internal surfaces, including welds, nozzle attachments, and, if equipped, baffles, internal stiffeners, surge protection devices for defects, corrosion, and missing or loose attachment;

2) Lined or coated, or those designed to preclude an internal visual inspection — If the cargo tank is externally lined, coated, or of a design that would prevent a complete and thorough external visual examination, the internal areas of the cargo tank that are not obstructed by the lining or coating shall be internally inspected;

3) Lined or coated, or those so designed to preclude access to the internal surfaces — The cargo tank shall be subjected to a hydrostatic or pneumatic test in accordance with NBIC Part 2, S6.13.6;

4) All corroded or abraded areas of a cargo tank wall must be thickness tested in accordance with the following procedures:

   a. Measurements must be made using a device capable of accurately measuring thickness within ± 0.051 mm (± 0.002 of an inch);

   b. Any individual performing thickness testing must be trained in the proper use of the thickness testing device in accordance with the testing device manufacturer's instructions;

   c. The minimum thickness requirements for the heads, shell baffle, and bulkhead, when used as tank reinforcement, shall meet the minimum thickness requirements for inservice requirements for cargo tank specifications MC 300, MC 303, MC 304, MC 306, MC 307, MC 310, MC 311 transport tanks, and MC 312 cargo tanks constructed of steel, steel alloys, aluminum, and aluminum alloys are based on 90% of the minimum manufactured thickness. Table S6.13.1-a, provides minimum inservice minimum thicknesses for steel and steel alloys. Table S6.13.1-b provides minimum thicknesses for aluminum and aluminum alloys.

S6.13.2 INSPECTION OF PIPING, VALVES, AND MANHOLES

a) The cargo tank piping, valves, and gaskets must be carefully inspected for corroded areas and the piping system and valve attachment welds or threads must be inspected for corrosion, leakage, or any other defects that might render the cargo tank unsafe for transportation service. This examination shall include:

b) All devices for securing manhole covers must be in satisfactory working condition, and the area must not show any evidence of leakage at either the manhole cover or the manhole gasket;

   1) When inspecting gaskets on any full opening of the cargo tank, the inspector should visually examine the gasket for defects to include cracks and/or splits that may prevent the gasket material from sealing properly;

   2) If the gasket shows any evidence of cuts or cracks that are likely to cause failure, the gasket shall be replaced;

c) All emergency devices and valves including self-closing stop valves, excess flow valves, and remote closure devices must be free of corrosion, distortion, erosion, and any external damage that will prevent safe operation of the cargo tank. Remote closure devices and self-closing stop valves must be operated during inspection to demonstrate that the devices are operating as designed;

d) Any missing bolts, nuts, and fusible links or elements shall be replaced. Loose bolts and nuts must be tightened;

e) All re-closing pressure relief valves shall be externally inspected for any corrosion or damage that might prevent the device from operating as designed;

1) All re-closing pressure relief valves on cargo tanks carrying lading corrosive to the pressure relief valve shall be removed from the cargo tank for inspection and testing;

2) Each re-closing pressure relief valve required to be removed and tested as specified in e) 1) above must open at the required test pressure and reseat to a leak-tight condition at 90% of the set-to-discharge pressure or the pressure prescribed for the applicable cargo tank specifications.

S6.13.3 INSPECTION OF APPURTENANCES AND STRUCTURAL ATTACHMENTS

a) Major appurtenances, as defined in CFR 49, 180.407 (d)(2)(viii), include but are not limited to suspension system attachments, connecting structures, and those elements of the upper coupler (kingpin) assembly that can be inspected without dismantling the upper coupler (kingpin) assembly. Major appurtenances shall be inspected for any corrosion or damage that might prevent safe operations.

b) If the cargo tank transports lading that is corrosive to the cargo tank, the upper coupler (kingpin) assembly must be inspected at least once in a two-year period. The upper coupler (kingpin) shall be removed for inspection of the following:

1) Corroded and abraded areas;

2) Dents;

3) Distortions;

4) Weld failures; and

5) Any other condition that might render the cargo tank unsafe for transportation service.

c) If the cargo tank is constructed of mild-or high-strength low-alloy steel and employs ring stiffeners or other appurtenances that create air cavities adjacent to the ring stiffeners or other appurtenances to the cargo tank's shell and these areas cannot be visually externally inspected, then the following shall be performed:

1) A thickness test on the stiffener rings shall be performed at least once every two years of at least four symmetrically distributed readings to establish an average thickness for the ring stiffener or appurtenance. The thickness requirements are specified in NBIC Part 2, Tables S6.13.1-a or S6.13.1-b, as applicable;

2) If any of the thickness testing readings for the ring stiffeners are less than the average thickness by more than 10%, thickness testing must be performed from inside the transport tank on the area of the tank wall covered by the appurtenance or ring stiffener. If the results of the thickness test of the transport tank fail to conform to the minimum thickness requirements prescribed for the design as manufactured, the tank must be repaired or removed from hazardous material service. The Owner of the transport tank can de-rate the tank to transport authorized material and reduced maximum weight of lading, reduce pressure, or a combination thereof under the following conditions:

Table S6.13
Periodic Inspections and Tests

Test or Inspection (cargo tank specification, configuration, and service)	Date by which first test must be completed (see Note 1)	Interval period after first test
External Visual Inspection		
All cargo tanks designed to be loaded by vacuum with full opening rear heads	September 1, 1991	6 Months
All other cargo tanks	September 1, 1991	1 Year
Internal Visual Inspection		
All insulated cargo tanks, except MC 330, MC 331, & MC 338 (see Note 4)	September 1, 1991	1 Year
All cargo tanks transporting lading corrosive to the tank	September 1, 1991	1 Year
All other cargo tanks, except MC 338	September 1, 1995	5 Years
Lining Inspection		
All lined cargo tanks transporting lading corrosive to the tank	September 1, 1991	1 Year
Leakage Test		
MC 330 and MC 331 cargo tanks in chlorine service	September 1, 1991	2 Years
All other cargo tanks, except MC 338	September 1, 1991	1 Year
Pressure Test		
Hydrostatic or Pneumatic (see Notes 2 and 3)	—	—
All cargo tanks which are insulated with no manhole or insulated and lined, except MC 338	September 1, 1991	1 Year
All cargo tanks designed to be loaded by vacuum with full opening heads	September 1, 1992	2 Years
MC 330 and MC 331 cargo tanks in chlorine service	September 1, 1992	2 Years
All other cargo tanks	September 1, 1995	5 Years
Thickness Test		
All unlined cargo tanks transporting material corrosive to the tank, except MC 338	September 1, 1992	2 Years

Note 1: If a cargo tank is subject to an applicable inspection or test requirement under the regulations in effect on December 30, 1990, and the due date (as specified by a requirement in effect on December 30, 1990) for completing the required test occurs before the compliance date listed in the Table, the earlier date applies.
Note 2: Pressure testing is not required for MC 300 and MC 331 cargo tanks in dedicated sodium metal service.
Note 3: Pressure testing is not required for uninsulated lined cargo tanks with a design pressure of MAWP 103 kPa (15 psi) or less, which receive an external visual inspection and lining inspection at least once each year.
Note 4: Insulated cargo tanks equipped with manholes or inspection openings may receive either an internal visual inspection in conjunction with the external visual inspection or a hydrostatic or pneumatic test of the cargo tank.

Table S6.13.1-a
Inservice Minimum Thicknesses for Steel and Steel Alloys

Minimum manufactured thickness (US "Manufacturers' Standard Gage for Steel Sheets" or inches)	Nominal decimal equivalent, mm (inches)	Inservice minimum reference, mm (inches)
19 gage	1.06 (0.0418)	0.97 (0.038)
18 gage	1.21 (0.0478)	1.09 (0.043)
17 gage	1.37 (0.0538)	1.22 (0.048)
16 gage	1.52 (0.0598)	1.37 (0.054)
15 gage	1.71 (0.0673)	1.55 (0.061)
14 gage	1.90 (0.0747)	1.70 (0.067)
13 gage	2.28 (0.0897)	2.06 (0.081)
12 gage	2.66 (0.1046)	2.39 (0.094)
11 gage	3.04 (0.1196)	2.74 (0.108)
10 gage	3.42 (0.1345)	3.07 (0.121)
9 gage	3.80 (0.1495)	3.43 (0.135)
8 gage	4.18 (0.1644)	3.76 (0.148)
7 gage	4.55 (0.1793)	4.09 (0.161)
3/16 inch	5 (0.1875)	4.29 (0.169)
1/4 inch	6 (0.2500)	5.72 (0.225)
5/16 inch	8 (0.3125)	7.14 (0.281)
3/8 inch	10 (0.3750)	8.59 (0.338)

Table S6.13.1-b
Inservice Minimum Thicknesses for Aluminum and Aluminum Alloys

Minimum manufactured thickness, mm (inches)	Inservice minimum thickness, mm (inches)
1.98 (0.078)	1.78 (0.070)
2.21 (0.087)	1.98 (0.078)
2.44 (0.096)	2.18 (0.086)
2.77 (0.109)	2.49 (0.098)
3.30 (0.130)	2.97 (0.117)
3.58 (0.141)	3.23 (0.127)
3.84 (0.151)	3.45 (0.136)
4.37 (0.172)	3.94 (0.155)
4.39 (0.173)	3.96 (0.156)
4.93 (0.194)	4.44 (0.175)
5.49 (0.216)	4.93 (0.194)
6.02 (0.237)	5.41 (0.213)
6.86 (0.270)	6.17 (0.243)
9.14 (0.360)	8.23 (0.324)
11.40 (0.450)	10.30 (0.405)
13.70 (0.540)	12.30 (0.486)

a. The reduced loadings, based on the cargo tank's design conditions and material thicknesses, are appropriate for the reduced loading conditions. This reduced loading shall be certified by a Design Certifying Engineer, and a revised manufacturer's certificate shall be issued reflecting these reduced loading conditions;

b. The cargo tank motor vehicle's manufacturer's nameplate shall be revised to reflect the reduced limits;

c. If (a) and (b) above cannot be satisfied, the Owner of the cargo tank should not return the cargo tank to hazardous material service. The Owner shall remove, or obliterate, or in a secure manner cover the tank's specification plate; and

d. The inspector shall record the results of the thickness test on the cargo tank's inspection report.

S6.13.4 VISUAL INTERNAL INSPECTION

When performing an internal visual inspection of a cargo tank and the cargo tank is equipped with a manhole or an inspection opening, the inspector shall examine the internal surfaces for corroded and abraded areas, dents, distortions, defects in welds, and any other conditions that might render the cargo tank unsafe for transportation service. As a minimum the inspection shall include:

a) The internal surfaces of the cargo tank shell and heads, and appurtenances such as baffles, clips, pads, piping or other internals;

b) Linings or coatings installed to prevent corrosion to the cargo tank wall shall be inspected in accordance with NBIC Part 2, S6.13.5 LINING INSPECTIONS, and Table S6.13.4;

c) When baffle assemblies prevent access required to perform the inspection of the interior surfaces of the cargo tanks or other interior appurtenances, either the entire baffle assembly or part thereof shall be detached to allow access or, other alternative means of inspection such as the use of boroscopes or cameras must be utilized;

d) For cargo tanks equipped with baffle assemblies, the baffle panels and the means of their attachment to the cargo tank wall shall be inspected for: weld defects, cracks, corrosion, deterioration at point of attachment, loose bolting, distortion or any other condition that might affect the structural integrity of the baffle assembly:

1) Baffle panels that cannot be inspected, as installed, shall be detached or removed for inspection;

2) Cracked or corroded baffle clips shall be replaced with material whose properties are equivalent to the material used for the cargo tank wall or material approved by a Design Certifying Engineer;

3) For baffle clips welded directly to the cargo tank wall on tanks constructed of quenched and tempered steel, the clip shall be examined for cracks using surface Non Destructive Examination (NDE) methods such as PT and MT. The attachment weld to the cargo tank wall shall be examined for cracks using the Wet Fluorescent Magnetic Particle method. NDE must be in accordance with Section V of the ASME Code;

4) Damaged or worn baffle panels shall be repaired or replaced. Particular attention must be given to bolt holes that are enlarged from original shape or size. Bolting that is worn shall be replaced;

e) If the cargo tank is not equipped with a manhole or inspection opening, or is welded closed and the cargo tank has not transported a lading that is corrosive to the cargo tank wall, it shall be subjected to a pressure test as provided in NBIC Part 2, Tables S6.13.4 and S6.13.6.

S6.13.5 LINING INSPECTIONS

Cargo tank linings include rubber linings and linings other than rubber (elastomeric materials) that are used to protect the tank from corrosion or other harmful effects of the lading material being transported. The inspection requirements are:

a) Rubber linings must be inspected for holes by using a high-frequency spark tester, as described in this section. If holes are found, they must be repaired using equipment and procedures prescribed by the lining manufacturer or lining installer;

b) Linings other than rubber (elastomeric materials) must be inspected and tested in accordance with procedures using equipment and procedures prescribed by the lining manufacturer or lining installers; and

c) If degraded or defective areas of the cargo tank lining are discovered, the lining in these areas shall be removed and the thickness of the cargo tank wall area under the lining defect shall be tested in accordance with the following:

    1) Measurements shall be made using a device capable of accurately measuring thickness to within ± 0.051 mm (± 0.002 of an inch);

    2) The individuals performing the thickness test must be trained in the proper use of the thickness testing device in accordance with the manufacturer's instructions; and

    3) The minimum inservice thickness requirements for series MC 300 cargo tanks for steel and steel alloy and aluminum and aluminum alloy material is specified in NBIC Part 2, Tables S6.13.1-a and S6.13.1-b.

S6.13.6 PRESSURE TESTS

Cargo tanks may be tested by either the hydrostatic or pneumatic test method. When performing a pressure test, the test procedure shall include the test method (hydrostatic or pneumatic) used for the cargo tank, and the test shall include all appurtenances, all baffles, bulkheads, and upper coupler (fifth wheel) that comprise the cargo tank and shall be pressure tested at pressures established in NBIC Part 2, Table S6.13.6. The pressure test procedure shall include the following:

a) The pressure test shall be performed in accordance with a test pressure that includes provision for the inspector to perform an internal and external visual inspection of all surfaces of the cargo tank. For MC 338 cargo tanks, and cargo tanks not equipped with a manhole, an internal visual inspection is not required.

    1) The visual external inspection shall be conducted while the cargo tank is under test pressure.

    2) The visual internal inspection shall be conducted after the pressure test is completed.

b) When performing the pressure test all self-closing pressure relief valves, including emergency relief vents, and normal vents shall be removed for inspection and test, except for line safety devices that may be removed or left in place.

Table S6.13.4
Periodic Inspections and Tests

Test or Inspection (cargo tank specification, configuration, and service)	Test and Inspection Interval After Original Certification Date
External Visual Inspection	
All cargo tanks designed to be loaded by vacuum with full opening rear heads	6 Months
All other cargo tanks	1 Year
Internal Visual Inspection	
All insulated cargo tanks, except MC 330, MC 331, & MC 338	1 Year
All cargo tanks transporting lading corrosive to the tank	1 Year
All other cargo tanks, except MC 338	5 Years
Lining Inspection	
All lined cargo tanks transporting lading corrosive to the cargo tank	1 Year
Leakage Test	
MC 330 and MC 331 cargo tanks in chlorine service	2 Years
All other cargo tanks, except MC 338	1 Year
Pressure Test (Note 1: sodium metal; Note 2: MAWP < 15 psig)	
All cargo tanks which are insulated with no manhole or insulated and lined, except MC 338	1 Year
All cargo tanks designed to be loaded by full vacuum with full opening in the rear head of the cargo tank	2 Years
MC 330 and MC 331 cargo tanks in chlorine service	2 Years
All other cargo tanks	5 Years
Thickness Test	
All unlined cargo tanks in corrosive service, except MC 338	2 Years
Note 1: Pressure testing is not required for MC 300 and MC 331 cargo tanks in dedicated sodium metal service. **Note 2**: Pressure testing is not required for uninsulated lined cargo tanks with a design pressure of MAWP 103 kPa (15 psi) or less, which receive an external visual inspection and lining inspection at least once each year.	

1) Each self-closing pressure relief valve that is an emergency relief vent shall be capable of opening at the required set pressure and seat to a leak-tight condition at 90% of the set-to-discharge pressure, or the pressure prescribed for the applicable cargo tank. It should be noted that self-closing pressure relief valves not tested or failing the pressure test must be repaired or replaced;

2) Normal vents 6.895 kPa (1 psig) shall be tested according to the testing criteria established by the valve manufacturer.

c) If the cargo tank is not carrying a corrosive lading, all areas that are covered by the upper coupler (fifth wheel) assembly must be inspected for corroded, abraded areas, dents, distortions, defects in welds, and any other condition that might render the tank unsafe for transport service. The upper coupler (fifth wheel) assembly must be removed from the cargo tank for this inspection.

d) If the cargo tank motor vehicle has multiple cargo tanks, each cargo tank shall be tested separately. The adjacent cargo tanks shall be empty and at atmospheric pressure.

e) When performing the hydrostatic or pneumatic test, the following requirements shall be specified in the test procedure:

1) All closures, except the pressure relief device, shall be in place during the test;

2) All required loading and unloading venting devices that are rated less than the test pressure may be removed during the test, or:

a. If the venting devices are not removed, the device shall be rendered inoperative by clamps, plugs, or other equally effective restraining devices;

b. The restraining devices shall not prevent detection of leaks or damage of the venting device and shall be removed immediately after the test.

Table S6.13.6
Pressure Test Requirements

Cargo Tank Specification	Test Pressure
MC 300, MC 301, MC 302, MC 303, MC 305, and MC 306	20.7 kPa (3 psig) or design pressure, whichever is greater
MC 304 and MC 307	275.8 kPa (40 psig) or 1.5 times design pressure, whichever is greater
MC 310, MC 311, and MC 312	20.7 kPa (3 psig) or 1.5 times design pressure, whichever is greater
MC 330 and MC 331	1.5 times either MAWP or the re-rated pressure, whichever is applicable
MC 338	1.25 times either MAWP or the re-rated pressure, whichever is applicable
DOT 406	34.5 kPa (5 psig) or 1.5 times the MAWP, whichever is greater
DOT 407	275.8 kPa (40 psig) or 1.5 times the MAWP, whichever is greater
DOT 412	1.5 times the MAWP

S6.13.6.1 HYDROSTATIC OR PNEUMATIC TEST METHOD

a) The Owner or user of the cargo tank may apply either the hydrostatic or pneumatic test method to satisfy the requirements of the pressure test specified in NBIC Part 2, Table S6.13.4.

b) If the hydrostatic test method is used, the cargo tank shall be completely filled including, if equipped, its dome with water or other liquids having similar viscosity. During the hydrostatic test, the inspector shall:

1) Ensure that the cargo tank is completely filled and free of any air pockets. During this operation, the liquid should flow freely out of the cargo tank's test vent;

2) Ensure that the temperature of the test media does not exceed 38°C (100°F);

3) Ensure that the test pressure cannot exceed the test pressures specified in NBIC Part 2, Table S6.13.6;

4) Ascertain that the test pressure shall be maintained for a minimum of 10 minutes; and

5) Visually examine the cargo tank for leakage, bulging or other defects. If any of the preceding occurs, terminate the test, drain the cargo tank, and evaluate the cargo tank's capabilities for repair or replacement of the affected areas.

c) If the Owner and/or user elect to use the pneumatic test method, precaution should be employed due to the possibility of failure of the cargo tank under pneumatic test pressure conditions. The test area should be limited to the authorized personnel only and the test personnel shall be experienced in the pneumatic testing method. The pneumatic test pressure for the cargo tank shall be:

1) gradually increased to one-half the test pressure;

2) after reaching one-half the test pressure, the test pressure shall be increased at a rate of approximately one-tenth of the test pressure until the test pressure is reached. The test pressure shall not exceed the test pressures specified in NBIC Part 2, Table S6.13.6;

3) when the test pressure is reached, the test pressure shall be held for a least 5 minutes, then reduced to the MAWP of the cargo tank;

4) at MAWP the inspector shall examine the cargo tank for any leakage, bulging, or any other defects; and

5) visually examine the cargo tank for leakage, bulging, or other defects. If any of the preceeding occurs, terminate the test, drain the cargo tank of all air or inert gas, and evaluate the cargo tank's suitability for repairs or replacement of the affected areas.

S6.13.6.2 PRESSURE TESTING INSULATED CARGO TANKS

a) When pressure testing an insulated cargo tank, the insulations and jacketing are not required to be removed, unless it is not possible to reach the test pressure and maintain a condition of pressure equilibrium after the test pressure is reached, or the vacuum integrity cannot be maintained in the insulation space.

b) For MC 338 cargo tanks that transport refrigerated liquid, flammable gas, or oxygen, if the cargo tank is opened for any reason, the cleanliness of the cargo tank shall be verified prior to closure as required by CFR Title 49, Part 178.338-15.

S6.13.6.3 PRESSURE TESTING CARGO TANKS CONSTRUCTED OF QUENCHED AND TEMPERED STEELS

When testing MC 330 and MC 331 cargo tanks constructed of quenched and tempered steels, in accordance with ASME Section XII, Modal Appendix 1, and for cargo tanks constructed prior to the adoption of ASME Section XII, Part UHT of ASME Section VIII, Div. 1, or constructed of other quenched and tempered steel, without postweld heat treatment, used for the transportation of anhydrous ammonia or any other hazardous material that are subject to stress corrosion cracking, and the transportation of liquefied petroleum gas, the following is required:

a) The cargo tanks must be subjected to an internal visual inspection of all internal surfaces of the cargo tank using the wet fluorescent magnetic particle examination method immediately prior to performing the required pressure test;

b) The fluorescent magnetic particle examination has to be performed in accordance with ASME Section V.

c) The required pressure test as specified in NBIC Part 2, Table S6.13.4 shall be required.

S6.13.6.4 PRESSURE TESTING CARGO TANKS EQUIPPED WITH A HEATING SYSTEM

If the cargo tank is equipped with a heating system, employing a medium such as, but not limited to, steam or hot water hydrostatically, pressure is as follows:

a) The cargo tank must be tested at least once every 5 years;

b) The test pressure for the heating system shall be at least to the maximum system design operating pressure;

c) The test pressure shall be maintained for a least 5 minutes; and

d) If the heating system employs flues for heating the lading, the flues must be tested to ensure that the lading cannot leak into the flues or into the atmosphere.

S6.13.6.5 EXCEPTIONS TO PRESSURE TESTING

a) MC 330 and MC 331 cargo tanks that are in dedicated sodium metal service are not required to be pressure tested.

b) Un-insulated cargo tanks, with a design pressure or MAWP of 103 kPa (15 psig) or less, which can be externally visually inspected and a lining inspection at least once every 5 years, are not required to be pressure tested.

S6.13.6.6 ACCEPTANCE CRITERIA

a) The acceptance criteria for the hydrostatic or pneumatic pressure test of the heating system is based on the cargo tank's capabilities to successfully pass the pressure test, without showing evidence of permanent distortion or other evidence of weakness that might render the cargo tank unsafe for transportation service.

b) If the cargo tank does not satisfy the requirements for the pressure test of the heating system identified in (a) above, the cargo tank cannot be returned to transportation service, unless:

    1) Cargo tanks with a heating system, which does not hold pressure, should remain inservice as an unheated cargo tank, if the heating system remains in place and is structurally sound and no lading may leak into the heating system; and

    2) The specification information for the heating system on the nameplate is changed to indicate that the cargo tank has no working heating system.

S6.13.6.7 INSPECTION REPORT

a) The Inspector shall prepare a written inspection report that identifies the results of the pressure test and specifies the following:

   1) Manufacturer's serial number of the cargo tank;

   2) Name of the cargo tank manufacturer;

   3) DOT or MC specification number;

   4) MAWP of the cargo tank;

   5) Minimum thickness of the head and shell of the cargo tank;

   6) Identify whether the cargo tank is lined, insulated, or both; and

   7) Identify if the cargo tank is for special service, i.e., transport material corrosive to the cargo tank, dedicated service, etc.

b) The written inspection report shall provide for the following additional information:

   1) The type of test or inspection performed;

   2) Date of the test or inspection (month and year).

c) Listing of all items tested or inspected, including information about pressure relief valve:

   1) If the relief valve is removed, inspected and tested, or replaced;

   2) If applicable, the type of device;

   3) Set to discharge pressure at which the device will reseat; or

   4) If the device was reinstalled, repaired, or replaced.

d) Information regarding the inspection of the upper coupler (fifth wheel) assembly, and when applicable:

   1) If the coupler assembly (fifth wheel) was visually inspected in place; or

   2) If the coupler assembly (fifth wheel) was removed for examination.

e) Information regarding leakage, and type of pressure test (hydrostatic or pneumatic);

f) The test pressure and holding time during the test;

g) Location of defects found and the method of repair;

h) Minimum thickness of the cargo tank's heads and shells, as specified in NBIC Part 2, Table S6.13.1-a or Table S6.13.1-b, as applicable;

   1) Name and address of the person performing the test;

2) Registration number of the facility or person performing the test;

3) Continued qualification statement, such as:

a. "Cargo tank meets the requirements of DOT specification identified in this report;"

b. "Cargo tank fails to meet the requirements of the DOT specification identified in this report;" or

i) DOT registration number of the registered inspector, and dated signature of the registered inspector and the cargo tank Owner.

j) The Owner and the motor carrier shall retain a copy of the test and inspection reports until the next test or inspection of the same type is successfully completed. This requirement does not apply to a motor carrier leasing a cargo tank for fewer than 30 days.

S6.13.7 ADDITIONAL REQUIREMENTS FOR MC 330 AND MC 331 CARGO TANKS

After completion of the pressure test, each motor carrier operating a Specification MC 330 and MC 331 cargo tank in anhydrous ammonia, liquefied petroleum gas, or any other service that is prone to stress corrosion cracking, shall make a written report containing the following information:

a) Carrier's name, address of principal place of business, and telephone number;

b) Complete identification plate data required by Specification MC 330 and MC 331 cargo tanks, including data required by the *ASME Boiler and Pressure Vessel Code*;

c) Carrier's equipment number;

d) Statement indicating whether or not the cargo tank was stress relieved after fabrication;

e) Name and address of the person performing the test and date of the test;

f) Statement of the nature and severity of any defects found. As a minimum, the information shall include:

1) Identification of the location of the defects detected, such as in weld, heat-affected zone, the liquid phase, the vapor phase, or the head to shell seam; or

2) If no defects or damage were discovered, this also shall be reported.

g) Statement indicating the methods employed to make repairs; that made the repairs; and the date the repairs were completed. If the cargo tank was stress relieved after the repairs were completed, whether full or local stress relieving was performed;

h) Statement of the disposition of the cargo tank, such as:

1) "cargo tank scrapped"; or

2) "cargo tank returned to service."

i) Statement as to whether or not the cargo tank is used in anhydrous ammonia service that is subject to stress corrosion cracking. If the cargo tank had been used in anhydrous ammonia service since the last report, the Owner has to provide a statement in the report indicating whether each shipment of ammonia was certified by its shipper as containing at least 0.2% water by weight;

j) A copy of the written inspection report must be retained by the carrier at its principal place of business during the period the cargo tank is in the carrier's service and for one year thereafter.

k) Upon written request to, and with the approval of the Field Administrator, Regional Service Center, and Federal Motor Carrier Safety Administration for the region in which a motor carrier has its principal place of business, the carrier may maintain the reports at a regional or terminal office.

S6.13.8 CERTIFICATES AND REPORTS

a) Each person offering a DOT specification cargo tank for sale or lease must provide the purchaser or lessee with the following:

1) A copy of the cargo tank certificate of compliance;

2) If applicable, a copy of the record of repair, modification, stretching, or rebarrelling; and

3) The most recent inspection and test reports.

b) Copies of the documents and reports identified in (a) above must be provided to the lessee if the cargo tank is leased for more than 30 days.

S6.13.9 LEAKAGE TEST

When leakage testing is required by NBIC Part 2, Table S6.13.4, the test shall include testing the product piping with all valves and accessories in place and operative, except that any venting devices set to discharge at less than the leakage test pressure must be removed or rendered inoperative during the test. The leakage test shall include:

a) All internal or external self-closing stop valves must be tested for leakage;

b) Each cargo tank of a multi-cargo tank motor vehicle must be tested with the adjacent cargo tanks empty and at atmospheric pressure;

c) The leakage test shall be maintained for a minimum of 5 minutes;

d) Cargo tanks in liquefied compressed gas service shall be:

1) Inspected externally for leaks during the leakage test;

2) Suitable safeguards must be provided to protect personnel should a failure occur, as follows:

a. Cargo tanks may be leakage tested with the hazardous material in the cargo tank during the test;

b. The leakage test pressure shall not be less than 80% of the MAWP marked on the specification plate, unless the cargo tank has a MAWP of 690 kPa (60 psig) or more, in which case it should be leakage tested at its maximum normal operating pressure provided it is in dedicated service or services;

c. MC 330 or MC 331 cargo tanks in dedicated liquefied petroleum gas service may be leakage tested at not less than 414 kPa (60 psig);

d. An operator of a MC 330 or MC331 cargo tank and a non-specification cargo tank equipped with a meter should check leak tightness of the internal self-closing stop valve by conducting a meter creep test; and

e. A non-specification cargo tank is a cargo tank that conforms and is marked in conformance with the edition of the ASME Code in effect when the cargo tank was fabricated and should be used for the transportation of liquefied petroleum gas, provided the cargo tank satisfies the following:

1. The cargo tank has a minimum design pressure no lower than 172 kPa (250 psig);

2. The cargo tank has a water capacity of 13,247.5 l (3500 gallons) or less.

3) The cargo tank has been manufactured in accordance with the ASME Code prior to January 1, 1981. This requirement requires the cargo tank to be stamped with the ASME Code Symbol Stamp and documented on an ASME Manufacturer's Data Report;

4) The cargo tank shall conform to the applicable provisions of NFPA 58, except if NFPA is inconsistent with the requirements of Parts 178 and 180 of Title 49;

5) The cargo tank shall be leakage tested in accordance with NBIC Part 2, Table S6.13.4;

6) MC 330 and MC 331 cargo tanks in dedicated service for anhydrous ammonia may be leakage tested at not less than 414 kPa (60 psig);

7) Non-specification cargo tanks must be leakage tested at pressure of not less than 16.6 kPa (2.4 psig), if the cargo tanks comply with one of the following:

a. For the transport of petroleum products that have a liquid capacity of 13,250 l (3500 gal); and

b. Permanently secured non-bulk tanks to a motor vehicle and protected against leakage or damage in the event of turnover, having a liquid capacity of less than 450 l (119 gal), used for transportation of a flammable liquid petroleum product.

8) The cargo tank is used to transport petroleum distillate fuels that are equipped with vapor collection equipment and should be leakage tested in accordance with the Environmental Protection Agency's "Model 27-Determination of Vapor Tightness of Gasoline Delivery Tank Using Pressure-Vacuum Test," as follows:

a. The test method and procedures and maximum allowable pressure and vacuum changes are in 40 CFR 63.425(e)(1);

b. The hydrostatic test alternative, using liquid in Environmental Protection Agency's "Method 27-Determination of Vapor Tightness of Gasoline Delivery Tank Using Pressure-Vacuum Test" should not be used to satisfy the leak testing requirements of this Section. The test shall be conducted using air; and

c. Cargo tanks equipped with vapor collection equipment should be leakage tested in accordance with (8)(b) above.

9) Cargo tanks that fail to retain leakage test pressure shall not be returned to service as a specification cargo tank, unless all sources of leakage are properly repaired prior to returning the cargo tank to hazardous material service.

10) It is required that after July 1, 2000, that the Registered Inspector who performs inspections on MC 330 and MC 331 cargo tanks inspect the delivery hose assembly and the piping system of the cargo tank under leakage test pressure utilizing the rejection criteria for cargo tanks unloading liquefied compressed gas. It should be noted that an operator should remove and replace damaged sections or correct defects discovered as provided in NBIC Part 2, S6.13.10. If any of the following is discovered, it is cause for rejection:

a. No operator shall use a delivery hose assembly for liquefied compressed gas if it is determined that any of the following conditions exist:

1. Damage to the hose cover that exposes the reinforcement;

2. If the wire braid reinforcement is kinked or flattened so as to permanently deform the wire braid;

3. Soft spots when the hose is not under pressure, or any loose outer covering on the hose;

4. Damaged, slipping, or excessively worn hose couplings; and

5. Loose or missing bolts or fastenings on the bolted hose coupling assembly.

b. No operator can use a cargo tank with a piping system for unloading liquefied compressed gases if any of the following conditions exist:

1. Any external leaks identifiable without the use of instruments;

2. Bolting that is loose, missing, or severely corroded;

3. Manual stop valves that will not actuate; and

4. Rubber hose flexible connectors with any of the following conditions:

aa. Damage to the hose cover that exposes the reinforcement;

bb. If the wire braid reinforcement is kinked or flattened so as to permanently deform the wire braid;

cc. Soft spots when the hose is under pressure, or any loose outer covering on the hose;

dd. Damaged, slipping, or excessively worn hose couplings;

ee. Loose or missing bolts or fastenings on the bolted hose coupling assembly;

ff. Stainless steel flexible connectors with damaged reinforcement braid;

gg. Internal self-closing stop valves that fail to close or that permit leakage through the valve detectable without the use of instruments;

hh. Pipes or joints that are severely corroded.

S6.13.10 NEW OR REPLACED DELIVERY HOSE ASSEMBLIES

The operator shall repair hose assemblies and place the cargo tank back in service if retested successfully in accordance with the following:

a) The new and/or replaced hose assembly is tested at a minimum of 120% of the hose's MAWP;

b) The operator shall visually examine the delivery hose assembly while it's under pressure;

c) If the test is successful, the operator shall ensure that the delivery hose assembly is permanently marked with the month and year of the test; and

d) It should be noted that after July 1, 2000, the operator shall complete a record documenting the test and inspection, which shall include the following:

   1) The date and signature of the Inspector that performed the inspection;

   2) The Owner of the hose assembly;

   3) The hose identification number;

   4) The date of the original delivery of the hose assembly and tests;

   5) Notes of any defects observed;

   6) Any repairs that may have been made; and

   7) Identification in the written report that the delivery hose assembly passed or failed the tests and inspections.

S6.13.10.1 THICKNESS TESTING

a) Thickness testing of the head and shell of unlined cargo tanks used for the transportation of materials corrosive to the cargo tank shall be measured at least once every two years.

b) Cargo tanks measuring less than the sum of the minimum prescribed thickness in NBIC Part 2, Tables S6.13.1-a or S6.13.1-b, as applicable, plus one-fifth of the original corrosion allowance, shall be tested annually.

S6.13.10.2 TESTING CRITERIA

The testing criteria that shall be used for these requirements are as follows:

a) The measuring device shall be capable of accurately measuring thickness to within ± .50mm (.002 inch);

b) The individuals performing thickness testing shall be trained in the proper use of the thickness testing device used in accordance with the testing device manufacturer's instructions;

c) Thickness testing shall be performed in the following areas, as a minimum:

1) Areas of the tank shell and heads, including around any piping that retains lading;

2) Areas of high shell stress, such as the bottom center of the cargo tank;

3) Areas near openings;

4) Areas around weld joints;

5) Areas around shell reinforcements;

6) Areas around appurtenance attachments;

7) Areas near the upper coupler (fifth wheel) assembly attachments;

8) Areas near suspension system attachments and connecting structures;

9) Known thin areas in the tank shell and nominal liquid level lines; and

10) Connecting structures joining multiple cargo tanks of carbon steel in a self-supporting cargo tank motor vehicle.

S6.13.10.3 THICKNESS REQUIREMENTS

a) The minimum thickness for MC 300, MC 301, MC 302, MC 303, MC 304, MC 305, MC 306, MC 307, MC 310, and MC 312 cargo tanks are determined based on the definition of minimum thickness defined in CFR, Title 49, Part 178.320(a).

b) NBIC Part 2, Tables S6.13.1-a and S6.13.1-b, identify the “Inservice Minimum Thickness” values to determine the minimum thickness for the referenced cargo tank.

c) The tables are divided into three columns. The column headed “Minimum Manufactured Thickness” indicates the minimum values required for new construction of DOT 400 series cargo tanks.

d) The “Inservice Minimum Thicknesses” for cargo tanks specified in (a) above are based on 90% of the manufactured thickness specified in the DOT Specification, rounded off to three places.

S6.13.11 CARGO TANKS THAT NO LONGER CONFORM TO THE MINIMUM THICKNESS REQUIREMENTS IN NBIC PART 2, TABLES S6.13.1-a AND S6.13.1-b

If a cargo tank does not conform to the minimum thickness requirements in NBIC Part 2, Tables S6.13.1-a and S6.13.1-b, for the design as manufactured, the cargo tank should be used at a reduced maximum weight of lading or reduced MAWP, or combinations thereof, provided the following are met:

a) The cargo tank’s design and thickness are appropriate for the reduced loadings conditions as follows:

1) The cargo tank’s design and thickness for the appropriate reduced loading shall be certified by a Design Certifying Engineer;

2) A revised manufacturer's certificate shall be issued; and

3) The cargo tank's motor vehicle's nameplate shall reflect the revised service limits.

b) It is required if a cargo tank no longer conforms with the minimum thickness requirements prescribed in the specification, that the cargo tank cannot be returned to hazardous material service. The cargo tank's specification plate shall be removed, obliterated, or covered in a secure manner. The inspector shall require that the cargo tank is calculated to identify the thickness of the material as required in NBIC Part 2, S6.13.10.1 and S6.13.10.2, of this Section.

c) MC cargo tanks constructed prior to October 1, 2003, require the minimum thickness, minus the corrosion allowance as provided on the Manufacturer's Data Report; and

d) MC cargo tanks constructed after October 1, 2003, require the minimum thickness will be the value indicated on the specification plate of the cargo tank. If no corrosion allowance is indicated on the Manufacturer's Data Report, then the thickness of the cargo tank shall be the thickness of the material of construction indicated on the Manufacturer's Data Report, with no corrosion allowance.

S6.13.11.1 MINIMUM THICKNESS FOR 400-SERIES CARGO TANKS

400 series cargo tanks are required to satisfy the minimum thickness requirements as established in Part 178.320(a) of Title 49 for DOT 406 cargo tanks, Part 178.347.2 of Title 49 for DOT 407 cargo tanks and Part 178.348.2 of Title 49 for DOT 412 cargo tanks.

S6.13.11.2 DOT 406 CARGO TANKS

a) It is required that all head, shell, bulkhead, and baffle materials used in the construction of DOT 406 cargo tanks satisfy Parts A and B of Section II of the *ASME Boiler and Pressure Vessel Code*,except that the following materials are authorized for cargo tanks constructed in accordance with *ASME Boiler and Pressure Vessel Code* that are not stamped with the "U" Code Symbol Stamp must be constructed out of ASTM materials permitted in Part 178.345-2 of Title 49. These materials are as follows:

1) ASTM A 569,

2) ASTM A 570,

3) ASTM A 572,

4) ASTM A 607,

5) ASTM A 622,

6) ASTM A 656, and

7) ASTM A 715.

b) Aluminum alloys suitable for fusion welding and conforming with the O, H 32, or H 34 temper of one of the following ASTM Specifications may be used for cargo tanks constructed in accordance with the *ASME Boiler and Pressure Vessel Code*:

1) ASTM B 209, Alloy 5052,

2) ASTM B 209, Alloy 5086,

3) ASTM B 209, Alloy 5154,

4) ASTM B 209, Alloy 5254,

5) ASTM B 209, Alloy 5454, and

6) ASTM B 209, Alloy 5652.

c) All heads, bulkheads, and baffles must be of O temper (annealed) or stronger temper. All shell material shall be of H 32, or H 34 temper, except that the lower ultimate strength temper should be used if the minimum shell thicknesses in the tables are increased in proportion to the lesser ultimate strength.

d) NBIC Part 2, Table S6.13.11.2-a, specifies the minimum thickness requirements for heads or bulkheads and baffles when used as tank reinforcement that is based on the volume capacity in liters per mm (gallons per inch) of length for MC 406 cargo tanks constructed out of Mild Steel (MS), High-Strength Low -Alloy Steel (HSLA), Austenitic Stainless Steel (SS), or Aluminum (AL).

e) NBIC Part 2, Table S6.13.11.2-b specifies the minimum thickness requirements for shell based on the cargo tank motor vehicle rated capacity in gallons when the cargo tank is constructed out of Mild Steel (MS), High-Strength Low-Alloy Steel (HSLA), Austenitic Stainless Steel (SS), or Aluminum (AL). The thickness requirements in these tables are specified in decimal of a mm (inch) after forming.

S6.13.11.3 DOT 407 CARGO TANKS

a) It is required that the type of materials used for DOT 407 cargo tanks, depending on the type of media being transferred be either Mild Steel (MS), High-Strength Low-Alloy Steel (HSLA), Austenitic Stainless Steel (SS), or Aluminum.

b) The minimum required thicknesses of materials specified in NBIC Part 2, Table S6.13.11.3-a, for DOT 407 cargo tanks, when the minimum thickness requirements are based on the volume capacity in liters per sq mm (gallons per square inch) for the cargo tank's heads, or bulkheads and baffles, when these items are used for reinforcement purposes. All thicknesses are expressed in decimals of a mm (inch) after forming.

c) The minimum required thicknesses of materials are specified in NBIC Part 2, Table S6.13.11.3-b, for DOT 407 cargo tanks, when the minimum thickness requirements are based on the volume capacity in liters per sq. mm (gallons per square inch) for the cargo tank shell. All thicknesses are expressed in decimals of a mm (inch) after forming.

S6.13.11.4 DOT 412 CARGO TANKS

a) It is required that the type of materials used for DOT cargo tanks, depending on the type of media being transferred be either Mild Steel (MS), High-Strength Low-Alloy Steel (HSLA), Austenitic Stainless Steel (SS), or Aluminum.

Table S6.13.11.2 -a
Minimum Thickness for Heads

Materials	Volume capacity in liter per mm of length (gallons per inch of length)								
	14 (0.21) or less			Over 14 to 23 (0.21 to 0.36)			Over 23 (0.36)		
	MS	HSLA SS	AL	MS	HSLA SS	AL	MS	HSLA SS	AL
Thickness, mm (in.)	2.54 (.100)	2.54 (.100)	.160 (4.06)	.115 (2.92)	.155 (3.94)	.173 (4.39)	.129 (3.28)	.129 (3.28)	.187 (4.75)

Table S6.13.11.2-b
Minimum Thickness for Shells, in. (mm)

Cargo tank motor vehicle rated capacity in liters (gallons)	MS	SS/HSLA	AL
More than 0 to at least 4,500 (0 to 17,000)	2.54 (0.100)	2.54 (0.100)	3.84 (0.151)
More than 4,500 to at least 8,000 (17,000 to 30,300)	2.92 (0.115)	2.54 (0.100)	4.06 (0.160)
More than 8,000 to at least 14,000 (30,300 to 53,000)	3.28 (0.129)	3.28 (0.129)	4.39 (0.173)
More than 14,000 (53,000)	3.63 (0.143)	3.63 (0.143)	4.75 (0.187)
Note: The maximum distance between bulkhead, baffles, or ring stiffeners shall not exceed 1,525 mm (60 inches)			

Table S6.13.11.3-a
Minimum Thickness for Heads (DOT 407), mm (in.)

Volume capacity sq. mm (in gal./sq. in. l/)	10 (0.122) or less	Over 10 to 14 (0.122 to 0.171)	Over 14 to 18 (0.171 to 0.22)	Over 18 to 22 (0.22 to 0.268)	Over 22 to 26 (0.268 to 0.317)	Over 26 to 30 (0.317 to 0.365)	Over 30 (0.365)
Thickness (MS)	2.54 (0.100)	2.54 (0.100)	2.92 (0.115)	3.28 (0.129)	3.28 (0.129)	3.63 (0.143)	3.96 (0.156)
Thickness (HSLA)	2.54 (0.100)	2.54 (0.100)	2.92 (0.115)	3.28 (0.129)	3.28 (0.129)	3.63 (0.143)	3.96 (0.156)
Thickness (SS)	2.54 (0.100)	2.54 (0.100)	2.92 (0.115)	3.28 (0.129)	3.28 (0.129)	3.63 (0.143)	3.96 (0.156)
Thickness (A)	4.06 (0.160)	4.06 (0.160)	4.39 (0.173)	4.75 (0.187)	4.92 (0.194)	5.49 (0.216)	6.02 (0.237)

Table S6.13.11.3-b
Minimum Thickness for Shells (DOT 407), mm (in.)

Volume capacity in gal./sq. in. (l/sq. mm)	10 (0.122) or less	Over 10 to 14 (0.122 to 0.171)	Over 14 to 18 (0.171 to 0.22)	Over 18 to 22 (0.22 to 0.268)	Over 22 to 26 (0.268 to 0.317)	Over 26 to 30 (0.317 to 0.365)	Over 30 (0.365)
Thickness (MS)	2.54 (0.100)	2.54 (0.100)	2.92 (0.115)	3.28 (0.129)	3.28 (0.129)	3.63 (0.143)	3.96 (0.156)
Thickness (HSLA)	2.54 (0.100)	2.54 (0.100)	2.92 (0.115)	3.28 (0.129)	3.28 (0.129)	3.63 (0.143)	3.96 (0.156)
Thickness (SS)	2.54 (0.100)	2.54 (0.100)	2.92 (0.115)	3.28 (0.129)	3.28 (0.129)	3.63 (0.143)	3.96 (0.156)
Thickness (A)	3.84 (0.151)	3.84 (0.151)	4.06 (0.160)	4.39 (0.173)	4.92 (0.194)	5.49 (0.216)	6.02 (0.237)

Table S6.13.11.4-a
Minimum Thickness for Heads (DOT 412)

Volume Capacity (gallons per inch)	10 or less				Over 10 to 14				Over 14 to 18			18 and over		
Lading density at 60°F in lbs/gal.	10 lbs and less	Over 10 to 13 lbs	Over 13 to 16 lbs	Over 16 lbs	10 lbs and less	Over 10 to 13 lbs	Over 13 to 16 lbs	Over 16 lbs	10 lbs and less	Over 10 to 13 lbs	Over 13 to 16 lbs	10 lbs and less	Over 10 to 13 lbs	Over 13 to 16 lbs
Thickness (inch), steel	0.100	0.129	0.157	0.187	0.129	0.157	0.187	0.250	0.157	0.250	0.250	0.157	0.250	0.312
Thickness (inch), aluminum	0.144	0.187	0.227	0.270	0.187	0.227	0.270	0.360	0.227	0.360	0.360	0.227	0.360	0.450

Table S6.13.11.4 M-a
Minimum Thickness for Heads (DOT 412)

Volume Capacity (liters per millimeter)	0.122 l/mm or less				Over 0.122 to 0.21 l/mm				Over 0.21 to 0.22 l/mm			0.22 l/mm and over		
Lading density at 15°C in kg/l	1.2 kg/l and less	Over 1.2 to 1.6 kg/l	Over 1.6 to 1.9 kg/l	Over 1.9 kg/l	1.2 kg/l and less	Over 1.2 to 1.6 kg/l	Over 1.6 to 1.9 kg/l	Over 1.9 kg/l	1.2 kg/l and less	Over 1.2 to 1.6 kg/l	Over 1.6 to 1.9 kg/l	1.2 kg/l and less	Over 1.2 to 1.6 kg/l	Over 1.6 to 1.9 kg/l
Thickness (mm), steel	2.54	3.28	3.99	4.75	3.28	3.99	4.75	6.35	3.99	6.35	6.35	3.99	6.35	7.92
Thickness (mm), aluminum	3.66	4.75	5.77	6.86	4.75	5.77	6.86	9.14	5.77	9.14	9.14	5.77	9.14	11.4

Table S6.13.11.4-b
Minimum Thickness for Shells (DOT 412)

Volume capacity (gallons per inch)	10 or less				Over 10 to 14				Over 14 to 18			18 and over		
Lading density at 60°F in pounds per gallon	10 lbs and less	Over 10 to 13 lbs	Over 13 to 16 lbs	Over 16 lbs	10 lbs and less	Over 10 to 13 lbs	Over 13 to 16 lbs	Over 16 lbs	10 lbs and less	Over 10 to 13 lbs	Over 13 to 16 lbs	10 lbs and less	Over 10 to 13 lbs	Over 13 to 16 lbs
Thickness (inch), steel Distances between heads (and bulkheads, baffles, and ring stiffeners when used as tank reinforcement					0.129	0.157	0.187	0.250	0.157	0.250	0.250	0.157	0.250	0.312
36 in. or less	0.100	0.129	0.157	0.187	0.100	0.129	0.157	0.187	0.100	0.129	0.157	0.129	0.157	0.187
Over 36 in. to 54 in.	0.100	0.129	0.157	0.187	0.100	0.129	0.157	0.187	0.129	0.157	0.187	0.157	0.250	0.250
Over 54 in. to 60 in.	0.100	0.129	0.157	0.187	0.129	0.157	0.187	0.250	0.157	0.250	0.250	0.187	0.250	0.312
Thickness (inch), aluminum Distances between heads (and bulkheads, baffles, and ring stiffeners when used as tank reinforcement	0.144	0.187	0.227	0.270	0.187	0.227	0.270	0.360	0.227	0.360	0.360	0.227	0.360	0.450
36 in. or less	0.144	0.187	0.227	0.270	0.144	0.187	0.227	0.270	0.144	0.187	0.227	0.187	0.227	0.270
Over 36 in. to 54 in.	0.144	0.187	0.227	0.270	0.144	0.187	0.227	0.270	0.187	0.227	0.270	0.157	0.360	0.360
Over 54 in. to 60 in.	0.144	0.187	0.227	0.270	0.187	0.227	0.270	0.360	0.227	0.360	0.360	0.270	0.360	0.450

Table S6.13.11.4 M-b
Minimum Thickness for Shells (DOT 412)

Volume capacity (liters per millimeter)	**0.122 or less**				**Over 0.122 to 0.21**				**Over 0.21 to 0.22**			**0.22 and over**		
Lading density at 15°F in kilograms per liter	1.2 kgs and less	Over 1.2 to 1.6 kgs	Over 1.6 to 1.9 kgs	Over 1.9 kgs	1.2 kgs and less	Over 1.2 to 1.6 kgs	Over 1.6 to 1.9 kgs	Over 1.9 kgs	1.2 kgs and less	Over 1.2 to 1.6 kgs	Over 1.6 to 1.9 kgs	1.2 kgs and less	Over 1.2 to 1.6 kgs	Over 1.6 to 1.9 kgs
Thickness (mm), steel; Distances between heads (and bulkheads, baffles, and ring stiffeners when used as tank reinforcement					3.28	3.99	4.75	6.35	3.99	6.35	6.35	3.99	6.35	7.92
914 mm or less	2.54	3.28	3.99	4.75	2.54	3.28	3.94	4.75	2.54	3.28	3.99	3.28	3.99	4.75
Over 914 mm to 1,372 mm	2.54	3.28	3.99	4.75	2.54	3.28	3.94	4.75	3.28	3.99	4.75	3.99	6.35	6.35
Over 1,372 mm to 1,524 mm	2.54	3.28	3.99	4.75	3.28	3.94	4.75	6.35	3.99	6.35	6.35	4.75	6.35	7.92
Thickness (mm), aluminum; Distances between heads (and bulkheads, baffles, and ring stiffeners when used as tank reinforcement	3.66	4.75	5.77	6.86	4.75	5.77	6.86	9.14	5.77	9.14	9.14	5.77	9.14	11.4
914 mm or less	3.66	4.75	5.77	6.86	3.66	4.75	5.77	6.86	3.66	4.75	5.77	3.66	5.77	6.86
Over 914 mm to 1,372 mm	3.66	4.75	5.77	6.86	3.66	4.75	5.77	6.86	4.75	5.77	6.86	3.99	9.14	9.14
Over 1,372 to 1,524 mm	3.66	4.75	5.77	6.86	4.75	5.77	6.86	9.14	5.77	9.14	9.14	6.86	9.14	11.4

b) The minimum required thickness of materials are specified in NBIC Part 2, Table S6.13.11.4-a, for DOT 412 cargo tanks, when the minimum thicknesses requirements are based on the volume capacity in liters per sq mm (gallons per square inch) for cargo tank heads, or bulkheads and baffles, when these items are used for reinforcement purposes. All thicknesses are expressed in decimals of mm (inch) after forming.

c) The minimum required thicknesses of materials are specified in NBIC Part 2, Table S6.13.11.4-b, for DOT 412 cargo tanks, when the minimum thickness requirements are based on the volume capacity in liters per sq mm (gallons per square inch) for the cargo tank's shell. All thicknesses are expressed in decimals of mm (inch) after forming.

S6.14 INSPECTION AND TESTS OF PORTABLE TANKS

a) For hazardous material ladings, all portable tanks shall be inspected and tested at frequencies specified in NBIC Part 2, Table S6.14. The inspection and tests shall include visual inspection of external and internal surfaces, leak test, pressure test, thickness measurements, and lining test. It should be noted that the information in NBIC Part 2, S6.14, is a summary of CFR Title 49, Part 180.601 through Part 180.605. The user is responsible for full compliance with the requirements in CFR Title 49, Part 180.601 through Part 180.605.

b) All portable tanks shall be visually inspected (internally, unless otherwise noted, and externally) for any condition that might render the portable tank unsafe for transportation service. The inspection shall include:

   1) Inspection of the shell for pitting, corrosion or abrasions, dents, distortions or abrasions, defects in welds, or any other conditions, including leakage; and

   2) Inspection of the piping, valves, and gaskets for corroded areas, defects, and other conditions, including leakage that may be unsafe during filling and discharge or transportation.

c) In addition to the required frequencies established in NBIC Part 2, Table S6.14, it is required that portable tanks be inspected and tested when any of the following occurs:

   1) The portable tank has been in an accident and has been damaged to an extent that may adversely affect the portable tank's ability to retain hazardous materials;

   2) The portable tank has been out of hazardous material transportation service for a period of one year or more;

   3) The portable tank has been modified from its original design specification; and

   4) The portable tank is in an unsafe operating condition based on the existence of observed damage, leaks, or missing safety devices, etc.

S6.14.1 PERIODIC INSPECTION AND TEST

Portable tanks shall be tested and inspected in accordance with the frequency set forth in NBIC Part 2, Table S6.14, and the procedures set forth in NBIC Part 2, S6.14.3 through S6.14.6.4.

Table S6.14
Inspection Intervals

Specification	Periodic Inspection and Test[1]	Intermediate Periodic Inspection and Test[2]
IM or UN Portable Tanks once placed in service	5 years	2-1/2 years
DOT 51 Portable Tanks	5 years	—
DOT 56 or DOT 57 Portable Tanks (The first periodic inspection and test is required 4 years after being placed into service and each 2-1/2 years thereafter.)	2-1/2 years	—
DOT 60 Portable Tanks (The first periodic inspection and test is required 4 years after being placed into service and then per the schedule to the right.)	For the first 12 years of service.....2 years	After 12 years of service.....yearly

[1] Retesting is not required on a rubber-lined tank, except before relining.
[2] For IM and UN Portable Tanks, periodic inspection and test shall include at least an internal and external inspection of the portable tank and fittings, taking into account the hazardous material intended to be transported.

S6.14.2 INTERMEDIATE PERIODIC INSPECTION AND TEST

a) Intermediate periodic inspections and testing shall be performed in accordance with NBIC Part 2, Table S6.14. The intermediate periodic inspection and testing shall include:

   1) An external and an internal inspection of the portable tank and its fittings taking into account the hazardous materials being transported;

   2) A leakage test of the transport tank; and

   3) A test for satisfactory operation of all service equipment;

b) When inspecting portable tanks equipped with sheathing and thermal insulation, etc., the insulation need only be removed to the extent required for a reliable appraisal of the condition of the portable tank;

c) For portable tanks intended for the transportation of a single hazardous material, the internal inspection may be waived if the portable tank is subjected to a leakage test that is performed in accordance with NBIC Part 2, S6.14.3, of this Section prior to each filling;

d) Portable tanks used for dedicated transportation of refrigerated liquefied gases that are not fitted with inspection openings are exempt from the internal inspection requirements, but shall be externally inspected.

S6.14.3 INTERNAL AND EXTERNAL INSPECTIONS

All portable tanks that are subject to five-year periodic inspection and testing (pressure test) are required to be inspected, both internally, unless exempt, and externally. The internal and external inspection shall include:

a) Sheathing, thermal insulation, etc. The sheathing and thermal insulation need only be removed to the extent required for reliable appraisal of the condition of the portable tank;

b) Except for DOT Specification 56 and 57 portable tanks, all re-closing pressure relief devices must be removed from the tank and tested separately unless they can be tested while installed on the portable tank;

c) For portable tanks where the shell and equipment have been pressure tested separately after assembly, the portable tank shall be subjected to a leakage test and effectively tested and inspected for corrosion;

d) Portable tanks used for the transportation of refrigerated, liquefied gases are exempt from the internal inspection and the hydrostatic test or other pressure test during the five-year periodic inspection if the portable tank was originally tested to a minimum test pressure of 1.3 times the design pressure using inert gas and provided that;

    1) The portable tank and its appurtenances were constructed to ASME Section XII, or ASME Section VIII, Division 1; the portable tank shall be inspected in accordance with the applicable requirements of this Code;

    2) Portable tanks shall be either hydrostatically or pneumatically tested with the formula 1.5 x design pressure + static head + 101 kPa (14.7 psi), if the tank is designed for external pressure;

    3) The portable tank shall be subjected to either a hydrostatic or pneumatic test at a test pressure of 1.5 x the sum of the design pressure + the static head of lading + 101 kPa (14.7 psi), if subjected to external vacuum. If the portable tank is constructed in accordance with ASME Section XII or Part UHT of ASME Section VIII, Div. 1, the test pressure shall be twice the design pressure; and

    4) A pneumatic test may be used in lieu of a hydrostatic test if the following conditions are met:

        a. The Owner-user has taken necessary precautions to ensure the safety of the inspection and test personnel;

        b. The pneumatic test pressure shall be reached gradually by increasing the test pressure to one-half of the test pressure. Once this pressure is reached, the test pressure will be increased in increments of approximately one-tenth of the test pressure until the required test pressure is reached; and

        c. When the test pressure is reached, the test pressure shall be reduced to at least four-fifths of the test pressure and held for a sufficient time to permit inspection of the portable tank.

S6.14.4 EXCEPTIONAL INSPECTION AND TEST

a) Exceptional inspection and test is necessary when a portable tank shows evidence of damage, corroded areas, or leakage, or other conditions that indicate a deficiency that could affect the integrity of the portable tank.

b) The extent of the exceptional inspection and test shall depend on the amount of deterioration of the portable tank. The exceptional inspection and test shall include the requirements of NBIC Part 2, S6.14.3, of this section.

c) Pressure relief devices do not need to be included in this test unless there is reason to believe the relief device has been affected by damage or deterioration.

S6.14.5 INTERNAL AND EXTERNAL INSPECTION PROCEDURE

An internal and external inspection, when required, shall be performed by the Owner-user. The inspection shall be conducted by the Inspector. This individual shall ensure that the portable tank is safe for continued transportation service. The Inspector shall evaluate the results of the inspection and report the applicable findings. The inspection shall include:

a) Inspection of the shell for pitting, corrosion or abrasions, dents, distortions, defects in welds, or any other conditions, including leakage;

b) Inspection of the piping, valves, and gaskets for corroded areas, defects, and other conditions, including leakage that might make the portable tank unsafe for filling, discharge, or transportation;

c) Ensuring that the tightening devices for manhole covers are operative, and there is no leakage at the manhole cover or gasket;

d) Checking for any missing or loose bolts or nuts on any flanged connections including piping flanges, pressure relief device connections, or blank flanges. If any bolts are loose or missing, these shall be tightened or replaced;

e) Checking all emergency devices and valves to ensure that they are free from corrosion, distortion, and any damage or defects that could prevent the devices from operating as designed;

f) Ensuring all remote closures and self-closing stop valves are operated to demonstrate their proper operation;

g) Ensuring the required markings on the portable tanks are legible and in accordance with the applicable requirements of CFR Title 49, Part 178.3, and Part 180.605; and

h) Ensuring the framework, supports, and the arrangements for lifting the portable tank are in a satisfactory condition.

S6.14.6 PRESSURE TEST PROCEDURES FOR SPECIFICATION 51, 57, 60, IM OR UN PORTABLE TANKS

This Section provides the requirements for pressure test procedures for Specification 51, 57, 60, IM or UN Portable Tanks as provided in CFR Title 49, Part 180.605(h). Pressure test requirements for Specification 51, 57, 60, IM and UN Portable Tanks are identified in NBIC Part 2, Table S6.13.6 of this Subsection.

S6.14.6.1 SPECIFICATION 57 PORTABLE TANKS

a) Specification 57 portable tanks shall be leak tested by a minimum sustained air pressure of at least 21 kPa (3 psig) applied to the entire tank.

b) During each air pressure test, the entire surface of all joints, whether welded or threaded, shall be coated with or immersed in a solution of soap and water, heavy oil, or other material suitable for the purpose of detecting leaks.

Table S6.14.6
Pressure Testing Requirements

Specification	Leak Test	Hydrostatic	Pneumatic	Test Media	Minimum Test Pressure
51 and 56	—	X	X	Liquid or Air	14 kPa (2 psi) or at least 1-1/2 times the design pressure, whichever is greater
51 and 56 used to transport refrigerated liquefied gas	X	X	X	Liquid or Air	90% of the Maximum Allowable Working Pressure
51 and 56 for the transport of all other materials	—	X	X	Liquid or Air	25% of the Maximum Allowable Working Pressure
57	X	—	—	—	21 kPa (3 psi) to the entire tank
60	—	—	—	Water or other similar liquid	413 kPa (60 psig)
UN nonrefrigerated gases	—	—	—	Water	130% of Maximum Allowable Working Pressure
UN refrigerated gases	—	X	X	Water or Air	1.3 times design pressure
IM refrigerated or nonrefrigerated liquefied gases	—	X	X	Water or Air	150% of the Maximum Allowable Working Pressure

c) The test pressure shall be held for a minimum of 5 minutes plus any additional time required to examine all portions of the portable tank.

d) During the air test, the pressure relief device may be removed or left in place. If the relief device is left in place during the test, the device's discharge opening shall be plugged.

e) All closure fittings must be in place during the pressure test.

f) If the portable tank is lagged or insulated, the lagging or insulation does not have to be removed if it is possible to maintain the required test pressure at a constant temperature with the portable tank disconnected from the source of pressure.

S6.14.6.2 SPECIFICATION 51 OR 56 PORTABLE TANKS

a) Specification 51 or 56 portable tanks shall be tested using either air or liquid. The minimum test pressure shall be at least 14 kPa (2 psig) or at least one and one-half times the maximum allowable working pressure (or re-rated pressure) of the portable tank. The greater test pressure shall be used.

b) The leak testing of all refrigerated liquefied gas tanks shall be performed at 90% of the maximum allowable working pressure of the portable tank.

c) Leak testing for all other portable tanks shall be at a test pressure of at least 25% of the maximum allowable working pressure of the portable tank.

d) If the portable tank is hydrostatically tested, the entire surface of the portable tank shall be inspected for leaks. This includes all welded joints and threaded connections. The requirements below shall be followed for hydrostatic testing:

1) The hydrostatic test pressure shall be held for a minimum of 5 minutes plus any additional time required to complete the inspection;

2) The pressure relief device should be removed or left in place during the hydrostatic test. If the relief device is left in place during the test, the device shall be isolated to prevent the relief device from discharging in accordance with the device manufacturer's recommendations;

3) It is required for DOT 51 specification tanks that the relief valve be removed during the pressure test; and

4) All closure fittings shall remain in place during the hydrostatic test.

e) If the portable tank is pressure tested by air, during the test all surfaces of welded joints and thread connections of the portable tank shall be inspected for leaks and the following procedure shall be followed:

1) All welded joints and threaded connections shall be coated with or immersed in a solution of soap and water, or heavy oil or other material suitable for the purpose of detecting leaks;

2) The air test pressure shall be held for a minimum of 5 minutes. This time period should be increased if so required by the Inspector;

3) The pressure relief device should be removed or left in place during the air test. If the relief device is left in place during the test, the device shall be isolated to prevent the pressure relief device from discharging in accordance with the device manufacturer's recommendations;

4) For Specification 51 portable tanks, the relief device shall be removed during the pressure test; and

5) All closure fittings shall remain in place during the air test.

f) If the portable tank is lagged or insulated and the pressure test performed is either hydrostatic or pneumatic, it is not necessary to remove the lagging or insulation for pressure testing provided the decay in test pressure can be measured at a constant temperature while the portable tank is disconnected from the source of pressure.

S6.14.6.3 SPECIFICATION 60 PORTABLE TANKS

Specification 60 portable tanks shall be tested by completely filling the portable tank with water or other liquid having a similar viscosity. The test procedure shall include:

a) The temperature of the liquid shall not exceed 37.7°C (100°F) during the test;

b) The test pressure applied shall be at least 413 kPa (60 psig);

c) The test pressure shall be maintained for a minimum of 10 minutes. This time period may be increased if required by the Inspector;

d) During the 10-minute time period, the portable tank shall be capable of maintaining the test pressure with no evidence of leakage;

e) All closures shall be left in place while the pressure test is being performed;

f) The pressure gage shall be located at the tip of the vessel during the test; and

g) Re-closing pressure relief devices must be removed from the tank and tested separately unless they can be tested while installed on the portable tank.

S6.14.6.4 SPECIFICATION IM OR UN PORTABLE TANKS

All Specification IM or UN portable tanks, except for UN portable tanks used for non-refrigerated and refrigerated liquefied gases, and all piping, valves, and accessories, except pressure relief devices, shall be hydrostatically tested with water, or other liquid similar in density and viscosity as follows:

a) All IM portable tanks used for non-refrigerated and refrigerated liquid gases shall be hydrostatically tested with water to a pressure of not less than 150% of the portable tanks maximum allowable working pressure;

b) All UN portable tanks used for the transportation of non-refrigerated liquefied gases shall be hydrostatically tested, with water to a pressure not less than 130% of the portable tanks maximum allowable working pressure.

   1) UN portable tanks used for the transportation of refrigerated gases should be tested either hydrostatically or pneumatically using an inert gas to a pressure of not less than 1.3 times the design pressure of the portable tank.

   2) If the portable tank is subjected to the pneumatic test method, the Owner-user shall take necessary precautions for the safety of the inspection and test personnel.

   3) The pneumatic test pressure shall be reached gradually by increasing the test pressure to one-half of the test pressure. Once this pressure is reached, the test pressure will be increased in increments of approximately one-tenth of the test pressure until the required test pressure is reached.

   4) When the test pressure is reached, the pressure shall be reduced to a value equal to four-fifths of the test pressure and held for a sufficient time to permit the inspection for leaks.

c) The minimum test pressure of IM and UN portable tanks is determined on the basis of the hazardous materials that are intended to be transported in the portable tank as required by CFR Title 49, Part 172.101.

d) For liquid, solid, and non-refrigerated gases, the minimum test pressure for a specific hazardous material is provided in the applicable “T” Codes assigned for a particular hazardous material, as specified in CFR Title 49, Part 172.102 Tables. See NBIC Part 2, Table S6.14.6.4.

e) While the portable tank is under test pressure, it shall be inspected for leakage, distortion, or any other condition that might render the portable tank unsafe for service.

f) If a portable tank fails to meet the requirements of the pressure test or if during the pressure test there are any of the following conditions, the portable tank shall be removed from transportation service, unless the portable tank is adequately repaired and, thereafter, a successful pressure test is conducted in accordance with this Section.

   1) Any permanent distortion of the portable tank exceeding that permitted by the applicable specification;

   2) Any leakage; or

3) Any deficiencies that would render the portable tank unsafe for transportation.

g) The approval agency shall witness the hydrostatic or pneumatic tests.

h) If the portable tank is damaged or a deficiency is discovered that might render the portable tank unsafe, the tank shall be repaired to a satisfactory condition. This test shall be witnessed by the applicable approval agency. As a minimum, the repair procedures shall include:

1) Retesting to the original pressure test requirements.

2) If the hydrostatic or pneumatic test is successful, the witnessing approval agency shall apply its name, identifying mark, or identifying number on the portable tank's nameplate as required in NBIC Part 2, S6.14.7; and

i) All thermal cutting or welding on the shell of IM or UN portable tanks shall be done in accordance with this Section. After completion of the thermal cutting or welding operation, a pressure test shall be performed to the requirements of the portable tank's original test requirements.

Table S6.14.6.4
"T" Codes

T1 to T22	For liquid and solid hazardous materials of Classes 3 through 9 that are transported in portable tanks.[1]
T23	Applies to self-reactive substances of Division 4.1 and organic peroxides of Division 5.2.
T50	Applies to liquefied compressed gases.
[1] Note: Class numbers of hazardous materials listed in CFR 49, Part 173.2.	

S6.14.7 INSPECTION AND TEST MARKINGS FOR IM OR UN PORTABLE TANKS

a) Each IM or UN portable tank shall be durably and legibly marked, in English, with the date (month and year) of the last pressure test.

b) The identifying agency shall witness the test, when required, and the date of the last visual inspection.

c) The markings required on the portable tank's identification plate shall be identified as follows:

1) Placed on or near the metal identification plate;

2) The size of the letters and numerals on the plate shall be no less than 3 mm (0.1 inches) high; and

3) If the letters and numerals are stamped into the portable tank's shell, they shall be at least 12 mm (0.5 inches) high.

S6.14.8 INSPECTION AND TEST MARKINGS FOR SPECIFICATION DOT 51, 56, 57, OR 60

a) Each Specification DOT 51, 56, 57, or 60 portable tank shall be durably and legibly marked, in English, with the date (month and year) of the most recent periodic test.

b) The markings shall be placed near the metal certification plate and shall be in accordance with the following:

1) Shall be marked on a non-removable component of the portable tank that identifies the specification markings;

2) Located in an unobstructed area with letters and numerals identifying the standard or specification, e.g., UN 1A1, DOT 4B240ET, etc.;

3) Shall identify the name and address or symbol of the portable tank manufacturer or, where specifically authorized, the symbol of the approval agency certifying compliance with the UN standard;

4) The markings shall be stamped, embossed, burned, printed, or otherwise marked on the portable tank to provide adequate accessibility, permanency, contrast, and legibility, so as to be readily apparent and understood; and

5) The letters and numerals shall be at least 3 mm (0.1 inches) high if stamped on a plate, and shall be at least 12.0 mm (0.5 inches) high when stamped on the portable tank's shell.

S6.14.9 RECORD RETENTION

The Owner of each portable tank or his authorized agent shall retain a written report of the date and results of all required inspections and tests, including the following:

a) If applicable, the ASME Manufacturer's Data Report (U-1 or U1A Forms);

b) The name and address of the person performing the inspection and/or test in accordance with the applicable specification;

c) The Manufacturer's Data Report including a certificate(s) signed by the manufacturer;

d) The authorized agency, as applicable, indicating compliance with the applicable specification of the portable tank; and

e) The records shall be retained in the Owner's files or should be retained by the Owner's authorized agent during the time that the portable tank is used. These records do not have to be maintained for DOT 56 and DOT 57 Specification tanks.

S6.15 GENERAL REQUIREMENTS FOR DOT SPECIFICATION 106A AND 110A TANK CARS (TON TANKS)

All Specification DOT 106A and DOT 110A multi-unit ton tanks shall be cylindrical, circular in cross-section and shall have heads of an approved design, with all fittings, i.e., couplings, nozzles, etc., located in the heads of the tank.

S6.15.1 SPECIAL PROVISIONS FOR TON TANKS

49 CFR, Section 179.300, has specific criteria for ton tanks that shall be met to satisfy DOT Specification 106A and 110A. The limitations are as follows:

a) Ton tanks shall have a water containing capacity of at least 0.68 tonne (1500 pounds), but in no case can the water containing capacity of the ton tank exceed 1.18 tonnes (2600 pounds);

b) Ton tanks shall not be insulated;

c) Thickness of plates for DOT Specifications 106A and 110A ton tanks shall be in accordance with NBIC Part 2, Table S6.15.1-a;

d) The maximum carbon content for carbon steel used in the fabrication of ton tanks shall not exceed 0.31%;

e) Permitted materials can be either an ASME, SA material, or an ASTM Material permitted by NBIC Part 2, Table S6.15.1-b;

f) DOT Specification 106A ton tanks shall only use forged-welded heads, convex to pressure. The forged-welded heads shall be torispherical with an inside radius not greater than the inside diameter of the shell. The heads shall be one piece, hot formed in one heat so as to provide a straight flange at least 100 mm (4 inches) long. The heads must have a snug fit into the shell;

g) DOT Specification 110A ton tanks shall only use fusion-welded heads formed concave to pressure. The fusion-welded heads shall be an ellipsoid of 2:1 ratio and shall be of one piece, hot formed in one heat so as to provide a straight flange at least 38 mm (1-1/2 inches) long;

h) All longitudinal welded joints on DOT Specification 106A and DOT Specification 110A ton tanks shall be a fusion weld. DOT Specification 106A ton tank head-to-shell attachments shall be a forged-welded joint.[5] DOT Specification 110A ton tank head-to-shell attachments shall be a fusion weld;

i) Postweld heat treatment is required after welding for all DOT Specification 106A and Specification 110A ton tanks;

j) DOT Specification 106A and DOT Specification 110A ton tanks shall be of such a design as to afford maximum protection to any fitting or attachment to the head, including loading and unloading valves. The protection housing[5] shall not project beyond the end of the ton tanks and shall be securely fastened to the tank head;

k) If applicable, siphon pipes and their couplings on the inside of the ton tank's head and lugs on the outside of the tank head for attaching valve protection housing shall be fusion welded prior to performing postweld heat treatment;

l) DOT Specification 106A and DOT Specification 110A ton tanks are required to be equipped with one or more approved types of pressure relief devices. The devices shall be made out of metal and the pressure relief devices shall not be subject to rapid deterioration by the lading. The device's inlet fitting to the tank shall be a screw-type fitting and installed or attached directly into the ton tank's head or attached to the head by other approved methods. For thread connections, the following shall apply:

    1) The threaded connections for all openings shall be in compliance with the National Gas Taper Threads (NGT);

    2) Pressure relief devices shall be set for start-to-discharge, and rupture discs shall burst at a pressure not exceeding the pressure identified in NBIC Part 2, Table S6.15.1-a; and

m) Fusible plugs, if used, shall be required to relieve the pressure from the tank at a temperature not exceeding 79°C (175°F) and shall be vapor tight at a temperature not exceeding 54°C (130°F).

5 The forged-welded joint shall be thoroughly hammered or rolled to ensure a sound weld.

Table S6.15.1-a
Thickness of Plates and Safety Valve Requirements

DOT Specification	106A500-X	106A800-X	110A500-W	110600-W	110A800-W	110A1000-W
Minimum required bursting pressure, MPa (psig)	None Specified	None Specified	8.62 (1,250)	10.34 (1,500)	13.8 (2,000)	17.2 (2,500)
Minimum thickness shell, mm (inches), Test Pressure (See CFR 179.300-15), MPa (psig)	10 mm (13/32) 3.45 (500)	17 mm (11/16) 5.52 (800)	10 mm (11/32) 3.45 (500)	10 mm (3/8) 4.41 (600)	12 mm (15/32) 5.52 (800)	15 mm (19/32) 6.89 (1,000)
Start-to-discharge, or burst pressure (maximum MPa (psig))	2.59 (375)	4.14 (600)	2.59 (375)	3.10 (450)	4.14 (600)	4.83 (700)

Table S6.15.1-b
Acceptable Materials with Acceptable Tensile Strength and Elongation Requirements

Material Specification	Minimum Tensile Strength MPa (psi) in the welded condition. *These values are to be used in the design calculations.*	Minimum Elongation in 50 mm (2 in.) (percent) in the welded condition. *These values are to be used in the design calculations.*
ASTM A 240 type 304	517 (75,000)	25
ASTM A 240 type 304L	483 (70,000)	25
ASTM A 240 type 316	517 (75,000)	25
ASTM A 240 type 316L	483 (70,000)	25
ASTM A 240 type 321	517 (75,000)	25
ASTM A 285 Gr. A	310 (45,000)	29
ASTM A 285 Gr. B	345 (50,000)	20
ASTM A 285 Gr. C	380 (55,000)	20
ASTM A 515 Gr. 65	448 (65,000)	20
ASTM A 515 Gr. 70	483 (70,000)	20
ASTM A 516 Gr. 70	483 (70,000)	20

S6.15.2 VISUAL INSPECTION OF TON TANKS

Without any regard to any other periodic inspection and test requirements, a ton tank shall be visually inspected for evidence of any:

a) Defects in welds;

b) Abrasions;

c) Corrosion;

d) Cracks;

e) Dents;

f) Distortions; or

g) Any other conditions that might make the ton tank unsafe for transportation.

S6.15.3 INSPECTION AND TESTS OF DOT SPECIFICATION 106A AND DOT SPECIFICATION 110A TON TANKS

Each ton tank shall be retested by subjecting the ton tank to a hydrostatic test in accordance with NBIC Part 2, Table S6.15.3. The hydrostatic test shall include an evaluation of the tank's permanent expansion. As a minimum, the hydrostatic test and the expansion procedure shall include:

a) The hydrostatic test pressure shall be maintained for a minimum of 30 seconds. This time period may be extended as long as necessary to secure complete expansion of the ton tank.

b) The pressure gage used for the hydrostatic test shall be accurate within1% of the range of the pressure gage. The accuracy of the pressure gage shall be verified prior to performing the hydrostatic test.

c) The expansion test procedure shall include the following requirements:

1) The expansion shall be recorded in cubic cm;

2) Permanent volumetric expansion shall not exceed 10% of the total volumetric expansion at the test pressure; and

3) The expansion gage shall be accurate within one percent of the hydrostatic test pressure.

d) The ton tank shall not show any signs of leakage or stress during the hydrostatic and expansion test.

e) The retest may be made at any time during the calendar year the retest falls due.

Table S6.15.3
Ton Tank Periodic Inspection and Test Frequencies

	Retest Interval, years		Minimum Retest Pressure, MPa (psig)		Pressure Relief Valve Pressure, MPa (psig)	
DOT Specification	Tank	Pressure Relief Device	Tank Hydrostatic Expansion	Tank Air Test	Start-to-Discharge	Vapor Tight
106A500	5	2	500 (3.45)	100 (0.69)	375 (2.59)	300 (2.07)
106A500X	5	2	500 (3.45)	100 (0.69)	375 (2.59)	300 (2.07)
106A800	5	2	800 (5.52)	100 (0.69)	600 (4.14)	480 (3.31)
106A800X	5	2	800 (5.52)	100 (0.69)	600 (4.14)	480 (3.31)
106A800NCI	5	2	800 (5.52)	100 (0.69)	600 (4.14)	480 (3.31)
110A500-W	5	2	500 (3.45)	100 (0.69)	375 (2.59)	300 (2.07)
110A600-W	5	2	600 (4.41)	100 (0.69)	500 (3.45)	360 (2.48)
110A800-W	5	2	800 (5.52)	100 (0.69)	600 (4.14)	480 (3.31)
110A1000-W	5	2	1,000 (6.89)	100 (0.69)	750 (5.17)	600 (4.41)

S6.15.3.1 AIR TESTS

a) All specification DOT 106A and DOT 110A ton tanks, in addition to the hydrostatic test shall be subjected to an air test at frequencies and pressures specified in NBIC Part 2, Table S6.15.3.

b) The air test shall be under positive control to ensure safety to all inspection and test personnel.

c) Any leakage observed will require the ton tank to be repaired and retested prior to placing the ton tank back into service.

S6.15.3.2 PRESSURE RELIEF DEVICE TESTING

All pressure relief devices shall be retested by air or gas for the start-to-discharge and vapor tightness requirements at frequencies and pressures specified in NBIC Part 2, Table S6.15.3.

S6.15.3.3 RUPTURE DISCS AND FUSIBLE PLUGS

All rupture discs required by NBIC Part 2, S6.15.1 l) 2), and fusible plugs required by NBIC Part 2, S6.15.1 m), shall be removed from the ton tank and inspected. The inspection shall include but not be limited to the following:

a) All rupture discs shall be inspected for corrosion, leakage, and manufacturer tolerances;

b) All fusible plugs shall be inspected for corrosion, loose, or deteriorated temperature sensitive materials; and

c) Any indication specified in a) and b) above will require the rupture disc or fusible plug to be replaced with devices specified in NBIC Part 2, S6.15.1 l) 2) and S6.15.1) m).

S6.15.3.4 SUCCESSFUL COMPLETION OF THE PERIODIC RETESTING

If the results of the periodic retest are successful, the ton tank shall be plainly and permanently stamped on one head or chime of each ton tank. The stamping shall include:

a) The month and year of the test followed by a “V”, and

b) Dates of previous tests and all prescribed markings shall not be removed. Previous dates and markings on the ton tank’s head or chime shall be legible.

S6.15.3.5 EXEMPTIONS TO PERIODIC HYDROSTATIC RETESTING

Ton tanks that satisfy DOT 106A and DOT 110A and are used exclusively for transporting fluorinated hydrocarbons and mixtures thereof, and are free from corroding components related to the ton tank, may be exempted from the periodic hydrostatic retest if:

a) The ton tank is given a complete internal and external visual inspection of all heads, shells, nozzles, couplings, pressure relief devices, i.e. pressure relief valves and rupture discs and fusible plugs for deterioration and leakage.

b) The visual internal and external inspection is performed by qualified personnel, i.e., registered inspector, employee of the Owner-user, etc.

S6.15.3.6 RECORD OF RETEST INSPECTION

The Owner or the person performing the required pressure test and visual inspection is required to retain a written record of the results as long as the ton tank is in service. The written report shall identify the following:

a) Date of the test and inspection;

b) DOT Specification Number of the ton tank;

c) Ton tank identification: registered symbol and serial number, date of manufacture, and Ownership symbol;

d) Type of protective coating, i.e., painting, etc.;

e) Statement as to the need for refinishing or recoating the ton tank;

f) Conditions checked for:

1) Leakage;

2) Corrosion;

3) Gouges;

4) Dents or dings;

5) Broken or damaged chimes, or protective rings;

6) Fire damage;

7) Internal conditions;

8) Test pressure; and

9) The written report shall also identify the results of the test:

a. Disposition of the tank, i.e., returned to service, returned to the manufacturer for repair, or scrapped; and

b. Identification of the person performing the retest or inspection.

S6.15.4 STAMPING REQUIREMENTS OF DOT 106A AND DOT 110A TON TANKS

To identify compliance with CFR 179.300-1, each DOT 106A and DOT 110A ton tank shall be plainly and permanently stamped with letters and figures 3/8 of an inch high on valve end chime of the ton tank's head. The minimum requirements for the stamping are as follows:

a) DOT Specification Number;

b) Material and cladding material, if any. This information shall be stamped directly below the DOT Specification Number;

c) Owner's or builder's identifying symbol and serial number. This information shall be stamped directly below the material identification stamping. The Owner's or builder's symbol shall be registered with the Bureau of Explosions (duplications are not authorized);

d) Inspector's official mark. This information shall be stamped directly below the Owner's or builder's symbol;

e) Date of the original ton tank test (month and year). Provisions should be made that subsequent tests may easily be added thereto;

f) Water capacity of the ton tank in kilograms (pounds); and

g) A duplicate of the stamping that satisfies (a) through (f) should be used if the plate is made of brass and is permanently attached to the ton tank's head.

S6.16 PRESSURE RELIEF DEVICES

S6.16.1 SCOPE

This Section provides details for the application, continued service inspection, and repair of pressure relief devices specified for overpressure protection of transport tanks.

Pressure relief devices are provided for all transport tanks to prevent internal pressure from exceeding design values. They may also be provided to prevent excessive internal vacuum. Overpressure protection may be provided by reclosing pressure relief valves, non-reclosing devices such as rupture disks or breaking bar or breaking pin valves, or combinations of pressure relief valves and non-reclosing devices.

S6.16.2 SAFETY CONSIDERATIONS

When inspections of pressure relief devices are being performed, inspectors should be aware that tests of these devices involve the discharge of the test fluid, which can result in high-velocity fluid flow, possible high -or low-temperature fluids, and high noise levels. If a test is being performed with the service fluid, it should be a fluid that is safe for discharge and not toxic or hazardous. Due to the nature of fluids being transported, most testing will involve removing the device from the transport tank and testing it on a test stand. (See NBIC Part 2, S6.12.1, Pre-Inspection Activities.)

S6.16.3 INSTALLATION PROVISIONS

Incorrect installation of a pressure relief device can have a detrimental effect on device performance. The following provisions shall be followed when installing pressure relief devices on transport tanks:

a) Inlet piping shall have an area at least equal to the pressure relief device inlet size with no restrictions which can affect flow through the device;

b) Pressure relief devices shall be installed to be in communication with the vapor space of the tank in its normal transport orientation as near as practicable on the longitudinal center line, and in the center of the tank;

c) If discharge piping is provided, it shall have an area at least equal to the pressure relief device, be as short and straight as possible, and of a length that will not affect the pressure relief device flow performance. It will typically discharge upward, and should be directed away from personnel that may be around the tank at ground level;

d) Provisions for protection of the outlet of pressure relief devices from contamination from the effects of rain, weather, etc., shall be provided. Where rain caps are provided, the fit shall not be tight enough to affect the valve performance;

e) Pressure relief devices may be installed inside a protective housing consisting of mechanical elements designed to protect the valve during roll-over events. These elements shall not obstruct the outlet of the device;

f) If a rupture disk is used in combination with a pressure relief valve, it shall be located inboard of the pressure relief valve;

g) When a rupture disk is used in combination with a pressure relief valve, a device to detect leakage through the rupture disk, or actuation of the rupture disk, shall be provided. These devices detect leakage or actuation by observation of the accumution of pressure between the disk and the pressure relief valve, and shall consist of a needle valve, try-cock, tell-tale indicator or pressure gage. Where a valve is provided, it shall be closed during normal operation. Leaking disks or disks, which have discharged, shall be replaced as soon as possible; and

h) Block valves shall not be used on either device inlets or outlets.

S6.16.4 PRESSURE RELIEF DEVICE INSPECTION

For pressure relief valves, inspection shall consist of an External and Internal Visual Inspection and a Pressure Test to determine valve function. For non-reclosing pressure relief devices, inspection shall consist of an External and Internal Visual Inspection as well.

S6.16.5 SCHEDULE OF INSPECTIONS

Pressure relief devices shall be inspected at the frequency as required by NBIC Part 2, Tables S6.13.4, S6.14, or S6.16.3. For both an External Visual Inspection and a Pressure Test, the frequency of inspection for pressure relief devices shall be the same as the frequency required for inspection of the transport tank itself.

S6.16.6 EXTERNAL VISUAL INSPECTION OF PRESSURE RELIEF DEVICES

The following items shall be inspected during the External Visual Inspection.

a) Pressure relief device nameplate data shall be reviewed, and the marked device set pressure compared to the transport tank data. The pressure relief device set pressure shall not exceed the tank maximum allowable working pressure (MAWP) except as permitted by the applicable transport tank specification Appendix.

b) Where seals are provided to seal external adjustments of pressure relief valves, the seal must be intact and bear the identification of the organization responsible for performing the adjustment. If the valve has been repaired or reset, it must bear a supplemental nameplate identifying the organization responsible for the repair or resetting.

c) Valves that have the set pressure adjustment permanently sealed, by means such as a rivet or roll pin through the adjustment, shall be checked to ensure there has been no tampering with the set pressure adjustment.

d) Check for evidence of leakage through the valve. For a valve installed with a rupture disk at the inlet, the rupture disk leakage detection device shall be checked for signs of leakage through the disk. When possible, this inspection should be performed with normal transport tank operating pressure present.

e) All connecting bolting shall be present and tight.

f) Evidence of rust or corrosion of the pressure relief device shall be investigated.

g) Where drain holes are provided on the side of the valve, check that the drain holes are not plugged.

h) Check that a valve spindle restraint (test gag) has not been left in place after pressure testing of the transport tank; and

i) Check for proper orientation of rupture disk devices. These devices will have a flow direction arrow or other designation such as inlet or vent side to designate the flow direction. Installation of rupture disk devices in the reverse direction can cause a disk to burst at a higher pressure than its marked burst pressure.

S6.16.7 PRESSURE TESTING OF PRESSURE RELIEF VALVES

A check of pressure relief valve operation shall be performed to ensure the valve is functioning properly. This testing shall be performed at the time of the transport tank pressure test when the tank pressure test will necessitate removal of the pressure relief valve. When the valve is removed for testing, the connection on the transport tank shall be inspected for corrosion or deposits which could block or reduce the connection area.

a) Prior to the test, the inlet and outlet passages of the valve shall be visually inspected for corrosion or deposits of material which could affect valve operation.

b) The test fluid shall be air or other suitable non-hazardous gas.

c) The valve shall be installed on a test stand and a calibrated test gage of suitable range shall be used.

d) Valves shall be tested for the following operational characteristics:

1) Seat Leakage: The test pressure shall be increased to seat leakage test pressure at which there should be no leakage as determined by a bubble test. This pressure will typically be 90% of the stamped set pressure or the pressure prescribed for the applicable transport tank specification. There shall be no audible or visible leakage at the specified seat leakage test pressure.

2) Set Pressure: The set pressure definition used by the valve manufacturer to originally set the valve shall be determined, and shall be used during evaluations of valve performance. For most transport tank valves this will usually be the “start” to “discharge” pressure which is the pressure at which the first audible discharge is detected. The test pressure shall be increased until the set pressure is determined. The valve shall open within the tolerance for set pressure as specified by the applicable transport tank specification.

3) Re-seal pressure: The test pressure shall then be decreased and the pressure at which the valve reseals shall be recorded. The valve shall reseal at or above the pressure specified by the applicable transport tank specification, or above the normal transport tank operating pressure; and

4) It is recommended that the test sequence be repeated several times to ensure repeatable valve performance. Erratic performance may indicate damage to the valve, including damage or deposits on the seating surface.

e) The results of testing shall be documented and be made available to the Inspector.

f) Testing shall be performed by trained individuals from an organization acceptable to the Competent Authority.

S6.16.8 CORRECTION OF DEFECTS

Any failure of the valve to meet applicable test specifications shall be brought to the attention of the Inspector and Owner, and steps shall be taken to correct the defect. If repairs are required they shall be performed by a qualified organization acceptable to the Competent Authority.

When a valve is to be repaired, it shall be completely disassembled, cleaned, all parts inspected, and repaired as necessary. It shall then be tested and all adjustments resealed with a seal identifying the repair organization. Parts replaced shall be from the valve manufacturer or meet the valve manufacturer's specifications. Where soft goods such as gaskets, o-rings, and other seals are replaced, new parts shall be used.

Repairs shall be identified with a repair nameplate which includes the organization responsible for the repair, date of the repair, and a unique identifier, identifying repair documentation. The goal of the repair is to bring the valve back to a "like new" condition.

A valve found to be defective may be replaced by a new valve or previously repaired valve. Care shall be taken to ensure that the replacement valve meets the same requirements as the valve being replaced.

S6.16.9 INSPECTION OF RUPTURE DISKS AND NON-RECLOSING DEVICES

Rupture disks and other non-reclosing devices cannot be tested. In lieu of the required pressure test for a pressure relief valve, the disk and disk holder must be removed from the transport tank and the disk inlet and outlet surfaces visually inspected. (This is considered the "Internal Inspection.") Signs of corrosion, damage, or deposits will require that the rupture disk be replaced.

A program to periodically replace rupture disks is recommended to prevent premature disk opening during normal operation. This can be caused by corrosion or deterioration of the disk or fatigue of the disk material due to cyclic operation of the transport tank and vibration during normal operation. The rupture disk manufacturer may have recommendations for the frequency of disk replacement. Replacement disks shall have the same specifications for burst pressure and coincident temperature as the disk being replaced, unless the service conditions for the transport vessel are being changed. It is recommended that replacement disks be specified by the complete disk description including model number, burst pressure, and coincident temperature, and the lot number from the disk being replaced. Disks and disk holders from different manufacturers shall not be interchanged.

S6.17 DEFINITIONS

These definitions shall be used in conjunction with those of Section 9 of the NBIC. Where conflicts between the two arise, those listed below shall prevail.

Approval — A written authorization, including a competent authority approval from the Associate Administrator or other designated department official, to perform a function for which prior authorization by the Associate Administrator is required.

Approval Agency — An organization or a person designated by the DOT to certify packaging as having been designed, manufactured, tested, modified, marked, or maintained in compliance with applicable DOT regulations.

Approved — Approval issued or recognized by the department unless otherwise specifically indicated.

Appurtenance — Any attachment to a cargo tank that has no lading retention or containment function and provides no structural support to the cargo tank.

Associate Administrator — The Associate Administrator for Hazardous Materials Safety, Research, and Special Programs Administration.

Atmospheric gas — Air, nitrogen, oxygen, argon, krypton, neon, and xenon.

Attachments — Structural members means the suspension sub-frame, accident protection structures, external circumferential reinforcements, support framing, and kingpin sub-frame (upper coupling).

Attachments, Light Weight — Welded to a cargo tank wall such as a conduit clip, brake line clip, skirting structure, lamp mounting bracing, or placard holder.

Authorized Inspector (AI) — An inspector regularly employed by an ASME-accredited Authorized Inspection Agency (AIA) who has been qualified accordingto ASME developed criteria, to perform inspections under the rules of any Jurisdiction that has adopted the ASME Code.

Baffle — A nonliquid-tight transverse partition device that deflects, checks, or regulates fluid motion in a tank.

Bar — 1 BAR = 100 kPa (14.5 psi).

Bottle — An inner packaging having a neck of relatively smaller cross-section than the body and an opening capable of holding a closure for retention of the contents.

Bottom Shell — That portion of a tank car surface, excluding the head ends of the tank car, that lies within two feet, measured circumferentially, of the bottom longitudinal center line of the tank car tank.

Bulk Packaging — A packaging other than the vessel or a barge, including a transport vehicle or freight container, in which hazardous materials are loaded with no intermediate form of containment and which has:

a) A maximum capacity greater than 450L (119 gallons) as a receptacle for a liquid;

b) A maximum net mass greater than 400 kg (882 pounds) and a maximum capacity greater than 450L (119 gallons) as a receptacle for a solid; or

c) A water capacity greater than 454 kg (1000 pounds) as a receptacle for a gas.

Bulkhead — A liquid-tight transverse closure at the ends of or between (compartment) cargo tanks.

Cargo Tank — A bulk packaging which:

a) Is a tank intended primarily for the carriage of liquids or gases and includes appurtenances, reinforcements, fittings, and closures;

b) Is permanently attached to or forms a part of a motor vehicle, or is not permanently attached to a motor vehicle but which, by reason of its size, construction, or attachment to a motor vehicle is loaded or unloaded without being removed from the motor vehicle; and

c) Is not fabricated under a specification for cylinders, portable tanks, tank cars, or multi-unit tank car tanks.

Cargo Tank Motor Vehicle — A motor vehicle with one or more cargo tanks permanently attached to or forming an integral part of the motor vehicle.

Carrier — A person engaged in the transportation of passengers or property by:

a) Land or water, as a common, contract, or private carrier; or

b) Civil aircraft.

Certified Individual — An individual that is qualified and certified by a manufacturer accredited by ASME to construct Class 3 Section XII Transport Tanks.

Combination Packaging — A combination of packaging for transport purposes, consisting of one or more inner packaging secured in a non-bulk outer packaging. It does not include a composite packaging.

Combustible Liquid — Any liquid that does not meet the definition of any other hazard class specified in 173.129 of Title 49 and has a flash point above 60.5°C (141.5°F) and below 93°C (100°F).

Competent Authority — A national agency responsible under its national law for the control or regulation of a particular aspect of the transportation of hazardous materials. In the United States, the Associate Administrator of the US Department of Transportation is the Competent Authority.

Composite Packaging — A packaging consisting of an outer package and an inner receptacle so constructed that the inner receptacle and the outer package are integral. Once assembled, it remains an integrated single unit. It is filled, stored, shipped, and emptied as such.

Compressed Gas in Solution — A non-liquefied compressed gas that is dissolved in a solvent.

Constructed and Certified in Accordance with the ASME Code — A cargo tank that is constructed and stamped in accordance with the ASME Code and is inspected and certified by an Authorized Inspector, Qualified Inspector, or a Certified Individual.

Corrosive Material — A liquid or solid that causes full thickness destruction of human skin at the site of contact within a specified period of time. A liquid that has a severe corrosion rate on steel or aluminum based on the criteria in 173.173(c) (3) of Title 49 is also a corrosive material.

Cryogenic Liquid — A refrigerated liquefied gas having a boiling point colder than -90°C (-130°F) at 101.3 kPa (14.7 psia) absolute.

Design Certification — That each cargo tank or cargo tank motor vehicle design type, including its required accident damage protection device, must be certified to conform to the specification requirements by a Design Certifying Engineer who is registered with the department. An accident damage protection device is a rear-end protection, overturn protection, or piping protection.

Design Certifying Engineer — A person registerd with the department in accordance with Subpart F of Part 107 of 49 CFR 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. In addition, Design Certifiying Engineer means a person who meets, at a minimum, any one of the following:

a) Has an engineering degree and one year of work experience in cargo tank structural or mechanical design;

b) Is currently registered as a professional engineer by the appropriate authority of a state of the United States or a province of Canada; or

c) Has at least three years experience in performing the duties of a Design Certifying Engineer by September 1, 1991, and was registered with the department by December 31, 1995.

Design Type — One or more cargo tanks that are made:

a) To the same specification;

b) By the same manufacturer;

c) To the same engineering drawings and calculations, except for minor variations in piping that do not affect the lading retention capabilities of the cargo tank;

d) Of the same materials of constructions;

e) To the same cross-sectional dimensions;

f) To a length varying by no more than 5 percent;

g) With the volume varying by no more than 5 percent (due to the change in length only); and

h) For the purposes of 178.338 of Title 49 only, with the same insulation system.

DOT or Department — US Department of Transportation.

Elevated Temperatures Material — A material which, when offered for transportation or transported in a bulk packaging:

a) Is in a liquid phase and at a temperature at or above 100°C (212°F);

b) Is in a liquid phase with a flash point at or above 37.8°C (100°F) that is intentionally heated and offered for transportation, or transported at or above the flash point; or

c) Is in a solid phase and at a temperature at or above 240°C (464°F).

Extreme Dynamic Loadings — The maximum loading of a cargo tank motor vehicle may experience during its expected life, excluding accident loadings resulting from an accident, such as overturn or collision.

Flammable Gas — Any material that is a gas at 20°C (68°F) or less and 101.3 kPa (14.7 psia) of pressure [a material that has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psia)] which:

a) Is ignitable at 101.3kPa (14.7 psia) when in a mixtue of 13% or less by volume with air; or

b) Has a flammable range at 101.3kPa (14.7 psia) with air of at least 12% regardless of the lower limit. Except for aerosols, the limits specified in paragraphs (1) and (2) shall be determined at 101.3kPa (14.7 psia) of pressure and a temperature of 20°C (68°F) in accordance with the ASTM E681-85, *Standard Test Method for Concentration Limits of Flammability of Chemicals*, or other equivalent method approved by the Associate Administrator, Hazardous Material Safety.

Gas — A material that has a vapor pressure greater than 300 kPa (43.5 psia) at 50°C (122°F) or is completely gaseous at 20°C (68°F) at a standard pressure of 101.3 kPa (14.7 psia).

Gross Weight or Gross — The weight of a packaging plus the weight of its contents.

Hazardous Class — The category of hazard assigned to a hazardous material under the definitional criteria of Part 173 of Title 49 and the provisions of the 172.101 Table. A material should meet the defining criteria for more than one hazard class but is assigned to only one hazard class.

Hazardous Material — A substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce and has been designated as hazardous under section 5103 of Federal Hazardous Law (49 U.S.C. 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Material Table (49 CFR 172.101), and materials that meet the defining criteria for hazard classes and divisions of 173 of subchapter C of 171.8 of Title 49.

Hazardous Zones — One of four levels of hazard (Hazard Zones A through D) as assigned to gases, as specified in 173.116(a) of Title 49, and one of two levels of hazard (Hazard Zones A and B) assigned to liquids that are poisonous by inhalation as specified in 173.133(a) of Title 49. A hazard zone is based on the LC 50 value for acute inhalation toxicity of gases and vapors.

High Pressure Liquefied Gas — A gas with a critical temperature between -50°C (-58°F) and + 65°C (149°F).

Inner Packaging — A packaging for which an outer packaging is required for transport. It does not include the inner receptacle of a composite packaging.

Inner Receptacle — A receptacle that requires an outer packaging in order to perform its containment function. The inner receptacle should be an inner packaging of a combination packaging or the inner receptacle of a composite packaging.

Inspection Pressure — The pressure used to determine leak tightness of the cargo tank when testing with pneumatic or hydrostatic pressure.

Lading — The hazardous material contained in the cargo tank

Liquefied Compressed Gas — a gas which, when packaged under pressure for transportation, is partially liquid at temperatures above -50°C (-58°F).

Liquid — A material, other than an elevated temperature material, with a melting point or initial melting point of 20°C (68°F) or lower at a standard pressure of 101.3 kPa (14.7 psig). Liquid Phase means a material that meets the definition of liquid when evaluated at the higher of the temperature at which it is offered for transportation or at which it is transported, not at the 37.8 °C (100°F) temperature specified in ASTM D 4359-84.

Low-Pressure Liquefied Gas — A gas with a critical temperature above + 65°C (149°F).

Manufacturer — Any person engaged in the manufacture of a DOT specification cargo tank, cargo tank motor vehicle, or cargo tank equipment that forms part of the cargo tank wall. This term includes attaching a cargo tank to a motor vehicle or to a motor vehicle suspension component that involves welding on a cargo tank wall. A manufacturer must register with the department in accordance Subpart F of Part 107 in Subpart A of 49 CFR.

Marking — A descriptive name, identification number, instructions, cautions, weight, specification, or UN marks, or combinations thereof, required by Title 49 on outer packaging or hazardous materials.

Mode — Any of the following transportation methods: rail, highway, air, or water.

Modification — Any change to the original design and construction of a cargo tank or a cargo tank motor vehicle that affects its structural integrity or lading retention capability including changes to equipment certified as part of an emergency discharge control system. Any modification that involves welding on the cargo tank wall must also meet all requirements for "Repair" as defined in this section. Excluded from this category are the following:

a) A change to motor vehicle equipment such as lights, truck, or tractor power train components, steering, and brake systems, suspension parts, and changes to appurtenances, such as fender attachments, lighting brackets, ladder brackets; and

b) Replacement of components such as valves, vents, and fittings with a component of a similar design and of the same size.

Motor Vehicle — A vehicle, machine, tractor, trailer, or semi-trailer, or any combination thereof, propelled or drawn by mechanical power and used upon the highways in the transportation of passengers or property. It does not include a vehicle operated exclusively on a rail or rails or a trolley bus operated by electric power derived from a fixed overhead wire, furnishing local passenger transportation similar to street-railway service.

Multi-Specification Cargo Tank Motor Vehicle — A cargo tank with two or more cargo tanks fabricated to more than one cargo tank specification.

Non-Liquefied Compressed Gas — When packaged under pressure for transportation is entirely gaseous at -50°C (-58°F) with a critical temperature less than or equal to -50°C (-58°F).

Normal Operating Loading — A cargo tank motor vehicle equipped with two or more cargo tanks fabricated to more than one cargo tank specification.

Operator — A person who controls the use of aircraft, vessel, or vehicle.

Outer Packaging — The outermost enclosure of a composite or combination packaging together with any absorbent material, cushioning, and any other components necessary to contain and protect inner receptacles or inner packaging.

Owner — The person who owns a cargo tank motor vehicle used for the transportation of hazardous materials, or that person's authorized agent.

Packaging — A receptacle and any other components or materials necessary for the receptacle to perform its containment function in conformance with the minimum packing requirements of Title 49.

Packing Group — A grouping according to the degree of danger present by hazardous materials. Packing Group I indicates great danger; Packing Group II indicates medium danger; Packing Group III indicates minor danger.

Person — An individual, firm, co-partnership, corporation, company, association, or joint-stock (including any trustee, receiver, assignee, or similar representative); or any government or Indian tribe (or an agency or instrumentality of any government or Indian tribe) that transports hazardous material to further a commercial enterprise or offers a hazardous material for transportation in commerce.

Poisonous Gas — A material that is a gas at 20°C (68°F) or less and a pressure of 101.3 kPa (14.7 psia) a material that has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psia) and which:

a) Is known to be so toxic to humans as to pose a hazard to health during transportation; or

b) In the absence of adequate data on human toxicity, is presumed to be toxic to humans because when tested on laboratory animals it has an LC50.

Poisonous Material — A material, other than a gas, which is known to be so toxic to humans as to afford a hazard to health during transportation, or which in the absence of adequate data on human toxicity.

Portable Tanks — A bulk packaging (except cylinders having a water capacity of 1,000 pounds or less) designated primarily to be loaded onto, or on, or temporarily attached to, a transport vehicle or ship and equipped with skids, mountings, or accessories to facilitate handling of the tank by mechanical means. It does not include a cargo tank, tank car, multi-unit tank car tanks, or trailers carrying 3AX, 3AAX, or 3T cylinders.

psi — Pounds per square inch.

psia — Pounds per square inch absolute.

psig — Pounds per square inch gage.

Qualified Inspector — An inspector regularly employed by an ASME Qualified Inspection Organization (QIO) who has been qualified to ASME developed criteria by a written examination, to perfom inspections under the rules of any jurisdiction that has adopted the ASME Code. The QI shall not be in the employ of the manufacturer. See ASME XII, TG-410.

Rail Car — A car designed to carry freight or nonpassenger personnel by rail, and includes a box car, flat car, gondola car, hopper car, tank car, and occupied caboose.

Rebarrelling — Replacing more than 50% of the combined shell and head material of a cargo tank.

Receptacle — A containment vessel for receiving and holding materials, including any means of closing.

Registered Inspector (RI) — A person registered with the department in accordance with Subpart F of Part 107 of 49 CFR who has the knowledge and ability to determine whether a cargo tank conforms with the applicable DOT specification. In addition, Registered Inspector means a person who meets, at a minimum, any one of the following:

a) Has an engineering degree and one year of work experience;

b) Has an associate degree in engineering and two years of work experience;

c) Has a high school diploma or General Equivalency Diploma and three years work experience; or

d) Has at least three years experience performing the duties of a Registered Inspector by September 1, 1991, and was registered with the DOT by December 31, 1995.

Repair — Any welding on a cargo tank wall done to return a cargo tank or a cargo tank motor vehicle to its orginial design and construction specification, or to a condition prescribed for a later equivalent specification in effect at the time of the repair. Excluded from this category are the following:

a) A change to motor vehicle equipment such as lights, truck, or tractor power train components. Steering and brake systems, suspension parts, and changes to appurtenances, such as fender attachments, lighting brackets, ladder brackets;

b) Replacement of components such as valves, vents, and fittings with a component of a similar design and of the same size; and

c) Replacement of an appurtenance by welding to a mounting pad.

Replacement of a Barrel — To replace the existing tank on a motor vehicle chassis with an unused (new) tank.

SCF (standard cubic foot) — One cubic foot of gas measured at 60°F and 14.7 psia.

Single Packaging — A nonbulk packaging other than a combination packaging.

Solid — A material that is not a gas or liquid.

Solution — Any homogenous liquid mixture of two or more chemical compounds or elements that will not undergo any segregation under conditions normal to transportation.

Specification Packaging — A packaging conforming to one of the specifications or standards for packaging in Part 178 or Part 179 of Title 49.

Strong Outside Container — The outermost enclosure that provides protection against the unintentional release of its contents under conditions normally incident to transportation.

Tanks — A container, consisting of a shell and heads that form the pressure vessel having opening designed to accept pressure tight fittings or closure, excluding any appurtenances, reinforcements, fittings, or closures.

Test Pressure — The pressure to which a tank is subjected to determine structural integrity.

Top Shell — The tank car surface, excluding the head ends and bottom shell of the tank car.

Transport Vehicle — A cargo-car-carrying vehicle such as an automobile, van, tractor, truck, semi trailer, tank car, or rail car used for the transportation of cargo by any mode. Each cargo-carrying body (trailer, rail car, etc.) is a separate transport vehicle.

UFC — Uniform Freight Classification.

UN — United Nations.

UN Portable Tank — An intermodal tank having a capacity of more than 450L (118.9 gallons). It includes a shell fitted with service equipment and structural equipment, including stabilizing members external to the shell and skids, mountings or accessories to facilitate mechanical handling. A UN portable tank must be capable of being filled and discharged without the removal of its structural equipment and must be capable of being lifted when full. Cargo tanks, rail tank car tanks, nonmetallic tanks, nonspecification tanks, bulk bins, and IBC's and packaging made to cylinder specifications are not UN portable tanks.

UN Recommendation — The UN Recommendations on the Transport of Dangerous Goods.

UN Standard Packaging — A conforming to standards in the UN Recommendations.

Vessel — Includes every description of watercraft, used or capable of being used, as a means of transportation on the water.

Viscous Liquid — A liquid material that has a measured viscosity in excess of 2500 centistokes at 25°C (77°F), when determined in accordance with the procedures specified in ASTM Method D 445-72 "Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)," or ASTM Method D 1200-70 "Viscosity of Paints, Varnishes, and Lacquers by Ford Viscosity Cup."

S6.18 TABLES AND FIGURES

a) TABLE S6.13, Periodic Inspections and Tests

b) TABLE S6.13-a, Inservice Minimum Thickness for Steel and Steel Alloys

c) TABLE S6.13-b, Inservice Minimum Thickness for Aluminum and Aluminum Alloys

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p) TABLE S6.15.1-a, Thickness of Plates and Safety Valve Requirements

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SUPPLEMENT 6
REPAIR, ALTERATION, AND MODIFICATION OF DOT TRANSPORT TANKS

S6.0 GENERAL REQUIREMENTS

S6.1 SCOPE

This Supplement provides general requirements that apply to the repairs, alterations, or modifications to DOT Transport Tanks used for the transportation of dangerous goods via highway, rail, air, or water.

S6.2 CONSTRUCTION STANDARDS

When the standard governing the original construction is the ASME Code or other regulations of the Competent Authority, repairs, alterations, or modifications shall conform, insofar as possible, to the edition of the construction standard or specification most applicable to the work. Where this is not possible or practical, it is permissible to use other codes, standards or specifications, including the ASME Code provided the "TR" Certificate Holder has the concurrence of the Inspector or the Competent Authority.

S6.3 ACCREDITATION

Organizations performing repairs, alterations, or modifications shall be accredited as in accordance with the National Board "TR" Program.

S6.4 MATERIALS

The materials used in making repairs, alterations, or modifications shall conform to the original code of construction including the material specification requirements. Carbon or alloy steel having a carbon content of more than 0.35% (0.30% for ton tanks) shall not be welded unless permitted by the original code of construction. The "TR" Certificate Holder is responsible for verifying identification of existing materials from original data, drawings, or unit records and identification of the material to be installed.

S6.5 REPLACEMENT PARTS

a) Replacement parts that will be subject to internal or external pressure that consist of new material which may be formed to the required shape by spinning, forging, die forming, and on which no fabrication welding is performed shall be supplied as material. Such parts shall be marked with the material and part identification and the name or trademark of the parts manufactured. In lieu of full identification marking on the material or part, the part manufacturer may use a coded marking system traceable to the original marking. Such markings shall be considered as the part manufacturer's certification that the part complies with the original code of construction. Examples include seamless or welded tube or pipe, forged nozzles, heads or subassemblies attached mechanically.

b) Replacement parts that will be subject to internal or external pressure, that are preassembled by attachment welds, shall have the welding performed in accordance with the original code of construction. This certificate shall be supplied in the form of a bill of material or drawings with statement of certification.

c) Replacement parts subject to internal or external pressure fabricated by welding that require shop inspection by an Authorized Inspector shall be fabricated by an organization having an appropriate ASME *Certificate of Authorization*. The item shall be inspected and stamped as required by the applicable section of the ASME Code and DOT specification requirements. A completed ASME *Manufacturer's Partial Data Report* shall be supplied by the manufacturer.

d) When the original code of construction is other than ASME, replacement parts subject to internal or external pressure fabricated by welding shall be manufactured by an organization certified as required by the original code of construction. The item shall be inspected and stamped as required by the original code of construction. Certification to the original code of construction as required by the original code of construction or equivalent shall be supplied with the item. When this is not possible or practicable the organization fabricating the part may have a National Board *Certificate of Authorization*. Replacement parts shall be documented on Form TR-1 and the "TR" Stamp applied as described in NBIC Part 3, S6.14.

S6.6 AUTHORIZATION

The Inspector's written authorization to perform a repair, alteration, or modification shall be obtained prior to initiation of the repair or modification to a transport tank .

S6.7 INSPECTION

Inspection and certification shall be made by an Inspector employed by one of the following:

a) An organization authorized and recognized by the Competent Authority.

b) The Authorized Inspection Agency of the "TR" Certificate Holder making the repair or modification.

S6.7.1 INSPECTOR DUTIES FOR REPAIRS, ALTERATIONS, AND MODIFICATIONS

a) Repair Organizations that possess the National Board "TR" *Certificate of Authorization* and DOT's Cargo Tank Registration (CTR) number when applicable shall use inspection services of a Registered Inspector while performing repairs, or Modifications of Transport Tanks. The Registered Inspector must have satisfied the following requirements:

   1) Has satisfied DOT requirements as a Registered Inspector.

   2) Has successfully completed the National Board's Web-based training program for Registered Inspectors and has been issued a National Board *Certificate of Completion*.

   3) Has received authorization from DOT as a Registered Inspector.

   4) Has been registered by DOT for the Classification(s) of Transport Tanks to be inspected.

b) Inspectors performing repair or modification inspections under the requirements of this Supplement shall satisfy the requirements of S6.7.1 to be authorized to sign the Form TR-1, *Repairs or Modifications* and Form TR-2, *Supplemental Form*.

c) For repairs and modifications of transport tanks, the duties of the Registered Inspector are detailed in Part 2, S6.10 through S6.15, as required by the Competent Authority.

d) In addition, the duties of the Registered Inspector are summarized below:

1) Verify the organization performing the repair or modification activity is properly accredited and in possession of a current *Certificate of Authorization* to apply the "TR" Stamp issued by the National Board and is working to an approved Quality Control System;

2) Verify that the design, if required, for the modification of the vessel is approved by a Design Certifying Engineer, or Designated Approval Agency or other applicable individual;

3) Verify the materials to be used to make the repair or modification are approved for use and comply with applicable Code requirements;

4) Verify the welding procedures and welders or welding operators are properly qualified;

5) Verify that all heat treatments, if required, including PWHT have been performed in accordance with the applicable standards and that the results are acceptable;

6) Verify that all NDE, impact tests, and other tests have been performed when required, and that the results are acceptable;

7) Make a visual inspection of the work performed to confirm there are no visible defects or deviations from Code requirements;

8) Perform external and internal visual inspections, if the vessel is equipped with a manway, and witness the hydrostatic or pneumatic pressure test and/or leak tightness test when they are required;

9) Verify the correct nameplate is properly attached to the vessel and that the current test and inspection markings are properly attached and displayed on the proper vessel;

10) Sign the Form TR-1 and, as appropriate, form TR-2.

S6.8 WELDING

a) Welding shall be performed in accordance with the requirements of the original code of construction used for the fabrication of the pressure vessel. For hydrogen control when low alloy steel filler metals are used, the filler metal classification shall include an H4 supplemental diffusible hydrogen designator (maximum 4 ml [H2]/100 g deposited metal) for each of the following:

1) electrodes for shielded metal arc welding conforming to SFA-5.5;

2) electrodes and fluxes for submerged arc welding conforming to SFA-5.26;

3) electrodes and rods for gas shielded metal arc welding conforming to SFA-5.28;

4) electrodes for flux-cored arc welding conforming to SFA 5.29.

b) Practices used for controlling storage and exposure of filler metals shall be those developed by the "TR" Certificate Holder or those recommended by the filler metal manufacturer.

S6.8.1 WELDING PROCEDURE SPECIFICATION

Welding shall be performed in accordance with a Welding Procedure Specification (WPS) qualified in accordance with the original code of construction. When this is not possible or practicable, the WPS may be qualified in accordance with ASME Section IX.

S6.8.2 STANDARD WELDING PROCEDURE SPECIFICATIONS

A "TR" Certificate Holder may use one or more applicable *Standard Welding Procedure Specifications* shown in NBIC Part 3, 2.3 without supporting *Procedure Qualification Records* (PQRs) since SWPS are pre-qualified and the PQR will not be supplied.

S6.8.3 PERFORMANCE QUALIFICATION

Welders or welding operators shall be qualified for the welding processes that are used. Such qualification shall be in accordance with the requirements of the original code of construction or ASME Section IX. Use of Standard Welding Procedures Specification shown in NBIC Part 3, 2.3 is permitted for performance qualification testing.

S6.8.4 WELDING RECORDS

The "TR" Certificate Holder shall maintain a record of the results obtained in welding procedure qualification, except for those qualifications for which the provisions of NBIC Part 3, S6.8.2 are used and of the results obtained in welding performance qualifications. These records shall be certified by the "TR" Certificate Holder and shall be available to the inspector.

S6.8.5 WELDERS' IDENTIFICATION

The "TR" Certificate Holder shall establish a system for the assignment of a unique identification mark to each welder/welding operator qualified in accordance with the requirements of the NBIC. The "TR" Certificate Holder shall also establish a written procedure whereby all welded joints can be identified as to the welder or welding operator who made them. This procedure shall use one or more of the following methods and be acceptable to the Inspector. The welder's or welding operator's identification mark may be stamped (low stress stamp) adjacent to all welded joints made by the individual or, in lieu of stamping, the "TR" Certificate Holder may keep a record of the welded joints and the welders or welding operators used in making the joint.

S6.8.6 WELDERS' CONTINUITY

The performance qualification of a welder or welding operator shall be affected when one of the following conditions occurs:

a) When the welder or welding operator has not welded using a specific process during a period of six months or more, their qualifications for that process shall expire;

b) When there is specific reason to question their ability to make welds that meet the specification, the qualification which supports the welding that is being performed shall be revoked. All other qualifications not questioned remain in effect.

S6.9 HEAT TREATMENT

S6.9.1 PREHEATING

Preheating may be employed during welding to assist in completion of the welded joint (see NBIC Part 3, 2.5.1). The need for and the temperature of preheat are dependent on a number of factors such as chemical analysis, degree of restraint of the items being joined, material thickness, and mechanical properties of the base metals being joined. The Welding Procedure Specification for the material being welded shall specify the preheat temperature requirements.

S6.9.2 POSTWELD HEAT TREATMENT

Postweld heat treatment may be performed as required by the original code of construction in accordance with a written procedure. The procedure shall contain the parameters for postweld heat treatment. Local PWHT that is not specified by the original code of construction may be performed in accordance with an Alternative Postweld Heat Treatment Method described in NBIC Part 3, 2.5.3 with acceptance by the Inspector and required by the Competent Authority.

S6.9.3 ALTERNATIVES TO POSTWELD HEAT TREATMENT

a) Under certain conditions, postweld heat treatment in accordance with the original code of construction may be inadvisable or impractical. In such instances, alternative methods of postweld heat treatment or special welding methods acceptable to the Inspector and Competent Authority may be used.

b) When the standard governing the original construction is the Code of Federal regulation for DOT/MC 331 cargo tanks for propane, butane, anhydrous ammonia, and other DOT permitted commodities, and the tanks are made to the ASME Code, Section VIII, Division 1, Part UHT, repairs, alterations, or modifications shall conform insofar as possible, to the edition of the construction standard or specification most applicable to the work. Where this is not possible or practicable, it is permissible to use other codes, standards, or specifications provided the “TR” Certificate Holder has the concurrence of the DOT. Shells and heads of MC 331 cargo tanks were made from quenched and tempered alloy steel plate, SA517, Grade E (originally Code Case 1298) and Grade F (originally Code Case 1204) prior to 1994.

c) The 1994 ASME Code Addenda revised UHT-5(b) to permit the joining of UHT materials to UCS or UHA materials in head and shell sections. Propane, butane, and anhydrous ammonia are the most common transported commodities and the shipper is required by DOT to comply with certain composition limitations. Propane and butane transported must have sufficiently low hydrogen sulfide content so as not to exceed the limitations for Classification One of the ASTM D1838-74 copper strip test, and the anhydrous ammonia transported must be inhibited with a minimum water content of 0.2% by weight. In addition, such cargo tanks made for propane, butane, and anhydrous ammonia service must be postweld heat treated, unless specifically exempted by a DOT special permit that exempts PWHT.

S6.10 NONDESTRUCTIVE EXAMINATION

a) The nondestructive examination (NDE) requirements, including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction used for the pressure vessel, and repairs, alterations, and modifications shall be subjected to the same nondestructive examination requirements as the original welds. Where this is not possible or

practicable, alternative NDE methods acceptable to the Inspector and the Competent Authority may be used on a case-by-case basis.

b) NDE personnel shall be qualified and certified in accordance with the requirements of the original code of construction. When this is not possible or practicable, NDE personnel may be qualified and certified in accordance with their employer's written practice. ASNT SNT-TC-1A, *Recommended Practice for Nondestructive Testing Personnel Qualification and Certification*, or ACCP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel*, may be used to fulfill the examination and demonstration requirements of SNT-TC-1A and the employer's written practice. Provisions for qualification and certification of NDE personnel shall be described in the "TR" Certificate Holder's written quality system.

S6.11 COATINGS AND LININGS

When coatings or linings are to be inspected, such inspections shall be done in accordance with the Structural Steel Painting Council, SSPC publication, No. 91-12, *Coating and Lining Inspection Manual*.

S6.12 MEASUREMENT, EXAMINATION, AND TEST EQUIPMENT

There shall be a system for calibration of pressure gages, measurement, examination, and test equipment. This system shall be documented.

S6.13 ACCEPTANCE INSPECTION

The Inspector making the acceptance inspection shall be the same Inspector who authorized the repairs, alterations, or modifications. Where this is not possible or practical, another Inspector may perform the acceptance inspection; however, in all cases, the Inspector who performs the acceptance inspection shall be an employee of the same organization as the Inspector who authorized the repairs, alterations, or modifications.

S6.14 STAMPING

The stamping of or attaching of a nameplate to a pressure-retaining item shall indicate that the work was performed in accordance with the requirements of this Code and any requirements of the Competent Authority. Such stamping or attaching of a nameplate shall be done only with the knowledge and authorization of the Inspector and Competent Authority. The "TR" Certificate Holder responsible for the repair or the construction portion of the modification/alteration shall apply the stamping. For a re-rating where no physical changes are made to the pressure-retaining item, the "TR" Certificate Holder responsible for the design shall apply the stamping. Requirements for stamping and nameplate information are shown in NBIC Part 3, Section 5.

S6.14.1 REMOVAL OF ORIGINAL STAMPING OR NAMEPLATE

If it becomes necessary to remove the original stamping, the Inspector shall, subject to the approval of the Competent Authority, witness the making of a facsimile of the stamping, the obliteration of the old stamping, and the transfer of the stamping. When the stamping is on a nameplate, the Inspector shall witness the transfer of the nameplate to the new location. Any relocation shall be described on the applicable NBIC "TR" Form. The restamping or replacement of a code symbol stamp shall be performed only as permitted by the governing code of construction.

S6.15 "TR" FORMS

S6.15.1 REGISTRATION OF "TR" FORMS

Organizations performing repairs, alterations, or modifications under the "TR" program must register such repairs, alterations, or modifications with the National Board.

S6.15.2 "TR" FORMS LOG

The "TR" Certificate Holder shall maintain a single, sequential log of "TR"; form numbers assigned for NBIC forms (i.e., TR-1) that are registered with the National Board.

S6.16 ADDITIONAL REQUIREMENTS FOR REPAIRS, ALTERATIONS, OR MODIFICATIONS

S6.16.1 SCOPE

This section provides additional requirements for repairs, alterations, or modifications to DOT Transport Tank pressure-retaining items and shall be used in conjunction with NBIC Part 3.

S6.16.2 REPAIRS OF DEFECTS

Before a repair is made to a defect in a welded joint or base metal, care should be taken to investigate its cause and to determine its extent and likelihood of recurrence. This information shall be made available to the Inspector.

S6.16.3 MODIFICATIONS

All modifications to the pressure-retaining item shall meet the requirements of NBIC Part 3, Section 6.

S6.16.4 DRAWINGS

Drawings or instructions shall be prepared to describe the repair, alterations, or modification. Drawings shall include sufficient information to satisfactorily perform the activity.

S6.16.5 AUTHORIZATION

Repairs, alterations, or modifications to a pressure-retaining item shall not be initiated without the authorization of the Inspector, who shall determine that the repair methods are acceptable and subject to acceptance of the Competent Authority.

S6.17 EXAMINATION AND TEST

The following requirements shall apply to all repairs, alterations, or modifications to DOT Transport Tank pressure-retaining items:

a) The integrity of repairs and replacement parts used in repairs, alterations, or modifications shall be verified by examination and test;

b) The "TR" Certificate Holder is responsible for all activities relating to examination and test of repair, alterations, or modifications;

c) Examination and tests to be used shall be subject to acceptance of the Inspector and the Competent Authority.

S6.17.1 METHODS

One, or a combination of the following examination and methods, shall be applied to DOT Transport Tank pressure retaining itmes with the concurrence of the Inspector and the Competent Authority.

a) Liquid Pressure Test
Pressure testing of repairs shall meet the following requirements:

1) Pressure tests shall be conducted using water or other suitable liquid. The test pressure shall be the minimum required to verify the leak tightness integrity of the repair, but not more than 150% of the maximum allowable working pressure (MAWP) stamped on the pressure-retaining item, as adjusted for temperature. When original test pressure included consideration of corrosion allowance, the test pressure may be further adjusted based on the remaining corrosion allowance;

2) During a pressure test where the test pressure will exceed 90% of the set pressure of the pressure relief device, the device shall be removed whenever possible. If not possible, a test gag should be used using the valve manufacturer's instructions and recommendations;

3) Hold time for the pressure test shall be a minimum of 10 minutes prior to examination by the Inspector. Where the test pressure exceeds the MAWP of the item, the test pressure shall be reduced to the MAWP for close examination by the Inspector. Hold time for close examination shall be as necessary for the Inspector to conduct the examination;

b) Pneumatic Test
A pneumatic test may be conducted. Concurrence of the owner shall be obtained in addition to that of the Inspector and the Competent Authority where required. The test pressure shall be the minimum required to verify leak tightness integrity of the repair, but shall not exceed the maximum pneumatic test pressure of the original code of construction. Precautionary requirements of the original code of construction shall be followed;

c) Nondestructive Examination
Nondestructive examination (NDE) may be conducted. NDE methods shall be suitable for providing meaningful results to verify the integrity of the repair.

S6.17.2 STAMPING

DOT Transport Tanks repaired in accordance with the NBIC shall be stamped as required by NBIC Part 3, Section 5.

S6.17.3 DOCUMENTATION

Repairs, alterations, or modifications that have been performed in accordance with the NBIC shall be documented on Form TR-1, *Report of Repair, Alteration, or Modification*, as shown in NBIC Part 3, Section 5. Form TR-2, *Report Supplementary Sheet*, shall be used to record additional data when space is insufficient on Form TR-1.

S6.18 PREPARATION OF "TR" FORMS

Preparation of "TR" Forms shall be the responsibility of the "TR" Certificate Holder performing the repairs, alterations, or modifications. An Inspector shall indicate acceptance by signing the appropriate "TR" form.

S6.18.1 DISTRIBUTION

a) Legible copies of the completed Form TR-1 together with attachments shall be distributed to the owner or user, the Inspector, and the Competent Authority, as required, and the Authorized Inspection Agency responsible for the inspection.

b) Distribution of the Form TR-1 and attachments shall be the responsibility of the organization performing the repair.

S6.18.2 REGISTRATION

Forms, TR-1 and TR-2 shall be registered with the National Board.

S6.19 REPAIRS, ALTERATIONS, OR MODIFICATION REPORTS

a) If repairs, alterations, or modifications are performed on a Transport Tank, i.e., cargo tank, portable tank, or ton tank, the Owner or User shall have the activity performed by a Repair Organization that has a valid "TR" *Certificate of Authorization* issued by the National Board.

b) The repair, alteration, or modification shall be recorded on the Form TR-1. If additional space is needed to properly record the repair, alteration, or modification, Form TR-2 shall be used.

c) It is the responsibility of the "TR" Symbol Stamp Holder to prepare, distribute, and maintain the Form TR-1 and, if required, Form TR-2. The Form(s) shall be distributed as follows:

    1) Owner-User;

    2) Registered Inspector;

    3) Competent Authority (DOT); and

    4) National Board.

d) The Form TR-1 shall be signed by a Registered Inspector as defined in NBIC Part 3, S6.7.1.

S6.19.1 REGISTRATION OF FORM TR-1 AND FORM TR-2

a) It is required by DOT that the Form TR-1 and, if applicable, Form TR-2 be registered with the National Board.

b) The repair organization shall maintain a sequential Form "TR" Log that shall identify the following:

1) Form number assigned for Form TR-1;

2) Identify if the activity was a repair, alteration, or modification; and

3) Date sent to the National Board.

S6.19.2 GENERAL REQUIREMENTS "TR" STAMPING AND NAMEPLATES

The holder of a "TR" *Certificate of Authorization* is required to affix a stamping or nameplate on the Transport Tank that indicates, as appropriate, that the repair, alteration, or modification has been performed in accordance with the requirements of NBIC Part 3, Supplement 6 and the additional requirements of the code of construction. The stamping or nameplate information shall satisfy the requirements of (a) thru (g) below:

a) The required data shall be in characters at least 4 mm (5/32 in.) high;

b) The markings may be produced by casting, etching, embossing, debossing, stamping, or engraving;

c) The selected method shall not result in any harmful contamination or sharp discontinuities to the pressure-retaining boundary of the Transport Tank;

d) Stamping directly on the Transport Tank, when used, shall be done with blunt-nose continuous or blunt-nose interrupted dot die stamps. If direct stamping would be detrimental to the item, required markings may appear on a nameplate affixed to the Transport Tank;

e) The "TR" Certificate Holder shall use its full name as shown on the *Certificate of Authorization* or an abbreviation acceptable to the National Board;

f) The stamping, when directly on the item or when a nameplate is used shall be applied adjacent to the original manufacturer's stamping or nameplate. A single repair, alteration, or modification stamping or nameplate may be used for more than one repair to a Transport Tank, provided the repair, alteration, or modification activity is carried out by the same certificate holder;

g) The date of each repair, alteration, or modification corresponding with the date on the Form TR-1 shall be stamped on the nameplate.

S6.19.3 STAMPING OF THE "TR" SYMBOL

All repairs, alterations, and modifications, after acceptance by the Registered Inspector, shall have the "TR" Symbol affixed to the stamping or the nameplate.