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Part III

# Department of Transportation

Research and Special Programs Administration

Cryogenic Liquids; Final Rule

**DEPARTMENT OF TRANSPORTATION**

**Research and Special Programs Administration**

**49 CFR Parts 171, 172, 173, 174, 176, 177, 178, and 179**

**[Docket No. HM-115, Amdt. Nos. 171-74, 172-82, 173-166, 174-43, 176-17, 177-60, 178-77, 179-32]**

## Cryogenic Liquids

**AGENCY:** Materials Transportation Bureau (MTB), Research and Special Programs Administration, DOT.

**ACTION:** Final rule.

**SUMMARY:** This rule amends the Hazardous Materials Regulations to establish requirements for the transportation of certain cryogenic liquids and also to authorize the transportation of certain gases that are transported in cold liquid form.

Included in the final rule are provisions—

(1) To provide a new DOT specification cargo tank for the transportation of cryogenic liquids;

(2) To authorize the rail carriage of ethylene, cryogenic liquid in addition to hydrogen, cryogenic liquid;

(3) To establish requirements governing the maintenance and use of packagings used to transport these liquids;

(4) To establish minimum requirements for the transportation of nonflammable, nonpressurized cryogenic liquids that until now were not generally subject to the Hazardous Materials Regulations;

(5) To authorize the bulk transportation of ethane and hydrogen chloride in cold liquid form; and

(6) For flammable cryogenic liquids—

(i) To expand the scope of the regulations to apply to the intrastate as well as the interstate transportation of these materials; and

(ii) To require DOT registration of shippers and carriers and the specific training of drivers.

This rule will alleviate the difficulties engendered under the exemption program and the standardization achieved by issuing these rules will contribute to improved overall safety in the transportation of these materials.

**EFFECTIVE DATE:** January 1, 1984. However, compliance with the regulations as amended herein is authorized on and after September 15, 1983.

For the purpose of this final rule, the 30 day limitation for the receipt of a petition for reconsideration (49 CFR 106.35) is hereby waived and 90 days provided in place thereof. Petitions for reconsideration will be received on or before September 14, 1983.

The incorporation by reference of certain publications listed in the regulation is approved by the Director of the Federal Register as of January 1, 1984.

**FOR FURTHER INFORMATION CONTACT:** Jose Pena, Office of Hazardous Materials Regulation, Materials Transportation Bureau, Department of Transportation, 400 Seventh Street, S.W., Washington, D.C. 20590, (202) 755-4906. Office hours are 8:30 to 5:00 p.m., Monday through Friday

**SUPPLEMENTARY INFORMATION:** Information collection requirements contained in this regulation have been approved by the Office of Management and Budget under the provisions of 44 U.S.C. Chapter 35 and have been assigned the following numbers: OMB #2137-0541 (Shipper's or Carrier's Registration Statements, §§ 173.11 and 177.826), OMB #2137-0542 (Cargo Tank Pressure and Temperature Records, § 177.840), OMB #2137-0539 (Special Instructions for Cryogenic Liquids, § 177.818), OMB #2137-0540 (Flammable Cryogenic Training Records, § 177.816), and OMB #2137-0017 (Cargo Tank Certification Record Requirements, §§ 178.338-2, 178.338-4, 178.338-19).

This rulemaking has a long history. Prior to today's publication the following notices have been published in the **Federal Register**, and a public hearing held, with regard to Docket HM-115:

(1) On March 1, 1974, the Hazardous Materials Regulations Board, MTB's predecessor, published a Notice of Proposed Rulemaking (NPRM) (39 FR 7950).

(2) On June 19, 1974, the Board extended the comment period (39 FR 21166).

(3) On September 10, 1974, the Board converted the NPRM into an Advance Notice Of Proposed Rulemaking (ANPRM) and further extended the comment period (39 FR 32624).

(4) On March 8, 1979, MTB published a NPRM which, while in general terms continuing the regulatory scheme proposed in the 1974 ANPRM, made significant changes in several areas. Readers who wish more information on these changes are referred to the preamble discussion in the NPRM (44 FR 12826). This notice also announced a public hearing.

(5) On April 5, 1979, corrections and changes were made to the NPRM (44 FR 20461).

(6) On April 17, 1979, MTB held a public hearing on the NPRM.

(7) On June 21, 1979, additional changes were made in the NPRM and the deadline for filing comments was extended (44 FR 36211).

The purpose of this rulemaking is discussed in the March 8, 1979 preamble. Briefly, some of the transportation subject to this rule has historically been permitted only under an exemption (called in years past a special permit). This exemption program, provided for in § 107(a) of the Hazardous Materials Transportation Act (49 U.S.C. 1806(a)), has required those wishing to transport these commodities to come to MTB for specific approval of the packaging (and how the packaging is to be maintained), the hazardous materials to be transported in the packaging and the conditions of transportation. Exemptions create burdens on shippers, carriers, packaging manufacturers and the MTB itself and should be replaced by regulation as soon as appropriate. To the extent that the regulations have not provided for the carriage of these materials, these burdens have been necessary in order to accommodate commerce and, at the same time, ensure public safety. This rule will alleviate the difficulties engendered under the exemption program and the standardization achieved by issuing these rules will contribute to improved overall safety in the transportation of these materials.

Another major impact of this rule is the application of certain regulatory requirements to nonflammable cryogenic gases, like nitrogen and helium, transported in nonpressurized form. These commodities have previously been unregulated by MTB except when transported by vessel. However, MTB believes that the extreme thermal hazards these materials pose in their cryogenic form warrant the imposition of the limited requirements contained in this rule. This will be more fully discussed below.

Approximately 30 comments were received on the proposals contained in the NPRM. All comments, including late submissions, have been fully considered by MTB during the development of this final rule. Several well-defined aspects of the NPRM were the subject of most of the commentary. These significant issues are discussed below by subject. Following the subject-by-subject review is a Review by Section which briefly discusses each section of the rule and the significant changes that have been made since the NPRM.

### Use of Aluminum

The NPRM proposed that aluminum be permitted to be used to fabricate the

inner vessel of an MC-338 cargo tank, but that the jacket surrounding the insulation of these containers, when used in oxygen service, must be made of steel. This proposal was based on the adequacy of recently developed industry cleaning standards. The NPRM included a discussion of the use of aluminum in certain packages that come in contact with cryogenic oxygen and specifically asked for public comment concerning this issue (44 FR 12828).

Several commenters supported the use of aluminum in the fabrication of the outer jacketing, as well as the inner vessels, of packagings used for the transportation of cryogenic oxygen. The commenters mentioned the excellent low temperature characteristics of aluminum and the fact that the oxygen does not react adversely with aluminum. In further support of this position, one commenter noted that MTB was planning to issue a proposal for an aluminum cylinder specification for the transportation of oxygen and other gases. (The final rule was published in the **Federal Register** on December 24, 1981, under Docket HM-176, Specification and Usage Requirements for DOT-3AL Seamless, Aluminum Cylinders (46 FR 62452)).

MTB agrees with these comments to the extent that it proposed, and now adopts in this rule, requirements permitting the use of inner tanks constructed of aluminum to transport cryogenic oxygen, if proper precautions are taken to ensure that the packaging is cleaned of all foreign matter. In order to ensure the cleanliness of cargo tanks, MTB is adopting the cleaning standards contained in Compressed Gas Association (CGA) Pamphlet G-4.1. However, MTB strongly believes that it should not permit the use of aluminum jackets on cargo tanks used to transport a flammable cryogen or pressurized, cryogenic oxygen. In a fire situation any escape of these materials would serve to greatly intensify the fire. Considering that aluminum loses most of its strength at 500° F. and melts at 1200° F., it follows that the protection afforded by aluminum is far less than that afforded by steel, which retains a great deal of its strength at aluminum's melting point and which does not melt until heated to approximately 2600° F. Notwithstanding the good safety experience of nonregulated, nonpressurized cryogenic oxygen cargo tanks, as well as some early exemption (special permit) tanks, and in the absence of any meaningful tests on cargo tanks demonstrating the survivability of aluminum in a fire environment, MTB has concluded that aluminum outer jackets do not provide an acceptable level of safety in cargo tanks used to transport cryogenic oxygen, at pressures in excess of 25.3 psig, or flammable cryogens.

As proposed in the NPRM, this rule prohibits the use of aluminum valves with rubbing or abrading aluminum internal parts in packagings transporting cryogenic oxygen. The reason for this prohibition is the possibility that the heat generated by abrading parts, together with the formation of feather-tipped projections creates a potential for combustion. The same prohibition was also proposed for flammable cryogens; however, in the final rule, based on comments and MTB's reevaluation of potential consequences resulting from release in a fire, this prohibition has been extended to any aluminum valve, pipe or fitting.

### Pressure Relief Device Systems

Several commenters suggested that the requirements contained in CGA Pamphlets S-1.1, S-1.2 and S-1.3 provide adequate protection for cargo tanks from overpressurization. One commenter contended that a single relief device system that is sized using the CGA standards is adequate. The commenter believes that the proposal in the NPRM, that there be a primary and secondary pressure relief device system of equal capacity, was excessive and unwarranted. This contention has also been raised in applications for exemption. MTB has consistently maintained that spring loaded relief valves are mechanical and therefore subject to malfunction, and that in an accident situation a tank may be in an inverted position discharging liquid and therefore relieving pressure at a much lower rate than when discharging vapor. There is also a significant body of analytical and experimental data that raises questions as to the adequacy of the CGA valve sizing due to several assumptions made in the formulas, such as the heat conduction values of the insulation and the total tank area considered as exposed to fire, which provide lower calculated capacities than MTB believes is necessary to assure an acceptable level of safety in a fire situation. Therefore, MTB considers that the primary and secondary relief capacities prescribed in the NPRM are necessary to assure an acceptable level of protection in transportation and they have been retained in this rule at § 173.318(b).

One commenter objected to the proposed marking of each valve with a rated pressure equal to or exceeding the tank design pressure at the coldest temperature expected to be encountered (proposed § 178.338-8(b)(2)). The commenter believed that such marking conflicts with requirements found to be acceptable by the ASME Code and various piping codes. MTB agrees and has determined that this marking is not necessary and therefore has revised this paragraph to require only that each valve must be constructed and rated for a pressure equal to or exceeding the tank design pressure at the coldest temperature to be encountered. Additional proposed market requirements in § 173.318(b)(5)(ii), for pressure relief devices remain unchanged in this final rule.

### Minimum Outage and Filling Densities

One commenter implied that the proposed minimum outage requirement was too restrictive for pressurized nonflammable cryogenic liquids. The commenter expressed that the minimum outage for pressurized nonflammable cryogenic liquids should be 0.5%. MTB believes that a 2.0% minimum outage is appropriate for pressurized nonflammable as well as flammable cryogenic liquids. The greater minimum outage requirement will significantly reduce the likelihood that a cryogenic liquid will vent as a liquid through a pressure relief device. Given the fact that thermal hazards are posed by the release of these extremely cold liquid materials, whether they are flammable or not, this rule retains the proposed outage requirements.

Section 173.318(d) has been revised to exclude helium from the outage requirement because at relieving pressures it is no longer a liquid.

The commenter also recommended that the filling densities proposed in § 173.318(f) be changed to be consistent with his minimum outage recommendation. Since MTB will continue to use a minimum outage of 2.0%, the filling density changes are not necessary.

### Venting, Holding Time, Trip Monitoring, and Equilibration of Cryogenic Liquids

In the NPRM venting, holding time and trip monitoring were addressed in proposed §§ 173.33(d)(1)(ii), 173.318(e), 177.840 (h), (i), and (j), and 178.338-9, and these requirements would have applied to all cryogenic liquids. Several commenters strongly urged that these requirements only apply to flammable cryogenic ladings. MTB has looked again at the issue of enroute venting and agrees with the commenters that enroute venting of nonflammable atmospheric cryogens and helium presents little hazard. Except for the holding time test contained in the MC-338 cargo tank specification, these requirements now

only apply to flammable cryogenic liquids. Each MC–338 cargo tank must have a rated holding time to be considered a specification cargo tank, whether it is used to transport flammable or pressurized nonflammable cryogenic liquids.

Equilibration, which was not addressed in the NPRM, is permitted at § 177.840 (i) and (j) of this rule. The concept of equilibration was advocated by several commenters. Essentially it represents a relaxation of the holding time requirement for flammable cryogens by allowing one-way travel time to be redetermined after a full equilibration of the cargo tank is performed. Equilibrations may only be performed at a facility that handles, and is therefore familiar with, flammable cryogenic liquids. Allowing such equilibrations will permit longer hauls to be made safely.

**Liquefaction Temperature**

There has been some confusion regarding the term "liquefaction temperature" which was used at several points in the NPRM in specifying design service requirements for packagings (see §§ 173.315(a) Table, Note 11, 178.338–1(c)(2)). The term was used without specifying the pressure at which the liquefaction temperature was to be established. This was an unintended omission because the liquefaction temperature of a cryogenic liquid or cold refrigerated gas varies with pressure. When transported in a pressurized condition the temperature is higher than at one atmosphere.

Several commenters called MTB's attention to this problem. (In the ANPRM at § 178.338–1(b)(2) the liquefaction temperature had been stated as being at one atmosphere.) Some commenters who favor design service temperatures based on liquefaction temperatures under pressurized shipping conditions indicated their belief that the omission seemed to support their position. One commenter indicated that it was his understanding that liquefaction temperature was to be determined at one atmosphere. It was MTB's intention that the liquefaction temperature be determined as indicated by this latter commenter.

Despite the omission in the NPRM, in the exemption process for cryogenic liquids and refrigerated gases such as ethane-propane mixes, MTB has, with but a single exception, specified that design service temperature be based on the liquefaction temperature at a pressure of one atmosphere, and MTB is continuing with the limitation in this rule. If a packaging has a design service temperature based on the liquefaction temperature of the lading under pressurized conditions and there is a sudden rapid release of the pressure for one reason or another, the release could result in temperatures colder than the design temperature of the packaging.

The reference pressure of one atmosphere has been added in the rule at §§ 173.315, Note 11, and 178.338–1(c)(2) to make the meaning of the term "liquefaction temperature" absolutely clear.

**Jacket Design**

Both the ANPRM and the NPRM contained lengthy formulas, details of welding and reinforcing ring construction, etc. for cargo tank evacuated jackets, which were patterned from rail car specifications. The June 21, 1979 **Federal Register** publication of changes to the NPRM altered this approach, at § 178.338–1(f), by simply referring to specific paragraphs of the ASME Code. One industry commenter was critical of this approach asserting that the ASME charts could be misapplied and/or are in error. As best MTB can determine, the commenter's point is that using ASME Appendix V charts in designing a tank for 7.5 p.s.i. minimum external pressure, which based on a safety factor of four should produce a collapsing pressure of 30 p.s.i., will theoretically result in a collapsing pressure of less than 30 p.s.i. as a result of a reduction in safety factors by ASME in 1977. MTB has dealt with this concern by revising § 178.338–1(f)(1) to reference a critical collapsing pressure of 30 p.s.i. rather than a design pressure of 7.5 p.s.i. This gives the same result as was intended in the NPRM and at the same time avoids any possible ambiguity that may result from the use of the ASME charts. This is consistent with the original Compressed Gas Association (CGA) proposal in CGA–341.

**Postweld Heat Treatment**

One commenter recommended that in the case of tanks constructed in accordance with Part UHT of the Code, postweld heat treatment be required by MTB only when required by the ASME Code (§ 178.338–2(e)). If postweld heat treatment were only conducted when required by the ASME Code, most of these cargo tanks would not be postweld heat treated since the cargo tank thickness is less than the thickness that the ASME Code requires be postweld heat treated. However, MTB believes that the postweld heat treatment of these thinner materials is necessary to provide maximum ductility to resist the vibrations and stresses inherent in the highway environment. Experience over many years with the use of postweld heat treatment in cargo tanks has been favorable and MTB feels there are important safety considerations justifying the requirement with regard to MC–338 tanks.

**Pressure Testing**

The NPRM, at § 178.338–16, proposed that newly constructed tanks be subjected to a pressure test at 1½ times design pressure, except that for tanks constructed of UHT steel a test pressure of two times design pressure was proposed. Several commenters urged that a test pressure of only 1¼ times design pressure be required. MTB believes that a test to 1½ times design pressure is necessary to prove tank integrity. One industry group asserted that such a requirement precludes pneumatic testing, which is necessary for tanks designed to carry large volumes of low density material, such as hydrogen or helium, and for which testing with dense material such as water presents difficulties. To the extent that a manufacturer does not wish to perform a pneumatic test, MTB does not believe this point is meritorious with regard to initial manufacturer's testing which can be performed while a tank is still on the fabrication floor where it can be supported over sufficient tank area to avoid distortion from water weight. MTB believes the general test pressure requirement of 1½ times design pressure ensures tank integrity and represents sound design and engineering practice in light of the fact that the highest setting for a relief device is 150 percent of design pressure.

The two times design pressure requirement for tanks constructed in accordance with Part UHT of the ASME Code is also being retained. It is not anticipated that this material will be used frequently in the construction of MC–338 cargo tanks; however, to the extent that it is used, MTB believes that the particular composition of this material and the process by which it is manufactured justify the higher test pressure requirements. This is consistent with other MTB requirements that exceed ASME Code requirements in several areas (such as in § 178.337 for MC–331 cargo tanks) when UHT steels are used.

One commenter recommended that the retest requirement at proposed § 173.33(d)(2) be eliminated for MC–338 cargo tanks with evacuated jackets. The commenter stated that such tanks in cryogenic liquid service are not subject to internal or external corrosion, and

that in effect the tank is under constant "leak test" because the slightest leak into the vacuum space would be readily detected. MTB does not agree that this retest should be eliminated. The retest, at higher that service pressure, is necessary to ensure the continued integrity of the tank.

MTB does agree with industry commenters that the proposed retest at 1½ times design pressure would, for purposes of personnel safety, require hydrostatic testing and that this not only poses structural problems for hydrogen and helium tanks, but creates problems in drying and preventing contaminants from entering the tank. Since the cryogenic materials are noncorrosive and since the tank has been subjected to a pressure integrity test of 1½ times design pressure at time of manufacture, MTB believes it is appropriate, without compromising safety, to allow the retest to be performed at 1¼ times design pressure. A procedure for performing pneumatic tests is provided at § 178.338–16(b).

**Design Loadings**

MTB received several comments concerning the "g" loading requirements. Concern was expressed regarding the different methods contained in the NPRM for defining the loadings (i.e., by "g" loadings and also as a function of weight of the tank). In order to clarify the support and anchoring requirements, MTB has revised § 178.338–13 by expressing all design forces as a function of the static loading imposed in the cargo tank and its attachments when the cargo tank is filled to the design weight of lading. These design forces apply to the tank and jacket as well as the support system.

One commenter urged that the proposed design forces be reduced. While present DOT exemptions (not specifying MC–331 construction) do not specify design forces for the tank or jacket of the vacuum-insulated cargo tank, MTB believes that it is necessary to specify some minimum design force considerations. It should be noted that the static loading requirements for the inner tank of a vacuum-insulated cargo tank were reduced from those proposed in the original NPRM by the June 21, 1979 publication modifying the NPRM. At the time this change was made, MTB stated that it would "not compromise the safety of the cargo tank because the outer tank, which is the structural member used in place of a motor vehicle frame, is proposed to be designed to "g" loadings of three vertical and two longitudinal and lateral." (44 FR 36211.)

As for the outer tank (generally referred to as a jacket in this rule) of a vacuum-insulated cargo tank, the same commenter believes the static loading requirements should be reduced from three vertical and two in all other directions to two vertical and 1½ in all other directions. This is the same loading requirement that was proposed (and is here made final) for the inner tank and its suspension members. MTB does not believe the commenter's recommended design forces are adequate. However, upon reevaluation, MTB does believe that the vertical loading requirement of three, proposed in the NPRM can be safely reduced since, for tanks with evacuated jackets, any dynamic forces are dampened by virtue of the double wall construction. This rule, therefore, imposes static loading requirements for the jacket of an MC–338 cargo tank of two in all directions. This agrees with the industry standard expressed in CGA–341.

Nonvacuum-insulated MC–338 cargo tanks are very similar in construction to MC–331 tanks with support members attached directly to the cold liquid tank. The NPRM proposed static loadings for this type of MC–338 tank that were the same as the required loadings for the MC–331. MTB believes the construction of this tank justifies the loading requirement of three in the vertical downward direction since those dampening factors that supported the reduction in vertical loading for the evacuated jacket are not present in this type of construction. There is also no logical reason for having a lower vertical loading requirement for this tank than for the MC–331 tank. For this tank, the proposed loadings in the NPRM are retained in the final rule.

**Nonpressurized Atmospheric Gases and Helium**

The MTB is adopting regulations that will apply to nonpressurized atmospheric gases and helium. In the NPRM, MTB stated as a basis for its proposed regulation of nonpressurized atmospheric gases and helium that "* * * certain requirements apply due to the extreme thermal hazard these low temperature materials pose to human tissue and, in the case of vessels, to shipboard structures."

Several commenters took strong exception to this specific proposal. Generally, they questioned the value of shipping papers and incident reports in dealing with the "so-called" thermal hazard of these cryogens. Also, commenters took exception to a statement in the regulatory evaluation for the proposal that indicated such materials could be considered corrosive from a technical standpoint. A commenter suggested that MTB's actual motivation was to obtain a reliable record (through incident reporting) of experience in transportation of such materials for purposes of more extensive regulation in the future. This commenter suggested such a record could be developed based on existing incident and accident reports without additional regulation. Further, he asserted that the existing safety record leads inevitably to the conclusion that such a "thermal hazard" does not, in fact, exist.

Another commenter noted that the ANPRM issued on March 1, 1974, and September 10, 1974 (39 FR 7950; 39 FR 32624) did not include these materials. He further indicated that MTB's proposal to regulate these materials due to the extreme thermal hazards these low temperature materials pose is tantamount to a finding by MTB, which the commenter felt had not been adequately supported, that, pursuant to 49 U.S.C. 1803 (enacted after the ANPRM was issued), the transportation of these cryogens may pose an unreasonable risk to health and safety or property.

MTB finds that the quantity and form of all materials subject to this final rule as cryogenic materials may pose an unreasonable risk to health and safety or property when transported in commerce due to the extreme thermal hazard they pose to human tissue. However, MTB acknowledges that the unreasonable risk potential presented by these materials because of their low temperature is not as significant as the risks posed by many other hazardous materials and, therefore, only a limited number of regulations should apply to their transportation.

If a liquid cryogen were to come into contact with any part of a human body, irreversible damage to tissue could be caused unless the contact is of short duration. This fact is verified in industry literature. While the industries known by MTB to engage in shipment and transportation of these materials have a good safety record, MTB concludes these materials are hazardous materials for purposes of transportation in commerce and that some, but not all, of the hazard communication regulations and the incident reporting requirements should apply to them.

Other cryogens are regulated because they pose risks in addition to their extreme thermal hazard. Principal among these risks are flammability and toxicity (e.g., carbon monoxide). A lesser degree of risk is posed by atmospheric gases and helium when transported at pressures greater than

25.3 psig. These pressurized materials are presently required to be carried in cargo tanks under conditions specified in exemptions because they are, by definition, compressed gases. The principal reason for a higher level of regulation of these materials is to assure that the integrity of their packagings is sufficient to prevent failure at the pressures the packagings can be expected to encounter during transportation. However, in terms of immediately available energy, there is no significant difference in the risk presented by a tank containing a cryogenic atmospheric gas at a pressure above 25.3 psig versus a tank containing a cryogenic atmospheric gas at a pressure below 25.3 psig. (MTB does not draw the same conclusion relative to tanks only partially filled since they have a greater immediate available energy potential when their relief valves are set at higher discharge pressures.)

Therefore, MTB concludes that the principal risk presented by packagings filled with atmospheric gases and helium is the thermal hazard these low temperture materials pose to human tissue and to shipboard structures and that specification packagings are not required for these materials when transported by motor vehicle or railroad at pressures at or below 25.3 psig.

It must be noted that the absence of accident data cannot be conclusive as to whether or not a material is a hazardous material. There are a number of hazardous materials currently subject to the regulations (e.g., spent nuclear fuel) for which there is no accident data indicating fatalities, injuries, or serious property damage as a result of accidents in transportation. If MTB were to agree that a material can not and should not be regulated unless there is accident data concerning transportation of the material in the form and manner to be regulated, MTB would be agreeing that it could only react to adverse experience in deciding if a material may pose an unreasonable risk when transported in commerce. The legislative history of the Hazardous Materials Transportation Act clearly establishes that a strictly reactive posture was not the intent of Congress.

In this final rule, MTB is adopting requirements pertaining to the identification of atmospheric gases and helium when they are carried in packagings at pressures at or below 25.3 psig, and incident reporting requirements consistent with those specified for other hazardous materials. The communications requirements relate to the preparation of shipping papers and the marking of packagings including cargo tanks and tank cars. Except for oxygen, MTB is not adopting requirements pertaining to labeling of packages and the placarding of vehicles and rail cars (except for carriage aboard aircraft and vessels). With the exception of oxygen, MTB does not believe that placarding and labeling are necessary for these materials. The identification of the materials by marking will be sufficient for communication of the risk they present during transportation and will allow for improved emergency response through use of identification numbers. MTB believes the risk presented by oxygen warrants the implementation of placarding and labeling requirements for this material (see NFPA Pamphlet 53M entitled, "Fire Hazards in Oxygen-Enriched Atmospheres 1979", for information concerning accidents involving oxygen, including cryogenic oxygen).

**The Impact of This Rulemaking on Existing Exemptions**

A number of cargo tanks are currently being operated under exemption, carrying pressurized and/or flammable cryogenic liquids. The NPRM proposed that where practicable these tanks be modified, remarked and rerated to MC-338 Specifications. Where not practicable, the NPRM proposed that the exemption holder so advise MTB, giving the reasons. The NPRM did not address what MTB would do after being so notified. The same process was proposed for rail cars currently transporting ethylene, cryogenic liquid under exemption. Exemption holders were concerned about the impact of the rule on outstanding exemptions and the extent of modifications to these existing tanks, and attendant expense, that MTB would require in an effort to bring them into compliance with the new specification requirements.

MTB has decided to completely resolve this issue by allowing existing cargo tanks and tank cars authorized to transport a cryogenic liquid or certain cold refrigerated gases under an outstanding exemption to be remarked and rerated as specification tanks without undergoing modification. MTB believes this "grandfathering" of existing tanks is necessary to avoid potential severe economic consequences to some exemption holders and can be justified from a safety point of view because of the thorough technical review involved in the exemption process, notwithstanding the fact that certain aspects of certain exemptions may differ from this final rule. However, no new construction under these exemptions may be initiated after January 1, 1984.

Under this rule, the owner or the person using a cargo tank or tank car complying with a DOT exemption listed below should remove the DOT exemption number stenciled on the cargo tank or tank car and stamp the identification plate as specified by § 173.31(a)(8), § 173.33(b)(2), or § 173.33(b)(3), as applicable, according to the proper specification. A copy of the applicable exemption in effect on December 31, 1983, must be retained by the owner or operator, if not the owner, for a tank remarked as a DOT specification packaging.

The DOT exemptions affected by this rulemaking are as follows:

*Exemptions—Tank Cars*

| | | |
|---|---|---|
| 4717 | 6231 | 7491 |
| 5736 | 6392 | |
| 5792 | 6825 | |

*Exemptions—MC-338 type Cargo Tanks*

| | | |
|---|---|---|
| 2587 | 5959 | 7192 |
| 2708 | 6039 | 7207 |
| 2805 | 6111 | 7444 |
| 3367 | 6113 | 7494 |
| 3648 | 6173 | 7513 |
| 4108 | 6197 | 7600 |
| 4399 | 6205 | 7603 |
| 4400 | 6218 | 7849 |
| 4404 | 6243 | 7911 |
| 4490 | 6403 | 8286 |
| 4497 | 6432 | 8393 |
| 4554 | 6464 | 6404 |
| 4760 | 6536 | 8583 |
| 5186 | 6545 | 8753 |
| 5196 | 6571 | 8783 |
| 5322 | 6738 | 8768 |
| 5365 | 6755 | 8778 |
| 5413 | 6768 | 8605 |
| 5485 | 6802 | 8889 |
| 5825 | 6919 | 8894 |
| 5852 | 6923 | 8954 |
| 5954 | 7025 | |

*Exemptions—MC-330 or MC-331 Cargo Tanks*

| | | |
|---|---|---|
| 5062 | 7744 | 8443 |
| 6939 | 7957 | 8476 |
| 6978 | 8336 | 8504 |
| 7632 | 8442 | |

*Exemptions-Cylinders*

Cylinders marked "DOT E-6668", "DOT E-8404" or cylinders marked "DOT SP-6668" prior to issuance of the exemption may be marked "DOT-4L" as specified by § 173.23(D) of the rule.

**Review by Section**

Readers are reminded that this Review discusses only significant comments on the proposals in the NPRM and changes made to the NPRM in this Final Rule. For those provisions that are unchanged, readers are referred to the preamble discussion in the original NPRM (44 FR 12823, March 8, 1979) and subsequent correction documents (44 FR 20461, April 5, 1979; 44 FR 36211, June 21, 1979).

*Section 171.1.* There is no change, except that the proposed language in § 171.1(a)(i) is now contained in § 171.1(a)(iii) due to amendments to the Hazardous Materials Regulations subsequent to the issuance of the NPRM. Due to the length of time between the NPRM and this Final Rule, provisions have been relocated within a section in a number of instances. Throughout the remainder of this preamble, only significant relocations will be commented on.

*Section 171.7.* In § 171.7, paragraph (c)(3) is revised to reflect the new address of the Compressed Gas Association and, although they were not a part of the NPRM, paragraph (d)(3)(v) is revised to recognize the 1980 edition of CGA Pamphlet S-1.2 and paragraph (d)(12) is revised to recognize the 1978 edition of Federal Standard H-28 which superseded National Bureau of Standards Handbook H-28. The purpose of these and other changes is to recognize the most up-to-date standards so that users of these references will not have to hold superseded editions. MTB has examined the new standards and for the purpose of this incorporation by reference, recognition of the newer editions does not substantively affect the Hazardous Materials Regulations.

*Section 171.8.* The proposed definition of "filling density" is changed by including a separate entry for hydrogen, cryogenic liquid, in cylinders. The separate filling density reference for hydrogen, cryogenic liquid, in cylinders is needed for clarity. The separate requirement for hydrogen existed at proposed § 173.316(c)(3) of the NPRM, however the lack of a separate reference in § 171.8 may have led to some confusion. This change will avoid that. Also, MTB has added definitions of "atmospheric gases", "BTU", "cryogenic liquids", and "NPT". These added definitions are also to add clarity. The definition of "atmospheric gases" is especially important since under certain circumstances this rule excepts these materials from certain requirements.

*Section 172.101.* Five commenters addressed the proposed changes to the Hazardous Materials Table, including the Air Transport Association (ATA) and the Compressed Gas Association (CGA).

ATA's comments included the following suggestions: (1) to add "air, cryogenic liquid", "neon, cryogenic liquid", and "cryogenic liquid, n.o.s." to the Hazardous Materials Table (the Table); (2) to forbid pressurized argon, helium, and nitrogen in cryogenic form from transportation by passenger aircraft; and (3) to authorize the use of cylinders for all cryogenic liquids listed in the Table. In the final rule, MTB has amended the Hazardous Materials Table as suggested by ATA to add "neon, cryogenic liquid". However, MTB does not agree that the descriptions "air, cryogenic liquid" and "cryogenic liquid, n.o.s." should be added to the Table. MTB is unaware of any exception from the practice whereby the various cryogenic liquid fractions are separated and shipped in the form of liquid oxygen, liquid nitrogen, etc. Concerning the prohibition proposed by the ATA on the transportation of cryogenic argon, helium and nitrogen aboard passenger carrying aircraft, ATA did not provide any explanation of its concerns that malfunctioning of a pressure controlling valve would result in operation of a safety relief valve. If for any reason, including a blockage in the pressure controlling valve, there is pressure rise in the cylinder, MTB believes that the safety valve should function at its set-to-discharge pressure. MTB's decision to authorize these materials aboard passenger carrying aircraft is consistent with the decision made by the Dangerous Goods Panel of the International Civil Aviation Organization (ICAO). MTB agrees with ATA that the use of cylinders should be allowed and, accordingly, has authorized these materials to be transported by air in DOT-4L cylinders or in accordance with ICAO requirements under § 171.11.

ATA also proposed that three separate entries be provided in the Table for each nonflammable cryogen. The entries would designate the cryogen as pressurized, low pressure and nonpressurized. MTB does not agree with ATA that three separate entries should be listed for the cryogenic liquids. The basis for ATA's recommendation was that separate entries, rather than the exception proposed at § 173.320, would clarify the applicable requirements for the varying pressures. MTB takes the position that the use of a single entry in the Table, with the exceptions referenced in column 5(a), is consistent with the format of the Table and is well understood by persons affected by the regulations. Should MTB conclude at some future date that some means are needed to differentiate among the various categories of these materials, it will consider the matter in a future rulemaking.

ATA also expressed concern that cryogenic liquids, such as helium and neon, having boiling points colder than the freezing point of air should not be permitted in air transportation when in Dewar flasks because of the possibility the vents may freeze with solid air thereby allowing internal pressure build-up MTB is aware that these packagings have been transported aboard passenger aircraft in the past with no reports of adverse experience that would justify such a prohibition. ATA provided insufficient data as to why this prohibition should be imposed and MTB is not aware of any data or information that supports ATA's position. MTB's decisions not to prohibit the transportation of Dewar flasks containing authorized cryogenic liquids by aircraft is consistent with ICAO. MTB's response is the same with regard to ATA's suggestion that, as another alternative, MTB should consider banning all air transportation of cryogenic liquids regardless of pressure in the packaging.

Another concern of ATA's was that the provisions in proposed § 173.320 do not clarify the fact that such shipments offered for transportation by aircraft are subject to shipping papers, marking, labeling and other requirements pertaining to carriage aboard an aircraft in Part 175. MTB agrees and has revised § 173.320 by removing the reference to aircraft.

Maximum net quantity limits aboard aircraft (the Table, column (6)) were recommended by ATA based on the pre-December 31, 1982 listings in the International Air Transport Association (IATA) Restricted Articles Regulations and the Air Transport Association's Tariff 6-D. CGA's comments also addressed quantity limits. CGA suggested quantity limitations for argon, helium, and neon (CGA, as well as ATA, suggested that neon be added to the Table) that exceeded those in the NPRM. A quantity limitation of 550 pounds of argon by cargo-only aircraft was recommended to allow the shipment of the "150 liter, industry standard container". A similar quantity limitation was recommended for neon. CGA recommended that the quantity limitation of 300 pounds of helium by cargo-only aircraft be increased to 1100 pounds to be consistent with present air shipments in standard containers that include a 1000 gallon container. CGA did not suggest any change in the proposed passenger aircraft limitation of 100 pounds for argon or helium and suggested the same limitation be provided for the new neon entry. MTB agrees with the intent of CGA's suggestions relative to maximum quantity per package aboard an aircraft, however, MTB has modified the suggestion by adopting the limitations used by ICAO for cryogenic liquids, rather than those of CGA, ATA or IATA. MTB believes usage of these

quantity limitations will facilitate transportation of these materials moving in international commerce by air without compromising safety. The maximum net quantity in one package by cargo-only aircraft of helium, neon, and nitrogen is 1,100 pounds and the maximum net quantity of argon is 300 pounds. The quantity limitation in one package of these gases by passenger aircraft is 100 pounds.

Several commenters addressed the proposed stowage requirements for water shipments, which in several instances were more stringent that the stowage currently allowed. Specifically, argon, cryogenic liquid and helium, cryogenic liquid were proposed to be allowed "on deck" stowage, and oxygen, cryogenic liquid was proposed to be allowed "on deck" stowage on a cargo vessel, but forbidden on a passenger vessel. (Present regulations allow helium and the cryogenic forms of argon and oxygen to be stowed on deck or under deck. Argon and oxygen when stowed under deck must be "under deck away from heat.") After further consideration of the proposed stowage requirements, the Coast Guard, which assisted MTB in the preparation of these requirements, agreed to the stowage requirements contained in the present regulations except for that which permits oxygen, cryogenic liquid, to be stowed "under deck" on a passenger vessel. This rule does, however, permit oxygen, cryogenic liquid to be stowed on deck on a passenger vessel and it does not appear there will be any hardship created by this requirement.

Three commenters also objected to the proposed provision prohibiting hydrogen, cryogenic liquid, on board a cargo vessel. The commenters argued that the "5" in column 7(a) should be changed to "1" for consistency with other flammable cryogenic liquids which have similar properties. MTB and the Coast Guard do not agree with the commenters because hydrogen with its wider flammability limits poses a greater potential hazard than other flammable cryogenic liquids. Therefore, the suggested change has not been made.

A change has been made in column (7)(b) for gaseous hydrogen from "54" to "4". The reason for this second change is to correct a typographical error since the number "54" had no meaning and the entries "5" and "4" were conflicting. Retaining only the number "4" allows the water shipment aboard passenger vessels of limited quantities of the material.

ATA and CGA were not in favor of including the term "cryogenic liquid" as part of the proper shipping name. ATA, as discussed earlier, supported use of the descriptions "low pressure", "non-pressurized" and "pressurized". CGA recommended that the term "pressurized liquid" be used for consistency with the terminology in existing regulations. MTB believes the "cryogenic liquid" terminology more readily conveys the thermal hazard posed by these materials to emergency personnel and transport workers. Therefore, the term "cryogenic liquid" is being retained as part of the proper shipping description in the final rule.

MTB has added identification numbers to the new entries being included in the Hazardous Materials Table. This is in accordance with the final rule issued under HM-126A (which was completed after the NPRM for this action (45 FR 34560; May 22, 1980)). The new cryogenic liquid descriptions are preceded by an "NA" prefix.

Another major change since the NPRM is the addition of certain entries designated as "liquid (*refrigerated*)". These entries cover materials that, while not meeting the definition of a cryogenic liquid, are gases at atmospheric pressure and ambient temperatures and are transported in cold liquid form. MTB has added these materials to this rulemaking in order to eliminate a number of exemptions. Because of the grandfathering of packagings covered by existing exemptions, the addition of these materials to the Table and related requirements will not add to the burden of current exemption holders. In fact, the addition of these materials to the Table eliminates the need for an exemption to transport these hazardous materials.

Finally, several commenters requested that the current proper shipping name of hydrogen chloride be retained rather than modified by the description "anhydrous", as proposed in the NPRM. The commenters pointed out that the use of "hydrogen chloride" to describe anhydrous material is universally known in the industry and adding the word "anhydrous" is unnecessary. As requested by these commenters, MTB has allowed the current name, "hydrogen chloride", to remain.

*Section 172.203.* Three commenters pointed out that the notation on shipping papers used to alert rail carriers that certain tank cars may not be humped or cut off while in motion should be applicable to DOT 113D tank cars. MTB agrees with the commenters. Omission of the DOT 113D tank car was an oversight. MTB has revised paragraph (g)(3) to clarify that the notation is applicable to any class DOT 113 tank car.

*Section 172.328.* The parenthetical language "(including a cryogenic liquid)" has been added to clarify the fact that this provision applies to those materials.

*Section 172.504.* Instead of deleting Note 2 to Table 2 and renumbering the remaining Notes, as proposed in the NPRM, the text to Note 2 is removed and Note 2 is reserved.

*Section 173.11 (proposed as § 173.5).* Several commenters objected to the proposed requirements in this section for shippers of flammable cryogenic liquids in portable tanks, cargo tanks and tank cars, and the proposed requirements in § 177.825 (now § 177.826) for carriers of flammable cryogenic liquids in cargo tanks by highway, to file registration statements with MTB. Three of the commenters opposed the requirements as unnecessary. One of the commenters pointed out that registration is not required for other hazardous materials, that there is no evidence that it is needed here, and that such a requirement is contrary to the intent of the Paperwork Reduction Act of 1980 (44 U.S.C. 3501–3520). Three commenters objected to the provision in the proposal that would require the registration statement to be acknowledged by MTB prior to shipment of flammable cryogenic liquids since it was believed this would result in unnecessary and unreasonable delays. A different commenter suggested that the words "cargo tank" should be included in paragraph (a)(5) for consistency with the intent stated in the preamble. The remaining commenter suggested that the requirement should not apply to shippers of tank cars since it was not a requirement in the exemptions and the requested information would not enhance safety.

MTB disagrees with the commenters who believe that there is no need for registration of shippers and highway carriers of flammable cryogens. The registration requirement adopted in this rule will provide important information which will enable MTB to identify and locate shippers and carriers of these very hazardous materials for periodic inspections of their operations. For the same reason, MTB has not excepted shippers of tank cars from the requirement.

MTB does agree with the commenters' concern regarding the potential time lapse prior to MTB acknowledgement. It is MTB's intention that the registration statements be processed in a timely manner. Accordingly, as suggested by one of the commenters, MTB has revised the requirement to allow the registration statements to be filed by certified mail with a return receipt requested. The signed copy of the returned certified

mail receipt will serve as MTB's acknowledgement of the registration statement. A similar change has been made to § 177.826.

Additional changes to this section since the NPRM, include the requirement that registration filings be with the Associate Director for Hazardous Materials Regulation, rather than the Associate Director for Operations and Enforcement. This is not a substantive change and merely represents a reorganization of functions within MTB. The section has been reorganized and the commenters suggestion that cargo tanks be added in proposed paragraph (a)(5) has been adopted (the corollary paragraph in the final rule is (b)(4)). Finally, the dates on which registration begins have been revised to be consistent with the effective date of this rule.

*Section 173.23.* A new paragraph (d) is added to permit remarking of cylinders covered by a DOT exemption, as discussed under the heading "Impact of This Rulemaking on Existing Exemptions."

*Section 173.29.* Proposed paragraph (f)(3) would have prohibited venting of any gas, other than an atmospheric gas, remaining in a tank car previously used to transport a cryogenic liquid. Upon review, MTB believes the same purpose is served by the present requirement of paragraph (c)(2) which requires that an empty tank car that has been used to transport a hazardous material must be shipped in the same manner as when it contained a greater quantity of material unless it has been cleaned, purged or reloaded with a material not subject to the regulations. Therefore, proposed paragraph (f)(3) has not been incorporated into the final rule.

*Section 173.31.* Proposed paragraph (a)(6) (paragraph (a)(8) herein) is revised as discussed under the heading "Impact of this Rulemaking on Existing Exemptions" to permit remarking of tank cars covered by a DOT exemption. Additionally, the provision has been changed to allow the operator as well as the owner to do the remarking.

A new paragraph (a)(9) is added to provide that tank cars built to Specifications DOT–113A175W, DOT–113C60W, DOT–113D60W, or DOT–113D120W may continue in service, but no new construction of these tank cars is authorized. No new construction of any of the tanks have been authorized under exemption since 1973. The only tank cars authorized for new construction are specification DOT–113A60W (for hydrogen) and specification DOT–113C120W (for ethylene).

Proposed paragraph (c)(13)(i) is revised, as suggested by two commenters, to clarify that a class DOT–113 tank car is not required to be retested unless the pressure rise in the tank exceeds 3 psi per day. If the pressure rise exceeds 3 psi, the tank must be properly retested prior to being returned to service. The NPRM language was not as clear and referred only to 113A cars. Application of this provision to all DOT–113 cars was intended. The correction of this oversight represents a relaxation of the proposed requirements. Two commenters to paragraph (c)(13)(i) stated that the requirement to monitor the cars for pressure rise should only apply to cars transporting flammable cryogens. MTB notes that at the present time the only cryogens authorized for shipment in tank cars are flammable and hence although the language of this section does not limit application to flammable cryogens, § 172.101 does.

In paragraph (c)(13)(ii)(B), the proposed evaporation rate retest has been replaced with a calculated heat transfer rate (CHTR) retest to more accurately reflect the performance tests specified for class DOT–113 tank cars operating under exemption and to be consistent with a change made to proposed § 179.400–4 and published in this rule. The CHTR retest provides a method for qualification of a tank car insulation system that can be more readily accomplished than that which was proposed in the NPRM.

Paragraph (c)(iii) has been rewritten to clarify the fact that successfully completing either of the retests prescribed in (c)(ii) will allow a car to be placed back in service.

In this section, as in a number of others, the term "safety relief valve" has been replaced by the term "pressure relief valve." While both terms are generally understood by industry to refer to the same device, MTB believes that "pressure relief valve" is the more accurate term and MTB, in line with certain industry groups, is using this terminology in this rule. MTB has not attempted to change all references in the Hazardous Materials Regulations where the term "safety relief valve" is used. For purposes of the Hazardous Materials Regulations the terms have the same meaning.

Retest Table 1, which until this rule followed paragraph (d)(4), now follows paragraph (c)(13) and has been expanded to include tank cars formerly under DOT exemption that are to be remarked in accordance with paragraph (a)(8) of this section. Additionally, the DOT–113A175W car, proposed to be deleted, has been left in the Retest Table to meet the needs of a commenter who indicated that tank cars of this type have been reconditioned and returned to service. In response to another comment, the footnote references have been corrected. Also, the vapor tight pressure for the DOT–113A175W tank car has been reduced to 80 percent of the start-to-discharge pressure of the safety relief valve. This change is consistent with the vapor tight pressure valves used for other DOT class tank cars. Two other commenters recommended that a new footnote "t" be added following the table to cover the retest of alternate safety relief valves when installed. Such a footnote is not necessary, however, because § 173.31(c)(13)(v) prescribes a retest that is applicable to any alternate safety relief device.

*Section 173.33.* Several changes to this section have been discussed previously in the preamble in the subject-by-subject review: (1) Cargo tanks currently used to transport cryogenic liquids under exemption will be "grandfathered" and will not have to be modified or have the inability to make such modifications explained to MTB (proposed §§ 173.33 (b)(2) and (b)(2)(iii)); (2) the holding time verification (proposed § 173.33(d)(1)(ii)) now only applies to cargo tanks containing flammable cryogenic liquids rather than all cryogenic liquids; and (3) the required retest pressure for an MC–338 tank (proposed § 173.33(d)(2)) has been reduced from 1½ times maximum allowable working pressure to 1¼ times that figure.

Additionally, the section has been revised to require cargo tanks currently used to transport certain cold, refrigerated gases under exemption to be stamped with the MC–330 or MC–331 specification identification followed by the exemption number. This serves to "grandfather" these tanks, thereby removing them from the exemption program (although the exemption number will remain with the tank for its service life to substantiate the authorized use of the tank).

The pneumatic testing method in paragraph (d)(2) no longer specifies that a soap and water solution or other suitable material must detect leaks through the presence of foaming or bubbling. Now any "equally sensitive method" is acceptable. This change provides greater flexibility and recognizes that there may be a number of acceptable methods for detecting leaks.

Another change allows either the owner or operator of a tank currently operating under exemption to perform the remarking. The NPRM spoke in terms of the exemption "holder". This

change recognizes the fact that frequently a tank may be under long-term lease to an operator who has exclusive use and possession of the tank. This person is authorized to perform the remarking, thereby reducing the possibility that a tank would have to be taken out of service so that the "holder" could perform the remarking.

The names "carbon dioxide" and "nitrous oxide" are removed and replaced by "carbon dioxide, liquid *(refrigerated)*" and "nitrous oxide, liquid *(refrigerated)*" each time they appear in this section.

*Section 173.300.* A commenter suggested that the definition of a cryogenic liquid in proposed paragraph (f) be changed to specify a reference pressure at 14.7 psig for "technical clarification." MTB believes a reference pressure would clarify the provision and, for consistency with the liquefaction temperature, has specified a pressure of one atmosphere.

In the NPRM, the definition for filling density in paragraph (g) would have been redesignated as paragraph (h) and amended to indicate the different sections applicable to cryogenic liquids. However, MTB has removed present paragraph (g) in the final rule since a definition of filling density has been added to § 171.8.

*Section 173.304.* The proposed Table to paragraph (a)(2) has been changed. "Hydrogen chloride" is no longer being deleted and added as "Hydrogen chloride, anhydrous." As noted in the discussion of § 172.101, the name of this material is no longer being changed. However, the name "carbon dioxide, liquefied" is being removed and the name "carbon dioxide" is added.

As noted in the April 5, 1979 addition to the NPRM, paragraph (b) has been revised to clarify filling limits for vinyl fluoride, inhibited.

*Section 173.314.* Several commenters suggested that tank cars containing hydrogen chloride, liquid *(refrigerated)* should be marked "HYDROGEN CHLORIDE" for consistency with the requirement for chloride materials which have similar hazards. MTB agrees and has added the requirement in paragraph (b)(6). In addition, in the Table to paragraph (c), the maximum pressure for tank cars containing hydrogen chloride, liquid *(refrigerated)* when offered for transportation is increased from 80 psig to 90 psig, based on the concerns of several commenters that increased time be allowed for adequate inspection of tank cars. The effect of the change is minimal and will have no adverse effect on safety. Also, the entries to the Table have been changed, as noted in discussions of other sections, to reflect different shipping names for carbon dioxide, liquid *(refrigerated)* and hydrogen chloride, liquid *(refrigerated)*.

*Section 173.315.* MTB believes the reference to the marking requirement in the introduction text to this paragraph is unnecessary and, therefore, it has been deleted. In the Table to paragraph (a), the obviously incorrect filling density for hydrogen chloride, liquid *(refrigerated)* of "10.3 percent" is changed to "103.0 percent". Also, MTB is authorizing the shipment of refrigerated ethane, ethane-propane mixture, and hydrogen chloride, liquid *(refrigerated)*, in insulated MC-338, as well as MC-331, cargo tanks. This eliminates an unnecessary restriction in the NPRM that precluded the use of an MC-338 tank for materials for which a less heavily insulated MC-331 tank was authorized.

Note 11 to the Table has been extensively revised. The NPRM proposed that each tank have a design service temperature no warmer than the material's liquefaction temperature. As discussed earlier in the preamble under the heading "Liquefaction Temperature," the term "liquefaction temperature" has been replaced with the more readily understood term "boiling point at one atmosphere" to eliminate possible ambiguity. The requirement in present Note 11 that a cargo tank must be designed for a service temperature no higher than minus 100° F, which was inadvertently omitted in the NPRM, has been retained.

The holding time requirement has been rewritten for clarity, but without changing the substance of the requirement.

The last sentence in proposed Note 11 would have required that, before being transported in an empty condition, a cargo tank be drained, vented or blown down sufficiently to prevent venting while en route, in view of the existing requirement that an empty cargo tank last used to transport a hazardous material must be transported in the same manner as when it contained a greater quantity of material, MTB does not believe the provision is necessary and therefore it has not been included in the final rule.

A requirement has been added to Note 11 that a cargo tank used to transport a flammable gas must have an outer steel jacket. The reasons are discussed earlier in this preamble under the heading "Use of Aluminum."

Finally, the names "carbon dioxide" and "nitrous oxide" are removed and replaced by the names "carbon dioxide, liquid (*refrigerated*)" and "nitrous oxide, liquid (*refrigerated*)," respectively, each time they appear in this section.

*Section 173.316.* Proposed paragraph (a)(3) has been changed so that the steel jacket requirement does not apply to cylinders transporting cryogenic oxygen. This change was urged by several commenters and also responds to petitions submitted by CGA dated July 3, 1975, and January 19, 1977. This change is supported by the satisfactory safety record of aluminum jacketed cylinders in cryogenic oxygen service under DOT E-6668, and the fact that prior to the granting of this exemption, in 1972, extensive fire tests were performed with satisfactory results. These factors, as well as the quality of material in each package, distinguish cylinders from cargo tanks and support the position adopted in this final rule that aluminum jackets be authorized for cylinders, but not for cargo tanks, used to transport cryogenic oxygen. See the earlier preamble discussion under the heading "Use of Aluminum."

Proposed paragraph (a)(4) has been revised to limit its applicability to cylinders used to transport cryogenic oxygen. Flammable cryogens are now addressed in a new paragraph (a)(5), which prohibits an aluminum valve, pipe or fitting on any cylinder used to transport a flammable cryogenic liquid. This prohibition was supported by the commenters and is necessary, due to the low melting point of aluminum, in order to preclude an increase in the consequences of a fire involving a cylinder containing a flammable cryogenic liquid.

One commenter suggested that pressure relief devices on cylinders should comply with CGA Pamphlet S-1.1, entitled "Pressure Relief Device Standards, Parts I—Cylinders for Compressed Gases." MTB adopted CGA Pamphlet S-1.1 under an earlier rulemaking to require that pressure relief devices on cylinders comply with CGA standards (Docket HM-163E, 46 FR 22194, April 16, 1981). The requirement is contained in § 173.34(d).

Hydrogen has been excepted from applicability of the filling density definition in paragraph (c)(1) and a separate definition has been added as Note 1 to the Table in (c)(3). This was an oversight in the NPRM since the Table to (c)(3) clearly stated that filling density was based on cylinder capacity at minus 423° F.

As suggested by commenters and discussed in the explanation for § 172.101, cryogenic helium and neon are authorized for shipment in cylinders in this final rule and this is reflected by their addition to paragraph (c)(2).

*Section 173.318.* The proposed requirement to allow aluminum valves

without rubbing or abrading aluminum parts has been retained in paragraph (a)(4) for cargo tanks used to transport cryogenic oxygen. However, a prohibition on an aluminum valve, pipe or fitting being used on a cargo tank used to transport a flammable cryogenic liquid has been placed in a new paragraph (a)(5). The reason for this change is the same as for the similar change made to §173.316.

A new paragraph (b)(1)(ii) has been added to clarify that each pressure relief valve must be designed and constructed for a pressure equal to or exceeding the tank design pressure at the coldest temperature to be encountered. New paragraph (b)(5)(iii) contains a requirement to mark the set-to-discharge pressure of each pressure control valve. This requirement is consistent with that contained in § 173.315 for other cargo tanks.

In the Table to proposed paragraph (f)(3), the design service temperature for methane or natural gas was −320° F. This was in error. The correct design service temperature specified in the final rule is −260° F.

The operational requirement, proposed in §§ 178.338–9(c) and 178.338–18(d), specifying that a cargo tank containing a flammable cryogenic liquid must be marked with the one-way travel time (OWTT) for the material contained in the cargo tank has been deleted from the specification section. The requirement is now, more appropriately, in new paragraph 173.318(g). Additional comments and changes to this section have been addressed earlier in this preamble under the headings "Pressure Relief Device Systems," "Minimum Outage and Filling Densities," and "Venting, Holding Time, Trip Monitoring and Equilibration of Cryogenic Liquids."

*Section 173.319.* The requirements in this section have been revised to clarify that they apply only to flammable cryogens.

MTB received conflicting comments on the use of scales to determine the amount of cryogenic liquids loaded into a tank car as proposed in paragraph (a)(2). MTB has decided to delete the required use of scales for hydrogen cars, but has retained the method for cars containing other cryogenic liquids. The exception for hydrogen is made due to the extremely low density of this material and the fact that even a reasonably accurate scale capable of weighing a rail tank car would likely have a plus or minus error that would make it unreliable as a method of checking the amount of hydrogen that has been loaded.

The requirement in proposed paragraph (a)(3) to notify the Bureau of Explosives (B of E) when a tank car has not been received by the consignee after 20 days was opposed by three commenters. One of these commenters pointed out that a tank car operating between such places as Texas and Alaska would exceed 20 days in transit on every shipment. The other two commenters argued that the design of cars for flammable cryogenic ladings provides for a 30 day holding time and therefore taking action after 20 days is premature. After considering the matter, MTB has decided to retain the notification requirement. MTB and the Federal Railroad Administration believe that, for tank cars transporting flammable cryogens, tracing should begin after 20 days in transit to ensure that a car will be located and routed to reach its destination within the holding time of the car.

Paragraph (c) has been changed to relate filling temperature to pressure rise, instead of the holding time, for consistency with changes made to § 179.400–4. These changes recognize that it is not current practice to conduct holding time tests on tank cars in cryogenic liquid service.

Finally, the permitted filling densities in the table in paragraph (d)(2) have been modified for ethylene to accommodate tank cars currently operating under a DOT exemption that under this rule will be remarked in accordance with § 173.31(a)(1). The DOT–113A175W car has been added to the authorized specifications for hydrogen as noted in the preamble discussion of § 173.31.

*Section 173.320.* The applicability of the exception provided by this section is expanded to include all atmospheric gases and to make it clear that the regulations pertaining to cryogenic liquids do not apply to refrigeration systems during transportation by motor vehicle, railcar, or vessel. The wording has also been clarified to emphasize that in order to qualify for this section, the design and construction of the packaging, not the thermal protection, must limit the pressure to 25.3 psig.

The exception has also been expanded to exclude atmospheric gases (except oxygen) and helium in qualifying packaging from the labeling and placarding requirements in Part 172. For carriage aboard aircraft, the provisions of § 173.11 apply; therefore, there is no reference to aircraft in § 173.320.

The issue of imposing any requirements on the shipment of atmospheric gases and helium is discussed earlier in this preamble under the heading "Nonpressurized Atmospheric Gases and Helium."

*Part 174.* Except for minor reorganization of § 174.204(a)(2), the sections in this Part are amended and revised as proposed in the NPRM.

*Section 176.76.* A number of changes have been made to this section. Several commenters recommended that this section be expanded to provide for cargo tanks formerly under a DOT exemption that have been remarked in accordance with § 173.33(b)(2). MTB agrees and this change has been made in paragraph (h)(1).

The reference, in proposed paragraph (h)(1) to § 173.318(a)(4) is now treated more clearly by restating the applicable requirements in paragraph (h)(2). Proposed paragraph (h)(2) is now (h)(3).

In line with other provisions regarding holding time, proposed paragraph (h)(2) (now paragraph (h)(3)) has been changed so that it now only applies to flammable cryogens. See the discussion under the heading "Venting, Holding Time, Trip Monitoring and Equilibration of Cryogenic Liquids" earlier in this preamble. Several commenters correctly pointed out that proposed paragraph (h) does not provide for tank cars containing a cryogenic liquid to be transported by vessel. This was an oversight on MTB's part. Accordingly, a new paragraph (h)(4) has been added to allow shipment of cryogenic liquids by vessel in DOT–113 or (for nonpressurized atmospheric gases and helium) AAR 240W tank cars. Because of the extreme thermal hazard cryogenic liquids pose to shipboard structures, a requirement has been added in new paragraph (h)(4) to require portable tanks, cargo tanks and tank cars containing cryogenic liquids to be stowed "on deck" only.

*Section 177.816.* The NPRM proposed that drivers of cargo tanks used to transport a flammable cryogenic liquid be required to receive formal training, at least once every 24 months, on the proper handling of the particular flammable cryogen being transported in the particular type of cargo tank. Included in the proposal were requirements that written records of training be kept by the carrier and that the driver be issued a certificate of training to be carried on his person while operating the motor vehicle. Three comments were received concerning this section. The Interstate Commerce Commission supported a detailed, structured curricula. The second commenter suggested that corresponding revisions should be made to §§ 391.11, 391.51, and 397.19 of the Federal Motor Carrier Safety Regulations, and the third commenter opposed the proposal as redundant and

as an unnecessary regulatory burden that would do nothing to enhance safety in view of § 177.800. This commenter also questioned whether the driver would be placed out-of-service if he did not have the certificate of training in his possession during a DOT roadside inspection.

This final rule adopts a driver training requirement because MTB believes that the program will increase a driver's knowledge and general awareness of the applicable Hazardous Materials Regulations, and his knowledge of the hazard of cryogenic liquids and the handling and operating characteristics of the particular vehicle used to transport the material. This requirement reflects good business practice and helps to ensure that this type of training will be performed at regular intervals.

In response to the comments, MTB notes that the training presently required by § 177.800 is general in nature and does not cover the details proposed, and now contained, in § 177.816, which is specifically applicable to flammable cryogenic liquids. Adoption of a structured curricula as suggested by the ICC, is outside the scope of this rulemaking. If MTB determines in the future that there is a need for a structured driver training program, it will be made the topic of a future rulemaking.

The major change to the NPRM is that a certificate of training is no longer required. MTB reevaluated the burdens and benefits of such a requirement and now believes that requiring the paperwork to be completed and then retained by the driver is unnecessary in view of the fact that the information can be obtained from the carrier's files.

In order to reduce paperwork burdens, MTB has reduced the period of time that a carrier must keep the driver's record of training after a driver has left the carrier's employ from three years to 90 days.

Paragraph (a) is changed to indicate that when interchange operations are involved, only the originating carrier is subject to this section.

*Section 177.818.* One commenter recommended that the provisions of this section be limited to transportation of *flammable* cryogenic liquids. The omission of the word "flammable" preceding "cryogenic liquid" in this section was in error. The omission has been corrected.

*Section 177.824.* This section is adopted as proposed in the NPRM.

*Section 177.826.* MTB has revised this section along the lines of § 173.11 to allow carriers to file registration statements by certified mail with a return receipt serving as MTB's acknowledgment. One commenter expressed concern that certain information contained in the registration statement, such as the number and type of vehicles in use by a carrier, may be considered proprietary and should be protected from public release. For years, each motor carrier has filed with the Federal Highway Administration's Bureau of Motor Carrier Safety (BMCS) a listing of all MC-330 and MC-331 cargo tanks the carrier has in service (49 CFR § 177.824(f)). MTB does not believe that the type of information that must be provided under this section is any more proprietary than that provided to BMCS on the MC-330 and MC-331 cargo tanks. However, if a carrier believes that its information is entitled to confidentiality under the Freedom of Information Act (5 U.S.C. 552), or is the type of material referred to in 18 U.S.C. 1905, the carrier is entitled to request confidential treatment under the terms of 49 CFR 107.5.

In paragraph (c), the initial filing period has been revised to be consistent with the effective date of this amendment.

*Section 177.840.* Paragraph (h) has been restructured for clarity.

Paragraphs (i) and (j) have been rewritten to allow for equilibrations. This is discussed earlier in the preamble under the heading "Venting, Holding Time, Monitoring, and Equilibration of Cryogenic Liquids."

MTB believes paragraph (j) of the NPRM which specified a 50 percent reduction in one-way travel time for cargo tanks used in distribution service (peddle runs) is no longer necessary in light of the new provision on equilibration specified in § 177.840 and the modified provisions to allow venting of nonflammable cryogens as specified in § 173.320. Accordingly, it has been deleted.

Paragraph (k) of the NPRM, which discussed empty cargo tanks has also been removed, as discussed previously in this preamble with regard to § 173.29. MTB believes that this proposal was unnecessary in light of the present requirement in § 173.29(c)(2).

Paragraph (l) of the NPRM is now paragraph (k) and has been clarified to indicate that the apparatus must be approved by the National Institute of Occupational Safety and Health.

*Section 178.57.* Several changes have been made to this section that were not addressed in the NPRM. These changes, however, reflect an expanded use of the DOT-4L cylinder and in most instances are necessary to conform to other changes that have been made in this rule.

In § 178.57-2, The maximum service pressure has been revised to more accurately reflect the maximum pressures authorized in Part 173 for cryogenic liquids during transportation. In paragraph (c) of this section, design service temperatures are specified for argon, helium, neon, nitrogen and oxygen, in addition to hydrogen. The temperatures specified are the same as those previously required under paragraph (c) except for helium and neon, which were not previously authorized for transportation in DOT-4L cylinders.

Section 178.57-5 has been changed to reflect the fact that for the carriage of certain commodities an aluminum outer jacket is authorized. See the discussion of this in the preamble discussion of § 173.316.

Section 178.57-8 has been revised to provide for aluminum as well as steel jackets on DOT-4L cylinders. A steel jacket on a non-evacuated insulation system may be no less than 0.060 inch thick, as prescribed by present regulations. When an aluminum jacket is used on a non-evacuated insulation system, it may be no less that 0.070 inch thick. This is consistent with existing exemptions. Paragraph (c) also provides that when a steel or an aluminum jacket is used on vacuum insulated cylinders, the jacket must be designed to a minimum collapsing pressure of 30 psi. The 30 psi minimum collapsing pressure will provide greater flexibility than the specification of a minimum thickness and is better suited to controlling the wall thickness of an evacuated jacket to provide resistance to collapsing. Paragraph (d) of the same section has been added to ensure that the requirement in § 178.57-20(a)(4) is complied with at the time of manufacture.

In § 178.57-10, the definition of "P" has been rewritten to indicate that the pressure test need not be hydrostatic and to clarify that this figure is to be expressed in psi.

Section 178.57-12 now provides that the fitting, boss or pad provided for each opening may be "integral" in lieu of "securely attached". The reference in paragraph (a)(2) has been changed from "American Standard taper pipe threads" to "NPT". This change, with the associated definition in § 171.8, helps pinpoint the reference without making a substantive change. Paragraph (a)(3) has been rewritten for clarity. As previously worded it was unclear whether the required inertness and leakage prevention characteristics referred to the threads or the gasket. Although the

answer may have been obvious, it has now been stated correctly.

Section 178.57–13 was addressed in the NPRM and it is adopted here with the added requirement that flow capacity meet the industry standard in CGA Pamphlet S–1.1.

In § 178.57–20, the references to "service temperature" in paragraph (a)(2) have been changed to "design service temperature", without substantive effect. An identical change has been made in paragraph (a)(4) along with minor rewriting for clarity. The examples shown in the present paragraph (a)(4) have been moved to paragraph (a)(5). Paragraphs (a)(8) and (a)(9) have been added to require special orientation instructions and, when appropriate, a marking which identifies a cylinder with an aluminum jacket.

Section 178.57–21 has been revised to recognize that an aluminum jacket is authorized for nonflammable cryogens and therefore the materials of construction for the cylinder and outer jacket are now specified separately.

Section 178.57–22 is being changed to make very minor changes to correct improper uses of plurals, to change "service temperature" to "design service temperature" and to move the chemical analysis table to the proper location.

*Section 178.337.* MTB has revised § 178.337–1(a) for clarity and to authorize MC–331 cargo tanks to be constructed with aluminum. If aluminum is used for the inner tank, the tank must be insulated. When an insulated tank is intended to be used to transport a flammable gas, a steel jacket is required. Although not addressed in the NPRM, MTB believes these modifications are justified in view of its decision to allow aluminum in the construction of MC–338 cargo tanks under similar conditions. Section 178.337–1(e) has been revised to recognize the changes made to §§ 173.315(a) Table Note 11 and 178.337–1(a).

Section 178.337–11(c) has been revised to include the term "NPT" as a reference standard for the discharge openings. Also the reference to hydrogen chloride has been changed to be consistent with the new proper shipping name "hydrogen chloride, liquid *(refrigerated)*."

*Section 178.338–1.* An additional reference has been added in paragraph (a)(2) of § 178.338–1 to clarify the design service temperature. See the preamble discussion under the heading "Liquefaction Temperature" for further discussion.

A commenter requested that paragraph (c)(1) be revised to require each tank to be "designed, constructed, *and stamped* * * *." A tank constructed to the MC–338 specification is required to be marked by stamping, embossing, or other means, as prescribed by § 178.338–18. Therefore, MTB believes adding the word "stamped" to this section is not appropriate. Also, the commenter requested that paragraph (c)(1) allow closing welds to be made with non-removable backing strips. Construction of such a cargo tank is not prohibited by the regulations provided the tank is designed and constructed to allow washing of the interior surface, as prescribed by paragraph (c)(3), and meets the cleanliness requirements contained in § 178.338–15. Therefore, no change is necessary. As suggested by the same commenter, MTB has made a minor revision in the lower design pressure value specified in paragraph (c)(1) from 25 psig to 25.3 psig for consistency with § 173.320. The word "cargo" has been removed, in the reference to "cargo tank" in paragraph (c)(3), for consistency with the definition of tank in § 178.338–1(b).

In paragraph (e), a commenter requested that MTB specify a thickness in inches, in addition to the gauge values specified for the minimum metal thicknesses, in order to ensure proper calculations. However, the gauge-to-inch values suggested by the commenter were not in accordance with guage thicknesses prescribed in the Table to § 173.24(c). The commenter did not explain why the values in § 173.24 were unsuitable. MTB has now specified minimum thicknesses, in inches, based upon the minimum thicknesses prescribed in § 173.24(c).

The design parameters for evacuated jackets in paragraph (f) were revised in the June 21, 1979 notice. In that notice, MTB acceded to commenter's requests and incorporated some of CGA's recommendations for a vacuum jacket contained in CGA–341 which, to a large extent, references the ASME Code. In its comments to the NPRM, as modified, the CGA recommended adoption of § 178.338–1(f) as initially proposed in the March 8, 1979 NPRM and expressed its view that the June 21, 1979 revision to paragraph (f)(2) was unsuitable. After considering these comments, and for reasons discussed under the heading "Jacket Design" earlier in this preamble, MTB has adopted the proposals for evacuated jackets contained in the June 21, 1979 notice, but has specified that the minimum collapsing pressure for evacuated jackets must be at least 30 p.s.i. This is consistent with standards in Pamphlet CGA–341.

*Section 178.338–2.* A commenter objected to the proposed requirements in paragraph (a) that jacket material must be in accordance with the ASME Code and to the additional postweld heat treatment required for cargo tanks constructed of UHT materials in proposed paragraph (e). The commenter stated that ASME material has never been mandatory for evacuated jacket material. This commenter cited the narrow temperature range for proper heat treatment of 5%, 8% and 9% nickel steels as the reason for opposing the proposed requirements for UHT materials. These same objections were raised to proposed § 178.338–4(a).

MTB is not aware of any test or experience data on the suitability of cargo tanks constructed of UHT materials that have not been postweld heat treated. Also, MTB is not aware of any cargo tank constructed of 5% or 8% nickel steels in pressurized cryogenic liquid service. Furthermore, there is no authorized cargo tank constructed of 9% nickel steels in pressurized cryogenic liquid service under exemption that MTB can use as the basis for obtaining experience data. The one cryogenic cargo tank constructed of a modified 9% nickel steel being operated under exemption has not been postweld heat treated, but it is mounted on a flat-bed trailer; therefore, it is not subject to full torsional forces and dynamic shock loadings normally encountered during transportation. In the absence of such data, MTB strongly believes the requirements proposed in the NPRM are justified in order to fully account for the dynamic forces encountered in the transportation environment. These forces are not considered by the ASME Code, which basically establishes standards for stationary pressure vessels. Furthermore, MTB believes that anyone who fabricates with UHT material is capable of properly heat treating these materials. Other UHT steel pressure vessels require postweld heat treatment. Therefore, the proposed requirements are retained in the final rule.

*Section 178.338–3.* A commenter requested that MTB incorporate the more lenient metal thickness requirements of the ASME Code. Since, as noted above, ASME designs do not consider the dynamics of the transportation environment, MTB is adopting the proposal contained in the NPRM.

*Section 178.338–4.* One commenter recommended that proposed § 178.338–4(c), which deals with the intersection of nozzles, supports, and other welds with longitudinal welds in the tank and load bearing jacket, be deleted. The commenter believes that the ASME Code adequately addresses welding

details. However, MTB believes that the prohibition on such intersections, other than by the welds of load rings or stiffening rings, contributes to overall tank integrity at negligible additional cost. Therefore, MTB is retaining § 178.338–4(c) and, along the same lines, is adding language to proposed § 178.338–13(d) (now at § 178.338–13(a)), specifically providing for fillet weld discontinuity in the attachment of supports and bumpers, in order to reinforce the § 178.338–4(c) requirement.

*Section 178.338–5.* This section is adopted as proposed in the NPRM.

*Section 178.338–6.* One commenter recommended that MTB delete the requirement for a manhole on cargo tanks in oxygen service. The manhole requirement was proposed as § 178.338–6 in the June 21, 1979 **Federal Register** publication amending the NPRM. The commenter stated that oxygen is not a corrosive and that by following the proposed tank cleaning requirements the possibility of contamination of the tanks would be reduced to a level that would eliminate the need for a manhole. The commenter also believes that a manhole would provide a means of future contamination by allowing for an internal inspection without proper follow-up cleaning procedures. MTB believes that contamination of oxygen tanks during construction could pose a serious safety problem and therefore, in order to assure that the proper degree of cleanliness has been accomplished, the tank must be internally inspected after construction and prior to final closure. At the time of tank manufacture, a manhole provides the surest means of ensuring that the tank is contaminant-free prior to final closure. This assurance of cleanliness is crucial in tanks intended for oxygen service.

After the tank has been in service, the presence of a manhole allows for subsequent thorough internal examination. MTB believes the benefits to be gained by having the manhole outweigh any risk that a subsequent examination will cause contamination. The cleanliness requirements are geared to ensuring that after a tank has been reentered, and prior to subsequent reuse, that an oxygen compatible environment, i.e. no contamination, is reestablished.

*Section 178.338–7.* A commenter recommended that proposed paragraph (a), providing for complete drainage of flammable ladings, be revised to remove the implication that a pipe must drain down from the lowest point of the tank. MTB agrees and has revised the paragraph accordingly. The requirement for the closure of openings in a tank in proposed paragraph (b) is addressed in §§ 178.338–8, 178.338–10 and 178.338–11; therefore, proposed paragraph (b) has not been adopted.

*Section 178.338–8.* Paragraph (a) has been reworded to specifically require compliance with § 173.318(b) rather than merely referring to that section. The wording in paragraph (b)(2) has been simplified without a change in meaning. In paragraph (b)(5), at the suggestion of one commenter, MTB is allowing a check valve to be used on MC–338 cargo tanks. Allowing the use of a check valve provides an alternative that meets the intent of MTB s initial proposal in that it provides for complete, positive closure. Further discussion of this section is contained under the heading "Pressure Relief Device Systems" earlier in the preamble.

*Section 178.338–9.* In response to proposed paragraph (b), a commenter pointed out that it is impossible to maintain a liquefied gas at a temperature corresponding to its boiling point at atmospheric pressure, as proposed in the NPRM. The commenter maintained that "in the absence of thermal stratification, the fluid would maintain itself at a saturation temperature corresponding to the lowest back pressure that can be maintained stable after filling the vessel." MTB agrees with the commenter. Accordingly, MTB has specified the boiling point at a reference pressure of one atmosphere and has revised the requirements to reflect a more practical pressure as suggested by the commenter. The requirement appears in paragraph (b)(1) of the final rule.

In proposed paragraph (b)(1) (paragraph (c) of this final rule), a commenter recommended that the holding time obtained in the optional test be required to be not less than 90% of the marked rate holding time, rather than requiring test results be within 10% of the original test. The commenter also recommended that MTB specify the Normal Evaporation Rate (NER) at not more than 110% of the original test. MTB has incorporated the suggested change to the optional test regimen in paragraph (c), but has not included the NER test (which was not defined by the commenter). This test has been mentioned by various industry members in the past and MTB has always requested that the test be defined. Further, MTB believes a test should be performed to validate the use of the NER test by comparing the results of the NER to the currently specified holding time tests. Without this information, MTB is unable to evaluate the value of the NER versus the holding time test.

Proposed paragraph (c) has been revised for clarity and it appears as paragraph (b)(2) in the final rule. The one-way travel time requirements have been moved to § 173.318(g).

*Section 178.338–10.* A commenter recommended certain changes be made in proposed paragraph (a) to specify applicability of the collision damage protection requirements to lines on a tank which, if damaged, could result in the loss of the lading, and to lines which connect to the safety relief devices. MTB has incorporated the intent of the comment into the final rule. In paragraph (c), the word "cargo" is added, as suggested by a commenter, when referring to the tank. MTB is not incorporating a comment suggesting a specific bumper height requirement. The NPRM contained a performance-oriented requirement ("adequate to protect all valves and fittings * * *.") that is adopted in this final rule.

*Section 178.338–11.* A commenter suggested that the first sentence in paragraph (b) be revised to read "Each *liquid* filling and *liquid* discharge line * * *." MTB agrees that the word "liquid" should be added since the lines being referred to in this paragraph are not those which discharge vapor. This change makes the meaning clearer and it has also been incorporated into paragraphs (b) and (c).

As proposed in paragraph (c) in the NPRM, the location of valve seats on cargo tanks was dependent on whether the tank was vacuum insulated or not. A commenter disagreed with the proposal as it related to tanks with evacuated jackets. The commenter pointed out that, based on its information, the construction of vacuum jacketed valves does not facilitate location of the valve seat inside the jacket. The commenter argued that attempts to comply with the proposed requirement will result in vacuum and maintenance problems. As part of its analysis of the comment, MTB reviewed the outstanding DOT exemptions for vacuum insulated cargo tanks designed to carry flammable cryogens. This review revealed that none of these cargo tanks had the construction specified in the NPRM. After reevaluating the matter, MTB agrees with the commenter that for evacuated jacket construction it is not necessary to specify valve seat location inside the jacket and therefore this provision has been changed to require the valve to be as close to the tank as practicable.

The wording regarding the remotely controlled valves in proposed paragraph (c) has been changed in response to a comment. For consistency with other requirements in paragraph (c), the references in proposed paragraphs (c)(1)

and (c)(2) to internal shut-off valves have been changed to remotely controlled shut-off valves. Paragraph (c)(1) has also been changed to make clear that the thermal means of closure need not be a fusible element and that equivalent devices are acceptable.

*Section 178.338–12.* A commenter objected to the proposal on yield section and suggested that it be deleted. The commenter indicated that it had been reported to him that yield sections are hazardous and voiced the opinion that the risk of catastrophic failure appears to exceed the hazard which the yield section was intended to eliminate. The yield section is designed to break under strain without affecting the product retention capabilities of valves on a tank, and there is no evidence that safety has been compromised because of such a requirement in the past. Therefore, MTB has incorporated the requirement in the rule. The term "shear section" rather than "yield section" is being used since MTB believes the former term more accurately describes the mode of failure.

*Section 178.338–13.* This section has been reorganized. Paragraph (d) in the NPRM is now paragraph (a). Paragraph (b) in the NPRM is essentially continued as paragraph (b), however paragraph (c) in the NPRM, which referred to paragraph (b), has been deleted as unnecessary. Paragraph (e) in the NPRM is now paragraph (c). Paragraph (a) in the NPRM which dealt with cargo tanks that were "not permanently attached to or integrated with" the vehicle chassis has been deleted since it is unnecessary. MTB is not aware of any cargo tank designed or fabricated in this fashion that is used in cryogenic service.

Changes in static loading requirements in this section have been made and these are discussed earlier in the preamble under the heading "Design Loadings."

*Section 178.338–14.* The only change made to this section since the NPRM is in paragraph (a)(1) where the requirement that the device indicate the maximum permitted liquid level now specifies that this indication be "at the loading pressure." MTB believes this improves the clarity of this provision without making a substantive change.

*Section 178.338–15.* The only change to this section is that the closure that is now specified is that of the "manhole of the tank" instead of the "manway or the tank" specified in the NPRM. This change is necessary to conform to the requirements in § 178.338–6, which were first proposed in the June 21, 1979 amendment of the NPRM (§ 178.338–15 was not corrected at that time).

*Section 178.338–16.* The discussion of testing requirements in this section is discussed earlier in this preamble under the heading "Pressure Testing."

Paragraph (a) has been reorganized so that the basic test pressure requirements need not be stated twice, once under "hydrostatic test" and once under "pneumatic test". Now the basic test requirements have been set out as paragraph (a) and the additional requirements applicable to pneumatic testing are set forth in paragraph (b).

It was proposed in paragraph (b) that "all welds in or on the cargo tank shell or heads shall be radiographed * * *." One commenter recommended that jacket welds not be required to be radiographed and that additional methods of weld inspection be authorized for the internal tank. MTB agrees that jacket welds need not be radiographed because weld integrity is established by other means, such as the thermal integrity test. However, MTB believes that radiographic inspection of all tank heads and shell welds is necessary to ensure the pressure integrity of the tank. The revised requirement, which is at § 178.338–16(c) of the rule, does not preclude the use of other inspection methods in addition to that required by this rule, so long as any deposits or other contamination from such methods are removed prior to final tank closure. This incorporates a change to the NPRM that was made in the June 21, 1979 **Federal Register** publication.

Paragraph (c) in the NPRM (paragraph (d) herein) has been changed by removing the proposed requirement that any non-mechanical cutting undertaken in defect repair required the qualification of the cutter, the welder and the combination of cutting and welding. These requirements are covered by the ASME Code.

*Section 178.338–17.* This section has been adopted as proposed in the NPRM.

*Section 178.338–18.* A commenter recommended that the nameplate be affixed to the left side rather than to the right (curb) side of the vehicle. No reason was provided for the suggested change, which would modify a long standing requirement. The recommendation is not adopted.

The commenter also stated that it is unnecessary and redundant to require two plates. The matter of duplicate plates is particularly important. The ASME Code requires that the nameplate be attached to the Code vessel and be visible after insulation is applied to the Code vessel. If duplicate plates were not used, an opening would have to be made in the insulation system to expose the nameplate. Such an opening would adversely affect the efficiency of the insulation system. Further, paragraph UG–119(e) of the Code contains provisions for installation of a duplicate nameplate on the insulation jacket. This duplicate plate must contain all of the information found on the original plate, including the Code symbol. Therefore, MTB is retaining the requirement in this final rule.

Finally, the commenter favored a ¼ inch size letter requirement in place of the proposed ⅜ inch lettering for the identification plates. MTB believes ⅜ inch letters provide more legible markings than smaller sizes without imposing undue burdens on manufacturers and therefore has retained the proposed requirement in this rule.

Only minor changes have been made in this section. Paragraphs (b)(6) and (b)(9) in the NPRM have been placed in reverse order in this rule. Paragraph (b)(9) has been expanded to specify that for a cargo tank used to transport several cryogenic liquids only one MRHT need be marked on the specification plate. The MRHT's for the additional commodities may be placed adjcent thereto.

The NPRM proposal for paragraph (d) has been deleted from this section and is now the introductory paragraph of § 173.318(g).

*Section 178.338–19.* Certain minor changes have been made to this section. A commenter recommended to delete the words "including the ASME Code" in proposed paragraph (a) because "the manufacturer will provide the U–1 form as required by the Code." These forms are not always available. A person has only to review the exemption requests received by MTB to realize the significant number of instances wherein an applicant has a tank made to ASME Code, but where no drawings, nameplates, or U–1 forms are available. Therefore, the proposed requirement has been retained in the final rule. Paragraph (a) has been restructured and it now specifies that the manufacturer shall furnish the required documents to the owner.

Paragraph (b) has been changed to specifically require the manufacturer of each stage to not only furnish a certificate covering his work to any succeeding manufacturer, but also to pass along any certificates received from earlier manufacturers. This will ensure that at the end of staged construction the final manufacturer will possess certificates covering the entire construction. Another change requires that all these certificates be furnished to the owner.

Paragraph (c) has been changed so that upon change of ownership, the old owner does not retain the original documents for one year as proposed in the NPRM, but need only retain photocopies for that time. This change allows the original documents to be transferred to the new owner.

*Section 179.100–7.* In § 179.100–7(a), the reference entry "ASTM–A537–70, Grade A" is corrected to read "ASTM–A537–80, Class 1." The erroneous reference to Grade A has appeared in several editions of Title 49 CFR. This change correcting the error is also made at various other places in §§ 179.102–4 and 179.102–17.

Section 179.102—1. In § 179.102—1 the heading and the introductory text to paragraph (a) have been amended to read "carbon dioxide, liquid (refrigerated)."

*Section 179.102–4.* Several commenters recommended that proposed paragraph (b) be revised to allow the manway, nozzles and anchorlegs to be fabricated with stainless steel, which would not be required to be impact tested. The commenters supported their position on the grounds that stainless steel can substantially reduce the heat flow into the tank, and thereby increase the holding time and improve transportation safety. MTB believes the recommendation has merit and has provided for the use of ASTM A240 Type 304, 304L, 316, or 316L stainless steel. The use of ASTM Specification A516 and A537 materials are authorized, as proposed in the NPRM.

Several commenters objected to the requirement in proposed paragraph (c) that insulation material must be "self-extinguishing." The commenters argued that even though most insulations do not support combustion, the materials are not technically "self-extinguishing" as the term would indicate. Two commenters indicated that they were unsure how the term would be defined. MTB agrees with the commenters that the use of the term "self-extinguishing" without further definition would be confusing and that presently approved materials are not in fact "self-extinguishing." After reevaluating this proposal, MTB has decided to remove the "self-extinguishing" requirement and require that the insulation be of approved material.

Commenters pointed out that in proposed paragraph (d) there is no need to require dual safety relief systems for vinyl fluoride. Two commenters indicated that a rupture disc on a tank of flammable gas can be considered a poor safety practice. MTB agrees with the commenters and has deleted the proposed requirement for a safety vent. In proposed paragraph (d) the word "piped" is changed to "directed", as suggested by two commenters, for consistency with § 179.102–3(a)(2), which requires openings in the protective housing cover for relief valve discharge.

In paragraphs (f) and (h), the use of a thermometer well or a pressure gage has been made optional rather than mandatory. This option offers a shipper flexibility in the manner in which compliance with the provisions of Note 17 to the Table in § 173.314(c) is determined

Finally, paragraph (l) has been revised to define more clearly the acceptance standards for welds. The welds must meet the acceptance standards contained in W11.06 of AAR specifications for Tank Cars, Appendix W.

*Section 179.102–17.* Paragraphs (b), (c), (d), (f) and (m) have been changed in the same manner, and for the same reasons, as their counterparts in § 179.102–4 ((b), (c), (d), (f) and (l)). In addition, as suggested by commenters, paragraph (d) has been revised to allow a pressure relief device to be trimmend with monel "or other approved material" and to change "teflon coated monel" to read "fluoronated hydrocarbon polymer coated monel" since the word "teflon" is a registered trademark of E. I. du Pont de Nemours and Company.

*Section 179.400.* The nomenclature used to identify tank cars was questioned by two commenters. In the final rule, "Class DOT–113" is used to refer inclusively to specifications DOT–113A, DOT–113C, DOT–113D, etc. When a specific design is being referred to, it will be identified by a particular specification, for example "DOT–113A60W". This procedure conforms to that stated in section 2–2(b) of AAR Specifications for Tank Cars.

*Section 179.400–1.* Except for an editorial change, this section is adopted as proposed in the NPRM.

*Section 179.400–2.* This section is adopted as proposed in the NPRM.

*Section 179.400–3.* This section has been restructured for clarity. Additionally, a change was made to correct an error in the NPRM which indicated that the tank must have "heads designed concave to pressure." While this is correct for the inner tank heads, it is wrong with regard to the jacket heads. Jacket heads must be designed convex to pressure and this necessary change has been made in the final rule.

*Section 179.400–4.* The section heading and the requirements in § 179.400–4 are revised. The performance standard proposed in the NPRM has been modified, as suggested by commenters, to allow nitrogen to be used as the test medium rather than the actual lading which may be a flammable gas. In addition, the formulas for heat transfer rates have been defined and clarified.

*Section 179.400–5.* Two commenters to this section requested that MTB allow the use of nickel steel in the construction of DOT–113D tank cars. MTB is not authorizing nickel steels for newly constructed Class DOT–113 tank cars because this material does not have adequate impact properties when subject to temperatures as low as the design service temperature authorized for these tank cars.

*Section 179.400–6.* Two commenters requested that in proposed paragraph (b) the words "and stresses" be deleted since the AAR Specifications for Tank Cars specifies "loads". This has been done. An updated section of AAR Specifications for Tank Cars is also referenced.

*Section 179.400–7 (proposed § 179.400–8).* MTB has deleted the reference to "approved contour" of tank heads since all heads specified meet this requirement.

*Section 179.400–8 (proposed § 179.400–7 (a) through (d)).* In proposed paragraphs (a) and (b) (which are also paragraphs (a) and (b) herein), the inference that 2:1 or 3:1 ellipsoidal heads are required for the inner tank has been removed by replacing the word "the" with the word "any". Paragraph (d) has been reworded for consistency with the wording in the other paragraphs. Also, the jacket head thickness of ⅛ inch provides head puncture resistence equivalent to that required of certain other classes of tank cars.

*Section 179.400–9 (proposed § 179.400–7(e)).* The formula in paragraph (b) (proposed paragraph (e)(1)), which specifies the width of the jacket plate on each side of the stiffening ring, has been corrected. Also as suggested by commenters, MTB has reworded § 179.400–9(c) (proposed as § 179.400–7(e)(2)) to allow differing structural shapes to be credited for stiffening of the outer jacket with external pressure, and to add a provision to require external closed rings be provided with a drain opening to reduce corrosion of the stiffening ring.

*Sections 179.400–10, 179.400–12 through 179.400–15, 179–400–18, 179.400–21 through 179.400–23 and 179.400–26.* Except for minor corrections and editorial changes, requirements in these sections have been adopted as proposed in the NPRM. Most of the changes were suggested by commenters. The sections

have been renumbered in the sequence normally followed in designing a tank car:

| Present | Proposed |
|---|---|
| 179.400-10 | 179.400-7(f) |
| 179.400-12 | 179.400-10 |
| 179.400-13 | 179.400-11 |
| 179.400-14 | 179.400-12 |
| 179.400-15 | 179.400-13 |
| 179.400-18 | 179.400-16 |
| 179.400-21 | 179.400-19 |
| 179.400-22 | 179.400-20 |
| 179.400-23 | 179.400-21 |
| 179.400-26 | 179.400-24 |

*Section 179.400-11 (proposed as § 179.400-9).* Two commenters suggested in proposed paragraph (a) that "access opening" be changed to "opening" to eliminate the implication that the opening is a manway, and to revise the weld procedures to recognize difficulties in performing a fusion double welded butt joint for certain circumferential closing joints in the cylindrical portion of the outer jacket. MTB agrees with the commenters and has revised paragraphs (a) and (b) accordingly.

*Section 179.400-16 (proposed as § 179.400-14).* Except for an editorial change, the requirements are adopted as proposed in the NPRM. Two commenters has suggested that the provision in the last sentence in paragraph (b), stating that a cutting torch "may not be used", be revised by using the wording "must not". The term "may not", as used in this sentence, means no person is authorized or permitted to use a cutting torch on the welded closure. This use of the term is consistent with the rule of construction set forth at § 171.9(b)(4).

*Section 179.400-17 (proposed as § 179.400-15).* Two commenters brought to MTB's attention that the proposed requirements for vacuum insulated loading and unloading lines and insulated shut-off valves in paragraph (a)(1) should apply only to DOT-113A60W tank cars (which are designed only for hydrogen). Other DOT-113 tank cars are designed for the warmer cryogens and the requirements are unnecessary. MTB agrees and has made an appropriate revision.

The commenters also requested that the proposed provision in paragraph (a)(3) requiring vapor phase blowdown line discharge to be directed upward and away from operating personnel be deleted. The commenters indicated that the vapor blowdown valve is used only when the tank car is hooked up to a closed system and that "blowdown flare may be hazardous to personnel." Despite the fact that in normal operations the line will only be opened to a closed system. MTB agrees with the commenters about the hazard of blowdown flare but believes if a flare occurs, for whatever reason (including inadvertently opening the wrong valve), the flare should be directed away from operating personnel. For this reason, MTB has retained this requirement in the final rule.

*Section 179.400-19 (proposed as § 179.400-17).* Proposed paragraph (b) of this section contained a requirement that a tank car be equipped with a connection for a liquid gage and, in addition, a fixed length dip tube and a vapor phase pressure gage. As recommended by two commenters, the word "liquid" has been removed before the word "gage" and all of paragraph (b) has been reorganized to clarify that a car is required to be equipped with only one of the two alternative methods provided in paragraph (b)(1) to determine the quantity of liquid lading in the car.

*Section 179.400-20 (proposed as § 179.400-18).* Paragraph (c)(4) has been revised to include a pressure controlling and mixing device on DOT-113A60W tank car, as required in the past by § 179.400-18(c)(3). The requirement in § 179.400-18(c)(3) that the device must prevent venting of certain gas mixtures was inadvertently omitted in the proposal and has been added in paragraph (c)(4)(iii) of the final rule.

*Section 179.400-24 (proposed as § 179.400-22).* Three commenters took exception to the proposal in paragraph (b) to prohibit marking, stenciling or stamping on shells or heads of inner tanks. One of the commenters pointed out the provision would conflict with requirements for identification markings of plate thickness, material, and welds contained in § AAR.15 (now contained in § AAR 5.1.4) and in Appendix W, § W10.04, of the AAR Specifications for Tank Cars. MTB believes that the structural integrity of a tank at cold temperatures should not be compromised by stamping; however, MTB agrees that there is no valid reason to preclude the marking or stenciling of a tank and these prohibitions have been removed from the final rule. The requirements in the final rule are consistent with present requirements in the AAR Specifications for Tank Cars.

*Section 179.400-25 (proposed as § 179.400-23).* Two commenters recommended that in proposed paragraph (a) MTB reference the standard stenciling requirements of Appendix C of the AAR Specifications for Tank Cars. MTB believes the commenters' suggestion has merit and has incorporated the change into the final rule at § 179.400-25.

Three commenters maintained that the requirement for marking the name of the hazardous material for which the tank was designed on a tank car is covered by § 173.319 and, therefore, proposed paragraph (b) is unnecessary. MTB agrees with the commenters. Proposed paragraph 173.319(a)(4)(iv) (which has been adopted into the final rule) requires a tank car be marked with the name of the material contained in the tank car during transportation. Therefore, proposed paragraph (b) has been removed. The remaining paragraphs have been redesignated as paragraphs (b), (c), (d), and (e) in this final rule.

Exceptions were taken, in proposed paragraph (c), to the use of the words "minimum loading temperature", on the basis that "design service temperature" was used elsewhere in the proposal to indicate the same thing. MTB agrees with the commenters and has made the change in the final rule.

Finally, exception was taken to the proposals in paragraphs (c) and (d) on the basis that these requirements would conflict with a suggestion by the commenters that the filling density volume be marked on the tank. This suggestion was tied to a suggested revision to the definition of filling density in § 173.300 of the NPRM. MTB has not adopted this revision to the definition of filling density in § 173.300 and therefore, has not incorporated these additional changes suggested here.

*Section 179.401-1.* Except for minor changes in terminology due to changes elsewhere in the rule, this section is adopted as proposed in the NPRM.

**List of Subjects**

*49 CFR Part 171*

Hazardous materials transportation, Reporting and recordkeeping requirements.

*49 CFR Part 172*

Hazardous materials transportation.

*49 CFR Part 173*

Gases, Hazardous materials transportation, Packaging and containers, Reporting and recordkeeping requirements.

*49 CFR Part 174*

Hazardous materials transportation, Railroad safety.

*49 CFR Part 176*

Hazardous materials transportation, Maritime carriers, Cargo vessels.

*49 CFR Part 177*

Motor carriers, Hazardous materials transportation, Highway safety.

*49 CFR Part 178*

Hazardous materials transportation, Packaging and containers.

*49 CFR Part 179*

Hazardous materials transportation, Packaging and containers.

In consideration of the foregoing, Parts 171, 172, 173, 174, 176, 177, 178 and 179 of Title 49 Code of Federal Regulations are amended as follows:

## PART 171—GENERAL INFORMATION, REGULATIONS, AND DEFINITIONS

1. In § 171.1, paragraph (a)(3)(iii) is added to read as follows:

**§ 171.1 Purpose and scope.**

* * * * *

(a) * * *

(3) * * *

(iii) Flammable cryogenic liquids in portable tanks and cargo tanks.

* * * * *

2. In § 171.7, paragraphs (c)(3), (d)(3)(v) and (d)(12) are revised and paragraphs (d)(3)(ix) and (d)(5)(xix) through (d)(5)(xxiii) are added to read as follows:

**§ 171.7 Matter incorporated by reference.**

* * * * *

(c) * * *

(3) CGA: Compressed Gas Association, Inc., 1235 Jefferson Davis Highway, Arlington, Virginia 22202.

* * * * *

(d) * * *

(3) * * *

(v) CGA Pamphlet S–1.2 is titled, "Pressure Relief Device Standards, Part 2, Cargo and Portable Tanks for Compressed Gases," 1980 edition.

* * * * *

(ix) CGA Pamphlet G–4.1 is titled, "Cleaning Equipment for Oxygen Service," 1977 edition.

* * * * *

(5) * * *

(xix) ASTM A 20–81 is titled, "Standard Specification for General Requirements for Steel Plates for Pressure Vessels," revision C, 1982 edition.

(xx) ASTM A 240–82 is titled, "Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Fusion-Welded Unfired Pressure Vessels," revision A, 1982 edition.

(xxi) ASTM A 370–77 is titled, "Standard Methods and Definition for Mechanical Testing of Steel Products," 1982 edition.

(xxii) ASTM A 516–79b is titled, "Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service," 1982 edition.

(xxiii) ASTM A 537–80 is titled "Standard Specification for Pressure Vessel Plates, Heat-Treated, Carbon-Manganese-Silicon Steel," 1982 edition.

* * * * *

(12) Federal Standard H28 is titled, "Screw-Thread Standards for Federal Services," March 31, 1978, edition.

3. In § 171.8, definitions for "atmospheric gases," "Btu," "cryogenic liquid," "filling density," "NPT" and "SCF" are added in alphabetical sequence to read as follows:

**§ 171.8 Definitions and abbreviations.**

* * * * *

"Atmospheric gases" means gases that are commercially derived through an air separation process. For purposes of this subchapter, "atmospheric gases" means argon, krypton, neon, nitrogen, oxygen and xenon.

* * * * *

"Btu" means British thermal unit.

* * * * *

Cryogenic liquid. See § 173.300(f).

* * * * *

"Filling density" has the following meanings:

(1) For compressed gases in cylinders, see § 173.304(a)(2) Table Note 1.

(2) For compressed gases in tank cars, see § 173.314(c) Table Note 1.

(3) For compressed gases in cargo tanks and portable tanks, see § 173.315(a) Table Note 1.

(4) For cryogenic liquids in cylinders, except hydrogen, see § 173.316(c)(1).

(5) For hydrogen, cryogenic liquid in cylinders, see § 173.316(c)(3) Table Note 1.

(6) For cryogenic liquids in cargo tanks, see § 173.318(f)(1).

(7) For cryogenic liquids in tank cars, see § 173.319(d)(1).

* * * * *

"NPT" means an American Standard taper pipe thread in compliance with the requirements of Federal Standard H28, Part II, Section VII. See § 171.7(d)(12).

* * * * *

"SCF" (standard cubic foot) means one cubic foot of gas measured at 60° F. and 14.7 psia.

* * * * *

## PART 172—HAZARDOUS MATERIALS TABLES AND HAZARDOUS MATERIALS COMMUNICATIONS REGULATIONS

4. In § 172.101, the Hazardous Materials Table is amended by removing, revising and adding various entries, in alphabetical sequence, as follows:

**§ 172.101 Hazardous Materials Table**

| (1) | (2) | (3) | (3A) | (4) | (5) | | (6) | | (7) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Packaging | | Maximum net quantity in one package | | Water shipments | | |
| +EAW | Hazardous materials descriptions and proper shipping names | Hazard class | Identification number | Label(s) required if not excepted) | Exceptions | Specific requirements | Passenger carrying aircraft or railcar | Cargo only aircraft | Cargo vessel | Passenger vessel | Other requirements |
| | | | | | (a) | (b) | (a) | (b) | (a) | (b) | (c) |
| | **Remove** | | | | | | | | | | |
| | Argon, liquid pressurized | Nonflammable gas | UN 1951 | Nonflammable gas | None | 173.304 | Forbidden | 300 pounds | 1,3 | 1,3 | |
| | Carbon dioxide, liquified | Nonflammable gas | UN 2187 | Nonflammable gas | 173.306 | 173.304<br>173.314<br>173.315 | 150 pounds | 300 pounds | 1,2 | 1,2 | |
| + | Hydrogen, liquefied | Flammable gas | UN 1966 | Flammable gas | None | 173.316 | Forbidden | Forbidden | | | Forbidden. |
| | Nitrogen, pressurized liquid | Nonflammable gas | UN 1977 | Nonflammable gas | None | 173.304 | Forbidden | 300 pounds | 1,3 | 1,3 | |
| | Oxygen, pressurized liquid | Nonflammable gas | UN 1073 | Oxidizer | None | 173.304 | Forbidden | Forbidden | 1,3 | 1,3 | Stow separate from acetylene. Do not overstow with other cargo |

| (1) | (2) | (3) | (3A) | (4) | (5) | | (6) | | (7) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Packaging | | Maximum net quantity in one package | | Water shipments | | |
| +EAW | Hazardous materials descriptions and proper shipping names | Hazard class | Identification number | Label(s) required if not excepted | Exceptions | Specific requirements | Passenger carrying aircraft or railcar | Cargo only aircraft | Cargo vessel | Passenger vessel | Other requirements |
| | **Revise** | | | | | | | | | | |
| | Argon | Nonflammable gas | NA 1006 | Nonflammable gas | 173.306 | 173.302<br>173.314 | 150 pounds | 300 pounds | 1,2 | 1,3 | |
| + | Ethane | Flammable gas | NA 1035 | Flammable gas | 173.306 | 173.304 | Forbidden | 300 pounds | 1,2 | 4 | Stow away from living quarters. |
| + | Ethylene | Flammable gas | NA 1962 | Flammable gas | 173.306 | 173.304 | Forbidden | 300 pounds | 1,2 | 4 | Stow away from living quarters. |
| | Helium | Nonflammable gas | NA 1046 | Nonflammable gas | 173.306 | 173.302<br>173.314 | 150 pounds | 300 pounds | 1,2 | 1,2 | |
| + | Hydrogen | Flammable gas | NA 1049 | Flammable gas | 173.306 | 173.302<br>173.314 | Forbidden | 300 pounds | 1,2 | 4 | Stow away from living quarters. |
| E | Hydrogen chloride (*RO-5000/2270*) | Nonflammable gas | NA 1050 | Nonflammable gas | 173.306 | 173.304 | Forbidden | 300 pounds | 1 | 4 | Stow away from foodstuff and living quarters. |
| + | Methane | Flammable gas | NA 1971 | Flammable gas | 173.306 | 173.302 | Forbidden | 300 pounds | 1,2 | 4 | Stow away from living quarters. |
| | Neon | Nonflammable gas | NA 1065 | Nonflammable gas | 173.306 | 173.302 | 150 pounds | 300 pounds | 1,2 | 1,2 | |
| | Nitrogen | Nonflammable gas | NA 1066 | Nonflammable gas | 173.306 | 173.302<br>173.314 | 150 pounds | 300 pounds | 1,2 | 1,2 | |
| | Nitrous oxide | Nonflammable gas | NA 1070 | Nonflammable gas | 173.306 | 173.304 | 150 pounds | 300 pounds | 1,2 | 1,2 | Under deck stowage must be in well ventilated space. |
| | Oxygen | Nonflammable gas | NA 1072 | Oxidizer | 173.306 | 173.302<br>173.314 | 150 pounds | 300 pounds | 1,2 | 1,2 | Under deck stowage must be in well ventilated space. |
| | **Add** | | | | | | | | | | |
| | Argon, cryogenic liquid | Nonflammable gas | NA 1951 | Nonflammable gas | 173.320 | 173.316<br>173.318 | 100 pounds | 300 pounds | 1,3 | 1,3 | |
| | Carbon dioxide | Nonflammable gas | UN 1013 | Nonflammable gas | 173.306 | 173.302<br>173.304 | 150 pounds | 300 pounds | 1,2 | 1,2 | |
| | Carbon dioxide, liquid (*refrigerated*) | Nonflammable gas | NA 2187 | Nonflammable gas | 173.306 | 173.314<br>173.315 | 150 pounds | 300 pounds | 1,2 | 1,2 | |
| | Carbon monoxide, cryogenic liquid | Flammable gas | NA 9202 | Flammable gas | None | 173.318 | Forbidden | Forbidden | 1 | 5 | Stow away from living quarters. |
| | Ethane, liquid (*refrigerated*) | Flammable gas | NA 1961 | Flammable gas | None | 173.315 | Forbidden | Forbidden | 1 | 5 | Stow away from living quarters. |
| | Ethane-Propane mixture, liquid (*refrigerated*) | Flammable gas | NA 1961 | Flammable gas | None | 173.315 | Forbidden | Forbidden | 1 | 5 | Stow away from living quarters. |
| | Ethylene, cryogenic liquid | Flammable gas | NA1038 | Flammable gas | None | 173.318<br>173.319 | Forbidden | Forbidden | 1,3 | 5 | Stow away from living quarters |
| | Helium, cryogenic liquid | Non-flammable gas. | NA 1963 | Non-flammable gas. | 173.320 | 173.316<br>173.318 | 100 pounds | 1,100 pounds. | 1,3 | 1,3 | |
| | Hydrogen, cryogenic liquid | Flammable gas | NA 1966 | Flammable gas | None | 173.318<br>173.318<br>173.319 | Forbidden | Forbidden | 5 | 5 | |
| F | Hydrogen chloride liquid (*refrigerated*) (*RO-5000/2270*) | Nonflammable gas | NA 2186 | Nonflammable gas | None | 173.314<br>173.315 | Forbidden | 300 pounds | 1,2 | 4 | Stow in well ventilated space. |
| | Methane, cryogenic liquid | Flammable gas | NA 1972 | Flammable gas | None | 173.318 | Forbidden | Forbidden | 1 | 5 | Stow away from living quarters. |
| | Natural gas, cryogenic liquid | Flammable gas | NA1972 | Flammable gas | None | 173.318 | Forbidden | Forbidden | 1 | 5 | Stow away from living quarters. |
| | Neon, cryogenic liquid | Nonflammable gas | NA1913 | Nonflammable gas | 173.320 | 173.316 | 100 pounds | 1,100 pounds. | 1,3 | 1,3 | |
| | Nitrogen, cryogenic liquid | Nonflammable gas | NA1977 | Nonflammable gas | 173.320 | 173.316<br>173.318 | 100 pounds | 1,100 pounds. | 1,3 | 1,3 | |
| | Nitrous oxide, liquid (*refrigerated*) | Nonflammable gas | NA 2201 | Nonflammable gas | 173.306 | 173.315 | Forbidden | Forbidden | 1 | 1 | Stow away from flammables. Do not overstow with other cargo. |
| | Oxygen, cryogenic liquid | Nonflammable gas | NA 1073 | Oxidizer | 173.320 | 173.316<br>173.318 | Forbidden | Forbidden | 1 | 1 | Stow separate from flammables. Do not overstow with other cargo. |

5. In § 172.203, paragraph (g)(3) is added to read as follows:

**§ 172.203 Additional description requirements.**

* * * * *

(g) * * *

(3) The shipping paper for each Class DOT–113 tank car must contain the appropriate notation, such as "DOT–113A," and the statement "Do Not Hump or Cut Off Car While in Motion."

* * * * *

6. In § 172.328, the introductory text of paragraph (c) is revised to read as follows:

**§ 172.328 Cargo tanks.**

* * * * *

(c) *Required markings: Gases.* Each cargo tank transporting flammable or nonflammable gas (including a cryogenic liquid) subject to this subchapter must be marked as specified

in this part on each end and each side with—

* * * * *

7. In § 172.504, Table 2 is amended by removing the entry for "Nonflammable gas (oxygen, pressurized liquid)", replacing it with an entry for "Nonflammable gas (oxygen, cryogenic liquid)" and footnote 2 is removed and reserved, as follows:

**§ 172.504 General placarding requirements.**

* * * * *

TABLE 2

| If the motor vehicle, rail car, or freight container contains a material classed (described) as— | The motor vehicle, rail car, or freight container must be placarded on each side and each end— |
|---|---|
| **(Remove)** | |
| Nonflammable gas (oxygen, pressurized liquid). | Oxygen. |
| **(Add)** | |
| Nonflammable gas (oxygen, cryogenic liquid) | Oxygen. |

* * * * *

[2] [Reserved]

* * * * *

## PART 173—SHIPPERS—GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS

8. The Table of Sections to Part 173 is amended by revising the headings for §§ 173.315 and 173.316 and adding headings for §§ 173.11, 173.318, 173.319 and 173.320 to read as follows:

**Subpart A—General**

* * * * *

Sec.

173.11 Shipper's registration statement: flammable cryogenic liquids.

* * * * *

**Subpart G—Compressed gases; definition and preparation**

* * * * *

173.315 Compressed gases in cargo tanks and portable tanks.
173.316 Cryogenic liquids in cylinders.
173.318 Cryogenic liquids in cargo tanks.
173.319 Cryogenic liquids in tank cars.
173.320 Cryogenic liquids: exceptions.

* * * * *

9. Section 173.11 is added to read as follows:

**§ 173.11 Shipper's registration statement: flammable cryogenic liquids.**

(a) No person may offer a flammable cryogenic liquid for transportation in a portable tank, cargo tank or a tank car unless he has filed a registration statement by certified mail, return receipt requested, with the Associate Director for HMR, MTB, in accordance with paragraphs (b), (c) and (d) of this section.

(b) The registration statement must contain the following information:

(1) The shipper's name and principal place of business;

(2) Location where flammable cryogenic liquids are offered for transportation, including transportation by private carriage;

(3) The name and principal place of business of each initial carrier used to transport flammable cryogenic liquids and the name of each flammable cryogenic liquid the carrier is offered for transportation; and

(4) The serial number or vehicle identification number of each portable tank and cargo tank, and the reporting mark and number of each tank car, owned, leased, or otherwise controlled by the shipper and used to offer a flammable cryogenic liquid for transportation.

(c) The registration statement must be filed:

(1) Initially between July 1 and August 31, 1984 (this initial statement is only required to contain information regarding operations that took place during the 90 days prior to the date of the statement); and

(2) Subsequently, between July 1 and August 31 of each even numbered year after 1984.

(d) For operations begun between the two-year filing intervals specified in paragraph (c) of this section, the information must be provided on the registration statement filed during the next required filing period.

10. In § 173.23, paragraph (d) is added to read as follows:

**§ 173.23 Previously authorized packaging.**

* * * * *

(d) After January 1, 1984, cylinders manufactured for use under exemptions DOT E-6666 or E-8404 may be continued in use, and must be marked "DOT-4L" in compliance with Specification 4L (§ 178.57 of this subchapter) before or at the time of the first required retest. The "DOT-4L" marking must appear in proximity to other required specification markings.

11. In § 173.31, paragraphs (a)(8), (a)(9) and (c)(13) are added; Retest Table I, which now appears after paragraph (d)(4), is amended by removing certain entries and adding others in the proper number/alphabet sequence and transferred to immediately follow paragraph (c)(13); footnote "s" following Retest Table I is revised to read as follows:

**§ 173.31 Qualification, maintenance, and use of tank cars.**

(a) * * *

(8) The owner or operator, if not the owner, of each tank car used under, and in conformance with, an exemption issued before January 1, 1984, which authorizes the transportation of a cryogenic liquid in a tank car, shall remove the exemption number stenciled on the car and stamp the tank car with the appropriate Class DOT-113 Specification followed by the applicable exemption number, for example, "DOT-113D60W-E****." (Asterisks to be replaced by the exemption number.) The owner or operator, if not the owner, of a tank car that is remarked in this manner must retain a copy of the exemption that is in effect on December 31, 1983. No new construction of such tank cars may be initiated on or after January 1, 1984.

(9) Specification DOT-113A175W, DOT-113C60W, DOT-113D60W, and DOT-113D120W tank cars may continue in use, but new construction is not authorized.

* * * * *

(c) * * *

(13) *Special requirements for Class DOT-113 tank cars.*

(i) A Class DOT-113 tank car need not be periodically pressure tested; however, each shipment must be monitored to determine the average daily pressure rise in the tank car. If the average daily pressure rise during any shipment exceeds 3 psi per day, the tank car must be retested for thermal integrity prior to any subsequent shipment.

(ii) Thermal integrity retest. Either of the following alternative thermal integrity retests may be used:

(A) *Pressure rise retest:* The pressure rise in the tank may not exceed 5 psi in 24 hours. When the pressure rise retest is performed, the absolute pressure in the annular space of the loaded tank car may not exceed 75 microns of mercury at the beginning of the retest, and may not increase more than 25 microns during the 24 hour period; or

(B) *Calculated heat transfer rate retest:* The insulation system must be performance tested as prescribed in § 179.400-4 of this subchapter. When the calculated heat transfer rate retest is performed, the absolute pressure in the annular space of the loaded tank car may not exceed 75 microns of mercury at the beginning of the retest, and may not increase more than 25 microns during the 24 hour period. The calculated heat transfer rate in 24 hours may not exceed—

(*1*) 120 percent of the appropriate standard heat transfer rate specified in § 179.401-1 of this subchapter, for DOT-113A60W and DOT-113C120W tank cars:

(2) .1164 Btu/day/lb. of inner tank water capacity, for DOT–113A175W tank cars;

(3) .3272 Btu/day/lb. of inner tank water capacity, for DOT–113C60W and 113D60W tank cars; or

(4) .4740 Btu/day/lb. of inner tank water capacity, for DOT–113D120W tank cars.

(iii) If the car fails either of the retests prescribed in paragraph (c)(13)(ii) of this section, the car must be removed from service and may not be placed back in service until one of the applicable retests in paragraph (c)(13)(ii) of this section is successfully completed.

(iv) Each frangible disc must be replaced every 12 months and the replacement date stenciled on the car near the pressure relief value information.

(v) An alternate pressure relief valve must be retested at the same time interval prescribed for the required pressure relief valve. The start-to-discharge pressure and vapor tight pressure requirements for the alternate pressure relief valve must be as shown in § 179.401–1 of this subchapter.

RETEST TABLE 1

| Specification | Retest interval years[1] | | | Safety relief valve | Tank | Retest pressure—p.s.i. | |
|---|---|---|---|---|---|---|---|
| | Tank and interior heater systems | | | | | Safety relief valve | |
| | Up to 10 years | Over 10 to 22 years | Over 22 years | | | Start-to-discharge | Vapor tight |
| (Remove) | | | | | | | |
| DOT–113A60W | (*) | (*) | (*) | 5 | (*) | 30 | 24 |
| DOT–113A175W | (*) | (*) | (*) | 5 | (*) | 115 | 95 |
| (Add) | | | | | | | |
| DOT–113A60W | (*) | (*) | (*) | 5 | (*) | (*)30 | (*)24 |
| DOT–113A175W | (*) | (*) | (*) | 5 | (*) | (*)115 | (*)92 |
| DOT–113C60W | (*) | (*) | (*) | 5 | (*) | (*)45 | (*)36 |
| DOT–113C120W | (*) | (*) | (*) | 5 | (*) | (*)75 | (*)60 |
| DOT–113D60W | (*) | (*) | (*) | 5 | (*) | (*)45 | (*)36 |
| DOT–113D120W | (*) | (*) | (*) | 5 | (*) | (*)75 | (*)60 |

[1] See paragraph (c)(13) of this section for additional requirements for Class DOT–113 cars.

* * * * *

12. In § 173.33, all references to "carbon dioxide" are changed to read "carbon dioxide, liquid (*refrigerated*)" and all references to "nitrous oxide" are changed to read "nitrous oxide, liquid (*refrigerated*)", paragraphs (a) and (b) are revised, and paragraphs (d) (1), (2) and (4) are revised to read as follows:

**§ 173.33 Qualification, maintenance, and use of cargo tanks.**

(a) *General:* Unless otherwise provided in this Part, every cargo tank (or compartment) used for the transportation of hazardous materials must be an authorized packaging. Such authorized packaging shall comply with requirements as set forth in this section, in addition to those regulations applicable for the transportation of the particular material. For the purposes of this Part, whenever reference is made to a Specification MC–338 insulated cargo tank, the definitions in §§ 178.338–1 (a) and (b) of this subchapter apply.

(1) A cargo tank is authorized for shipment of a hazardous material by vessel when in conformance with the requirements of Part 176 of this subchapter and the following limitations:

(i) On carfloats or trailerships if the material is permitted aboard a cargo vessel by § 172.101 of this subchapter, or

(ii) On passenger ferry vessels or railroad car ferry vessels if the material is permitted aboard a passenger vessel by § 172.101 of this subchapter.

(2) [Reserved]

(b) Cargo tank qualification as an authorized packaging requires compliance with the applicable specification MC–300, MC–301, MC–302, MC–303, MC–304, MC–305, MC–306, MC–307, MC–310, MC–311, MC–312, MC–330, MC–331, or MC–338 (§ 178.341, § 178.342, § 178.343, § 178.337 or § 178.338 of this subchapter), this section, and the inspection, retest and marking requirements of § 177.824 of this subchapter. Any specification MC–304 cargo tank on which construction began before September 2, 1967, may have the vents and outlets modified to comply with specification MC–307 cargo tanks (See §§ 178.342–4 and 178–342–5).

(3) A cargo tank of the specification listed in Column 1 may be used when authorized in this Part, provided the tank construction began before the date in Column 2:

| Column 1 | Column 2 |
|---|---|
| MC–300 | Sept. 2, 1967. |
| MC–301 | June 12, 1961. |
| MC–302, MC–303, MC–304, MC–305 MC–310, MC–311. | Sept. 2, 1967. |
| MC–330 | May 15, 1967. |

(2) The owner or operator, if not the owner, of each cargo tank used under, and in conformance with, an exemption issued before January 1, 1984, which authorizes the transportation of a cryogenic liquid in a cargo tank, shall remove the exemption number stenciled on the cargo tank and stamp the specification plate (or a plate placed adjacent to the specification plate) "DOT MC–338" followed by the applicable exemption number, for example, "DOT MC–338–E****." (Asterisks to be replaced by the exemption number.) The owner or operator, if not the owner, of a cargo tank that is remarked in this manner must retain a copy of the exemption in effect on December 1, 1983. No new construction of such cargo tanks may be initiated on or after January 1, 1984.

(i) The holding time must be determined, as required in § 178.338–9 of this subchapter, on each cargo tank or on at least one cargo tank of each design. Any subsequent cargo tank manufactured to the same design, if not individually tested, must have the optional test regimen performed during the first shipment (see §§ 178.338–9 (b) and (c) of this subchapter). For the purpose of performing the holding time test, same design means cargo tanks having the same manufacturer, same drawings, same dimensions (of length, diameter, and volume), same materials of construction, and the same insulation system.

(ii) The holding time determined by test for one authorized cryogenic liquid may be used as the basis for establishing the holding time for other authorized cryogenic liquids.

(3) The owner or operator, if not the owner, of each MC–331 (§ 178.337 of this subchapter) cargo tank operating under an exemption issued before January 1, 1984, that authorizes the transportation of ethane, liquid (*refrigerated*); ethane-propane mixture, liquid (*refrigerated*); or hydrogen chloride, liquid (*refrigerated*) shall remove the exemption number stenciled on the cargo tank and stamp the exemption number on the specification plate immediately after the DOT Specification, for example, "DOT MC–331–E* * * *." (Asterisks to be replaced by the exemption number.) If there is not adequate room on the specification plate, the exemption number may be stamped on a plate placed adjacent to the specification plate. The owner or operator, if not the owner, of a cargo tank that is remarked in this manner must retain a copy of the exemption in effect on December 31, 1983.

* * * * *

(d) A Specification MC-330, MC-331 or MC-338 (§ 178.337 or § 178.338 of the subchapter) cargo tank may not be used unless it meets the following requirements, as applicable:

(1) Each cargo tank must be tested and inspected at least once every 5 years in accordance with paragraphs (d)(2), (3), (4), (10), (11) and (12) of this section.

(i) The tank, and each pressure relief valve, of any cargo tank used for the transportation of chlorine must be tested at least once every 2 years.

(ii) Each cargo tank used to transport a flammable cryogenic liquid must be examined after each shipment to determine its actual holding time. The record required by § 177.840(h) of this subchapter may be used for this determination. If the examination indicates that the actual holding time of the cargo tank, after adjustment to reflect an average ambient temperature of 85° F., is less than 90 percent of the marked rated holding time (MRHT) for the cryogenic liquid marked on the specification plate or adjacent thereto (§ 178.338-18(b) of this subchapter), the tank may not be refilled with any flammable cryogenic liquid until it is restored to its marked rated holding time value or it is re-marked with the actual marked rated holding time determined by this examination. If the name of the flammable cryogenic liquid that was transported and its marked rated holding time is not displayed on or adjacent to the specification plate, this requirement may be met by deriving the MRHT of the cargo tank for that flammable cryogenic liquid and comparing that derived MRHT with the actual holding time after adjustment.

(2) Each tank (less fittings) must be subjected to a minimum internal pressure as shown below:

| Specification | Ratio[1] |
|---|---|
| MC-330, MC-331 | 1½ |
| MC-338 | 1¼ |

[1] Ratio of test pressure to the design pressure (maximum allowable working pressure or re-rated pressures) of the test.

The internal pressure may be hydraulically or pneumatically generated. If a pneumatic test is used, a suitable method must be used for detecting the existence of leaks at all joints under pressure. This method must consist either of coating the entire surface of all joints under pressure with a solution of soap and water, or using another equally sensitive method. When a pneumatic test is performed, suitable safeguards should be provided to protect employees and other persons should a failure occur.

* * * * *

(4) When testing cargo tanks, the insulation and jacketing need not be removed unless it is otherwise impossible to reach test pressure and maintain a condition of pressure equilibrium after test pressure is reached, or the vacuum integrity cannot be maintained in the insulation space.

* * * * *

13. In § 173.300, paragraph (g) is removed, paragraph (f) is redesignated paragraph (g), and a new paragraph (f) is added to read as follows:

**§ 173.300 Definitions.**

* * * * *

(f) *Cryogenic liquid.* A "cryogenic liquid" is a refrigerated liquefied gas having a boiling point colder than −130°F. (−90°C.) at one atmosphere, absolute.

* * * * *

14. In § 173.304, the text of paragraph (a)(2) preceding the Table is revised, paragraph (a)(2) Table is amended by removing the entries for "Argon, pressurized liquid," "Carbon dioxide, liquefied," "nitrogen, pressurized liquid" and "Oxygen, pressurized liquid," and by adding an entry for "Carbon dioxide", and paragraph (b) is revised to read as follows:

**§ 173.304 Charging of cylinders with liquefied compressed gas.**

(a) * * *

(2) The following requirements must be complied with for the gases named (for cryogenic liquids, see § 173.316):

| Kind of gas | Maximum permitted filling density (see note 1) | Containers marked as shown in this column or of the same type with higher service pressure must be used except as provided in §§ 173.34 (a) and (b), and 173.301(j) (see notes following table) |
|---|---|---|
| **(Remove)** | | |
| Argon, pressurized liquid. | 115 | DOT-4L200. |
| Carbon dioxide, liquefied (see Notes 4, 7 and 8). | 68 | DOT-3A1800, DOT-3AX1800, DOT-3AA1800; DOT-3AAX1800; DOT-3, DOT-3E1800; DOT-3T1800; DOT-3HT2000; DOT-39 |
| Nitrogen, pressurized liquid. | 68 | DOT-4L200. |
| Oxygen, pressurized liquid. | 96 | DOT-4L200. |
| **(Add)** | | |
| Carbon dioxide (see Notes 4, 7, and 8). | 68 | DOT-3A1800; DOT-3AX1800, DOT-3AA1800; DOT-3AAX1800; DOT-3, DOT-3E1800; DOT-3T1800; DOT-3HT2000; DOT-39 |

* * * * *

(b) *Filling limits.* Except for carbon dioxide, nitrous oxide and vinyl fluoride, inhibited, the liquid portion of a liquefied gas must not completely fill the packaging at any temperature up to and including 130°F. The liquid portion of vinyl fluoride, inhibited, may completely fill the cylinder at 130°F. provided the pressure at the critical temperature does not exceed one and one-fourth times the service pressure.

* * * * *

15. In § 173.314, paragraphs (b)(6) and (c) preceding the Table are revised, the Table in paragraph (c) is amended by removing, revising and adding various entries, in alphabetical sequence, Note 17 to the Table in paragraph (c) is revised, paragraph (g) is redesignated paragraph (h), and a new paragraph (g) is added to read as follows:

**§ 173.314 Requirements for compressed gases in tank cars.**

* * * * *

(b) * * *

(6) Each tank car containing anhydrous ammonia; hydrogen chloride, liquid (*refrigerated*); or chlorine must be marked "Anhydrous Ammonia," "Hydrogen Chloride," or "Chlorine," as appropriate, in accordance with the requirements of § 172.330 of this subchapter.

(c) *Authorized gases, filling densities, tank cars.* A compressed gas offered for transportation in a tank car must be prepared in accordance with paragraphs (b) and (h) of this section, § 173.432, and the following table (for cryogenic liquids, see § 173.319):

| Kind of gas | Maximum permitted filling density, Note 1 | Required tank car, see § 173.31(a) (2) and (3) |
|---|---|---|
| **(Remove)** | | |
| Carbon dioxide, liquefied. | Note 5 | DOT-105A500W, Note 6. |
| **(Add)** | | |
| Carbon dioxide, liquid (*refrigerated*). | Note 5 | DOT-105A500W, Note 6. |
| Hydrogen chloride, liquid (*refrigerated*). | 89.0 maximum to 60.1 minimum at maximum 65 psig, when offered for transportation. | DOT-105A600W, Note 17. |
| **(Revise)** | | |
| Vinyl fluoride, inhibited. | 59.8 maximum to 53.6 minimum at maximum 105 psig, when offered for transportation. | DOT-105A500W, Note 17. |

* * * * *

Note 17.— See paragraph (g) of this section.

* * * * *

(g) *Special requirements for hydrogen chloride, liquid (refrigerated), and vinyl fluoride, inhibited.*

(1) The shipper shall notify the Bureau of Explosives whenever a car is not received by the consignee within 20 days from the date of shipment.

(2) Prior to the release of an "empty" car for transportation, the pressure in the car may not exceed 70 psig.

(3) A tank car containing hydrogen chloride, liquid *(refrigerated)* must have the auxiliary valve on the pressure relief device closed during transportation.

* * * * *

16. In § 173.315, all references to "carbon dioxide" are changed to read "carbon dioxide, liquid *(refrigerated)*" and all references to "nitrous oxide" are changed to read "nitrous oxide, liquid *(refrigerated)*", the introductory text of paragraph (a) is revised, the Table in paragraph (a) is amended by adding certain entries in alphabetical sequence, Note 11 to the Table in paragraph (a), and paragraph (c) are revised, and the Table in paragraph (h) is amended by adding certain entries in alphabetical sequence to read as follows:

**§ 173.315 Compressed gases in cargo tanks and portable tanks.**

(a) A compressed gas offered for transportation in a cargo tank or a portable tank must be prepared in accordance with this section (for cryogenic liquids, see § 173.318) and may only be shipped in a tank as provided in §§ 173.32, 173.33 and this section, as follows:

| Kind of gas | Maximum permitted filling density | | Specification container required | |
|---|---|---|---|---|
| | Percent by weight (see note 1) | Percent by volume (see par. (f) of this section) | Type (see note 2) | Minimum design pressure (psig) |
| **(Remove)** | | | | |
| Carbon dioxide, liquefied | See par. (c) of this section. | 95 | do | 200; see Note 3 |
| Nitrous oxide | See par. (c) of this section. | 95 | do | 200; see Note 3. |
| **(Add)** | | | | |
| Carbon dioxide, liquid *(refrigerated)* | See par. (c) of this section. | 95 | do | 200; see Note 3. |
| Ethane, liquid *(refrigerated)* | | See par. (c) of this section. | MC 331, MC-338 | 100; see Note 11. |
| Ethane-propane mixture, liquid *(refrigerated)*. | | See par. (c) of this section. | MC-331, MC-338 | 275; see Note 11. |
| Hydrogen chloride, liquid *(refrigerated)* | 103.0, 91.8, 86.7 | See Note 7 | MC-331, Mc-338 | 100; see Note 11. 300; see Note 11. 450; see Note 11. |
| Nitrous oxide, liquid *(refrigerated)* | See par. (c) of this section. | 95 | do | 200; See Note 3. |

**Note 11:** MC-330, MC-331 and MC-338 cargo tanks must be insulated. Cargo tanks must meet all the following requirements. Each tank must have a design service temperature of minus 100°F., or no warmer than the boiling point at one atmosphere of the hazardous material to be shipped therein, whichever is colder, and must comply with the low-temperature requirements of the ASME Code. When the normal travel time is 24 hours or less, the tank's holding time as loaded must be at least twice the normal travel time. When the normal travel time exceeds 24 hours, the tank's holding time as loaded must be at least 24 hours greater than the normal travel time. The holding time is the elapsed time from loading until venting occurs under equilibrium conditions. The cargo tank must have an outer jacket made of steel when the cargo tank is used to transport a flammable gas.

* * * * * * *

(c) Except as otherwise provided, the loading of a liquefied gas into a cargo tank or a portable tank shall be determined by weight or by a suitable liquid level gauging device. The liquid portion of the gas shall not fill the tank at 105°F. if the tank is lagged, or at 115°F. if the tank is unlagged, except that this requirement shall not apply to—

(1) A tank containing carbon dioxide, liquid *(refrigerated)* or nitrous oxide, liquid *(refrigerated)*. Such tank is required to be equipped with suitable pressure control valves and may not be filled to a level exceeding 95 percent of the volumetric capacity of the tank.

(2) A tank containing ethane, liquid *(refrigerated)*; ethane-propane mixture, liquid *(refrigerated)*; or hydrogen chloride, liquid *(refrigerated)*. Such tank must be filled to allow at least two percent outage below the inlet of the pressure relief valve or pressure control valve under conditions of incipient opening, with the tank in a level attitude.

* * * * * * *

(h) * * *

| Kind of gas | Gauging device permitted for filling purposes |
|---|---|
| **(Remove)** | |
| Carbon dioxide, liquefied | Rotary tube; adjustable slip tube; fixed length dip tube. |
| Nitrous oxide | Rotary tube; adjustable slip tube; fixed length dip tube. |
| **(Add)** | |
| Carbon dioxide, liquid *(refrigerated)*. | Rotary tube; adjustable slip tube; fixed length dip tube. |
| Ethane, liquid *(refrigerated)* | Rotary tube; adjustable slip tube; fixed length dip tube. |
| Ethane-propane mixture, liquid *(refrigerated)*. | Rotary tube; adjustable slip tube; fixed length dip tube. |
| Hydrogen chloride, liquid *(refrigerated)*. | None |
| Nitrous oxide, liquid *(refrigerated)*. | Rotary tube; adjustable slip tube; fixed length dip tube. |

* * * * * *

17. In Part 173, § 173.316 is revised to read as follows:

**§ 173.316 Cryogenic liquids in cylinders.**

(a) *General requirements.*

(1) A cylinder may not be loaded with a cryogenic liquid colder than the design service temperature of the packaging.

(2) A cylinder may not be loaded with any material which may combine chemically with any residue in the packaging to produce an unsafe condition.

(3) The jacket covering the insulation on a cylinder used to transport any flammable cryogenic liquid must be made of steel.

(4) A valve or fitting made of aluminum with internal rubbing or abrading aluminum parts that may come in contact with oxygen in the cryogenic liquid form may not be installed on any cylinder used to transport oxygen, cryogenic liquid.

(5) An aluminum valve, pipe or fitting may not be installed on any cylinder used to transport any flammable cryogenic liquid.

(6) Each cylinder must be provided with one or more pressure relief devices, which must be installed and maintained in compliance with the requirements of this subchapter.

(7) Each pressure relief device must be installed and located so that the cooling effect of the contents during venting will

not prevent effective operation of the device.

(8) The maximum weight of the contents in a cylinder with a design service temperature colder than −320° F. may not exceed the design weight marked on the cylinder (see § 178.57–20(a)(4) of this subchapter).

(b) *Pressure control valves.* Each cylinder containing a cryogenic liquid must have a pressure control valve that complies with § 173.34(d) and is designed and installed so that it will prevent the cylinder from becoming liquid full.

(c) *Specification cylinder requirements and filling limits.* Specification 4L cylinders (§ 178.57 of this subchapter) are authorized for the shipment of cryogenic liquids as follows:

(1) For purposes of this section, "filling density," except for hydrogen, is defined as the percent ratio of the weight of lading in the packaging to the weight of water that the packaging will hold at 60° F. (1 lb. of water = 27.737 cubic inches at 60° F.).

(2) The cryogenic liquids of argon, nitrogen, oxygen, helium and neon must be loaded and shipped in accordance with the following table:

| Pressure control valve setting (Maximum start-to-discharge pressure, psig) | Maximum permitted filling density (percent by weight) | | | | |
|---|---|---|---|---|---|
| | Argon | Nitrogen | Oxygen | Helium | Neon |
| 45 | 133 | 76 | 108 | 12.5 | 109 |
| 75 | 130 | 74 | 105 | 12.5 | 104 |
| 105 | 127 | 72 | 103 | 12.5 | 100 |
| 170 | 122 | 70 | 100 | 12.5 | 92 |
| 230 | 119 | 69 | 98 | 12.5 | 85 |
| 295 | 115 | 69 | 96 | 12.5 | 77 |
| 360 | 113 | 65 | 93 | 12.5 | |
| Design Service Temperature | −320°F | −320°F | −320°F | −452°F | −411°F |

(3) *Hydrogen (minimum 95 percent parahydrogen)* must be loaded and shipped as follows:

| Column 1 | Column 2 |
|---|---|
| Design service temperature | Minus 423° F. or colder. |
| Maximum permitted filling density, based on cylinder capacity at minus 423° F (see Note 1). | 6.7 percent. |
| The pressure control valve must be designed and set to limit the pressure in the cylinder to not more than. | 17 psig |

**Note 1.**—The filling density for hydrogen, cryogenic liquid is defined as the percent ratio of the weight of lading in a packaging to the weight of water that the packaging will hold at minus 423° F. The volume of the packaging at minus 423° F is determined in cubic inches. The volume is converted to pounds of water (1 lb. of water = 27.737 cubic inches).

(i) Each cylinder must be constructed, insulated and maintained so that during transportation the total rate of venting shall not exceed 30 SCF of hydrogen per hour.

(ii) In addition to the marking requirements in § 178.57–20 of this subchapter, the total rate of venting in SCF per hour (SCFH) shall be marked on the top head or valve protection band in letters at least one-half inch high as follows: "VENT RATE**SCFH" (with the asterisks replaced by the number representing the total rate of venting, in SCF per hour).

(iii) Carriage by highway is subject to the conditions specified in § 177.840(a) of this subchapter.

18. In Part 173, § 173.318 is added to read as follows:

**§ 173.318 Cryogenic liquids in cargo tanks.**

(a) *General requirements.*

(1) A cargo tank may not be loaded with a cryogenic liquid colder than the design service temperature of the packaging.

(2) A cargo tank may not be loaded with any material that may combine chemically with any residue in the packaging to produce an unsafe condition (see § 178.338–15).

(3) The jacket covering the insulation on a tank used to transport a cryogenic liquid must be made of steel if the cryogenic liquid—

(i) Is to be transported by vessel (see §§ 173.320(a)(4) and 176.76(h)(1) of this subchapter); or

(ii) Is oxygen or a flammable material.

(4) A valve or fitting made of aluminum with internal rubbing or abrading aluminum parts that may come in contact with oxygen in the cryogenic liquid form may not be installed on any cargo tank used to transport oxygen, cryogenic liquid.

(5) An aluminum valve, pipe or fitting, external to the jacket may not be installed on any cargo tank used to transport oxygen, cryogenic liquid or any flammable cryogenic liquid.

(6) A cargo tank used to transport oxygen, cryogenic liquid must be provided with a manhole (see § 178.338–6 of this subchapter).

(b) *Pressure relief devices and pressure control valves.*

(1) *General requirements.*

(i) Each tank must be protected by a primary system of one or more spring loaded pressure relief valves and, except for tanks in carbon monoxide service, by a secondary system of one or more frangible discs arranged to discharge upward and unobstructed to the outside of the protective housing in such a manner as to prevent impingement of gas upon the jacket or any structural part of the vehicle. For tanks in carbon monoxide service, the secondary system must be comprised of one or more pressure relief valves instead of the frangible discs.

(ii) Each pressure relief device must be designed and constructed for a pressure equal to or exceeding the tank's design pressure at the coldest temperature reasonably expected to be encountered.

(iii) The rated relieving capacity for each pressure relief valve, pressure control valve and frangible disc must be as determined by the flow formulas contained in paragraph 4.3.4 of CGA Pamphlet S–1.2.

(iv) Each pressure relief valve must be designed and located to minimize the possibility of tampering. If the pressure setting or adjustment is external to the valve, the valve adjustement must be sealed.

(v) Each pressure relief device must have direct communication with the vapor space of the tank at the midlength of the top centerline.

(vi) Each connection to a pressure relief device must be of sufficient size to allow the required rate of discharge through the pressure relief device.

(vii) No shut-off valve may be installed between a pressure relief device and the tank except when two or more pressure relief valves or two or more frangible discs are installed on the same tank. In that case, one or more shut-off valves may be so installed if the installation is arranged to allow the required relief capacity at all times through at least one pressure relief valve and at least one frangible disc.

(viii) Any shut-off valve or device that interferes with the proper operation of a pressure control valve must be designed and installed so that the cargo tank may not be operated for transportation purposes when the pressure control valve operation is impeded.

(ix) Each pressure relief valve must be arranged or protected to prevent the accumulation of foreign material between the relief valve and the

atmospheric discharge opening in any relief piping. The arrangement or protection must not impede flow through the device.

(x) Each pressure relief device must be installed and located so that the cooling effect of the contents during venting will not prevent the effective operation of the device.

(2) *Capacity and performance.*

(i) The required primary system of pressure relief valves and the required secondary system of relief devices must each have, as a minimum, the total capacity prescribed in section 4 of CGA Pamphlet S–1.2 for a bare tank, unless the insulation remains in place and effective under accident-fire conditions, in which case the insulation space is considered to be saturated with the gaseous lading at atmospheric pressure.

(ii) The primary system of pressure relief valves must have the minimum total capacity specified in paragraph (b)(2)(i) of this section, at a pressure not exceeding 120 percent of the tank design pressure.

(iii) The secondary system of frangible discs or additional pressure relief valves must have the minimum total capacity specified in paragraph (b)(2)(i) of this section, at a pressure not exceeding 150 percent of the tank design pressure.

(iv) The primary system of pressure relief valves must have a liquid flow capacity equal to or exceeding the maximum rate at which the tank is to be filled, at a pressure not exceeding 120 percent of the tank design pressure.

(v) Each primary pressure relief valve must have a set pressure no higher than 110 percent of the tank design pressure.

(vi) The secondary system of pressure relief devices must be designed to commence functioning at a pressure no lower than 130 percent and no higher than 150 percent of the tank design pressure.

(3) *Pressure relief devices for piping, hose and vacuum-insulated jackets.*

(i) Each portion of connected liquid piping or hose that can be closed at both ends must be provided with either a hydrostatic pressure relief valve without an intervening shut-off valve, or a check valve permitting flow from the pipe or hose into the tank. If used, the relief valve must be located so as to prevent its discharge from impinging on the tank, piping, or operating personnel.

(ii) On a vacuum-insulated cargo tank the jacket must be protected by a suitable relief device to release internal pressure. The discharge area of this device must be at least 0.00024 square inch per pound of water capacity of the tank. This relief device must function at a pressure not exceeding the internal design pressure of the jacket, calculated in accordance with the ASME Code, or 25 psig, whichever is less.

(4) *Optional pressure relief devices and pressure control valves.*

(i) In addition to the required pressure relief devices, a cargo tank may be equipped with one or more pressure control valves if they meet applicable requirements contained in this Part.

(ii) In addition to the required pressure relief devices, a cargo tank may be equipped with one or more frangible discs set to function at a pressure not less than one and one-half times or more than two times the tank design pressure.

(5) *Tank inlet, outlet, pressure relief device and pressure control valve markings.*

(i) Each tank inlet and outlet, except pressure relief devices and pressure control valves, must be permanently marked to indicate whether it communicates with "vapor" or "liquid" when the tank is filled to the maximum permitted filling density.

(ii) Each pressure relief valve must be plainly and permanently marked with the pressure, in psig, at which it is set-to-discharge, the actual discharge rate of the device in SCF per minute (SCFM), and the manufacturer's name or trade name and catalog number. The marked set pressure valve must be visible with the valve in its installed position. The rated discharge capacity of the device must be determined at a pressure of 120 percent of the design pressure of the tank.

(iii) Each pressure control valve must be plainly and permanently marked with the pressure, in psig, at which it is set-to-discharge.

(c) *Weight of lading requirements.* The weight of a cryogenic liquid in the tank must be determined by weighing or by the use of a liquid level gauging device authorized in § 178.338–14(a) of this subchapter, and may not exceed the lesser of:

(1) The weight of lading in the tank, based on the water capacity stamped on the nameplate (§ 178.338–18(a)(4) of this subchapter) and the appropriate maximum permitted filling density specified in paragraph (f) of this section; or

(2) The maximum weight of lading for which the cargo tank was designed, as marked on the specification plate (see § 178.338–18(b) of this subchapter).

(d) *Outage.* Except for a cargo tank containing helium, cryogenic liquid, a cargo tank offered for transportation must have an outage of at least two percent below the inlet of the pressure relief device or pressure control valve, under conditions of incipient opening, with the tank in a level attitude.

(e) *Temperature.* A flammable cryogenic liquid must be loaded into a cargo tank at a temperature sufficiently cold that the pressure setting of the pressure control valve or the required pressure relief valve, whichever is lower, will not be reached in less time than the marked rated holding time for the cryogenic liquid (see §§ 173.33(d)(1)(ii) and 178.338–9(b) of this subchapter).

(f) *Specification MC–338 (§ 178.338 of this subchapter) cargo tanks* are authorized for the shipment of the following cryogenic liquids subject to the following additional requirements:

(1) For purposes of this section, "filling density" is defined as the percent ratio of the weight of lading in the tank to the weight of water that the tank will hold at the design service temperature (one pound of water = 27.737 cubic inches at 60° F., or one gallon of water = 231 cubic inches at 60° F. and weighs 8.32828 pounds).

(2) *Argon, helium, nitrogen, and oxygen, cryogenic liquids* must be loaded and shipped in accordance with the following table:

PRESSURE CONTROL VALVE SETTING OR RELIEF VALVE SETTING

| Maximum set-to-discharge pressure (psig) | Maximum permitted filling density (percent by weight) | | | |
|---|---|---|---|---|
| | Argon | Helium | Nitrogen | Oxygen |
| 26 | | 12.5 | | |
| 30 | 129 | 12.5 | 74 | 105 |
| 40 | | 12.5 | | |
| 50 | | 12.5 | | |
| 55 | 125 | 12.5 | 71 | 102 |
| 60 | | 12.5 | | |
| 80 | | 12.5 | | |
| 85 | 121 | 12.5 | | 99 |
| 100 | | 12.5 | | |
| 105 | | 12.5 | 67 | |
| 120 | | 12.5 | | |
| 140 | | 12.5 | | |
| 145 | 115 | 12.5 | 64 | 94 |
| 180 | | 12.5 | | |
| 200 | 110 | 12.5 | 61 | 91 |
| 250 | 106 | 12.5 | 57 | 87 |
| 275 | 105 | 12.5 | 56 | 86 |
| 325 | 101 | | 53 | 83 |
| Design service temperature. | Minus 320° F. | Minus 452° F | Minus 320° F | Minus 320° F. |

(3) *Carbon monoxide, hydrogen (minimum 95 percent para-hydrogen), ethylene, and methane or natural gas, cryogenic liquids* must be loaded and shipped in accordance with the following table:

PRESSURE CONTROL VALVE SETTING OR RELIEF VALVE SETTING

| Maximum set-to-discharge pressure (psig) | Maximum permitted filling density (percent by weight) | | | |
|---|---|---|---|---|
| | Carbon monoxide | Ethylene | Hydrogen | Methane or natural gas |
| 3 | | | 6.6 | |
| 5 | 75.0 | | 6.6 | |
| 7 | 74.0 | | 6.5 | |
| 20 | | 53.5 | | 40.0 |
| 25 | 73.0 | | | |
| 30 | 72.0 | 52.7 | 6.3 | 39.1 |
| 35 | | | | |
| 40 | | 52.0 | | 38.6 |
| 45 | 71.5 | | | |
| 50 | | 51.4 | 6.0 | 38.2 |
| 55 | | | | |
| 60 | | 50.8 | | |
| 70 | | 50.2 | 5.7 | 37.5 |
| 90 | | 49.2 | | |
| 95 | | | | |
| 100 | | 48.4 | 5.4 | 36.6 |
| 115 | | 48.2 | | |
| 125 | | | 5.0 | |
| 175 | 62.5 | 45.8 | | |
| 285 | 56.0 | | | |
| Design service temperature. | Minus 320° F. | Minus 155° F. | Minus 423° F. | Minus 260° F. |

(g) *One-way travel time; marking.* The jacket of a cargo tank to be used to transport a flammable cryogenic liquid must be marked on its right side near the front, in letters and numbers at least two inches high, "One-way Travel Time ——— hrs.", with the blank filled in with a number indicating the one-way travel time (OWTT), in hours, of the cargo tank for the flammable cryogenic liquid to be transported.

(1) OWTT is based on the marked rated holding time (MRHT) of the cargo tank for the cryogenic liquid to be transported in the cargo tank. If the MRHT for the flammable cryogenic liquid is not displayed on or adjacent to the specification plate, this MRHT may be derived.

(2) The MRHT is converted to OWTT, in hours, as follows:

(i) For a tank with an MRHT of 72 hours or less,

$$OWTT = MRHT - 24/2$$

(ii) For a tank with an MRHT greater than 72 hours,

$$OWTT = MRHT - 48$$

(3) Only the OWTT for the flammable cryogenic liquid in the cargo tank may be displayed on the cargo tank.

19. In Part 173, § 173.319 is added to read as follows:

**§ 173.319 Cryogenic liquids in tank cars.**

(a) *General requirements.*

(1) A tank car containing a flammable cryogenic liquid may not be shipped unless it was loaded by, or with the consent of, the owner of the tank car.

(2) The amount of flammable cryogenic liquid loaded into a tank car must be determined, either by direct measurement or by calculation based on weight, to verify that the tank has not been filled to a level in excess of the limits specified in paragraph (d)(2) of this section. The weight of any flammable cryogenic liquid loaded, except hydrogen, must be checked by use of scales after disconnecting the loading line.

(3) Whenever a tank car containing any flammable cryogenic lading is not received by the consignee within 20 days from the date of shipment, the shipper of the lading shall notify the Bureau of Explosives.

(4) A tank car may not be loaded with any flammable cryogenic liquid—

(i) That may combine chemically with any residue in the tank to produce an unsafe condition,

(ii) That is colder than the design service temperature of the tank,

(iii) If the average daily pressure rise in the tank exceeded 3 psi during the prior shipment (see § 173.31(c)(13)),

(iv) Unless it is marked with the name of contents, in accordance with § 172.330 of this subchapter.

(b) When a tank car containing a flammable cryogenic liquid is offered for transportation—

(1) At least 0.5 percent outage must be provided below the inlet of the pressure relief or pressure control valve at the start-to-discharge pressure setting of the valve, with the tank car in a level attitude, and

(2) The absolute pressure in the annular space must be less than 75 microns of mercury.

(c) *Temperature.* A flammable cryogenic liquid must be loaded into a tank car at such a temperature that the average daily pressure rise during transportation will not exceed 3 psi (see paragraph (a)(4)(iii) of this section and § 173.31(c)(13)).

(d) A Class DOT-113 tank car is authorized for the shipment of the following cryogenic liquids subject to the following additional requirements:

(1) For purposes of this section, "filling density" is defined as the percent ratio of the weight of lading in the tank to the weight of water that the tank will hold at the design service temperature (one pound of water = 27.737 cubic inches at 60° F., or one gallon of water = 231 cubic inches at 60° F. and weighs 8.32828 pounds).

(2) *Ethylene, and hydrogen (minimum 95 percent parahydrogen), cryogenic liquids* must be loaded and shipped in accordance with the following table:

PRESSURE CONTROL VALVE SETTING OR RELIEF VALVE SETTING

| Maximum start-to-discharge pressure (psig) | Maximum permitted filling density (percent by weight) | | | |
|---|---|---|---|---|
| | Ethylene | Ethylene | Ethylene | Hydrogen |
| 17 | | | | 6.60. |
| 45 | 52.8. | | | |
| 75 | | 51.1 | 51.1 | |
| Maximum pressure when offered for transportation. | 10 psig | 10 psig | 20 psig | |
| Design service temperature | Minus 260° F. | Minus 260° F. | Minus 155° F. | Minus 423° F. |
| Specification (see § 173.31(a)(9)) | 113D60W<br>113C60W | 113C120W | 113D120W | 113A175W.<br>113A60W. |

20. In Part 173, § 173.320 is added to read as follows:

**§ 173.320 Cryogenic liquids; exceptions.**

(a) Atmospheric gases and helium, cryogenic liquids, in Dewar flasks, insulated cylinders, insulated portable tanks, insulated cargo tanks, and insulated tank cars, designed and constructed so that the pressure in such packagings will not exceed 25.3 psig under ambient temperature conditions during transportation (excluding loading and unloading operations or operation of a process system such as a refrigeration system) are not subject to the requirements of this subchapter when transported by motor vehicle or railcar except:

(1) Sections 171.15 and 171.16 of this subchapter pertaining to the reporting of incidents, not including a release that is the result of venting through a pressure control valve, or the neck of the Dewar flask.

(2) Subparts A, B, C, and D of Part 172, Sections 174.24 (for rail) and 177.817 for highway) and in addition, Part 172 in its entirety for oxygen.

(b) For transportation by vessel, the requirements of this subchapter do not apply to atmospheric gases used in a refrigeration system.

## PART 174—CARRIAGE BY RAIL

21. The Table of Sections to Part 174 is amended by revising the heading for § 174.204 to read as follows:

Sec.

174.204 Tank car delivery of gases, including cryogenic liquids.

22. In § 174.25, paragraph (a), the Table is amended by removing the entry "Oxygen (liquefied)" and adding in its place the entry "Oxygen, cryogenic liquid," as follows:

**§ 174.25 Additional information on waybills, switching orders and other billings.**

(a) * * *

| Hazardous material or class | Placard notation | Placard endorsement |
|---|---|---|
| REMOVE | | |
| Oxygen (liquefied). | Placarded OXYGEN | Dangerous. |
| ADD | | |
| Oxygen, cryogenic liquid. | Placarded OXYGEN | Dangerous. |

* * * * *

23. In § 174.67, the introductory text of paragraph (a) is revised to read as follows:

**§ 174.67 Tank car unloading.**

(a) In unloading tank cars, the following rules must be observed (see subpart F of this Part for gases):

* * * * *

24. In § 174.83, paragraph (b) is revised to read as follows:

**§ 174.83 Switching of cars containing hazardous materials.**

* * * * *

(b) Any tank car placarded "EXPLOSIVE A" or "POISON GAS" and any Class DOT–113 tank car placarded "FLAMMABLE GAS" may not be—

(1) Cut off while in motion,

(2) Coupled into with more force than is necessary to complete the coupling, or

(3) Struck by any car moving under its own momentum.

* * * * *

25. In § 174.204, the heading and paragraph (a)(2) are revised to read as follows:

**§ 174.204 Tank car delivery of gases, including cryogenic liquids.**

(a) * * *

(2) The following tank cars may not be delivered and unloaded on carrier tracks unless the lading is piped directly from the car to permanent storage tanks of sufficient capacity to receive the entire contents of the car; however, such cars may be stored on a private track (see § 171.8 of this subchapter) or on carrier tracks designated by the carrier for such storage:

(i) A tank car containing flammable cryogenic liquid; or

(ii) A tank car, except for a DOT–106A or 110A multi-unit tank car tank (§ 179.300 or § 179.301 of this subchapter), containing anhydrous ammonia; hydrogen chloride, liquid (*refrigerated*); hydrocarbon gas, liquefied; or liquefied petroleum gas; and having interior pipes for liquid and gas discharge valves equipped with check valves.

## PART 176--CARRIAGE BY VESSEL

26. In § 176.76, paragraph (h) is added to read as follows:

**§ 176.76 Highway vehicles, railroad vehicles, freight containers, and portable tanks containing hazardous materials.**

* * * * *

(h) *Cryogenic liquids.* For shipment of cryogenic liquids on board a vesel the packaging must be designed and filled so that:

(1) Any cryogenic liquid being transported in a cargo tank, regardless of the pressure in the package, must be contained in a steel jacketed Specification MC–338 (§ 178.338 of this subchapter) insulated cargo tank, or a cargo tank approved under the provisions of § 173.33(b)(2) of this subchapter.

(2) Any valve or fitting with moving or abrading parts that may come in contact with any cryogenic liquid may not be made of aluminum.

(3) For a flammable cryogenic liquid being transported in a cargo tank, the elapsed time between the loading of the cargo tank and the subsequent unloading of the cargo tank at its final destination may not exceed the marked rated holding time (MRHT) of the cargo tank for the cryogenic liquid being transported, which must be displayed on or adjacent to the specification plate.

(4) Portable tanks, cargo tanks, and tank cars containing cryogenic liquids must be stowed "on deck" regardless of the stowage authorized in § 172.101 of this subchapter. Cargo tanks or tank cars containing cryogenic liquids may be stowed one deck below the weather deck when transported on a trailership or trainship that is unable to provide "on deck" stowage because of the vessel's design. Tank cars must be Class DOT–113 or AAR–204W tank cars.

## PART 177--CARRIAGE BY PUBLIC HIGHWAY

27. In Part 177, the Table of Sections is amended by revising the headings for §§ 177.816 and 177.840, and adding headings for §§ 177.818 and 177.826 to read as follows:

* * * * *

Sec.

177.816 Training

* * * * *

Sec.

177.818 Special instructions; flammable cryogenic liquids.

* * * * *

177.826 Carrier's registration statement; flammable cryogenic liquids.

* * * * *

177.840 Compressed gases, including cryogenic liquids.

* * * * *

28. In Part 177, § 177.816 is revised to read as follows:

**§ 177.816 Training.**

(a) *Applicability.* No carrier may transport a flammable cryogenic liquid in a cargo tank on a public highway unless the driver of the vehicle has received the training specified in paragraph (b) of this section This section applies only to an originating carrier when an interchange operation is involved.

(b) *Training required.* Each carrier subject to paragraph (a) of this section must—

(1) Provide the required training in written form;

(2) Provide the required training before a driver may drive a motor vehicle transporting a flammable cryogenic liquid in a cargo tank and at least one every 24 months thereafter;

(3) Include in the training program instructions pertaining to—

(i) Requirements in this subchapter applicable to cryogenic liquids, generally;

(ii) Requirements in the Federal Motor Carrier Safety Regulations, Parts 390–397 of this title, applicable to drivers;

(iii) The properties and potential hazards of the particular material to be transported;

(iv) The safe operation of the type of cargo tank the driver will be operating, including its handling characteristics, emergency features and loading limitations; and

(v) Procedures to be followed in case of accident or other emergency, including unanticipated pressure increase or decrease.

(c) *Record of training.* A record certifying that current training has been provided in accordance with paragraph (b) of this section shall be retained in the driver's qualification file (see § 391.51 of this title) for as long as the driver is employed by that carrier and for 90 days thereafter. The record shall include—

(1) The driver's name and operators license number;

(2) The date the driver was provided the training and the due date for subsequent training;

(3) A copy of the written training material required by paragraph (b) of

this section or a reference indicating the location of a readily available copy; and

(4) The name and address of the person providing the training.

29. In Part 177, § 177.818 is added to read as follows:

**§ 177.818 Special instructions; flammable cryogenic liquids.**

(a) No carrier may operate, and no driver may drive, a motor vehicle transporting a flammable cryogenic liquid in a package exceeding 125 gallons water capacity unless written instructions containing the following information are carried with the required shipping papers:

(1) General precautions,

(2) Manual venting instructions,

(3) Emergency procedures, and

(4) The names and telephone numbers of persons to be contacted in case of emergency or accident.

(b) [Reserved]

30. In § 177.824, paragraph (a)(1) is amended by revising the first phrase to read, "Each cargo tank, except a specification MC–330, MC–331, or MC–338 cargo tank, * * *." and paragraph (e) is revised to read as follows:

**§ 177.824 Retesting and inspection of cargo tanks.**

* * * * *

(e) *Compressed gas and cryogenic liquid cargo tanks, specifications MC–330, MC–331, and MC–338.*

(1) *Specification MC–330 and MC–331.* Each cargo tank constructed in compliance with specification MC–330 or MC–331 (§ 178.337 of this subchapter) must be inspected and tested in accordance with § 173.33 of this subchapter.

(2) *Specification MC–338 insulated cargo tanks.* Each insulated cargo tank constructed in compliance with specification MC–338 (§ 178.338 of this subchapter) must be tested, except for the retest pressure, in accordance with § 173.338–16(a) of this subchapter, and must be in compliance with § 173.33 of this subchapter. If the tank is opened for any reason, the cleanliness must be verified after closure in accordance with § 178.338–15.

* * * * *

31. In Part 177, §177.826 is added to read as follows:

**§ 177.826 Carrier's registration statement; flammable cryogenic liquids.**

(a) No person may transport a flammable cryogenic liquid in a portable tank or a cargo tank unless he has filed a registration statement by certified mail, return receipt requested, with the Associate Director for HMR, MTB in accordance with paragraphs (b), (c) and (d) of this section.

(b) The registration statement must contain the following information:

(1) The carrier's name and principal place of business.

(2) Locations where cargo tanks used to transport flammable cryogenic liquids are domiciled.

(3) The serial number or vehicle identification number of each cargo tank used by the carrier to transport flammable cryogenic liquids, and the name of each flammable cryogenic liquid transported in each cargo tank.

(c) The registration statement must be filed:

(1) Initially between January 1 and February 28, 1984 (this initial statement is only required to contain information regarding operations that took place during the 90 days prior to the date of the statement); and

(2) Subsequently, between January 1 and February 28 of each even numbered year after 1984.

(d) For equipment obtained or operations begun between the two-year filing intervals specified in paragraph (c) of this section, the information must be provided on the registration statement filed during the next required filing period.

* * * * *

32. In § 177.840, the heading and paragraph (a)(2) are revised; paragraphs (h), (i), (j), and (k) are added to read as follows:

**§ 177.840 Compressed gases, including cryogenic liquids.**

(a) * * *

(2) *Cylinders for hydrogen, cryogenic liquid.* A Specification DOT–4L cylinder containing hydrogen, cryogenic liquid may only be transported on a motor vehicle as follows:

(i) The vehicle must have an open body equipped with a suitable rack or support having a means to hold the cylinder upright when subjected to an acceleration of 2 "g" in any horizontal direction;

(ii) The combined total of the hydrogen venting rates, as marked, on the cylinders transported on one motor vehicle may not exceed 60 SCF per hour;

(iii) The vehicle may not enter a tunnel; and

(iv) Highway transportation is limited to private and contract carriage and to direct movement from point of origin to destination.

* * * * *

(h) The driver of a motor vehicle transporting a flammable cryogenic liquid in a package exceeding 125 gallons of water capacity shall avoid unnecessary delays during transportation. If unforeseen conditions cause an excessive pressure rise, the driver shall manually vent the tank at a remote and safe location. For each shipment, the driver shall make a written record of the cargo tank pressure and ambient (outside) temperature—

(1) At the start of each trip,

(2) Immediately before and after any manual venting,

(3) At least once every five hours, and

(4) At the destination point.

(i) No person may transport a flammable cryogenic liquid in a cargo tank unless the one-way travel time (OWTT), marked on the tank in compliance with § 173.318(g) of this subchapter, is equal to or greater than the elapsed time between loading and unloading of the cargo tank. This prohibition does not apply if, prior to expiration of the OWTT, the tank is brought to full equilibration as specified in paragraph (j) of this section.

(j) Full equilibration of a cargo tank transporting a flammable cryogenic liquid may only be done at a facility that loads or unloads a flammable cryogenic liquid and must be performed and verified as follows:

(1) The temperature and pressure of the liquid must be reduced by a manually controlled release of vapor;

(2) The pressure in the cargo tank must be measured at least ten minutes after the manual release is terminated, and

(3) The pressure in the cargo tank must be equal to or less than the pressure at which the cargo tank was loaded.

(k) A carrier of carbon monoxide, cryogenic liquid must provide each driver with a self-contained air breathing apparatus that is approved by the National Institute of Occupational Safety and Health; for example, Mine Safety Appliance Co., Model 401, catalog number 461704.

## PART 178—SHIPPING CONTAINER SPECIFICATIONS

33. In Part 178, the Table of Sections is amended by adding a heading for § 178.338 to read as follows:

Sec.

178.338 Specification MC–338, insulated cargo tank.

34. In § 178.57–2, the heading and paragraphs (b) and (c) are revised and footnotes 1 and 2 are removed to read as follows:

**§ 178.57–2 Type, size, service pressure, and design service temperature.**

* * * * *

(b) The service pressure shall be at least 40 and not more than 360 pounds

per square inch. The service pressure limits the use of the cylinder and is shown by marks on the cylinder. For example, DOT-4L200 indicates the authorized pressure is 200 pounds per square inch.

(c) The design service temperature is the coldest temperature for which a cylinder is suitable. The required design service temperatures for each cryogenic liquid is as follows:

| Cryogenic liquid | Design service temperature |
|---|---|
| Argon | Minus 320°F. or colder |
| Helium | Minus 452 F. or colder |
| Hydrogen | Minus 423°F. or colder |
| Neon | Minus 411°F. or colder |
| Nitrogen | Minus 320°F. or colder |
| Oxygen | Minus 320°F. or colder |

* * * * *

35. Section 178.57-5 is revised to read as follows:

**§ 178.57-5 Material.**

(a) *Inner containment vessel (cylinder).* Designations and limiting chemical compositions of steel authorized by this specification shall be as shown in § 178.57-21(a) Table 1.

(b) *Outer jacket.* Steel or aluminum may be used subject to the requirements of § 178.57-21(b).

36. In § 178.57-8, paragraph (c) is revised and paragraph (d) is added to read as follows:

**§ 178.57-8 Manufacture.**

* * * * *

(c) The surface of the cylinder must be insulated. The insulating material must be fire resistant. The insulation on non-evacuated jackets must be covered with a steel jacket not less than 0.060-inch thick or an aluminum jacket not less than 0.070 inch thick, so constructed that moisture cannot come in contact with the insulating material. If a vacuum is maintained in the insulation space, the evacuated jacket must be designed for a minimum collapsing pressure of 30 psi differential whether made of steel or aluminum. The construction must be such that the total heat tranfer, from the atmosphere at ambient temperature to the contents of the cylinder, will not exceed 0.0005 Btu per hour, per Fahrenheit degree differential in temperature, per pound of water capacity of the cylinder. For hydrogen, cryogenic liquid service, the total heat transfer, with a temperature differential of 520 Fahrenheit degrees, may not exceed that required to vent 30 SCF of hydrogen gas per hour.

(d) For a cylinder having a design service temperature colder than minus 320°F, a calculation of the maximum weight of contents must be made and that weight must be marked on the cylinder as prescribed in § 178.57-20(a)(4).

* * * * *

37. In § 178.57-10, paragraph (b) is amended by revising the definition of "P" as follows:

**§ 178.57-10 Wall thickness.**

* * * * *

(b) * * *

P=minimum test pressure prescribed for pressure test in pounds per square inch;

* * * * *

38. In § 178.57-12, paragraph (a) is revised to read as follows:

**§ 178.57-12 Openings in cylinder.**

(a) Openings permitted in heads only. They must be circular and shall not exceed 3 inches diameter or one third of the cylinder diameter, whichever is less. Each opening in the cylinder must be provided with a fitting, boss or pad, either integral with, or securely attached to, the cylinder body by fusion welding. Attachments to a fitting, boss or pad may be made by welding, brazing, mechanical attachment, or threading. Threads must comply with the following:

(1) Threads must be clean-cut, even, without checks and cut to gauge.

(2) Taper threads to be of a length not less than that specified for NPT.

(3) Straight threads must have at least 4 engaged threads, tight fit and calculated shear strength at least 10 times the test pressure of the cylinder. Gaskets, which prevent leakage and are inert to the hazardous material, are required.

* * * * *

39. Section 178.57-13 is revised to read as follows:

**§ 178.57-13 Pressure relief devices and pressure control valves.**

Each cylinder must te equipped with pressure relief devices and pressure control valves as prescribed in §§ 173.34(d) and 173.316 of this subchapter. Flow capacity of relief devices must meet the requirements of paragraph 5.9 of CGA Pamphlet S-1.1.

40. In § 178.57-20, paragraphs (a)(2) and (a)(4) are revised, paragraphs (a)(5) and (a)(6) are redesignated (a)(6) and (a)(7) respectively, and new paragraphs (a)(5), (a)(8) and (a)(9) are added to read as follows:

**§ 178.57-20 Marking.**

(a) * * *

(2) ST followed by the design service temperature (for example, ST-423F), on cylinders having a design service temperature of colder than minus 320°F. only. Location to be just below the DOT mark.

* * * * *

(4) Maximum weight of contents, in pounds (for example, Max. Content 51#), on cylinders having a design service temperature colder than minus 320°F. only. Location to be near symbol.

(5) Examples of required markings are:

| Design service temperature minus 320° F. or warmer. | Design service temperature colder than minus 320° F. |
|---|---|
| DOT-4L 150 | DOT-4L 150 |
| 1234 | ST-423F |
| XY | 1234 |
| | XY |
| | MAX CONTENT 51# |

* * * * *

(8) Special orientation instructions (for example, THIS END UP), if the cylinder is used in an orientation other than vertical with openings at the top of the cylinder.

(9) "Aluminum Jacket," if the jacket of the cylinder is constructed of aluminum.

* * * * *

41. Section 178.57-21 is revised to read as follows:

**§ 178.57-21 Authorized materials of construction.**

(a) *Inner containment vessel (cylinder).* Electric furnace steel of uniform quality. Chemical analysis must conform to ASTM A240, Type 304 Stainless Steel. The following chemical analyses and physical properties are authorized:

TABLE 1—AUTHORIZED MATERIALS

| Designation | Chemical analysis, limits in percent |
|---|---|
| Carbon [1] | 0.08 max. |
| Manganese | 2.00 max. |
| Phosphorus | 0.045 max. |
| Sulphur | 0.030 max. |
| Silicon | 1.00 max. |
| Nickel | 8.00-10.50 |
| Chromium | 18.00-20.00 |
| Molybdenum | |
| Titanium | |
| Columbium | |

[1] The carbon analysis must be reported to the nearest hundredths of one percent.

| | Physical properties (annealed) |
|---|---|
| Tensile strength, p.s.i. (minimum) | 75,000 |
| Yield strength, p.s.i. (minimum) | 30,000 |
| Elongation in 2-inches (minimum), percent | 30.0 |
| Elongation other permissible gauge lengths (minimum), percent | 15.0 |

NOTE 1.—A heat of steel made under the above specification is acceptable, even though its check chemical analysis is slightly out of the specified range, if it is satisfactory in all other respects, provided the tolerances shown in the following table are not exceeded.

CHECK ANALYSIS TOLERANCES

| Elements | Limit or maximum of specified range, percent | Tolerance over the maximum limit or under the minimum limit |
|---|---|---|
| Carbon | To 0.030, inclusive | 0.005 |
| | Over 0.030 to 0.20, inclusive. | 0.01 |
| Manganese | To 1.00, inclusive | 0.03 |
| | Over 1.00 to 3.00, inclusive. | 0.04 |
| Phosphorus [1] | To 0.040, inclusive | 0.005 |
| | Over 0.040 to 0.20 inclusive. | 0.010 |
| Sulfur | To 0.40, inclusive | 0.005 |
| Silicon | To 1.00, inclusive | 0.05 |
| Chromium | Over 15.00 to 20.00, inclusive. | 0.20 |
| Nickel | Over 5.00 to 10.00, inclusive. | 0.10 |
| | Over 10.00 to 20.00, inclusive. | 0.15 |

[1] Rephosphorized steels not subject to check analysis of the phosphorus.

(b) *Outer jacket.*

(1) *Nonflammable cryogenic liquids.* Cylinders intended for use in the transportation of nonflammable cryogenic liquid must have an outer jacket made of steel or aluminum.

(2) *Flammable cryogenic liquids.* Cylinders intended for use in the transportation of flammable cryogenic liquid must have an outer jacket made of steel.

42. Section 178.57–22 is revised to read as follows:

**§ 178.57–22 Inspector's report.**

(a) This report is required to be clear, legible and in following form:

(Place) ———
(Date) ———

*Steel gas cylinders*

Manufactured for ———
Location at ———
Manufactured by ———
Location at ———
Consigned to ———
Location at ———
Quantity ———
Size ——— inches outside diameter by ——— inches long
Cylinders were pressure tested at ——— pounds per square inch and found to be satisfactory.
Maximum and minimum weight ———.
Maximum and minimum volumetric capacity ———
Jacket material ———
Insulation type ———
Marks stamped into the ——— (Location of marking) of the cylinder are:
Specification DOT ———
Design service temperature—minus———°F.
Maximum weight of content — (pounds)
Serial numbers — to — inclusive
Inspector's mark ———
Identifying symbol (registered) ———
Test date ———
Tare weight (yes or no) ———
Other marks ———
These cylinders were made by process of———

The material used was authorized by § 178.57–21.

The material used was identified by the following ——— (Heat-purchase order) numbers ———

The material used was verified as to chemical analysis and record thereof is attached hereto. The heat numbers ——— (were—were not) marked on the material.

| Test No. | Heat No. | Check analysis No. | Cylinders represented (serial Nos.) | Chemical analysis C | P | S | Si | Mn | Ni | Cr | Mo | Cu | Al | Zr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |

All material was inspected and all that was accepted was found free from seams, cracks, laminations and other injurious defects.

The compliance of cylinders with specification requirements was verified including markings, condition of inside, tests, threads, etc. All cylinders with defects which might prove injurious were rejected. The processes of manufacture and heat treatment were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was —— inch. The outside diameter was determined by a close approximation to be —— inches. The wall stress was calculated to be —— pounds per square inch under an internal pressure of —— pounds per square inch.

Pressure tests, tensile tests of material, and other tests as prescribed in specification No. DOT–4L——— were made in the presence of the inspector and all cylinders accepted were found to be in compliance with the requirements of that specification. Records thereof are attached hereto.

Each cylinder ——— (Has—has not) been equipped with safety devices as follows:

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the requirements of Department of Transportation specification No. 4L except as follows:

Exceptions ———
(Manufacturer's name) ———
By ———
(Signed) ———
(Inspector)
(Place) ———
(Date) ———

**Record of Chemical Analysis of Steel for Cylinders**

Numbered ——— to ——— inclusive.
Size —— inches outside diameter by —— inches long.
Made by ——— Company.
For ——— Company.

Steel was manufactured by ——— Company. The originals of the certified mill test reports are in the files of the manufacturer.

**Note:** Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Chemical analyses were made by ———
(Date) ———
(Place) ———

**Record of Physical Tests of Material For Cylinders**

Numbered ——— to ——— inclusive.
Size ——— inches outside diameter by——— inches long
Made by ——— Company
For ——— Company

| Test No. | Cylinders represented by test (serial Nos.) | Yield strength (pounds per square inch) | Tensile strength (pounds per square inch) | Elongation (percent in inches) | Impact test results | Weld tensile test | Weld bend test |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

(Signed) ———

43. In § 178.337–1, paragraphs (a) and (e) are revised to read as follows:

**§ 178.337–1 General requirements.**

(a) *ASME Code construction.* Tanks must be—

(1) Seamless or welded construction, or a combination of both;

(2) Designed and constructed in accordance with the ASME Code;

(3) Made of steel or aluminum; however, if aluminum is used, the cargo tank must be insulated and the hazardous material to be transported must be compatible with the aluminum (see §§ 173.33(i), 173.315(a) Table Note 11, and 178.337–2(a)(1) of this subchapter); and

(4) Covered with a steel jacket if the cargo tank is insulated and used to transport a flammable gas (see § 173.315(a) Table Note 11 of this subchapter).

* * * * *

(e) *Insulation.* Compliance with the requirements for use and performance of insulation is required (see §§ 173.33(i), 173.315(a) Table Note 11, and 178.337-1(a)(3) of this subchapter).

* * * * *

44. In § 178.337-11, the introductory text to paragraph (c) is revised to read as follows:

**§ 178.337-11 Emergency discharge control.**

* * * * *

(c) *Liquid or vapor discharge openings.* Except for an engine fuel line on a truck-mounted tank of not over ¾ inch NPT and equipped with a valve having an integral excess flow valve, each liquid or vapor discharge opening in a tank intended to be used for a flammable liquid; flammable compressed gas; hydrogen chloride, liquid (*refrigerated*); or anhydrous ammonia, must be equipped with a remotely controlled internal shut-off valve. However, on any liquid or vapor discharge opening 1¼ inches NPT or smaller, an excess flow valve together with a manually operated external valve may be used in place of a remotely controlled internal shut-off valve. Each remotely controlled internal valve must comply with the following requirements:

* * * * *

45. In Part 178, § 178.338 consisting of §§ 178.338-1 to 178.338-19 is added to read as follows:

**§ 178.338 Specification MC-338; insulated cargo tank.**

**§ 178.338-1 General requirements.**

(a) For the purposes of this section—

(1) *"Design pressure"* means the "maximum allowable working pressure" as used in the ASME Code, and is the gauge pressure at the top of the tank.

(2) *"Design service temperature"* means the coldest temperature for which the tank is suitable (see §§ 173.318 (a)(1) and (f) of this subchapter).

(b) Each cargo tank must consist of a suitably supported welded inner vessel enclosed within an outer shell or jacket, with insulation between the inner vessel and outer shell or jacket, and having piping, valves, supports and other appurtenances as specified in this subchapter. For the purpose of this specification, "tank" means inner vessel and "jacket" means either the outer shell or insulation cover.

(c) Each tank must be designed and constructed to meet the requirements of the ASME Code.

(1) The design pressure of the tank must be at least 25.3 psig but not more than 500 psig. To determine the required thicknesses of the parts of the tank, the static head of the lading shall be added to the design pressure. If the jacket is evacuated, the tank must be designed for a pressure of 14.7 psi, plus the lading static head, higher than its "design pressure." The jacket must be designed in accordance with paragraph (e) or (f) of this section, as appropriate.

(2) The design service temperature of the tank, piping and valves may not be warmer than the liquefaction temperature at one atmosphere of the lading to be transported (see §§ 173.318 (a)(1) and (f) of this subchapter).

(3) Design and construction details of the tank interior may not allow collection and retention of cleaning materials or contaminants. To preclude the entrapment of foreign material, the design and construction of the tank must allow washing of all interior surfaces by the normal surging of the lading during transportation.

(d) The exterior surface of the tank must be insulated with a material compatible with the lading.

(1) Each cargo tank must have an insulation system that will prevent the tank pressure from exceeding the pressure relief valve set pressure within the specified holding time when the tank is loaded with the specific cryogenic liquid at the design conditions of—

(i) The specified temperature and pressure of the cryogenic liquid, and

(ii) The exposure of the filled cargo tank to an average ambient temperature of 85°F.

(2) For a cargo tank used to transport oxygen, the insulation may not sustain combustion in a 99.5 percent oxygen atmosphere at atmospheric pressure when contacted with a continuously heated glowing platinum wire. The cargo tank must be marked in accordance with § 178.338-18(b)(7).

(3) Each vacuum-insulated cargo tank must be provided with a connection for a vacuum gauge to indicate the absolute pressure within the insulation space.

(e) The insulation must be completely covered by a metal jacket. The jacket or the insulation must be so constructed and sealed as to prevent moisture from coming into contact with the insulation (see § 173.318(a)(3) of this subchapter). Minimum metal thicknesses are as follows:

| Type metal | Jacket evacuated | | Jacket not evacuated | |
|---|---|---|---|---|
| | Gauge | Inches | Gauge | Inches |
| Stainless steel | 18 | 0.0428 | 20 | 0.0324 |
| Low Carbon Mild Steel | 12 | 0.0946 | 14 | 0.0677 |
| Aluminum | | 0.125 | | 0.0100 |

(f) An evacuated jacket must be in compliance with the following requirements:

(1) The jacket heads, shell and stiffening rings must be designed in accordance with paragraphs UG-28, UG-29 and UG-33 of the ASME Code to sustain a critical collapsing pressure of at least 30 psi. The jacket need not be marked with the ASME stamp.

(2) If the jacket also supports additional loads, such as the weight of the tank and lading, the combined stress, computed according to the formula in § 178.338-3(b), may not exceed 25 percent of the minimum specified tensile strength.

**§ 178.338-2 Material.**

(a) All material used in the construction of a tank and its appurtenances that may come in contact with the lading must be suitable for use with the lading to be transported. All material used for tank pressure parts, including evacuated jackets, must conform to the requirements of the ASME Code.

(b) All tie-rods, mountings, and other appurtenances within the jacket and all piping, fittings and valves must be of material suitable for use at the lowest temperature to be encountered.

(c) Impact tests are required on all tank materials, except aluminum, and must be performed using the procedure prescribed in the ASME Code.

(d) The direction of final rolling of the shell material must be the circumferential orientation of the tank shell.

(e) Each tank constructed in accordance with Part UHT of the ASME Code must be postweld heat treated as a unit after completion of all welds to the shell and heads. Other tanks must be postweld heat treated as required by the ASME Code. For all tanks the method must be as prescribed in the ASME Code. Welded attachments to pads may be made after postweld heat treatment.

(f) The fabricator shall record the heat and slab numbers and the certified Charpy impact values of each plate used in the tank on a sketch showing the location of each plate in the shell and heads of the tank. A copy of the sketch must be provided to the owner of the cargo tank and a copy must be retained by the fabricator for at least five years and made available, upon request, to any duly identified representative of the Department.

**§ 178.338-3 Metal thickness.**

(a) The metal thickness of the tank must be as prescribed in the ASME Code and paragraph (b) of this section.

Metal less than 3/16 inch thick may not be used for the shell or heads of a tank unless the tank is enclosed in an evacuated or load-bearing jacket. Metal less than 1/8 inch thick may not be used for the shell or heads of the tank under any circumstances.

(b) The minimum thickness of metal in the shell (cylindrical portion) of the tank must be such that at no point will the stress on a plane normal to the longitudinal axis exceed 25 percent of the minimum specified tensile strength of the metal. The forces, loads, and stresses considered in this requirement must take into account the weight of the tank itself, its maximum weight of contents, and articles supported by the tank, not including the weight of structures supporting the tank in normal conditions. The stresses involved are not all uniform through the length of the tank. For purposes of this requirement, calculation must be made by the following formula:

$$S = (T/2) + \{(T^2/4) + S_s^2\}^{0.5}$$

where at any point under consideration and for the worst combination of loadings:

S = Effective stress as limited by this requirement, in psi;

T = The sum of the longitudinal tensile stresses due to external vacuum and internal pressure and other causes, including direct tensile stress due to a rearward acceleration force, tensile stress due to the bending moment of a rearward acceleration force applied at the road surface, and tensile flexure stress using applicable static loadings specified in paragraphs (b), (e) and (f) of § 178.338–13, in psi; and

$S_s$ = The vectorial sum of the shear stresses in the plane in question, including direct vertical shear due to the static vertical loading, direct lateral shear due to a lateral accelerative force, and torsional shear due to a lateral accelerative force, applied at the road surface using applicable static loadings specified in paragraphs (b), (e) and (f) of § 178.338–13, in psi.

(c) Maximum stress concentrations that may be created at supports due to shear, bending, and torsion must be calculated in accordance with Appendix G of the ASME Code.

(d) Where a tank support is attached to any part of a tank head, the stresses imposed on the head must be in accordance with the requirements in paragraph (c) of this section.

**§ 178.338–4 Joints.**

(a) All joints in the tank, and in the jacket if evacuated, must be as prescribed in the ASME Code, with all undercutting in shell and head material repaired as specified therein.

(b) Welding procedure and welder performance tests must be made in accordance with Section IX of the ASME Code. Records of the qualification must be retained by the tank manufacturer for at least five years and must be made available, upon request, to any duly identified representative of the Department, or the owner of the cargo tank.

(c) All longitudinal welds in tanks and load bearing jackets must be located so as not to intersect nozzles or supports other than load rings and stiffening rings.

(d) Substructures must be properly fitted before attachment and the welding sequence must minimize stresses due to shrinkage of welds.

(e) Filler material containing more than 0.05 percent vanadium may not be used with quenched and tempered steel.

(f) All joints must be in accordance with Part UW of the ASME Code, except that a butt weld with one plate edge offset is not authorized. All tank nozzle to shell and nozzle to head welds must be full penetration welds.

**§ 178.338–5 Stiffening rings.**

(a) A tank is not required to be provided with stiffening rings, except as prescribed in the ASME Code.

(b) If a jacket is evacuated, it must be constructed in compliance with § 178.338–1(f). Stiffening rings may be used to meet these requirements.

**§ 178.338–6 Manholes.**

(a) Each tank in oxygen service must be provided with a manhole as prescribed in the ASME Code.

(b) Each tank having a manhole must be provided with a means of entrance and exit through the jacket, or the jacket must be marked to indicate the manway location on the tank.

(c) When a manhole is provided, it may not be located on the front head of the tank.

**§ 178.338–7 Openings.**

(a) The inlet to the liquid product discharge opening of each tank intended for flammable ladings must be at the bottom centerline of the tank.

(b) If the leakage of a single valve, except a pressure relief valve, pressure control valve, full trycock or gas phase manual vent valve, would permit loss of flammable material, an additional closure that is leak tight at the tank design pressure must be provided outboard of such valve.

**§ 178.338–8 Pressure relief devices, piping, valves, and fittings.**

(a) *Pressure relief devices.* Each tank pressure relief device must be designed, constructed, and marked in accordance with § 173.318(b) of this subchapter.

(b) *Piping, valves, and fittings.*

(1) All piping, valves, and fittings shall be as required by §§ 173.33(f) and 173.318(b) of this subchapter.

(2) Each valve must be suitable for the tank design pressure at the tank design service temperature.

(3) All fittings must be rated for the maximum tank pressure and suitable for the coldest temperature to which they will be subjected in actual service.

(4) All piping, valves and fittings must be grouped and protected from damage as required by § 178.338–10.

(5) When a pressure-building coil is used on a tank designed to handle oxygen or flammable ladings, the vapor connection to that coil must be provided with a valve or check valve as close to the tank as practicable to prevent the loss of vapor from the tank in case of damage to the coil. The liquid connection to that coil must also be provided with a valve.

**§ 178.338–9 Holding time.**

(a) "Holding time" is the time, as determined by testing, that will elapse from loading until the pressure of the contents, under equilibrium conditions, reaches the level of the lowest pressure control valve or pressure relief valve setting.

(b) *Holding time test.*

(1) The test to determine holding time must be performed by charging the tank with a cryogenic liquid having a boiling point, at a pressure of one atmosphere, absolute, no lower than the design service temperature of the tank. The tank must be charged to its maximum permitted filling density with that liquid and stabilized to the lowest practical pressure, which must be equal to or less than the pressure to be used for loading. The cargo tank together with its contents must then be exposed to ambient temperature.

(2) The tank pressure and ambient temperature must be recorded at 3-hour intervals until the pressure level of the contents reaches the set-to-discharge pressure of the pressure control valve or pressure relief valve with the lowest setting. This total time lapse in hours represents the measured holding time at the actual average ambient temperature. This measured holding time for the test cryogenic liquid must be adjusted to an equivalent holding time for each cryogenic liquid that is to be identified on or adjacent to the specification plate, at an average ambient temperature of 85°F. This is the rated holding time (RHT). The marked rated holding time (MRHT) displayed on or adjacent to the specification plate (see §178.318(b)(9)) may not exceed this RHT.

(c) *Optional test regimen.*

(1) If more than one cargo tank is made to the same design, only one cargo tank must be subjected to the full holding time test at the time of manufacture. However, each subsequent cargo tank made to the same design must be performance tested during its first trip. The holding time determined in this test may not be less than 90 percent of the marked rated holding time. This test must be performed in accordance with §§ 173.33(d)(1)(ii) and 177.840(h) of this subchapter, regardless of the classification of the cryogenic liquid.

(2) *Same design.* The term "same design" as used in this section means cryogenic cargo tanks made—

(i) By the same manufacturer;

(ii) To the same engineering drawings, and calculations;

(iii) To the same dimensions of length, diameter, and volume;

(iv) Of the same materials of construction; and

(v) With the same insulation system.

**§ 178.338–10 Collision damage protection.**

(a) All valves, fittings, pressure relief devices and other accessories to the tank proper, which are not isolated from the tank by closed intervening shut-off valves or check valves, must be installed within the motor vehicle framework or within a suitable collision resistant guard or housing, and appropriate ventilation must be provided. Each pressure relief device must be protected so that in the event of the upset of the vehicle onto a hard surface, the device's opening will not be prevented and its discharge will not be restricted.

(b) Each protective device or housing, and its attachment to the vehicle structure, must be designed to withstand static loading in any direction that it may be loaded as a result of front, rear, side, or sideswipe collision, or the overturn of the vehicle. The static loading shall equal twice the loaded weight of the tank and attachments. A safety factor of four, based on the ultimate strength of the material, shall be used. The protective device or the housing must be made of steel at least $\frac{3}{16}$-inch thick, or other material of equivalent strength.

(c) Each tank motor vehicle must be provided with a least one rear bumper designed to protect the cargo tank and piping in the event of a rear end collision. The bumper design must transmit the force of the collision directly to the chasis of the vehicle. The rear bumper and its attachments to the chasis must be designed to withstand a load equal to twice the weight of the loaded cargo tank and attachments, using a safety factor of four based on the ultimate strength of the materials used, with such load being applied horizontally and parallel to the major axis of the cargo tank, or within 30 horizontal degrees thereof. The rear bumper dimensions must meet the requirements of §393.86 of this title and extend vertically to a height adequate to protect all valves and fittings located at the rear of the cargo tank from damage that could result in loss of lading.

(d) Every part of the loaded cargo tank, and any associated valve, pipe, enclosure, or protective device or structure (exclusive of wheel assemblies), must be at least 14 inches above level ground.

**§ 178.338–11 Discharge control devices.**

(a) Excess-flow valves are not required.

(b) Each liquid filling and liquid discharge line must be provided with a shut-off valve located as close to the tank as practicable. Unless this valve is manually operable at the valve, the line must also have a manual shut-off valve.

(c) Each liquid filling and liquid discharge line on a cargo tank intended for service transporting a flammable lading must be provided with a remotely controlled shut-off valve. If pressure from a reservoir or from an engine driven pump or compressor is used to open this valve, the control must be of fail-safe design, spring-biased to stop the admission of such pressure. If the jacket is not evacuated, the seat of the valve must be inside the tank, in the opening nozzle or flange, or in a companion flange bolted to the nozzle. If the jacket is evacuated, the remotely controlled valve must be located as close to the tank as practicable.

(1) On a cargo tank with a capacity in excess of 3,500 gallons of water, each remotely controlled shut-off valve must be provided with remote means of automatic closure, both mechanical and thermal, installed at the ends of the cargo tank in at least two diagonally opposite locations. The thermal means shall consist of fusible elements actuated at a temperature not exceeding 250°F., or equivalent devices. One means may be used to close more than one remotely controlled valve.

(2) On a cargo tank with a capacity of 3,500 gallons of water or less, each remotely controlled shut-off valve must be provided with at least one remote control station on the end of the cargo tank opposite the main control station. The remote control station must contain a manual means of closure. In addition, it may contain fusible elements actuated at a temperature not exceeding 250°F., or equivalent devices. One means may be used to close more than one remotely controlled valve.

**§ 178.338–12 Shear section.**

The design or installation of each valve, damage to which could result in loss of liquid or vapor, must incorporate a shear section or breakage groove adjacent to and outboard of the valve. The section or groove must yield or break under strain without damage to the valve that would allow the loss of liquid or vapor. The protection specified in § 178.338–10 is not a substitute for a shear section or breakage groove.

**§ 178.338–13 Supports and anchoring.**

(a) All attachments of supports and bumpers to tanks and to load-bearing jackets must be made by means of pads of material similar to that of the tank or jacket, by load rings, or by bosses designed or gusseted to distribute the load. The pad must be at least ¼-inch thick, or as thick as the tank or jacket material, if less, but shall in no case be thicker than the tank or jacket material. Each pad must extend at least four times its thickness, in each direction, beyond the weld attaching the support or bumper. Each pad must be preformed to an inside radius no greater than the outside radius of the tank or jacket at the place of attachment. Each pad corner must be rounded to a radius at least one-fourth the width of the pad and no greater than one-half the width of the pad. If weep holes or telltale holes are used, they must be drilled or punched before the pads are attached. Each pad must be attached to the tank or jacket by continuous fillet welding using filler material having properties conforming to the recommendations of the manufacturer of the tank or jacket material. Any fillet weld discontinuity may only be for the purpose of preventing an intersection between the fillet weld and a tank or jacket seam weld.

(b) A tank motor vehicle constructed so that the cargo tank constitutes in whole or in part the structural member used in place of a motor vehicle frame must have the tank or the jacket supported by external cradles or by load rings. A cargo tank mounted on a motor vehicle frame must have the tank or jacket supported by external cradles, load rings, or longitudinal members. If cradles are used, they must subtend at least 120 degrees of the cargo tank circumference. The design calculations for the supports and load bearing tank or jacket, and the support attachments must include beam stress, shear stress, torsion stress, bending moment, and acceleration stress for the loaded

vehicle as a unit, using a safety factor of four, based on the ultimate strength of the material, and static loadings that take into consideration the weight of the cargo tank and its attachments when filled to the design weight of the lading (see Appendix G of the ASME Code). The effects of fatigue must also be considered in the calculations. Minimum static loadings must be as follows:

(1) For a vacuum-insulated cargo tank—

(i) Vertically downward of 2;
(ii) Vertically upward of 2;
(iii) Longitudinally of 2; and
(iv) Laterally of 2.

(2) For a nonvacuum-insulated cargo tank—

(i) Vertically downward of 3;
(ii) Vertically upward of 2;
(iii) Longitudinally of 2; and
(iv) Laterally of 2.

(c) When a loaded tank is supported within the vacuum jacket by structural members, the design calculations for the tank and its structural members must use a safety factor of four, based on the ultimate strength of the material at the tank's design service temperature, and static loadings that take into consideration the weight of the tank and the structural members when the tank is filled to the design weight of lading (see Appendix G of the ASME Code). When load rings in the jacket are used for supporting the tank they must be designed to carry the fully loaded tank at the specified static loadings, plus external pressure. Minimum static loadings must be as follows:

(1) Vertically downward of 2;
(2) Vertically upward of 1½;
(3) Longitudinally of 1½; and,
(4) Laterally of 1½.

**§ 178.338-14 Gauging devices.**

(a) *Liquid level gauging devices.*

(1) Unless a cargo tank is intended to be filled by weight, it must be equipped with one or more gauging devices, which accurately indicate the maximum permitted liquid level at the loading pressure, in order to provide a minimum of two percent outage below the inlet of the pressure control valve or pressure relief valve at the condition of incipient opening of that valve. A fixed-length dip tube, a fixed trycock line, or a differential pressure liquid level gauge must be used as the primary control for filling. Other gauging devices, except gauge glasses, may be used, but not as the primary control for filling.

(2) The design pressure of each liquid level gauging device must be at least that of the tank.

(3) If a fixed length dip tube or trycock line gauging device is used, it must consist of a pipe or tube of small diameter equipped with a valve at or near the jacket and extending into the cargo tank to a specified filling height. The fixed height at which the tube ends in the cargo tank must be such that the device will function when the liquid reaches the maximum level permitted in loading. The setting (percent outage) must be indicated in a visible location at or adjacent to the valve.

(4) The liquid level gauging device used as a primary control for filling must be designed and installed to accurately indicate the maximum filling level at the point midway of the tank both longitudinally and laterally.

(b) *Pressure gauges.* Each cargo tank must be provided with a suitable pressure gauge indicating the lading pressure and located on the front of the jacket so it can be read by the driver in the rear view mirror. Each gauge must have a reference mark at the cargo tank design pressure or the set pressure of the pressure relief valve or pressure control valve, whichever is lowest.

(c) *Orifices.* All openings for dip tube gauging devices, trycock lines, and pressure gauges must be restricted at or inside the jacket by orifices no larger than 0.060-inch diameter.

**§ 178.338-15 Cleanliness.**

A cargo tank constructed for oxygen service must be thoroughly cleaned to remove all foreign material in accordance with CGA Pamphlet G-4.1. All loose particles from fabrication, such as weld beads, dirt, grinding wheel debris, and other loose materials, must be removed prior to the final closure of the manhole of the tank. Chemical or solvent cleaning with a material compatible with the intending lading must be performed to remove any contaminants likely to react with the lading.

**§ 178.338-16 Inspection and testing.**

(a) *General.* The material of construction of a cargo tank, its appurtenances, and the jacket if evacuated, must be inspected for compliance with the ASME Code. The tank must be subjected to either a hydrostatic or pneumatic test. The test pressure must be one and one-half times the sum of the design pressure, plus static head of lading, plus 14.7 psi if subjected to external vacuum, except that for tanks constructed in accordance with Part UHT of the ASME Code the test pressure must be twice the design pressure.

(b) *Additional requirements for pneumatic test.* A pneumatic test may be used in place of the hydrostatic test. Due regard for protection of all personnel should be taken because of the potential hazard involved in a pneumatic test. The pneumatic test pressure in the tank must be reached by gradually increasing the pressure to one-half of the test pressure. Thereafter, the test pressure must be increased in steps of approximately one-tenth of the test pressure until the required test pressure has been reached. Then the pressure must be reduced to a value equal to four-fifths of the test pressure and held for a sufficient time to permit inspection of the cargo tank for leaks.

(c) *Weld inspection.* All tank shell or head welds subject to pressure shall be radiographed in accordance with the ASME Code. A tank which has been subjected to inspection by the magnetic particle method, the liquid penetrant method, or any method involving a material deposit on the interior tank surface, must be cleaned to remove any such residue by scrubbing or equally effective means, and all such residue and cleaning solution must be removed from the tank prior to final closure of the tank.

(d) *Defect repair.* All cracks and other defects must be repaired as prescribed by the ASME Code. The welder and the welding procedure must be qualified in accordance with the ASME Code. After repair, the tank must again be postweld heat-treated, if such heat treatment was previously performed, and the repaired areas must be retested.

(e) Verification must be made of the interior cleanliness of a tank constructed for oxygen service by means that assure that all contaminants that are likely to react with the lading have been removed as required by § 178.338-15.

**§ 178.338-17 Pumps.**

See §§ 173.33(f) and 173.318(a)(4) of this subchapter.

**§ 178.338-18 Marking.**

(a) *Nameplate.* On the right side near the front of each tank a corrosion resistant metal nameplate must be permanently affixed by brazing or welding around its perimeter. If this nameplate is attached by welding, it must be welded before the tank is postweld heat-treated. The nameplate must be plainly marked by stamping, embossing, or other means of forming letters into the metal of the plate, in characters at least ⅜-inches high. The following information, in addition to that required by the ASME Code, must be included (parenthetical abbreviations may be used):

(1) DOT Specification number MC-338 (DOT MC-338);

(2) Material specification number (Mat. Spec. No.);

(3) Maximum density of lading for which the tank is designed (Max. Dens. of Lading);

(4) Water capacity, in pounds net at 60°F., with the tank at its coldest operating temperature, after deduction for the volume above the inlet to the pressure relief device or pressure control valve, structural members, baffles, piping, and other appurtenances inside the tank (W. Cap.); and

(5) Original test date (Orig. Test Date);

(b) *Specification plate.* An additional plate, in the form specified in paragraph (a) of this section, must be welded, brazed, or riveted to the jacket on the right side near the front, or at the control station, in a position readily legible to operating personnel. It must be marked with the information specified in paragraph (a) of this section and in addition, in characters at least ⅜-inches high, the following (parenthetical abbreviations may be used):

(1) Vehicle manufacturer (Veh. Mfr.);

(2) Manufacturer's vehicle serial number (Veh. No.);

(3) Lining material, if any (Lining);

(4) Date of manufacture (Date of Mfr.);

(5) Certificate date (Cert. Date);

(6) Design service temperature (Design Serv. Temp.);

(7) "Insulation for Oxygen Service" or "Not Authorized for Oxygen Service," as appropriate;

(8) Maximum weight of lading for which the cargo tank is designed, in pounds (Max. Net Wgt.——lbs.);

(9) Marked rated holding time for at least one cryogenic liquid, in hours, and the name of that cryogen (MRHT—— hrs., name of cryogen). MRHT markings for additional cryogenic liquids may be displayed on or adjacent to the specification plate.

(c) The design weight of lading used in determining the loading in §§ 178.338–3(b), 178.338–10 (b) and (c), and 178.338–13 (b) and (c) must be shown as the maximum weight of lading marking required by paragraph (b) of this section.

**§ 178.338–19 Certification.**

(a) The manufacturer of a cargo tank vehicle shall furnish to the owner of the completed vehicle, at or before the time of delivery, the following:

(1) the tank manufacturer's data report required by the ASME Code,

(2) a photograph, pencil rub, or other facsimile of the plates required by paragraphs (a) and (b) of § 178.338–18, and

(3) a certificate bearing the manufacturer's vehicle serial number stating that the completed cargo tank vehicle conforms to all applicable requirements of Specification MC–338, including the ASME Code, in effect on the date (month, year) of certification.

(b) In the case of a cargo tank vehicle manufactured in two or more stages, each manufacturer who performs a manufacturing operation on the incomplete vehicle or portion thereof shall furnish to the succeeding manufacturer, at or before the time of delivery, a certificate covering the particular operation performed by that manufacturer and any certificates received from previous manufacturers. The certificates must 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 tank. Each certificate must be signed by an official of the manufacturing firm responsible for the portion of the complete cargo tank vehicle represented thereby, such as basic tank fabrication, insulation, jacket, or piping. The final manufacturer shall furnish the owner with all certificates, as well as the documents required by paragraph (a) of the section.

(c) The owner shall retain the data report, certificates, and related papers throughout his ownership of the cargo tank. In the event of change of ownership, the prior owner shall retain non-fading photographically reproduced copies of these documents for at least one year. Each operator using the cargo tank vehicle, if not the owner thereof, shall obtain a copy of the data report and the certificate or cetificates and retain them during the time he uses the cargo tank and for at least one year thereafter.

## PART 179—SPECIFICATIONS FOR TANK CARS

46. The Table of Sections of Part 179 is amended by revising the headings for Subpart F and §§ 179.400 and 179.401 to read as follows:

**Subpart F—Specification for Cryogenic Liquid Tank Car Tanks and Seamless Steel Tanks (Classes DOT–113 and 107A)**

* * * * *

179.400 *General specification applicable to cryogenic liquid tank car tanks.*

179.401 *Individual specification requirements applicable to inner tanks for cryogenic liquid tank car tanks.*

* * * * *

47. In § 179.100–7, the Table in paragraph (a) is amended by removing the entry for "ASTM A 537–70, GR. A" and replacing it with an entry for "ASTM A 537–80, Class 1" as follows:

**§ 179.100–7 Materials.**

(a) * * *

| Specifications | Minimum tensile strength (p.s.i.) welded condition [1] | Minimum elongation in 2 inches (percent) welded condition (longitudinal) |
|---|---|---|
| **(REMOVE)** | | |
| ASTM A 537–70, GR. A | 70,000 | 23 |
| **(ADD)** | | |
| ASTM A 537–80, Class 1 | 70,000 | 23 |

* * * * *

**§ 179.102–1 [Amended]**

48. In § 179.102–1, the heading and the introductory text of paragraph (a) are amended by removing the words "liquefied carbon dioxide" and inserting, in their place, the words "carbon dioxide, liquid (*refrigerated*)".

49. Section 179.102–4 is revised to read as follows:

**§ 179.102–4 Vinyl fluoride, inhibited.**

Each tank used to transport vinyl fluoride, inhibited, must comply with the following special requirements:

(a) The tank must comply with specification DOT–105A600W and must be designed for loading at minus 50° F. or colder.

(b) All plates for the tank, and appurtenances must be fabricated of—

(1) Stainless steel, ASTM Specification A240, Type 304, 304L, 316 or 316L, in which case impact tests are not required; or

(2) Steel complying with ASTM Specification A516; Grade 70; ASTM Specification A537, Class 1; or AAR Specification TC128, Grade B, in which case impact tests must be performed as follows:

(i) ASTM Specification A516 and A537 material must meet the Charpy V-notch test requirements, in longitudinal direction of rolling, of ASTM Specification A20.

(ii) AAR Specification TC128 material must meet the Charpy V-notch test requirements, in longitudinal direction of rolling, of 15 ft./lb. minimum average for 3 specimens, with a 10 ft./lb. minimum for any one specimen, at minus 50° F. or colder, in accordance with ASTM Specification A370.

(iii) Production welded test plates must—

(A) Be prepared in accordance with AAR Specifications for Tank Cars, Appendix W, W4.00;

(B) Include impact specimens of weld metal and heat affected zone prepared and tested in accordance with AAR Specifications for Tank Cars, Appendix W, W9.00; and

(C) Meet the same impact requirements as the plate material.

(c) Insulation must be of approved material.

(d) The tank must be equipped with at least one safety relief valve, set for the start-to-discharge pressure listed in § 179.101-1. The discharge capacity of each safety relief device must be sufficient to prevent the build up of pressure in the tank in excess of 82½ percent of the tank test pressure. The discharge from each safety relief device must be directed outside the protective housing.

(e) Excess flow valves must be installed under all liquid and vapor valves, except safety relief valves.

(f) A thermometer well may be installed.

(g) A gaging device may be installed. If one is installed it must be a fixed length dip tube.

(h) A pressure gage may be installed.

(i) Aluminum, copper, silver, zinc, or an alloy containing any of these metals may not be used in the tank construction, or in fittings in contact with the lading.

(j) The jacket must be stenciled, adjacent to the water capacity stencil, "COLDEST LADING TEMPERATURE ——— ° F."

(k) The tank car and insulation must be designed to prevent the vapor pressure of the lading from increasing from the pressure at the maximum allowable filling density to the start-to-discharge pressure of the safety relief valve within 30 days, at an ambient temperature of 90° F.

(l) Tank anchor-to-tank shell fillet welds must be examined by radioscopy or other non-destructive testing technique and must meet the acceptance standards of AAR Specifications for Tank Cars, Appendix W, paragraph W11.06.

50. Section 179.102-17 is added to read as follows:

**§ 179.102-17 Hydrogen chloride, liquid (refrigerated).**

Each tank car used to transport hydrogen chloride, liquid (*refrigerated*) must comply with the following special requirements:

(a) The tank car must comply with Specification DOT-105A500W and be designed for loading at minus 50° F. or colder.

(b) All plates for the tank and appurtenances must be fabricated of—

(1) Stainless steel, ASTM Specification A240, Type 304, 304L, 316, or 316L, in which case impact tests are not required; or

(2) Steel complying with ASTM Specification A516, Grade 70; ASTM Specification A537, Class 1; or AAR Specification TC128, Grade B, in which case impact tests must be performed as follows:

(i) ASTM Specification A516 and A537 material must meet the Charpy V-notch test requirements, in longitudinal direction of rolling, of ASTM Specification A20.

(ii) AAR Specification TC128 material must meet the Charpy V-notch test requirements, in longitudinal direction of rolling, of 15 ft./lb. minimum average for 3 specimens, with a 10 ft./lb. minimum for any one specimen, at minus 50° F. or colder, in accordance with ASTM Specification A370.

(iii) Production welded test plates must—

(A) Be prepared in accordance with AAR Specifications for Tank Cars, Appendix W, W4.00;

(B) include impact test specimens of weld metal and heat affected zone prepared and tested in accordance with AAR Specifications for Tank Cars, Appendix W, W9.00; and

(C) meet the same impact requirements as the plate material.

(c) Insulation must be of approved material.

(d) Safety relief valves must be trimmed with monel or other approved material and equipped with a frangible disc of silver, a fluorinated hydrocarbon polymer coated monel, or tantalum. Each safety relief device shall have the space between the frangible disc and the relief valve vented with a suitable auxiliary valve. The discharge from each safety relief valve must be directed outside the protective housing.

(e) Loading and unloading valves must be trimmed with Hastelloy B or C, monel, or other approved material, and identified as "Vapor" or "Liquid". Excess flow valves must be installed under all liquid and vapor valves, except safety relief valves.

(f) A thermometer well may be installed.

(g) A gaging device may be installed. If installed the gage must be a fixed length dip tube.

(h) A sump must be installed in the bottom of the tank under the liquid pipes.

(i) All gaskets must be made of, or coated with, a fluorinated hydrocarbon polymer, or other approved material.

(j) The tank car tank may be equipped with exterior cooling coils on top of the tank car shell.

(k) The jacket must be stenciled, adjacent to the water capacity stencil, "COLDEST LADING TEMPERATURE ——— ° F."

(l) The tank car and insulation must be designed to prevent the pressure of the lading from increasing from the pressure at the maximum allowable filling density to the start-to-discharge pressure of the safety relief valve within 30 days, at an ambient temperature of 90° F.

(m) Tank anchor-to-tank shell fillet welds must be examined by radioscopy or other non-destructive testing techniques and must meet the acceptance standards of AAR Specifications for Tank Cars, Appendix W, paragraph W11.06.

51. The heading of Subpart F and § 179.400 consisting of §§ 179.400-1 to 179.400-26 are revised to read as follows:

**Subpart F—Specification for Cryogenic Liquid Tank Car Tanks and Seamless Steel Tanks (Classes DOT—113 and 107A)**

**§ 179.400 General specification applicable to cryogenic liquid tank car tanks.**

**§ 179.400-1 General.**

A tank built to this specification must comply with §§ 179.400 and 179.401.

**§ 179.400-2 Approval.**

See § 179.3 for approval procedure.

**§ 179.400-3 Type.**

(a) A tank built to this specification must—

(1) Consist of an inner tank of circular cross section supported essentially concentric within an outer jacket of circular cross section, with the out of roundness of both the inner tank and outer jacket limited in accordance with Section VIII, Division I, Paragraph UG-80 of the ASME Code;

(2) Have the annular space evacuated after filling the annular space with an approved insulating material;

(3) Have the inner tank heads designed concave to pressure; and

(4) Have the outer jacket heads designed convex to pressure.

(b) The tank must be equipped with piping systems for vapor venting and transfer of lading, and with pressure relief devices, controls, gages and valves, as prescribed herein.

**§179.400-4 Insulation system and performance standard.**

(a) For the purposes of this specification—

(1) *Standard Heat Transfer Rate* (SHTR), expressed in Btu/day/lb., means the rate of heat transfer used for determining the satisfactory performance of the insulation system of a cryogenic tank car tank (see § 179.401-1 Table).

(2) *Test cryogenic liquid* means the cryogenic liquid, which may be different from the lading intended to be shipped

in the tank, being used during the performance tests of the insulation system.

(3) *Normal evaporation rate* (NER), expressed in lbs. (of the cryogenic liquid)/day, means the rate of evaporation, determined by test of a test cryogenic liquid in a tank maintained at a pressure of approximately one atmosphere, absolute. This determination of the NER is the NER test.

(4) *Stabilization period* means the elapsed time after a tank car tank is filled with the test cryogenic liquid until the NER has stabilized, or 24 hours has passed, whichever is greater.

(5) *Calculated heat transfer rate.* The calculated heat transfer rate (CHTR) is determined by the use of test data obtained during the NER test in the formula:

$$q=[N(\Delta h)(90-t_i)]/[V(8.32828)(t_a-t_d)]$$

Where:

q = CHTR, in Btu/day/lb.;
N = NER, determined by NER test, in lbs./day;
$\Delta h$ = latent heat of vaporization of the test cryogenic liquid at the NER test pressure of approximately one atmosphere, absolute, in Btu/lb.;
90 = ambient temperature at 90° F.
V = gross water volume at 60° F. of the inner tank, in gallons;
$t_i$ = equilibrium temperature of intended lading at maximum shipping pressure, in ° F.;
8.32828 = constant for converting gallons of water at 60° F. to lbs. of water at 60° F., in lbs./gallon;
$t_a$ = average temperature of outer jacket, determined by averaging jacket temperatures at various locations on the jacket at regular intervals during the NER test, in ° F.;
$t_d$ = equilibrium temperature of the test cryogenic liquid at the NER test pressure of approximately, one atmosphere, absolute, in ° F.

(b) DOT–113A60W tank cars must—

(1) Be filled with hydrogen, cryogenic liquid to the maximum permitted fill density specified in § 173.319(d)(2) Table of this subchapter prior to performing the NER test; and

(2) Have a CHTR equal to or less than the SHTR specified in § 179.401–1 table for a DOT–113A60W tank car.

(c) DOT–113C120W tank cars must—

(1) Be filled with ethylene, cryogenic liquid to the maximum permitted fill density specified in § 173.319(d)(2) Table of this subchapter prior to performing the NER test, or be filled with nitrogen, cryogenic liquid to 90 percent of the volumetric capacity of the inner tank prior to performing the NER test; and

(2) Have a CHTR equal to or less than 75 percent of the SHTR specified in § 179.401–1 Table for a DOT–113C120W tank car.

(d) Insulating material must approved.

(e) If the insulation consists of a powder having a tendency to settle, the entire top of the cylindrical portion of the inner tank must be insulated with a layer of glass fiber insulation at least one-inch nominal thickness, or equivalent, suitably held in position and covering an area extending 25 degrees to each side of the top center line of the inner tank.

(f) The outer jacket must be provided with fittings to permit effective evacuation of the annular space between the outer jacket and the inner tank.

(g) A device to measure the absolute pressure in the annular space must be provided. The device must be portable with an easily accessible connection or permanently positioned where it is readily visible to the operator.

**§ 179.400–5 Materials.**

(a) Stainless steel of ASTM Specification A240, Type 304 or 304L must be used for the inner tank and its appurtenances, as specified in AAR Specifications for Tank Cars, Appendix M, and must be—

(1) In the annealed condition prior to fabrication, forming and fusion welding;

(2) Suitable for use at the temperature of the lading; and

(3) Compatible with the lading.

(b) Any steel casting, steel forging, steel structural shape or carbon steel plate used to fabricate the outer jacket or heads must be as specified in AAR Specifications for Tank Cars, Appendix M.

(c) *Impact tests* must be—

(1) Conducted in accordance with AAR Specifications for Tank Cars, Appendix W, W9.01;

(2) Performed on longitudinal specimens of the material;

(3) Conducted at the tank design service temperature or colder; and

(4) Performed on test plate welds and materials used for inner tanks and appurtenances and which will be subjected to cryogenic temperatures.

(d) Impact test values must be equal to or greater than those specified in AAR Specifications for Tank Cars, Appendix W. The report of impact tests must include the test values and lateral expansion data.

**§ 179.400–6 Bursting and buckling pressure.**

(a) The inner tank shall have a bursting pressure no less than that listed in § 179.401–1.

(b) The outer jacket of the required evacuated insulation system must be designed in accordance with § 179.400–7(d) and in addition must comply with the design loads specified in Section 6.2 of the AAR Specifications for Tank Cars. The designs and calculations must provide for the loadings transferred to the outer jacket through the support system.

**§ 179.400–7 Tank heads.**

(a) Tank heads of the inner tank and outer jacket must be flanged and dished, or ellipsoidal.

(b) Flanged and dished heads must have—

(1) A main inside dish radius not greater than the outside diameter of the straight flange;

(2) An inside knuckle radius of not less than 6 percent of the outside diameter of the straight flange; and

(3) An inside knuckle radius of at least three times the head thickness.

**§ 179.400–8 Thickness of plates.**

(a) The minimum wall thickness, after forming, of the inner shell and any 2:1 ellipsoidal head for the inner tank must be that specified in § 179.401–1, or that calculated by the following formula, whichever is greater:

$$t=Pd/2SE$$

Where:

t = minimum thickness of plate, after forming, in inches;
P = minimum required bursting pressure, in psi;
d = inside diameter, in inches;
S = minimum tensile strength of the plate material, as prescribed in AAR Specifications for Tank Cars, Appendix M, Table M1, in psi;
E = 0.9, a factor representing the efficiency of welded joints, except that for seamless heads, E = 1.0.

(b) The minimum wall thickness, after forming, of any 3:1 ellipsoidal head for the inner tank must be that specified in § 179.401–1, or that calculated by the following formula, whichever is greater:

$$t=1.83\ Pd/2SE$$

Where:

t = minimum thickness of plate, after forming, in inches;
P = minimum required bursting pressure, in psi;
d = inside diameter, in inches;
S = minimum tensile strength of the plate material, as prescribed in AAR Specifications for Tank Cars, Appendix M, Table M1, in psi;
E = 0.9, a factor representing the efficiency of welded joints, except that for seamless heads, E = 1.0.

(c) The minimum wall thickness, after forming, of a flanged and dished head for the inner tank must be that specified

in § 179.401–1, or that calculated by the following formula, whichever is greater:

$t = PL[(3 + \sqrt{(L/r)}]/8SE$

Where:

t = minimum thickness of plate, after forming, in inches;
P = minimum required bursting pressure, in psi;
L = main inside radius of dished head, in inches;
r = inside knuckle radius, in inches;
S = minimum tensile strength of plate material, as prescribed in AAR Specifications for Tank Cars, Appendix M, Table M1, in psi;
E = 0.9, a factor representing the efficiency of welded joints, except that for seamless heads, E = 1.0.

(d) The minimum wall thickness, after forming, of the outer jacket shell may not be less than 7/16 inch. The minimum wall thickness, after forming, of the outer jacket heads may not be less than ½ inch and they must be made from steel specified in § 179.100–23(a)(1). The annular space is to be evacuated, and the cylindrical portion of the outer jacket between heads, or between stiffening rings if used, must be designed to withstand an external pressure of 37.5 psi (critical collapsing pressure), as determined by the following formula:

$P_c = [2.6E(t/D)^{2.5}]/[(L/D) - 0.45(t/D)^{0.5}]$

Where:

$P_c$ = Critical collapsing pressure (37.5 psi minimum), in psi;
E = modulus of elasticity of jacket material, in psi;
t = minimum thickness of jacket material, after forming, in inches;
D = outside diameter of jacket, in inches;
L = distance between stiffening ring centers in inches. (The heads may be considered as stiffening rings located ⅓ of the head depth from the head tangent line.)

### § 179.400–9 Stiffening rings.

(a) If stiffening rings are used in designing the cylindrical portion of the outer jacket for external pressure, they must be attached to the jacket by means of fillet welds. Outside stiffening ring attachment welds must be continuous on each side of the ring. Inside stiffening ring attachment welds may be intermittent welds on each side of the ring with the total length of weld on each side not less than one-third of the circumference of the tank. The maximum space between welds may not exceed eight times the outer jacket wall thickness.

(b) A portion of the outer jacket may be included when calculating the moment of inertia of the ring. The effective width of jacket plate on each side of the attachment of the stiffening ring is given by the following formula:

$W = 0.78(Rt)^{0.5}$

Where:

W = width of jacket effective on each side of the stiffening ring, in inches;
R = outside radius of the outer jacket, in inches;
t = plate thickness of the outer jacket, after forming, in inches.

(c) Where a stiffening ring is used that consists of a closed section having two webs attached to the outer jacket, the jacket plate between the webs may be included up to the limit of twice the value of "W", as defined in paragraph (B) of this section. The outer flange of the closed section, if not a steel structural shape, is subject to the same limitations with "W" based on the "R" and "t" values of the flange. Where two separate members such as two angles, are located less than "2W" apart they may be treated as a single stiffening ring member. (The maximum length of plate which may be considered effective is 4W.) The closed section between an external ring and the outer jacket must be provided with a drain opening.

(d) The stiffening ring must have a moment of inertia large enough to support the critical collapsing pressure, as determined by either of the following formulas:

$I = [0.035D^3LP_c]/E$, or
$I' = [0.046D^3LP_c]/E$

Where:

I = required moment of inertia of stiffening ring about the centroidal axis parallel to the vessel axis, in inches to the fourth power;
I' = required moment of inertia of combined section of stiffening ring and effective width of jacket plate about the centroidal axis parallel to the vessel axis, in inches to the fourth power;
D = outside diameter of the outer jacket, in inches;
L = one-half of the distance from the centerline of the stiffening ring to the next line of support on one side, plus one-half of the distance from the centerline to the next line of support on the other side of stiffening ring. Both distances are measured parallel to the axis of the vessel, in inches. (A line of support is:

(1) A stiffening ring which meets the requirements of this paragraph, or

(2) A circumferential line of a head at one-third the depth of the head from the tangent line):

$P_c$ = critical collapsing pressure (37.5 psi minimum), in psi;
E = modulus of elasticity of stiffening ring material, in psi.

(e) Where loads are applied to the outer jacket or to stiffening rings from the system used to support the inner tank within the outer jacket, additional stiffening rings, or an increased moment of inertia of the stiffening rings designed for the external pressure, must be provided to carry the support loads.

### § 179.400–10 Sump or siphon bowl.

A sump or siphon bowl may be in the bottom of the inner tank shell if—

(a) It is formed directly into the inner tank shell, or is formed and welded to the inner tank shell and is of weldable quality metal that is compatible with the inner tank shell;

(b) The stress in any orientation under any condition does not exceed the circumferential stress in the inner tank shell; and

(c) The wall thickness is not less than that specified in § 179.401–1.

### § 179.400–11 Welding.

(a) Except for closure of openings and a maximum of two circumferential closing joints in the cylindrical portion of the outer jacket, each joint of an inner tank and the outer jacket must be a fusion double welded butt joint.

(b) The closure for openings and the circumferential closing joints in the cylindrical portion of the outer jacket, including head to shell joints, may be a single welded butt joint using a backing strip on the inside of the joint.

(c) Each joint must be welded in accordance with the requirements of AAR Specifications for Tank Cars, Appendix W.

(d) Each welding procedure, welder, and fabricator must be approved.

### § 179.400–12 Postweld heat treatment.

(a) Postweld heat treatment of the inner tank is not required.

(b) The cylindrical portion of the outer jacket, with the exception of the circumferential closing seams, must be postweld heat treated as prescribed in AAR Specifications for Tank Cars, Appendix W. Any item to be welded to this portion of the outer jacket must be attached before postweld heat treatment. Welds securing the following need not be postweld heat treated when it is not practical due to final assembly procedures:

(1) the inner tank support system to the outer jacket,

(2) connections at piping penetrations,

(3) closures for access openings, and

(4) circumferential closing joints of head to shell joints.

(c) When cold formed heads are used on the outer jacket they must be heat treated before welding to the jacket shell if postweld heat treatment is not practical due to assembly procedures.

### § 179.400–13 Support system for inner tank.

(a) The inner tank must be supported within the outer jacket by a support

system of approved design. The system and its areas of attachment to the outer jacket must have adequate strength and ductility at operating temperatures to support the inner tank when filled with the lading to any level incident to transportation.

(b) The support system must be designed to support, without yielding, impact loads producing accelerations of the following magnitudes and directions when the inner tank is fully loaded and the car is equipped with a conventional draft gear:

| | |
|---|---|
| Longitudinal | 7"g" |
| Transverse | 3"g" |
| Vertical | 3"g" |

The longitudinal acceleration may be reduced to 3"g" where a cushioning device of approved design, which has been tested to demonstrate its ability to limit body forces to 400,000 pounds maximum at 10 miles per hour, is used between the coupler and the tank structure.

(c) The inner tank and outer jacket must be permanently bonded to each other electrically, by either the support system, piping, or a separate electrical connection of approved design.

**§ 179.400–14 Cleaning of inner tank.**

The interior of the inner tank and all connecting lines must be thoroughly cleaned and dried prior to use. Proper precautions must be taken to avoid contamination of the system after cleaning.

**§ 179.400–15 Radioscopy.**

Each longitudinal and circumferential joint of the inner tank, and each longitudinal and circumferential double welded butt joint of the outer jacket, must be examined along its entire length in accordance with the requirements of AAR Specifications for Tank Cars, Appendix W.

**§ 179.400–16 Access to inner tank.**

(a) The inner tank must be provided with a means of access having a minimum inside diameter of 16 inches. Reinforcement of the access opening must be made of the same material used in the inner tank. The access closure must be of an approved material and design.

(b) If a welded closure is used, it must be designed to allow it to be reopened by grinding or chipping and to be closed again by rewelding, preferably without a need for new parts. A cutting torch may not be used.

**§ 179.400–17 Inner tank piping.**

(a) *Product lines.* The piping system for vapor and liquid phase transfer and venting must be made for material compatible with the product and having satisfactory properties at the lading temperature. The outlets of all vapor phase and liquid phase lines must be located so that accidental discharge from these lines will not impinge on any metal of the outer jacket, car structures, trucks or safety appliances. Suitable provison must be made to allow for thermal expansion and contraction.

(1) *Loading and unloading line.* A liquid phase transfer line must be provided and it must have a manually operated shut-off valve located as close as practicable to the outer jacket, plus a secondary closure that is liquid and gas tight. This secondary closure must permit any trapped pressure to bleed off before the closure can be removed completely. A vapor trap must be incorporated in the line and located as close as practicable to the inner tank. On a DOT–113A60W tank car, any loading and unloading line must be vacuum jacketed between the outer jacket and the shut-off valve and the shut-off valve must also be vacuum jacketed

(2) *Vapor phase line.* A vapor phase line must connect to the inner tank and must be of sufficient size to permit the pressure relief devices specified in § 179.400–20 and connected to this line to operate at their design capacity without excessive pressure build-up in the tank. The vapor phase line must have a manually operated shut-off valve located as close as practicable to the outer jacket, plus a secondary closure that is liquid and gas tight. This secondary closure must permit any trapped pressure to bleed off before the closure can be removed completely.

(3) *Vapor phase blowdown line.* A blowdown line must be provided. It must be attached to the vapor phase line specified in paragraph (a)(2) of this section, upstream of the shut-off valve in that line. A by-pass line with a manually operated shut-off valve must be provided to permit reduction of the inner tank pressure when the vapor phase line is connected to a closed system. The discharge from this line must be outside the housing and must be directed upward and away from operating personnel.

(b) Any pressure building system provided for the purpose of pressurizing the vapor space of the inner tank to facilitate unloading the liquid lading must be approved.

**§ 179.400–18 Test of inner tank.**

(a) After all items to be welded to the inner tank have been welded in place, the inner tank must be pressure tested at the test pressure prescribed in § 179.401–1. The temperature of the pressurizing medium may not exceed 100°F. during the test. The inner tank must hold the prescribed pressure for a period of not less than ten minutes without leakage or distortion. In a pneumatic test, due regard for the protection of all personnel should be taken because of the potential hazard involved. After a hydrostatic test the container and piping must be emptied of all water and purged of all water vapor.

(b) Caulking of welded joints to stop leaks developed during the test is prohibited. Repairs to welded joints must be made as prescribed in AAR Specifications for Tank Cars, Appendix W.

**§ 179.400–19 Valves and gages.**

(a) *Valves.* Manually operated shut-off valves and control valves must be provided wherever needed for control of vapor phase pressure, vapor phase venting, liquid transfer and liquid flow rates. All valves must be made from approved materials compatible with the lading and having satisfactory properties at the lading temperature.

(1) Liquid control valves must be of extended stem design.

(2) Packing, if used, must be satisfactory for use in contact with the lading and of approved materials that will effectively seal the valve stem without causing difficulty of operation.

(3) Each control valve and shut-off valve must be readily operable. These valves must be mounted so that their operation will not transmit excessive forces to the piping system.

(b) *Gages.* Gages, except portable units, must be securely mounted within suitable protective housings. A liquid level gage and a vapor phase pressure gage must be provided as follows:

(1) *Liquid level gage.*

(i) A gage of approved design to indicate the quantity of liquefied lading within the inner tank, mounted where it will be readily visible to an operator during transfer operations or storage, or a portable gage with a readily accessible connection, or

(ii) A fixed length dip tube, with a manually operated shut-off valve located as close as practicable to the outer jacket. The dip tube must indicate the maximum liquid level for the allowable filling density. The inner end of the dip tube must be located on the longitudinal centerline of the inner tank and within four feet of the transverse centerline of the inner tank.

(2) *Vapor phase pressure gage.* A vapor phase pressure gage of approved design, with a manually operated shut-off valve located as close as practicable to the outer jacket. The gage must

indicate the vapor pressure within the inner tank and must be mounted where it will be readily visible to an operator. An additional fitting for use of a test gage must be provided.

**§ 179.400-20 Pressure relief devices.**

(a) The tank must be provided with pressure relief devices for the protection of the tank assembly and piping system. The discharge from these devices must be directed away from operating personnel, principal load bearing members of the outer jacket, car structure, trucks and safety appliances. Vent or weep holes in pressure relief devices are prohibited. All main pressure relief devices must discharge to the outside of the protective housings in which they are located, except that this requirement does not apply to pressure relief valves installed to protect isolated sections of lines between the final valve and end closure.

(b) *Materials.* Materials used in pressure relief devices must be suitable for use at the temperature of the lading and otherwise compatible with the lading in both the liquid and vapor phases.

(c) *Inner tank.* Pressure relief devices for the inner tank must be attached to vapor phase piping and mounted so as to remain at ambient temperature prior to operation. The inner tank must be equipped with one or more pressure relief valves and one or more safety vents (except as noted in paragraph (c)(3)(iv) of this section), and installed without an intervening shut-off valve (except as noted in paragraph (c)(3)(iii) of this section). Additional requirements are as follows:

(1) *Safety vent.* The safety vent shall function at the pressure specified in § 179.401-1. The safety vent must be flow rated in accordance with the applicable provisions of AAR Specifications for Tank Cars, Appendix A, and provide sufficient capacity to meet the requirements of AAR Specifications for Tanks Cars, Appendix A, A8.07(a).

(2) *Pressure relief valve.* The pressure relief valve must:

(i) be set to start-to-discharge at the pressure specified in § 179.401-1, and

(ii) meet the requirements of AAR Specifications for Tank Cars, Appendix A, A8.07(b).

(3) *Installation of safety vent and pressure relief valve.*

(i) *Inlet piping.*

(A) The opening through all piping and fittings between the inner tank and its pressure relief devices must have a cross-sectional area at least equal to that of the pressure relief device inlet, and the flow characteristics of this upstream system must be such that the pressure drop will not adversely affect the relieving capacity or the proper operation of the pressure relief device.

(B) When the required relief capacity is met by the use of multiple pressure relief device placed on one connection, the inlet internal cross-sectional area of this connection must be sufficient to provide the required flow capacity for the proper operation of the pressure relief device system.

(ii) *Outlet piping.*

(A) The opening through the discharge lines must have a cross-sectional area at least equal to that of the pressure relief device outlet and may not reduce the relieving capacity below that required to properly protect the inner tank.

(B) When the required relieving capacity is met by use of multiple pressure relief devices placed on a common discharge manifold, the manifold outlet internal cross-sectional area must be at least equal to the combined outlet areas of the pressure relief devices.

(iii) Duplicate pressure relief devices may be used when an approved 3-way selector valve is installed to provide for relief through either duplicate pressure relief device. The 3-way valve must be included in the mounting prescribed by AAR Specifications for Tank Cars, Appendix A, A6.02(g), when conducting the flow capacity test on the safety vent prescribed by AAR Specifications for Tank Cars, Appendix A, A6.01. Flow capacity tests must be performed with the 3-way valve at both of the extreme positions as well as at the mid-position and the flow capacity must be in accordance with AAR Specifications for Tank Cars, Appendix A, A8.07(a).

(iv) An alternate pressure relief valve, set as required in § 179.401-1, may be used in lieu of the safety vent, provided it meets the flow capacity prescribed in AAR Specifications for Tank Cars, Appendix A at a flow rating pressure of 110 percent of its start-to-discharge pressure. Installation must—

(A) Prevent moisture accumulation at the seat by providing drainage away from that area,

(B) Permit periodic drainage of the vent piping, and

(C) Prevent accumulation of foreign material in the vent system.

(4) *Evaporation control.* The routine release of vaporized lading may be controlled with a pressure controlling and mixing device, except that a pressure controlling and mixing device is required on each DOT-113A60W car. Any pressure controlling and mixing device must—

(i) Be set to start-to-discharge at a pressure not greater than that specified in § 179.401-1;

(ii) Have sufficient capacity to limit the pressure within the inner tank to that pressure specified in § 179.401-1, when the discharge is equal to twice the normal venting rate during transportation, with normal vacuum and the outer shell at 130°F; and

(iii) Prevent the discharge of a gas mixture exceeding 50% of the lower flammability limit to the atmosphere under normal conditions of storage or transportation.

(5) *Safety interlock.* If a safety interlock is provided for the purpose of allowing transfer of lading at a pressure higher than the pressure control valve setting but less than the pressure relief valve setting, the design must be such that the safety interlock will not affect the discharge path of the pressure relief value or safety vent at any time. The safety interlock must automatically provide an unrestricted discharge path for the pressure control device at all times when the tank car is in transport service.

(d) *Outer jacket.* The outer jacket must be provided with a suitable system to prevent buildup of annular space pressure in excess of 16 psig or the external pressure for which the inner tank was designed, whichever is less. The total relief area provided by the system must be a minimum of 25 square inches, and means must be provided to prevent clogging of any system opening, as well as to ensure adequate communication to all areas of the insulation space. If a safety vent is a part of the system, it must be designed to prevent distortion of the frangible disc when the annular space is evacuated.

(e) *Piping system.* Where a piping circuit can be isolated by closing a valve, means for pressure relief must be provided.

**§ 179.400-21 Test of pressure relief valves.**

Each valve must be tested with air or gas for compliance with § 179.401-1 before being put into service.

**§ 179.400-22 Protective housings.**

Each valve, gage, closure and pressure relief device, with the exception of secondary relief valves for the protection of isolated piping, must be enclosed within a protective housing. The protective housing must be adequate to protect the enclosed components from direct solar radiation, mud, sand, adverse environmental exposure and mechanical damage

incident to normal operation of the tank car. It must be designed to provide reasonable access to the enclosed components for operation, inspection and maintenance and so that vapor concentrations cannot build up to a dangerous level inside the housing in the event of valve leakage or pressure relief valve operation. All equipment within the protective housing must be operable by personnel wearing heavy gloves and must incorporate provisions for locks or seals. A protective housing and its cover must be constructed of metal not less than 0.119 inch thick.

**§ 179.400–23 Operating instructions.**

All valves and gages must be clearly identified with corrosion-resistant nameplates. A plate of corrosion-resistant material bearing precautionary instructions for the safe operation of the equipment during storage and transfer operations must be securely mounted so as to be readily visible to an operator. The instruction plate must be mounted in each housing containing operating equipment and controls for product handling. These instructions must include a diagram of the tank and its piping system with the various gages, control valves and pressure relief devices clearly identified and located.

**§ 179.400–24 Stamping.**

(a) A tank that complies with all specification requirements must have the following information plainly and permanently stamped into the metal near the center of the head of the outer jacket at the "B" end of the car, in letters and figures at least ⅜-inch high, in the following order:

| | Example of required stamping |
|---|---|
| Specification | DOT–113A60W. |
| Design service temperature | Minus 423° F. |
| Inner tank | Inner Tank. |
| Material | ASTM A240–304. |
| Shell thickness | Shell ⅜₁₆ inch. |
| Head thickness | Head ⅜₁₆ inch. |
| Inside diameter | ID 107 inch. |
| Inner tank builder's initials | ABC. |
| Date of original test (month and year) and initials of person conducting original test. | 90–0000GHK |
| Water capacity | 00000 lbs. |
| Outer jacket | Outer jacket. |
| Material | ASTM A515–70. |
| Outer jacket builder's initials | DEF. |
| Car assembler's initials (if other than inner tank or outer jacket builder). | XYZ. |

(b) Any stamping on the shell or heads of the inner tank is prohibited.

(c) In lieu of the stamping required by paragraph (a) of this section, the specified markings may be incorporated on a data plate of corrosion-resistant metal, fillet welded in place on the head of the outer jacket at the "B" end of the car.

**§ 179.400–25 Stenciling.**

Each tank car must be stenciled in compliance with the provisions of the AAR Specifications for Tank Cars, Appendix C. The stenciling must also include the following:

(a) The date on which the frangible disc was last replaced and the initials of the person making the replacement, on the outer jacket in letters and figures at least 1½ inches high.

(b) The design service temperature and maximum lading weight, in letters and figures at least 1½ inches high adjacent to the hazardous material stencil.

(c) The water capacity, in pounds net at 60°F., with the tank at its coldest operating temperature, after deduction for the volume above the inlet to the pressure relief device or pressure control valve, structural members, baffles, piping, and other appurtenances inside the tank, in letters and figures at least 1½ inches high.

(d) Both sides of the tank car, in letters at least 1½ inches high, with the statement "Do Not Hump or Cut Off While in Motion."

(e) The outer jacket, below the tank classification stencil, in letters at least 1½ inches high, with the statement, "vacuum jacketed."

**§ 179.400–26 Certificate of construction.**

See § 179.5.

52. Section 179.401 is revised and § 179.401–1 is added to read as follows:

**§ 179.401 Individual specification requirements applicable to inner tanks for cryogenic liquid tank car tanks.**

**§ 179.401–1 Individual specification requirements.**

In addition to § 179.400, the individual specification requirements for the inner tank and its appurtenances are as follows:

| DOT specification | 113A60W | 113C120W |
|---|---|---|
| Design service temperature, °F. | –423 | –260. |
| Material | § 179.400–5 | § 179.400–5. |
| Impact test (weld and plate material). | § 179.400–5(c) | § 179.400–5(c). |
| Impact test values | § 179.400–5(d) | § 179.400–5(d). |
| Standard heat transfer rate. (Btu per day per lb. of water capacity, max.) (see § 179.400–4). | 0.097 | 0.412). |
| Bursting pressure, min. psi. | 240 | 300. |
| Minimum plate thickness shell, inches (see § 179.400–7(a)). | ⅜₁₆ | ⅜₁₆. |
| Minimum head thickness, inches (see § 179.400–7 (a), (b), and (c)). | ⅜₁₆ | ⅜₁₆. |
| Test pressure, psi (see § 179.400–16). | 60 | 120. |
| Safety vent bursting pressure, max. psi | 60 | 120. |
| Pressure relief valve start-to-discharge pressure, psi (± 3 psi) | 30 | 75. |
| Pressure relief valve vapor tight pressure, min. psi. | 24 | 60. |
| Pressure relief valve flow rating pressure, max. psi. | 40 | 85. |
| Alternate pressure relief valve start to-discharge pressure, psi (± 3 psi). | | 90. |
| Alternate pressure relief valve vapor tight pressure, min. psi. | | 72. |
| Alternate pressure relief valve rating pressure, max. psi | | 100. |
| Pressure control valve, psi | 17 | Not required. |
| Start to-vent, max. psi (see § 179.400–18(c)(4) Relief device discharge restrictions. | § 179.400–18 | § 179.400–18 |
| Transfer line insulation | § 179.400–15 | Not required. |

53. Paperwork Reduction Act: Information collection requirements contained in the following sections of this regulation have been approved by the Office of Management and Budget under the provisions of the Paperwork Reduction Act of 1980 (Pub. L. 96–511).

Following the text of each section listed below, add parenthetically the specified OMB control number.

| *Section* | *OMB Control No.* |
|---|---|
| 173.11 | 2137–0541 |
| 177.816 | 2137–0540 |
| 177.818 | 2137–0539 |
| 177.826 | 2137–0541 |
| 177.840 | 2137–0542 |
| 178.338–2 | 2137–0017 |
| 178.338–4 | 2137–0017 |
| 178.338–19 | 2137–0017 |

(49 U.S.C. 1803, 1804, 1808; 49 CFR 1.53 and App. A. to Part 1)

Note.—The Materials Transportation Bureau has determined that this document 1) will not result in a "major rule" under the terms of Executive Order 12291, 2) is not a significant regulation under DOT's regulatory policy and procedures (44 FR 11034), and 3) does not require an environmental impact statement under the National Environmental Policy Act (49 U.S.C. 4321 *et seq.*). Based on comments received in response to the NPRM, I certify that this amendment will not have a significant economic impact on a substantial number of small entities. A regulatory evaluation and environmental assessment is available for review in the docket. Approval of reporting and recordkeeping requirements under the Paperwork Reduction Act of 1980 has been issued by the Office of Management and Budget.

Issued in Washington, D.C. on June 2, 1983.

**L. D. Santman,**

*Director, Materials Transportation Bureau.*

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