

MC 331: High Pressure Cargo Tank

Training Objectives

This training session will provide the participant with a brief overview of the regulatory requirements for the MC 331 cargo tank as it pertains to the operator, roadside and registered inspector. The following areas will be discussed:

- #1 Communication requirements for transporting HM in an MC331 cargo tank
- #2 Certification plate(s) for required information and proper placement
- #3 Periodic cargo tank test and inspection requirements, test date and other markings.
- #4 Cargo Tank integrity and securment
- #5 Piping, valving and piping protection
- #6 Emergency Control Equipment and Operating Procedures
- #7 Venting, manhole closures, and accident damage protection
- #8 Discharge system and inspection and maintenance program for cargo tanks transporting liquefied compressed gases
- #9 Reporting and record retention

MC 331 Overview: High Pressure Cargo Tanks

High Pressure Tanks

High pressure product handling systems are constant pressure closed loops. Loading is done by a transfer of liquid from storage facilities to the cargo tank. Unloading is done with an on-board pump, generally shaft-driven from the vehicle transmission power takeoff (PTO).

In addition to the liquid line, a vapor line is attached between the two units to equalize pressure in the tank and storage vessel. This vapor line extends internally into the vapor space of the tank.

During the loading of the high pressure cargo tank, the liquid product is pumped into the tank through the discharge line or, more commonly through the liquid load line, usually located on the end of the tank. This line is usually attached to a "spray bar". The spray bar is a pipe, internal to the tank that extends into the vapor space allowing product to be sprayed into the tank, similar to a soaker hose. This spraying cools the product and reduces pressure.

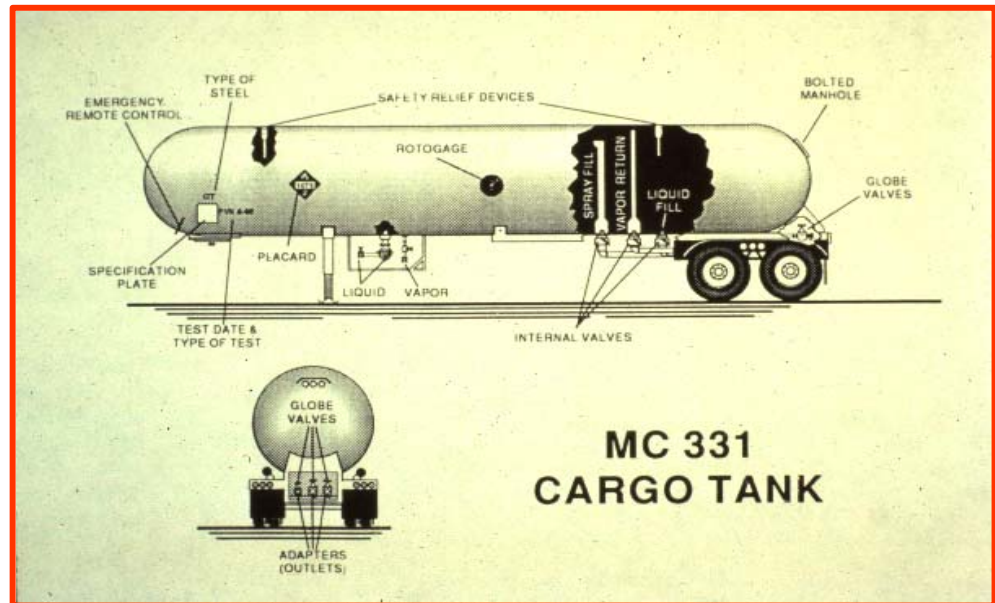
The high pressure tank is usually unloaded by a Power Take Off or PTO-powered pump located just below the internal valve.

High pressure cargo tanks are used to carry compressed gases. These tanks are manufactured to ASME Code and are designed to operate between 100 PSIG and 500 PSIG. These tanks operate under pressure at all times. Steel and aluminum construction are allowed, but aluminum tanks are quite rare.

Gases are compressed to reduce volume, in some cases as much as 600 to 1, allowing more product to fit into the cargo tank. When compressed, most gases cool and liquefy. The tank has a mixture of vapor and liquid at all times. The most common compressed gases transported are liquefied petroleum gases (Propane), anhydrous ammonia, chlorine, and carbon dioxide.

These tanks are under pressure at all times unless they are completely emptied, opened for inspection or testing. The hazard potential of these tanks is very high, so safe operation is a priority.

Most of these tanks are recognizable because of the circular cross-section. Below is a picture of a MC 331 cargo tank.



Not all MC 330/331 cargo tanks have manholes or inspection openings.

1 – Communication requirements - 49 CFR 172.200/300/400/500

Safety

As always, the first thing to be considered is safety. This is true throughout the entire inspection process whether it is conducted by the operator, roadside inspector or registered inspector.

The transportation of Hazardous Materials in cargo tanks requires a check of the DOT communication requirements. These requirements are contained in 49 CFR Part 172 of the HM Regulations. These items should be checked by the driver and roadside inspector and as applicable by the cargo tank facility during the periodic inspection procedures.

If the tank contains a hazardous material begin with checking the shipping papers.

- Check for Proper Shipping Name, Hazard Class, ID Number, and Packing Group as required, additional descriptions as required in Part 172, Subpart C and emergency response information.
- Verify the package is authorized by checking Column 8C of the HMT for Bulk Packages
Ammonia, anhydrous, 2.2, UN1005 – 173.315
Liquefied petroleum gas, 2.1, UN1075 – 173.315
- Check Column 7 of the HMT for any applicable Special Provisions
Ammonia, anhydrous, 2.2, UN1005 – SP 13
- Verify the vehicle is displaying the correct placards as required Part 172; Subpart F. Placards displayed indicate the presence of hazardous materials and should be a serious consideration when entering a facility or building.
- Verify the vehicle is displaying the correct ID numbers.
- Check for required additional markings:
- Proper Shipping Name for compressed gases
- QT or NQT Markings
- Remote shut-off markings
- Non-Odorized

Other Markings

Markings required by the specification will be discussed later

2 - Certification Plates - 49 CFR178.337-17

The identification plates on MC 331 cargo tank should be checked during the roadside inspection or at a cargo tank facility for proper mounting and required information. The nameplate and specification plate(s) contain information that must be documented and verified during the cargo tank periodic inspection process. The operator should ensure the plate(s) are present and appropriately attached.

Mounting

The certification plate is required to be:

- Prior to 10/1/04, permanently affixed to the cargo tank shell or its supporting structure (by means of brazing, or welding around it's perimeter. After 10/1/04 must have a corrosion-resistant metal name plate (ASME Plate) and specification plate permanently attached to the cargo tank by brazing, welding or other suitable means

- AND -

- near the front of the tank

- AND -

- readily accessible for inspection

Location

The certification plate must be mounted near the front of the tank on the tank shell.

IF:	THEN:
The cargo tank was built <u>before</u> July, 1985	The certification plate will be mounted on the <u>right</u> side of the tank
The cargo tank was built <u>after</u> July, 1985	The certification plate will be mounted on the <u>left</u> side of the tank

2 - Certification Plates (cont.) - 49 CFR178.337-17

<i>Required Information</i>	DOT requires certain information on the plate(s) as noted below.. The plate(s) must be legibly marked by stamping, embossing, or other means of forming letters into the metal of the plate. Key pieces of information are explained below,
<i>Tank Manufacturer</i>	Cargo tank manufacturers certify that the tanks they build comply with the regulatory specifications by placing a unique certification plate on each MC 331 cargo tank. MC 331 manufacturers are required to be registered with the US DOT FMCSA as a manufacturer and hold an ASME U stamp to manufacture the tank. To “repair” the tank the facility must hold a National Board of Boiler Inspectors “R” stamp.
<i>Specification Identification</i>	The specification identification number indicates to what specifications the tank was constructed (e.g., MC 331 etc.). This information is used to determine the specific regulations that apply. Always verify that the specification identification appears on the certification plate.
<i>Original Test Date</i>	The date that the cargo tank first passed required tests must be present on the certification plate, including either the month/date/year or the month/year. This information may be used later to verify compliance with testing regulations.
<i>Vessel Material Specification Number</i>	<p>The vessel material specification number is an indication of the type of metal the vessel is made of. For example, the most common vessel material specification number is “SA202B” which indicates high Tensile Strength, Lightweight Metal.</p> <p><i>Quenched and Tempered Steel Construction</i> can be identified on cargo tanks manufactured with “SA-517” material - (with a letter designation listed after it, or 1204 or 1208 with a letter designation after it) 1204 and 1208 were numbers given to SA-517 material during the approval period by the ASME. Most MC331 semi trailer transports are made of Quenched and Tempered Steel. (QT)</p>

2 - Certification Plates (cont.) - 49 CFR178.337-17

For MC 331 Cargo Tanks manufactured after October 1, 2004

Name Plate	Specification Plate
DOT Specification Number Original Test Date MAWP in PSIG Design Temperature Nominal Water Capacity in Pounds Lading pounds per gallon Mat'l Specification number Minimum Thickness Shell Minimum Thickness Head Manufactured Thickness Shell Manufactured Thickness Head Exposed Surface area (Sq Ft)	CTMV Manufacture CTMV certification date Cargo Tank Manufacture CT date of Manufacture Max weight of lading (pounds) Lining Materials, if applicable Heating System design pressure Heading system design temperature Cargo Tank Serial Number (Manufacturer)

ASME Required Information

MC 331 tanks are built to ASME Code. In addition to the identification plate information, these tanks are required to display information required by ASME. This information may be displayed on a separate plate or on a combined ASME/DOT plate. The plate(s) must contain at least the information required by the DOT and the ASME Code requirements.

Additional entries required by the ASME Code include the following:

- Year of manufacture
- Design pressure
- Water capacity (in gallons)
- The official U Code symbol

Official U Code symbol indicates that the cargo tank was manufactured by an ASME manufacturer.

3 - Periodic test and inspection requirements, test dates and markings

49 CFR 178.337-16, 180.407, 180.415

Location, Size, and Clarity Each cargo tank must be durably and legibly marked, in English, with the date (month and year) and the type of test or inspection performed. The markings must be in letters and numbers at least 32 mm (1.25 inches) high, near the specification plate or anywhere on the front head.

The table below identifies the six tests that potentially could be conducted, their associated symbol, and the maximum interval period allowed before periodic retesting is necessary for the MC 331.

Test or Inspection	Symbol	Interval
External Visual Inspection	V	1 year
Internal Visual Inspection	I	5 years
Lining Inspection	L	1 year
Leakage Test	K	1 year*
Pressure Test	P	5 years**
Thickness Test	T	2 years

* MC 331 in chlorine service must be leakage tested a least every two years.

** MC 331 in chlorine service must be pressure tested every two years.

**Pressure testing is not required for MC 330 and MC 331 cargo tanks in dedicated sodium metal service.

Insulated MC 331 with manholes or inspection openings:

You may perform either an internal visual inspection in conjunction with the external visual inspection or a hydrostatic or pneumatic pressure-test of the cargo tank on insulated cargo tanks equipped with manholes or inspection openings.

4 - Cargo Tank Integrity and Securement – 49 CFR 178.337-3, 178.337-13, 180.411

When performing a driver vehicle, roadside or external visual inspection for cargo tank integrity, the following items should be checked on the MC 331:

- Supports
- Anchors
- Shell and Head Integrity

Anchors

Truck-mounted cargo tanks are anchored to the truck frame by securing devices. Anchoring is accomplished by bolting or clamping the tank to the frame. Anchors, stops, or other means must prevent relative motion between the tank and vehicle chassis.

When performing an inspection of cargo tank integrity, verify that anchoring is intact, tight, and shows no sign of damage or corrosion.

Supports

MC 331 cargo tanks have cradles to support the tank. Cradles are also used to prevent welding directly to the tank. These cradles are normally constructed of the same material as the tank and provide a buffer between the tank and the support.

When inspecting supports, check that they look sound. Look for signs of poor weld integrity (e.g., weld cracks or corrosion) indicating problems.

Shell and Head Integrity

The shell and heads should be checked for corrosion, dents, or distortion. The same criteria apply to MC 331 cargo tanks as for any cargo tank. Inspecting dents is not a simple task. *Part 180.411, Acceptable Results of Tests and Inspections*, for cargo tanks, indicates that *Dents, cuts, digs and gouges*. For evaluation procedures, see CGA C-6 . For dents at welds or that include a weld, the maximum allowable depth is $\frac{1}{2}$ inch. For dents away from welds, the maximum allowable depth is $\frac{1}{10}$ of the greatest dimension of the dent, but in no case may the depth exceed one inch.

internal visual inspection. They should be mounted to pads during the manufacturing process.

5 - Piping, Valving and Piping Protection – 178.337-8, 178.337-9, 178.337-10

MC 331 Piping

Piping is used to connect the cargo tank to the loading or unloading facility. The product is loaded into, or unloaded from the cargo tank through the piping. A thorough inspection of the piping and the protection is conducted during the periodic inspection and test process and during the roadside inspection. The operator and roadside inspector are checking the piping for:

- Leakage
 - Protection
-

General Requirements

There are two types of openings: Inlets and Outlets

- Openings that allow the product to flow either into or out of the tank (outlets)
- Openings that allow the product to flow only into the tank (inlets)

Each opening on MC 331 cargo tanks transporting compressed gases (except carbon dioxide refrigerated liquid) must be closed with a(n):

- plug, cap, or bolted flange
- OR -
- excess flow valves on discharge openings or check valves on inlet openings
- OR -
- internal self-closing stop valve

The regulatory standards reference several valves, internal and others. It is necessary to be familiar with each and understand their basic function. Valves that may be required on MC 331 tanks are:

- Internal Self-Closing Stop-Valve (Internal Valves)
- Excess Flow Valve

- Check Valve (Back Flow Check)
- Manual Stop Valve

5 - Piping, Valving and Piping Protection (Cont) – 178.337-8, 178.337-9, 178.337-10

The valves also provide a factor of safety and are required to "seat" inside the tank and must incorporate a "shear section" in the attachments to the valve.

The specific valve requirements are determined by the product carried.

For example:

If a MC 331 is transporting anhydrous ammonia, an internal self-closing stop-valve is required. If the MC 331 is transporting carbon dioxide, the tank is **not** required to have internal valves. {178.337-8(c)}

Internal Valves

Liquid

The liquid internal valve (self-closing stop valve) is usually from 3 to 5 inches in diameter and used in the loading and unloading process. The valve controls the flow of the liquid and the valve seat is located inside the tank.

An integral part of the valve is the excess flow feature. This spring activated feature monitors the flow of the product through the valve with a preset flow rate. The liquid valve is required to be equipped with an excess flow feature so that in the event of a hose rupture or piping break, the excess flow feature will stop the flow of product through the valve. This valve is normally cable operated but may be hydraulic or air operated.

Vapor

The vapor internal valve (self-closing stop valve) is similar to the liquid internal valve with the exception of size. This valve is from 2 to 3 inches in diameter. The valve communicates with the vapor space of the tank by use of an upright pipe attached to the valve inside the tank and controls the flow of vapor into and out of the tank. It is required to be equipped with an excess flow feature and is typically cable operated.

Excess Flow Valve

Excess flow valves are spring activated valves designed to monitor the flow of product at a preset flow rate. There is a flow rating on the excess flow valve that identifies the maximum flow rate for the valve. This flow rating is indicated in GPM (gallons per minute). It is based on the style of pump (if any), number of angles in the piping, as well as size of piping and hose.

5 - Piping, Valving and Piping Protection (Cont) – 178.337-8, 178.337-9, 178.337-10

Check Valve

Check valves or back flow check valves allow product to travel in only one direction, into the tank. These valves by outward appearance resemble pipe fittings; however, the seat is located inside the tank. These valves can be identified by an arrow which indicates the direction of flow.

Manual Stop Valve

Manual stop valves are required on each filling and discharge line. These are typically globe or ball valves located near the hose connection point. These valves are designed to provide an additional positive shut-off in the liquid and vapor lines and facilitate safe hose connecting.

Valve Requirements

Each internal valve and excess flow valve must:

- automatically close if any attachments shear off;
- AND -
- seat inside either the tank, welded flange, its companion flange, a nozzle or coupling;
- AND -
- be made of material not subject to corrosion from the lading;
- AND -
- close automatically at the rated flow of the product as specified by the manufacturer.

Operators:49 CFR 177

177.734(j) All valves and other closures in liquid discharge systems must closed and free of leaks.

177.840(g) Each liquid discharge valve on a cargo tank motor vehicle, other than an engine fuel line valve, must be closed during transportation except during loading and unloading.

Isolation valves may be in the open position during transportation.

5 - Piping, Valving and Piping Protection (Cont) – 178.337-8, 178.337-9, 178.337-10

Markings of Inlets & Outlets

All tank inlets and outlets, except safety relief devices, are marked to designate whether they "communicate" with vapor or liquid space of the tank when the tank is filled to its maximum allowable limit.

The markings are "VAPOR" for a vapor line and "LIQUID" for a liquid line. These are usually found on the piping near the valve, on the tank near the valve, or on the protection around the end of the fixed piping. A filling line that communicates with vapor may be marked "SPRAYFILL" instead of "VAPOR".

Product Specific Requirements

There are certain product specific inlet and outlet valving requirements for the MC 331 cargo tank. The table below summarizes some of the more common requirements for inlets and outlets when transporting specific HM.

HM Being Transported:	Inlet Valving Requirement	Outlet Valving Requirement
Liquefied Petroleum Gas Anhydrous Ammonia	<ul style="list-style-type: none"> • check valves • manual shutoff valves 	<ul style="list-style-type: none"> • internal self-closing stop-valves on all liquid and vapor lines • excessive flow valve • manual shutoff valves
Chlorine	<ul style="list-style-type: none"> • as prescribed by the Chlorine Institute, Inc. 	<ul style="list-style-type: none"> • as prescribed by the Chlorine Institute, Inc.
Carbon Dioxide, refrigerated liquid	<ul style="list-style-type: none"> • no requirements 	<ul style="list-style-type: none"> • required to have manual stop valves near the hose connection

5 - Piping, Valving and Piping Protection (Cont) – 178.337-8, 178.337-9, 178.337-10

Exceptions to Valving Requirements

There are instances when the valving requirements are excepted. Pipe lines of 1.25 inches or less are allowable exceptions. The table below summarizes this valving requirement exception for vapor and liquid discharge openings.

Line Size (NPT*):	No Internal Valve Required If Protected By:
Less than 1.25"	Excess flow valve and a manually operated external self-closing stop valve.
0.75" (For example, the engine fuel line on a truck mounted tank.)	Excess flow valve.

*NPT = National Pipe Thread. Shear NPT is measured in inside diameter.

External Visual Inspection: 180.407(g)

During the external visual inspection the piping, valves, and gaskets must be carefully inspected for corroded areas, defects in welds, and other conditions, including leakage, that might render the tank unsafe for transportation service

Leakage Test: 180.407(h)

During the leakage test each cargo tank must be tested for leaks in accordance with Part 180.407(c). The leakage test must include testing 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. All internal or external self-closing stop valves must be tested for leak tightness. Each cargo tank of a multi-cargo tank motor vehicle must be tested with adjacent cargo tanks empty and at atmospheric pressure. Test pressure must be maintained for at least 5 minutes. Cargo tanks in liquefied compressed gas service must be externally inspected for leaks during the leakage test. Suitable safeguards must be provided to protect personnel should a failure occur. Cargo tanks may be leakage tested with hazardous materials contained in the cargo tank during the test.

Registered Inspectors of specification MC 330 and MC 331 cargo tanks, and nonspecification cargo tanks authorized under [§173.315\(k\)](#) of this subchapter must visually inspect the delivery hose assembly and piping system while the assembly is under leakage test pressure utilizing the rejection criteria listed in [§180.416\(g\)](#). Delivery hose assemblies not permanently attached to the cargo tank motor vehicle may be inspected separately from the cargo tank motor vehicle. In addition to a

written record of the inspection prepared in accordance with [§180.417\(b\)](#), the Registered Inspector conducting the test must note the hose identification number, the date of the test, and the condition of the hose assembly and piping system tested.

5 - Piping, Valving and Piping Protection (cont) – 178.337-8, 178.337-9, 178.337-10

Leakage test pressure must be no less than 80% of MAWP marked on the specification plate except as follows:

- A cargo tank with an MAWP of 690 kPa (100 psig) or more may be leakage tested at its maximum normal operating pressure provided it is in dedicated service or services; or
- An MC 330 or MC 331 cargo tank in dedicated liquefied petroleum gas service may be leakage tested at not less than 414 kPa (60 psig).
- An operator of a specification MC 330 or MC 331 cargo tank, and a non-specification cargo tank authorized under [§173.315\(k\)](#) of this subchapter, equipped with a meter may check leak tightness of the internal self-closing stop valve by conducting a meter creep test. (See [Appendix B](#) to this part.)
- An MC 330 or MC 331 cargo tank in dedicated service for anhydrous ammonia may be leakage tested at not less than 414 kPa (60 psig).
- A non-specification cargo tank required by [§173.8\(d\)](#) of this subchapter to be leakage tested, must be leakage tested at not less than 16.6 kPa (2.4 psig), or as specified in paragraph (h)(2) of this section.

Piping Protection

Fittings, valves, piping, etc. are protected against rollover or collision by shear sections and a metal device which may include any or all of the following: frame, rear bumper, control station deck or a cage.

Shear Section

All internal self-closing stop-valves, excess flow valves, and check valves located at outlets to the tank are protected so in the event of an accident, the piping will break away leaving the valve intact and retaining product. This is usually accomplished by cutting a groove around the valve body or by using shear bolts (bolts that are hollow or with reduced diameter to lessen strength) on bolted valves. This shear section is located outboard of the valve seat and is not always visible during an inspection.

Cage Protection

The regulations require that all piping and fittings be grouped and protected on MC 331 tanks. This area must be protected from damage that may be caused by collision with other vehicles, objects, or by jack-knifing, etc. It is normally protected by a device referred to as a "cage" which is constructed of 3 to 4 inch channel iron surrounding the area and is usually installed by the manufacturer.

The method of grouping and protection is different for the two common MC 331 tank motor vehicle designs, the Semi-Trailer and the Delivery Truck.

5 - Piping, Valving and Piping Protection (Cont) – 178.337-8, 178.337-9, 178.337-10

Cage Protection (cont.)

Semi-Trailer

The arrangement of piping and fittings on a semi-trailer transport is somewhat uniform. Two areas need protection:

- One is usually located near the center of the tank and includes a pump area with a 3-5 inch liquid internal valve, coupled to a PTO driven product pump and the necessary piping, manual shutoff valve and hose connection. Additionally in this area there will be a 2-3 inch vapor internal valve. This area is used for off-loading the product.
- A second area, called a loading station, may be located at the rear of the tank and is used for loading the tank. In this area there may be a 2-4 inch "spray fill" line, which actually communicates with the vapor space of the tank and may be equipped with an internal valve or check valve. This location may also have a 2-3 inch vapor line equipped with an internal valve. These valves may be located between the axles of the semi-trailer and piped to the rear where the controls are. In this case, the axles provide the required protection. A cage is also utilized to provide protection in this area.

Cage Protection (cont.)

Delivery Truck

The delivery truck is a truck mounted MC 331. Most often fittings and controls are located at the rear of the tank. It is simply a smaller version of the transport requiring similar protection of fittings.

A typical configuration would be the following:

- There will be a 3-4 inch internal valve located approximately in the bottom center of the tank. The PTO driven product pump is attached to the valve with necessary piping extending to the rear of the tank. The frame of the truck itself provides the protection of the fittings in this location.
- Generally, in the rear of the vehicle there is a 2-3 inch "spray fill" vapor line for loading and a vapor line for loading and unloading. The "spray fill" vapor line is

equipped with an internal or check valve. If the vapor line is larger than 1.25 inches, it is equipped with an internal valve. When a vapor line of 1.25 inches or less is utilized, a combination of an excess flow valve with a manual shut off may be utilized in place of an internal valve.

6 – Emergency Control Equipment & Operating Procedures – 173.315(n), 180.405(m), 180.416

Emergency Control Devices

There are three emergency control devices that must be inspected on the MC 331:

- Remote control shutoff
- Fusible devices
- Emergency discharge controls
 - Passive
 - Off Truck

Remote Control Shutoff & Fusible Devices

The table below summarizes the remote control shutoff and fusible device requirements for the MC 331.

On MC 331 cargo tanks, the requirements below apply to both liquid and vapor openings.

Tank capacity is:	Then:	Fusible Required?
Over 3500 gallons	The tank must be equipped with a remote means of automatic closure (mechanical and thermal) located on two diagonal ends of the tank. These closures are most often cable operated and should be examined to see the cable is not corroded and operates freely.	YES
3500 gallons or less	The tank must be equipped with a remote means of automatic closure (mechanical and thermal) located at the end of the tank furthest from the loading and unloading connections. These closures are generally cable operated. The thermal means of remote closure must be installed at or near the internal self-closing stop valve.	YES

Emergency discharge control:

Emergency Discharge Control means the ability to stop a cargo tank unloading operation in the event of an unintentional release. Emergency discharge control can utilize **passive or off-truck remote means** to stop the unloading operation. A **passive** means of emergency discharge control

automatically shuts off the flow of product without the need for human intervention within 20 seconds of an unintentional release caused by a complete separation of the liquid delivery hose. An **off-truck remote** means of emergency discharge control permits a qualified person attending the unloading operation to close the cargo tank's internal self-closing stop valve and shut off all motive and auxiliary power equipment at a distance from the cargo tank motor vehicle.

6 - Emergency Control Equipment & Operating Procedures (cont) – 49 CFR 173.315(n), 180.405(m), 180.416

. Emergency discharge control for cargo tank motor vehicles in liquefied compressed gas service

49 CFR 173.315(n)(1)(*)

Material	Delivery Service	Required Equipment
2.2, no subsidiary (except Anhydrous Ammonia)	All	None
2.3 Materials	All	Passive 173.315(n)(2)
2.2 Material with Subsidiary 2.1 Materials Anhydrous Ammonia	Other than Metered Delivery	Passive 173.315(n)(2)
2.2 Materials with Subsidiary 2.1 Materials Anhydrous Ammonia	Metered Delivery 3500 Gallons or Less	Off Truck Remote 173.315(n)(3)
2.2 Materials with Subsidiary 2.1 Materials Anhydrous Ammonia	Metered Delivery More than 3500 Gallons	Off Truck Remote 173.315(n)(3) and for obstructed deliveries 173.315(n)(2) or 173.315(n)(4) Query System

1. Each MC 331 certified 2 or more years after 7/1/99 must have one of the above systems.
2. Each MC 330, MC 331 or Non-Spec cargo tank must have one of the above systems no later than the date of its first scheduled pressure retest required after 7/1/01. All must be equipped by 7/1/06.
3. Each MC 330 and MC 331, 3500 gallons or more in metered delivery service must have one of the above systems no later than its first scheduled pressure retest after 7/1/01. All must be equipped by 7/1/03.

External Visual Inspection: 180.407(d)

During the External Visual Inspection the Registered Inspector will inspect all emergency devices and valves including self-closing stop-valves, excess flow valves and remote closure devices. These devices must be free from corrosion, distortion, erosion and any external damage that will prevent safe operation. Remote closure devices and self-closing stop valves must be functioned to demonstrate proper operation.

6 - Emergency Control Equipment & Operating Procedures (Cont) - Vehicle Operators: 49 CFR 177.840(l-t)

Operating procedure. Each operator of a cargo tank motor vehicle that is subject to the emergency discharge control requirements in [§173.315\(n\)](#) of this subchapter must carry on or within the cargo tank motor vehicle written emergency discharge control procedures for all delivery operations. The procedures must describe the cargo tank motor vehicle's emergency discharge control features and, for a passive shut-down capability, the parameters within which they are designed to function. The procedures must describe the process to be followed if a facility-provided hose is used for unloading when the cargo tank motor vehicle has a specially equipped delivery hose assembly to meet the requirements of [§173.315\(n\)\(2\)](#) of this subchapter.

Cargo tank motor vehicle safety check. Before unloading from a cargo tank motor vehicle containing a liquefied compressed gas, the qualified person performing the function must check those components of the discharge system, including delivery hose assemblies and piping, that are readily observed during the normal course of unloading to assure that they are of sound quality, without obvious defects detectable through visual observation and audio awareness, and that connections are secure. This check must be made after the pressure in the discharge system has reached at least equilibrium with the pressure in the cargo tank. Operators need not use instruments or take extraordinary actions to check components not readily visible. No operator may unload liquefied compressed gases from a cargo tank motor vehicle with a delivery hose assembly found to have any condition identified in [§180.416\(g\)\(1\)](#) of this subchapter or with piping systems found to have any condition identified in [§180.416\(g\)\(2\)](#) of this subchapter.

Emergency shut down. If there is an unintentional release of product to the environment during unloading of a liquefied compressed gas, the qualified person unloading the cargo tank motor vehicle must promptly shut the internal self-closing stop valve or other primary means of closure and shut down all motive and auxiliary power equipment.

Daily test of off-truck remote shut-off activation device. For a cargo tank motor vehicle equipped with an off-truck remote means to close the internal self-closing stop valve and shut off all motive and auxiliary power equipment, an operator must successfully test the activation device within 18 hours prior to the first delivery of each day. For a wireless transmitter/receiver, the person conducting the test must be at least 45.72 m (150 feet) from the cargo tank and may have the cargo tank in his line of sight.

Unloading procedures for liquefied petroleum gas and anhydrous ammonia in metered delivery service

An operator must use the following procedures for unloading liquefied petroleum gas or anhydrous ammonia from a cargo tank motor vehicle in metered delivery service:

For a cargo tank with a capacity of 13,247.5 L (3,500 water gallons) or less, excluding delivery hose and piping, the qualified person attending the unloading operation must remain within 45.72 meters (150 feet) of the cargo tank and 7.62 meters (25 feet) of the delivery hose and must observe both the

cargo tank and the receiving container at least once every five minutes when the internal self-closing stop valve is open during unloading operations that take more than five minutes to complete.

6 - Emergency Control Equipment & Operating Procedures (Cont) - Vehicle Operators: 49 CFR 177.840(l-t)

For a cargo tank with a capacity greater than 13,247.5 L (3,500 water gallons), excluding delivery hose and piping, the qualified person attending the unloading operation must remain within 45.72 m (150 feet) of the cargo tank and 7.62 m (25 feet) of the delivery hose when the internal self-closing stop valve is open.

Except as provided in paragraph below, the qualified person attending the unloading operation must have an unobstructed view of the cargo tank and delivery hose to the maximum extent practicable, except during short periods when it is necessary to activate controls or monitor the receiving container.

For deliveries where the qualified person attending the unloading operation cannot maintain an unobstructed view of the cargo tank, when the internal self-closing stop valve is open, the qualified person must observe both the cargo tank and the receiving container at least once every five minutes during unloading operations that take more than five minutes to complete. In addition, the cargo tank motor vehicle must have an emergency discharge control capability that meets the requirements of 49 CFR [§173.315\(n\)\(2\)](#) or [§173.315\(n\)\(4\)](#).

Unloading procedures for liquefied petroleum gas and anhydrous ammonia in other than metered delivery service. An operator must use the following procedures for unloading liquefied petroleum gas or anhydrous ammonia from a cargo tank motor vehicle in other than metered delivery service.

The qualified person attending the unloading operation must remain within 7.62 m (25 feet) of the cargo tank when the internal self-closing stop valve is open.

The qualified person attending the unloading operation must have an unobstructed view of the cargo tank and delivery hose to the maximum extent practicable, except during short periods when it is necessary to activate controls or monitor the receiving container.

Unloading using facility-provided hoses. A cargo tank motor vehicle equipped with a specially designed delivery hose assembly to meet the requirements of 49 CFR [§173.315\(n\)\(2\)](#) may be unloaded using a delivery hose assembly provided by the receiving facility under the following conditions: (1) The qualified person monitoring unloading must visually examine the facility hose assembly for obvious defects prior to its use in the unloading operation; (2) The qualified person monitoring unloading must remain within arm's reach of the mechanical means of closure for the internal self-closing stop valve when the internal self-closing stop valve is open except for short periods when it is necessary to activate controls or monitor the receiving container. For chlorine cargo tank motor vehicles, the qualified person must remain within arm's reach of a means to stop the flow of product except for short periods when it is necessary to activate controls or monitor the receiving container; (3) If the facility hose is equipped with a passive means to shut off the flow of product that conforms to and is maintained to the performance standard in [§173.315\(n\)\(2\)](#) of this

subchapter, the qualified person may attend the unloading operation in accordance with the attendance requirements prescribed for the material being unloaded in [§177.834](#) of this section.

6 - Emergency Control Equipment & Operating Procedures (Cont)) - Vehicle Operators: 49 CFR 177.840(l-t)

Off-truck remote shut-off activation device. For a cargo tank motor vehicle with an off-truck remote control shut-off capability as required by [§§173.315\(n\)\(3\)](#) or [\(n\)\(4\)](#) of this subchapter, the qualified person attending the unloading operation must be in possession of the activation device at all times during the unloading process. This requirement does not apply if the activation device is part of a system that will shut off the unloading operation without human intervention in the event of a leak or separation in the hose.

Unloading without appropriate emergency discharge control equipment. Until a cargo tank motor vehicle is equipped with emergency discharge control equipment in conformance with 49 CFR [§§173.315\(n\)\(2\)](#) and [180.405\(m\)\(1\)](#), the qualified person attending the unloading operation must remain within arm's reach of a means to close the internal self-closing stop valve when the internal self-closing stop valve is open except during short periods when the qualified person must activate controls or monitor the receiving container. Chlorine tank motor vehicles unloaded after December 31, 1999, the qualified person must remain within arm's reach of a means to stop the flow of product except for short periods when it is necessary to activate controls or monitor the receiving container.

7 - Manhole Closures, Overturn & Rear-End Protection and Venting.

Manhole Assemblies 178.337-6

Manholes or inspection openings on the MC 331 are not an inspection item for roadside inspectors. During the external visual inspection the Registered Inspector should be check all devices for tightening manhole covers or inspection openings. They must be operative and there must be no evidence of leakage at manhole covers or gaskets if present.

Overturn Protection 178.337-10

The MC 331 overturn protection must protect all fittings, valves, and safety relief devices. This is usually done by recessing all items within the cargo tank walls.

Rear-End Protection 178.337-10 393.86

Rear-end protection is required to provide protection for the tank and piping in the event of a rear-end collision. The dimensional requirements are the same as those contained 49 CFR Part 393.86. The forces encountered during a collision are transmitted to the chassis of the vehicle.

Pressure Relief Devices 178.337-9

Pressure relief devices are similar to vents on low pressure liquid tanks and are referred to as " Pressure Relief Devices" or "Vents" in the regulations. They protect the tank from over pressurization.

As a general rule, the devices are designed to start relieving pressure at

110 percent of the tank's design pressure and limit pressure to 120 percent. The devices are spring loaded, vary in length from 15 to 24 inches, and weigh between 15 and 25 pounds.

Pressure relief devices are located on the top of the tank. They must be protected in the case of rollover onto a hard surface and the operation must not be restricted. This is accomplished by recessing the vent into the tank, allowing the tank itself to provide protection. Although required, pressure relief devices are difficult to examine at roadside due to limited accessibility to the top of the tank. Special caution should be taken when inspecting these devices.

In addition, a pressure relief valve is required on each portion of connected liquid piping or hose that can be closed at both ends.

Pressure relief devices are protected from tampering by having the pressure adjustments internal to the tank, or sealed. They must be protected from the elements (rain, snow, dirt, etc.); this is typically accomplished by the use of a rain cap. Pressure relief devices are marked with the set-to-discharge pressure, rate of discharge and the manufacturer's name.

There are product specific venting requirements found in the HMT.

7 - Manhole Closures, Overturn, Rear-End Protection and Venting.

External visual inspection: 49 CFR 180.407(d)

The Registered Inspector will externally inspect all reclosing pressure relief valves for any corrosion or damage which might prevent safe operation. All reclosing pressure relief valves on cargo tanks carrying lading corrosive to the valve must be removed from the cargo tank for inspection and testing. Each reclosing pressure relief valve required to be removed and tested must open at the required set pressure and reseal to a leak-tight condition at 90 percent of the set-to-discharge pressure or the pressure prescribed for the applicable cargo tank specification.

For cargo tanks transporting lading corrosive to the tank, areas covered by the upper coupler (fifth wheel) assembly must be inspected at least once in each two year period for corroded and abraded areas, dents, distortions, defects in welds, and any other condition that might render the tank unsafe for transportation service. The upper coupler (fifth wheel) assembly must be removed from the cargo tank for this inspection.

The rear-end protection is part of the MC 331 specification and must be verified during the external visual inspection.

Pressure Test: 49 CFR 180.407(g)

All self-closing pressure relief valves, including emergency relief vents and normal vents, must be removed from the cargo tank for inspection and testing. Each self-closing pressure relief valve that is an emergency relief vent must open at the required set pressure and seat to a leak-tight condition at

90 percent of the set-to-discharge pressure or the pressure prescribed for the applicable cargo tank specification. Normal vents (1 psig vents) must be tested according to the testing criteria established by the valve manufacturer. Self-closing pressure relief devices not tested or failing the tests in this paragraph (g)(1)(ii) must be repaired or replaced.

Except for cargo tanks carrying lading corrosive to the tank, areas covered by the upper coupler (fifth wheel) assembly must be inspected for corroded and abraded areas, dents, distortions, defects in welds, and any other condition that might render the tank unsafe for transportation service. The upper coupler (fifth wheel) assembly must be removed from the cargo tank for this inspection.

Wet Fluorescent Magnetic Particle Test: 49 CFR 180.407(g(3))

Each MC 330 and MC 331 cargo tank constructed of quenched and tempered (**QT**) steel in accordance with Part UHT in Section VIII of the ASME Code, or constructed of other than **QT** steel but without post weld heat treatment, used for the transportation *of anhydrous ammonia or any other hazardous materials that may cause corrosion stress cracking*, must be internally inspected by the wet fluorescent magnetic particle method immediately prior to and in conjunction with the performance of the pressure test prescribed in this section.

Each MC 330 and MC 331 cargo tank constructed of **QT** steel in accordance with Part UHT in Section VIII of the ASME Code and used for the transportation of *liquefied petroleum gas* must be internally inspected by the wet fluorescent magnetic particle method immediately prior to and in conjunction with the performance of the pressure test. The wet fluorescent magnetic particle inspection must be in accordance with Section V of the ASME Code and CGA Technical Bulletin TB-2. This paragraph does not apply to cargo tanks that do not have manholes. (See [§180.417\(c\)](#) for reporting requirements.)

8 - Discharge system inspection and maintenance program for cargo tanks transporting liquefied compressed gases.

49 CFR §180.416

Applicability: This section is applicable to an operator using MC 330, MC 331, and nonspecification cargo tanks authorized under 49 CFR [§173.315\(k\)](#) for transportation of liquefied compressed gases other than carbon dioxide.

Hose identification: The operator must assure that each delivery hose assembly is permanently marked with a unique identification number and maximum working pressure.

Post-delivery hose check: After each unloading, the operator must visually check that portion of the delivery hose assembly deployed during the unloading.

Monthly inspections and tests: The operator must visually inspect each delivery hose assembly at least once each calendar month the delivery hose assembly is in service.

The operator must visually inspect the piping system at least once each calendar month the cargo tank is in service. The inspection must include fusible elements and all components of the piping system, including bolts, connections, and seals.

At least once each calendar month a cargo tank is in service, the operator must actuate all emergency discharge control devices designed to close the internal self-closing stop valve to assure that all

linkages operate as designed. See [Appendix A](#) of 49 CFR 180 which outlines acceptable procedures that may be used for this test.

The operator of a cargo tank must check the internal self-closing stop valve in the liquid discharge opening for leakage through the valve at least once each calendar month the cargo tank is in service. On cargo tanks equipped with a meter, the meter creep test as outlined in [Appendix B](#) of 49 CFR Part 180 or a test providing equivalent accuracy is acceptable. For cargo tanks that are not equipped with a meter, [Appendix B](#) to 49 CFR Part 180 outlines one acceptable method that may be used to check internal self-closing stop valves for closure.

Annual hose leakage test: The owner of a delivery hose assembly that is not permanently attached to a cargo tank motor vehicle must ensure that the hose assembly is annually tested in accordance with §180.407(h)(4).

New or repaired delivery hose assemblies: Each operator of a cargo tank must ensure each new and repaired delivery hose assembly is tested at a minimum of 120 percent of the hose maximum working pressure. The operator must visually examine the delivery hose assembly while it is under pressure. Upon successful completion of the pressure test and inspection, the operator must assure that the delivery hose assembly is permanently marked with the month and year of the test.

9 – Reporting and record retention

Design certification: 49 CFR 178.320

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 in accordance with 49 CFR subpart F of part 107. An accident damage protection device is a rear-end protection, overturn protection, or piping protection device.

The Design Certifying Engineer shall furnish to the manufacturer a certificate to indicate compliance with the specification requirements. The certificate must include the sketches, drawings, and calculations used for certification. Each certificate, including sketches, drawings, and calculations, shall be signed by the Design Certifying Engineer.

The manufacturer shall retain the design certificate at his principal place of business for as long as he manufactures DOT specification cargo tanks.

Certification: 49 CFR 178.337-18

The cargo tank motor vehicle manufacturer must supply and the owner must obtain, a cargo tank motor vehicle manufacturer's data report as required by Section VIII of the ASME Code, and a certificate stating that the completed cargo tank motor vehicle conforms in all respects to Specification MC 331 and the ASME Code. The registration numbers of the manufacturer, the Design Certifying Engineer, and the Registered Inspector, as appropriate, must appear on the

certificates. For each design type, the certificate must be signed by a responsible official of the manufacturer and a Design Certifying Engineer; and for each cargo tank motor vehicle, the certificate must be signed by a responsible official of the manufacturer and a Registered Inspector.

When a cargo tank motor vehicle is manufactured in two or more stages, each manufacturer who performs a manufacturing function or portion thereof on the incomplete cargo tank motor vehicle must provide to the succeeding manufacturer, at or before the time of delivery, a certificate that states the function performed by the manufacturer, including any certificates received from previous manufacturers, Registered Inspectors, and Design Certifying Engineers.

Prior manufacturers must list the specification requirements that are not completed on the Certificate of Compliance. When the cargo tank motor vehicle is brought into full compliance with the applicable specification, the cargo tank motor vehicle manufacturer must have a Registered Inspector stamp the date of certification on the specification plate and issue a Certificate of Compliance to the owner of the cargo tank motor vehicle. The Certificate of Compliance must list the actions taken to bring the cargo tank motor vehicle into full compliance. In addition, the certificate must include the date of certification and the person (manufacturer, carrier or repair organization) accomplishing compliance.

The certificate must state whether or not it includes certification that all valves, piping, and protective devices conform to the requirements of the specification. If it does not so certify, the installer of any such valve, piping, or device shall supply and the owner shall obtain a certificate asserting complete compliance with these specifications for such devices. The certificate, or certificates, will include sufficient sketches, drawings, and other information to indicate the location, make, model, and size of each valve and the arrangement of all piping associated with the cargo tank. The certificate must contain a statement indicating whether or not the cargo tank was postweld heat treated for anhydrous ammonia as specified in [§178.337-1\(f\)](#).

9 – Reporting and record retention (Cont)

The owner shall retain the copy of the data report and certificates and related papers in his files throughout his ownership of the cargo tank motor vehicle and for at least one year thereafter; and in the event of change in ownership, retention by the prior owner of nonfading photographically reproduced copies will be deemed to satisfy this requirement. Each motor carrier using the cargo tank motor vehicle, if not the owner thereof, shall obtain a copy of the data report and certificate and retain them in his files during the time he uses the cargo tank motor vehicle and for at least one year thereafter.

Repair, modification, stretching, or rebarrelling.: 49 CFR 180.413

Each owner of a cargo tank motor vehicle must retain at the owner's principal place of business all records of repair, modification, stretching, or rebarrelling, including notation of any tests conducted to verify the suitability of the repair, modification, stretching, or rebarrelling made to each cargo tank during the time the cargo tank motor vehicle is in service and for one year thereafter. Copies of these records must be retained by a motor carrier, if not the owner of the cargo tank motor vehicle, at its principal place of business during the period the cargo tank motor vehicle is in the carrier's service.

Monthly inspections and tests Delivery Hose Assembly: 49 CFR 180.416(d)

The operator must note each inspection required by 180.416(d) in a record. That record must include the inspection date, the name of the person performing the inspection, the hose assembly identification number, the company name, the date the hose was assembled and tested, and an indication that the delivery hose assembly and piping system passed or failed the tests and inspections. A copy of each test and inspection record must be retained by the operator at its principal place of business or where the vehicle is housed or maintained until the next test of the same type is successfully completed.

New or repaired delivery hose assemblies: 49 CFR 180.416(f)

The operator must complete a record documenting the test and inspection, required by 180.416(f), including the date, the signature of the inspector, the hose owner, the hose identification number, the date of original delivery hose assembly and test, notes of any defects observed and repairs made, and an indication that the delivery hose assembly passed or failed the tests and inspections. A copy of each test and inspection record must be retained by the operator at its principal place of business or where the vehicle is housed or maintained until the next test of the same type is successfully completed.

Vehicle certification: 49 CFR 180.417(a)

Each owner of a specification cargo tank must retain the manufacturer's certificate, the manufacturer's ASME U1A data report, where applicable, and related papers certifying that the specification cargo tank identified in the documents was manufactured and tested in accordance with the applicable specification. This would include any certification of emergency discharge control systems as required. The owner must retain the documents throughout his ownership of the specification cargo tank and for one year thereafter. In the event of a change in ownership, the prior owner must retain non-fading photo copies of these documents for one year.

9 – Reporting and record retention (Cont)

Each motor carrier who uses a specification cargo tank motor vehicle must obtain a copy of the manufacturer's certificate and related papers or the alternative report and retain the documents as noted in the above paragraph. A motor carrier who is not the owner of a cargo tank motor vehicle must also retain a copy of the vehicle certification report for as long as the cargo tank motor vehicle is used by that carrier and for one year thereafter. This information must be maintained at the company's principal place of business or at the location where the vehicle is housed or maintained. The provisions of this section do not apply to a motor carrier who leases a cargo tank for less than 30 days.

Missing Vehicle Certifications: 49 CFR 180.417(a)

For DOT Specification cargo tanks manufactured before 9/1/95

Non-ASME Code stamped cargo tanks – If an owner does not have a manufacturer's certificate for a cargo tank and he wishes to certify it as a specification cargo tank, the owner must perform appropriate tests and inspections, under the direct supervision of a Registered Inspector, to determine if the cargo tank conforms to the applicable specification. Both the owner and the Registered

Inspector must certify that the cargo tank fully conforms to the applicable specification. The owner must retain the certificate, as specified in this section.

ASME Code Stamped cargo tanks. If the owner does not have the manufacturer's certificate required by the specification and the manufacturer's data report required by the ASME, the owner may contact the National Board for a copy of the manufacturer's data report, if the cargo tank was registered with the National Board, or copy the information contained on the cargo tank's identification and ASME Code plates. Additionally, both the owner and the Registered Inspector must certify that the cargo tank fully conforms to the specification. The owner must retain such documents, as specified in this section.

Periodic Test or Inspection reporting: 49 CFR 180.417(b)

Each person performing a test or inspection as specified in 49 CFR [§180.407](#) must prepare a written report, in English and contain all the information as required in Part 180.417(b).

Wet Magnetic Particle Method test report: 49 CFR 180.417(c)

After completion of the pressure test specified in [§180.407\(g\)\(3\)](#), each motor carrier operating a Specification MC 330 or MC 331 cargo tank in anhydrous ammonia, liquefied petroleum gas, or any other service that may cause stress corrosion cracking, must make a written report containing the information required in 49 CFR 180.417(c).

LEGAL DISCLAIMER:

This training document focuses on the US DOT's regulations concerning hazardous materials transportation. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. This training program has been designed for delivery by a qualified instructor, who possess comprehensive knowledge in the Department of Transportation Hazardous Materials Regulations. It is the responsibility of each Hazardous Materials Employer to provide their Hazardous Materials Employees with specific personal safety training.