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PART II


# DEPARTMENT OF TRANSPORTATION

## Materials Transportation Bureau

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# CRYOGENIC LIQUIDS

Notice of Proposed Rulemaking and Public Hearing

[4910-60-M]

## DEPARTMENT OF TRANSPORTATION

### Materials Transportation Bureau

[49 CFR Parts 171, 172, 173, 174, 176, 177, 178, 179]

[Docket No. HM-115; Notice No. 79-3]

### CRYOGENIC LIQUIDS

AGENCY: Materials Transportation Bureau, Research and Special Programs Administration, Department of Transportation.

ACTION: Notice of Proposed Rulemaking and Public Hearing.

SUMMARY: The Materials Transportation Bureau (MTB) proposes to amend the Hazardous Materials Regulations (49 CFR Parts 170-189) by establishing requirements for the transportation of certain cryogenic liquids. Key provisions of this rulemaking would relate to flammable or pressurized cryogens and would (1) provide a DOT specification for a cargo tank for these liquids; (2) authorize the rail carriage of ethylene, cryogenic liquid, in addition to hydrogen, cryogenic liquid; (3) establish maintenance and use requirements for the containers used to transport these liquids; and (4) for flammable cryogens, expand the scope of the regulations to encompass the transportation of these materials in intrastate commerce by highway, require DOT registration of certain shippers and carriers of these materials, and require the training of drivers. It is also proposed that nonflammable, nonpressurized cryogenic liquids, currently not generally subject to the Hazardous Materials Regulations, be made specifically subject to certain regulations due to the hazard presented by their extremely low temperatures. In addition to cryogenic liquids, this notice proposes to authorize the bulk transportation of ethane and hydrogen chloride, anhydrous. Finally, due to substantial interest in the subject matter, this notice schedules a public hearing on the proposed rule.

DATES: *Comments:* Comments must be received by June 28, 1979. *Hearing:* A hearing will be held on April 17, 1979 from 9:00 a.m. to 5 p.m. Any person wishing to present an oral statement at the hearing must notify the Docket Branch at the address below prior to April 10, 1979. Each request must identify the speaker; organization represented, if any; daytime phone number; and the length of the presentation, not to exceed ten minutes.

ADDRESSES: *Comments:* Comments should be addressed to the Dockets Branch (HM-115), Information Services Division, Materials Transportation Bureau, Research and Special Programs Administration, Department of Transportation, Washington, D.C. 20590. It is requested that five copies be submitted. *Hearing:* The hearing will be held in Room 3201 of the Trans Point Building, 2100 2nd Street, SW., Washington, D.C.

FOR FURTHER INFORMATION CONTACT:

Paul H. Seay, Jr., Office of Hazardous Materials Regulation, 2100 Second St. SW., Washington, D.C. 20590, (202) 755-4906.

SUPPLEMENTARY INFORMATION: The generation of cryogenic, or extremely low temperature, materials on a commercial scale began in the late 1800's and production has steadily increased since that time. Recent increases in shipments have been sharper due to the use of cryogens as an energy source and in new scientific and industrial processes. While in large part cryogens are either used at the generation point or are converted and moved as gas via pipeline, significant amounts are transported in packages. Transporting gases in cryogenic form allows for the movement of large quantities of product in a relatively small space since a liquefied gas occupies only approximately 1/600th the volume of the atmospheric pressure gas. And using the maintenance of low temperature rather than high pressure to keep a gas liquefied allows for significant weight reduction in the container.

### ADVANCE NOTICE OF PROPOSED RULEMAKING

To date the regulation of cryogenic liquids under the Hazardous Materials Regulations has been done on a piecemeal basis that has resulted in a lack of completeness and uniformity. In 1974, to begin the process of rectifying this situation, MTB's predecessor issued an advance notice of proposed rulemaking (ANPRM) pertaining to the transportation of cryogenic liquids (39 FR 7950, March 1, 1974; 39 FR 32624, September 10, 1974). The ANPRM provided for packaging, shipping and carriage requirements applicable to flammable or pressurized cryogenic liquids. This notice of proposed rulemaking continues many of the provisions contained in the ANPRM, incorporates some changes made as a result of comments to the ANPRM and, in several areas, extends the scope of the ANPRM.

Under present regulations those cryogens that are flammable or pressurized cannot be transported in bulk (with the exception of hydrogen in tank cars) except when under an exemption issued by DOT. Also, nonflammable, nonpressurized cryogenic liquids, which make up the vast majority of container shipments are presently not regulated under the Hazardous Materials Regulations, except in the water mode.

Under this notice, the general scheme of regulation proposed in the ANPRM for flammable or pressurized cryogens is continued, with significant changes noted in this preamble. Additionally, this notice goes beyond the ANPRM in several areas, most notably in the following proposals:

1. The extension of jurisdiction to encompass bulk transportation of flammable cryogenic liquids in intrastate commerce by highway;

2. The requirement that shippers of flammable cryogenic liquids in portable tanks, cargo tanks or tank cars and carriers of flammable cryogenic liquids in cargo tanks by highway, file registration statements with DOT.

3. The provision for rail shipment of ethylene in the cryogenic form;

4. The requirement that drivers of vehicles used to transport flammable cryogenic liquid by cargo tanks be provided specific training.

5. The imposition of regulatory requirements on the transportation of nonflammable, nonpressurized cryogenic liquids.

A total of 48 comments to the ANPRM were received. The comments were generally favorable to the concept of a rulemaking with regard to cryogenic liquids, but the various comments took issue with aspects of the ANPRM. The significant comments and their resolution are discussed below.

### COMMENTS ON OTHER THAN THE CARGO TANK SPECIFICATION

Comments were received suggesting various changes to the definition of "cryogenic liquids." After a thorough search of available technical materials, the MTB has determined that there is no single, universally-accepted, definition of the term. The MTB is concerned with transportation safety which does not necessarily require using definitions that are the most scientifically accurate. In addressing safety concerns, however, it was determined that a modification of the ANPRM definition of "cryogenic liquid" was appropriate. Whereas the ANPRM defined the term relative to the temperature of the material at the time of loading and used the relatively high temperature of −40°F. as cutoff, this notice defines "cryogenic liquid" in terms of the boiling point of the material and uses −130°F. as a cutoff. This accomplishes the following:

1. Carbon dioxide, nitrous oxide and vinyl fluoride, whose bulk shipment is presently provided for as liquefied gases, are excluded from the definition;

2. Ethane and hydrogen chloride, anhydrous, while currently authorized

for bulk shipment only under exemption, have physical properties similar to carbon dioxide, nitrous oxide and vinyl fluoride and are not cryogens under this notice. This notice proposes to allow their bulk shipment in insulated, non-cryogenic tank cars and cargo tanks.

3. The ANPRM specifically proposed to except nonflammable, nonpressurized cryogens from regulation. That exception is deleted in this notice. While proposed section 173.320 exempts these materials from some of the requirements applicable to other cryogenic liquids, the MTB is proposing 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.

In response to comments received, the MTB has further refined and clarified the filling densities and design pressures for DOT 4L cylinders. The new proposal provides more flexibility in filling depending on the maximum start-to-discharge pressure and also provides for some increase in fill density to more accurately reflect the satisfactory results of current practice. However, the MTB does not agree that data applicable to 4L cylinders is also applicable to larger containers such as the proposed MC338 cargo tank. This is primarily due to the fact that the cargo tank is not designed to vent. The filling densities in the ANPRM for the cargo tank have been reviewed, but only minor modifications have been made, as appropriate.

Some commenters wanted the references in section 173.316 of the ANPRM to the cryogenic liquid at the time when it is offered for transportation or when transporation begins to instead refer to the liquid at the time the container is filled. While there is usually no distinction in the meanings of the various terms in relation to the condition of the material inside the container, this is not the case with cryogenic liquids. MTB agrees with the comments when cryogenic liquids are being considered in terms of holding time and has made the necessary changes reflected in sections 173.318 and 173.319 of this notice.

The MTB received comments requesting that the so-called atmospheric gases (i.e. nitrogen oxygen, argon and helium) in the form of pressurized cryogens be permitted to vent from cargo tanks during transportation. Some commenters compared these gases to the exhaust gases of the tractor unit and also pointed out the fact that the air we breathe is composed of 79% nitrogen and 21% oxygen. The MTB, however, is desinclined to permit promiscuous venting of pressurized cryogens. The design of the cargo tanks for these commodities is predicated on a holding time value that precludes the need for venting. These same design parameters determine the filling density of the tank. In the past, the great preponderance of these nonflammable cryogens have been transported by rail and highway in a nonpressurized, and hence nonregulated, form. This notice proposes to allow the venting of the atmospheric gases and helium, during transportation as a cryogen, if the venting occurs at pressures less than 25.3 psig.

Several commenters questioned the ANPRM requirement that cargo tanks be subjected to periodic retests at a pressure of 1.5 times the design pressure of the tank. The commenters felt that that pressure is unsafe and that the ratio of test pressure to design pressure should be 1.25 in order to avoid cyclic failure of the inner tank. The MTB firmly believes, however, that the 1.5 ratio retest pressure is necessary to establish the continued integrity of the cargo tank, and that pressure vessels designed and built according to the proposed DOT specification (which closely follows the ASME Code) will not experience cyclic failure at this pressure. It is possible that the data supplied by these commenters related only to non-ASME Code vessels. It should be noted that tank cars are not subject to this type of retest requirement. This is because of the required presence of a high grade vacuum (75 microns or less of mercury) at the time the tank car is offered for transportation. Since the vacuum is checked before each trip a constant log will indicate any leakage in the inner tank or outer jacket. Cargo tanks may or may not be vacuum insulated, thus there is no similar requirement for shipments in cargo tanks and greater reliance must be placed on the pressure integrity of the containment vessel.

### Comments on the Cargo Tank Specification

The new specification for a cargo tank for use in transporting cryogenic liquids, DOT specification MC 338, was proposed in the ANPRM. Numerous comments were received in response to this specification, and certain revisions have been made. While most of the proposed revisions are for the purpose of clarification and consistency, others are more substantive and are addressed in the following paragraphs.

A suggestion was made by a commenter that the simple combustion test is sufficient for determining the combustion-sustaining characteristics of insulation for cargo tanks used to transport oxygen. The MTB agrees with this suggestion and has incorporated it into this notice.

Some commenters stated the insulation on cargo tanks often is covered by a metal jacket that is lapped, but not sealed, and that this construction has given satisfactory service on cargo tanks where an inner material is used to seal the insulation. The MTB agrees with this position and has allowed for it in the proposal.

Comments were received recommending the deletion of the requirement that mixing devices be installed for venting cargo tanks transporting flammable ladings. It was pointed out that such devices have always been optional equipment and are available only for hydrogen. The MTB agrees that this deletion can be made, since the restrictions imposed on cargo tank loading and one way travel time provided adequate assurance that venting will not take place during transportation.

The Hazardous Materials Regulations require impact tests to be performed on many packaging materials and the MTB believes that they should be required for packaging materials used in cargo tanks where the lading temperature is extremely cold. However, because of available data on the high ductile strength of aluminum at cold temperatures, the MTB proposes to exclude it from the required impact tests.

This notice incorporates a change suggested by one commenter that all tank nozzle-to-shell and nozzle-to-head welds have full penetration. The MTB believes that this is a reasonable requirement that will contribute to the safety of the tank.

The Compressed Gas Association recommended that certain packaging materials be excluded from the requirement for manholes. They pointed out that both stainless steel and aluminum, in extensive low-temperature service, have demonstrated significant corrosion resistance. The added heat leak and other difficulties associated with manways outweigh, in their judgement, any safety benefits or convenience resulting from their use with these packaging materials. The MTB agrees with the recommendation in part, and has specified the packaging materials to be used in the construction of cargo tanks for which manways are not required. In addition, for the purpose of clarification, the manholes or manways which are required are proposed to be located at the rear, or on the rear, or on the rear head of the tank.

The MTB agrees with the suggestion of numerous commenters that any liquid connection to a pressure building coil should be required to have a shut-off valve, and has made this change to increase safety and reliability.

Some commenters suggested that other cryogens in addition to nitrogen be authorized for use in the holding time tests. The MTB can see no reason for restricting these tests to the use of nitrogen only and proposes to authorize that the tests be performed using any cryogenic liquid having a boiling point at atmospheric pressure equivalent to the coldest design service temperature of the tank.

The Compressed Gas Association requested that the holding time marked on the tank be permitted to be less than that to which the tank is actually rated by test under section 178.338-9. Such a practice could be economically beneficial if a tank with a long rated holding time is used on short hauls. By allowing a marked rated holding time less than the rated holding time, maintenance of thermal integrity costs could be reduced without compromising safety. MTB is proposing to include this suggestion in section 178.338-9.

The proposed MC 338 specification anticipates two basic designs. The first design encompasses an inner tank that not only contains the cargo, but also acts as the main structural member of the tank. The insulation in this design is affixed to the inner tank and shrouded with a metal jacket. The second design encompasses an inner tank supported within an outer tank that provides a vacuum envelope and the main structural strength of the assembled cargo tank. In both designs the structural members must be designed to withstand identical "g" loadings, with identical safety factors. And in the second design this is true for both the inner tank and outer tank structural members. A number of comments were directed to this second design and pointed out that in an accident the outer tank will be able to contain the inner tank because the insulation material between the two tanks will absorb some of the energy of any acceleration forces, and therefore the inner tank structural members should be permitted to be designed to lower "g" loadings. The commenters suggested that the inner tank members be designed, with a safety factor of four, to 1½ "g" in the vertical upward, longitudinal and lateral directions and 2 "g" in the vertical downward direction versus the ANPRM's proposed 2 "g" longitudinal and lateral and 3 "g" vertical. This notice continues to propose the higher values for "g" loadings.

The Compressed Gas Association recommended that appropriate gauging devices be authorized as a primary control for filling cargo tanks. They stated that certain gauging devices have proven safe and accurate for large containers and are often the only means available to accurately determine fill level. The MTB concurs in this opinion, and has removed the mandatory verification by weight requirement for cargo tanks from this notice.

Based on a recommendation by the Compressed Gas Association, the MTB proposes to require each MC 338 tank vehicle owner to obtain photographs, pencil rubs, or other facsimiles of the required cargo tank nameplates. In support of their recommendation, the Association maintained that it is both advisable and customary in the industry for the owner to obtain this information.

### Aluminum Cargo Tanks in Oxygen Service

Until recently the MTB has prohibited the use of aluminum in certain packages that come in contact with cryogenic oxygen. At one time this prohibition extended to gaseous oxygen. Several years ago, however, aluminum high pressure cylinders under exemption were permitted to contain gaseous oxygen and certain clean bore, portable tanks have been permitted to transport oxygen under an exemption. Also, there are many aluminum cargo tanks currently in use transporting nonpressurized, thus nonregulated, cryogenic oxygen.

In the past MTB has stated, in response to public queries, that the general prohibition on aluminum use in cryogenic oxygen service is not due to any inherent incompatibility between aluminum and oxygen. Rather, it is based on concern regarding the potential hazard resulting from the mixture of contaminants with oxygen in an aluminum cargo tank either designed in such a way as to allow for areas of contaminant entrapment, or improperly cleaned of contaminants after manufacture and prior to use, or both.

The National Aeronautics and Space Administration has collected and published standards for oxygen equipment cleaning procedures. Similarly, the Compressed Gas Association has developed a new standard for oxygen service cleaning equipment.

The proposals contained in the ANPRM prohibited the use of aluminum for an inner vessel used to transport oxygen. Numerous comments opposed this position pointing to the relatively successful industry use of large aluminum tanks in oxygen applications under exemption and in nonregulated use. Commenters also discussed the refined cleaning procedures currently available.

In view of these past applications and the recently developed cleaning standards promulgated by the Compressed Gas Association, the MTB is proposing in this notice to allow the use of aluminum for MC 338 tanks in oxygen service. By making this proposal, MTB is able to show the public what specific regulatory controls may be used to permit the use of aluminum in the containment of oxygen, cryogenic liquid. Based on comments received MTB will decide whether or not to go forward with this proposal.

MTB is interested in public comment on this proposal reflecting on whether aluminum tanks should be permitted for cryogenic oxygen service at all and, if this practice can be safely permitted, whether the proposed regulatory controls are adequate. MTB is particularly interested in comments on CGA Pamphlet G-4.1, "Cleaning Equipment for Oxygen Service," which is incorporated into the cleanliness standard proposed in section 178.338-15, and its adequacy for aluminum tanks in oxygen service. A copy of this publication is available for review in the public docket. Besides the cleanliness standard in section 178.338-15, the important sections of the proposal relating to the use of aluminum tanks in oxygen service are 178.338-16(d), which requires that after inspection and testing the interior cleanliness of the tank must be verified, 178.338-1(c), which requires that the tank be designed and constructed so as to preclude the entrapment of foreign material, and 178.338-16(b), which prohibits the use of certain weld inspection methods for tanks intended for oxygen service.

### Economic Considerations

While many special permits (now called exemptions) for the bulk transportation of pressurized cryogenic liquids were in effect prior to 1979, the terms of these exemptions were not uniform, and to a certain extent were incomplete. Since 1970, however, the regulatory thrust, has been to enhance and standardize these terms and conditions. As a result of this, design features and performance requirements have been more closely delineated and quantified, with resulting modifications and redesign of such cargo tanks.

Since all shippers and carriers involved with the transportation of flammable or pressurized cryogenic liquids are legally required to be operating under exemption procedures, and since these exemptions generally reflect the scope and nature of the regulations set forth in this notice, the MTB has determined: (1) that the economic costs of complying with the proposed specification requirements have been or should have been already incurred; and (2) that consequently the economic impact does not represent a net significant impact on industry. The MTB also concludes that the proposed regulations covering the transportation of nonflammable, nonpressurized cryogenic liquids will have no measurable impact on shipper/carrier

operating revenues or profit margins, or an end-use cost to consumers.

However, in response to several commenters who stated that potentially severe economic impacts may be sustained by individual firms—especially small, marginal operators—in complying with this revised proposal, the MTB invites, and will seriously consider, the views and comments of all interested parties as to how their revisions will affect phases of their operating and investment cost schedules, utilization of equipment, and all other relevant expense categories.

The MTB wishes to emphasize, however, that this information will not be considered as a basis for providing exemptions or relief from any subsequent or final regulations that may be promulgated. The purpose of the requested information is to enable the MTB to set in perspective the nature and extent of the expected improvement in public safety which this proposal is designed to achieve.

There are approximately 52 exemptions for cryogenic cargo tanks and tank cars currently in effect. There are approximately 22 exemptions for portable tanks. This notice does not cover the portable cryogenic cargo tanks. The current exemptions will continue to remain in effect until the petitioner allows them to expire. All original exemptions authorized within the last 30 months or so for cargo tanks and rail cars should comply fully with the proposal contained in this notice. Exemptions which originated prior to this time would be in varying degrees of compliance with the proposals contained in this notice and the feasibility of modifying the container to conform would have to be ascertained on an individual basis. This is provided for in this notice.

### Impact of Notice on Existing Exemptions

This notice contains some proposed relaxed requirements and specifications that are at variance with current exemptions in some cases. Such proposals originated in large part as a result of the exemption appeal process, but were not resolved in that forum. Rather, these issues, raised in the exemption process, were determined by the Associate Director for Hazardous Materials Regulation to be matters of such general applicability and future effect as to warrant being made the subject of rulemaking. Therefore, in accordance with 49 CFR 107.109(e) the issues have been incorporated in this rulemaking. No further action on these matters will be accomplished in the exemption process.

### Review by Sections.

The following is an analysis and explanation, by section, of the more significant features of this regulatory proposal.

*Section 171.1.* This section would be amended to clarify the scope of the Department's regulations and to make them applicable to the bulk transportation of flammable cryogenic liquids in intrastate commerce by highway. The authority for this extension of regulatory jurisdiction is found in sections 103 and 105 of the Hazardous Materials Transportation Act (49 U.S.C. 1802, 1804). The Department may issue regulations for the safe transportation in commerce of hazardous materials and "commerce" includes any trade, traffic, commerce, or transportation that affects interstate trade, traffic, commerce, or transportation. Bulk quantities of flammable cryogenic materials, when transported by motor vehicle in intrastate commerce, affect interstate trade, traffic, commerce, or transportation because of the inherent risk presented by such material to people and property in interstate commerce on the same highways.

*Section 171.7.* This section incorporates certain industry publications by reference, most importantly for the purposes of this rulemaking a Compressed Gas Association pamphlet entitled "Cleaning Equipment for Oxygen Service."

*Section 171.8.* Defines "filling density" and "SCF" (standard cubic foot). For "filling density" the existing locations of the definitions for compressed gases in various containers are noted, as are the locations of the definitions proposed in this notice applicable to cryogenic liquids in various containers. The proposed definitions of filling density for cryogenic liquids reflect the need to allow for shrinkage in cargo tank and tank car capacity resulting from cryogenic temperatures.

*Section 172.101.* It is proposed that the Hazardous Material Table be revised to reflect the definition of a cryogenic liquid to be established in this rulemaking. All "cryogenic liquids" would have that term reflected in their proper shipping names. Additionally an entry in the Table would be provided for ethane-propane mixtures and the hydrogen chloride entry would become hydrogen chloride, anhydrous.

For the cryogenic liquids, the proposed additions and changes to this section prescribe maximum quantity limitations for the air mode and various other restrictions for water shipments. The weight limitations for aircraft shipments were determined based on the properties of each material. Relatively inert materials are authorized on both passenger and cargo aircraft, but in differing amounts depending on the material and type of aircraft. Flammables and oxidizers are forbidden on both classes of aircraft. Substantive comments are solicited on the proposed weight limits and restriction.

*Section 172.203.* A notation is proposed for the shipping papers for DOT 113 tank cars indicating that these cars may not be humped or cut off while in motion.

*Section 172.328.* The word "compressed" would be deleted from paragraph (c) to ensure that cargo tank marking requirements would apply to non-pressurized cryogens.

*Section 172.504.* Table 2 of the general placarding requirements would be amended by correcting the existing reference to "Nonflammable gas (fluoride)" to "Nonflammable gas (fluorine)." Also, the reference to oxygen would be changed to reflect the "cryogenic liquid" terminology in this docket and the present Note 2 to the Table would be deleted to reflect the fact that the placarding requirement must be complied with under this proposal whether the oxygen, cryogenic liquid is pressurized or not.

*Section 173.5.* It is proposed to require that shippers of flammable cryogenic liquids in portable tanks, cargo tanks or tank cars file registration statements with MTB. This proposal implements the authority provided in section 106(b) of the Hazardous Materials Transportation Act (49 U.S.C. 1805(b)), and consistent with that provision a registration statement would only be required once every two years, beginning in 1980, and a "registration window" of two months duration would be provided. The information obtained through the registration statements would enable MTB to ascertain who is shipping these materials, the location of facilities, warranting periodic inspections, and the number and types of portable tanks, cargo tanks and tank cars used.

*Section 173.29.* An addition would be made to this section covering empty packagings previously used to ship flammable cryogenic liquids. All residual cryogenic liquid would be required to be removed. This requirement would not apply to DOT 4L cylinders.

*Section 173.31.* Paragraph (a) of this section would be revised to provide for tank cars now transporting cryogenic liquids under exemption to be examined to see if the appropriate DOT specifications are or can be met. If not, MTB must be notified. Since only one additional cryogenic liquid, ethylene, could be transported by rail under this proposal, only tank cars currently carrying ethylene under exemption would be affected by this provision. This section also requires the monitoring of the daily pressure rise in Class 113 cars and if certain limits are exceeded requires the successful completion of one of two alternative retests prior to

the next shipment. The reference in Retest Table 1 to the DOT-113A175W car would be deleted since this car is no longer used, the Table provisions for the DOT-113A60W car would be made consistent with the requirements in this section, and the DOT-113C120W car would be added to the Table.

*Section 173.33.* The primary changes proposed for this section involve the inclusion of cargo tanks used to carry cryogenic liquids into the existing provisions in this section. A provision, like that in 173.31, would require holders of exemptions permitting cargo tanks to carry cryogenic liquids to attempt to bring the tanks into compliance with the new DOT MC 338 specification. This would include performing a holding time test. A provision in paragraph (d) would required that a MC 338 tank be examined after each shipment to determine that "the actual holding time is not significantly different from the marked rated holding time."

*Section 173.300.* A definition would be added for "cryogenic liquid" and the definition of "filling density" would be amended to indicate the different sections that apply to cryogenic liquids.

*Section 173.304.* Atmospheric cryogens would be removed from this section (they are proposed to be placed in § 173.316) and the redesignation of hydrogen chloride to hydrogen chloride, anhydrous would be reflected.

*Section 173.314.* Hydrogen chloride, anhydrous would be added as an authorized compressed gas for shipment by tank car. This material may currently be shipped by tank car only under DOT exemption. The entry for vinyl fluoride inhibited in the Table in paragraph (c) has been revised to provide a range of allowable filling densities. The maximum density has been increased from that currently permitted, based on proven safe practice under exemption, and the safety provided by the new special requirements paragraph in this section and in section 179.102-4. Note 17 to the Table in paragraph (c) of this section has been revised. The existing note 17 improperly addresses construction requirements in a part directed towards shippers. Proposed paragraph (g) would establish special requirements for hydrogen chloride, anhydrous and vinyl fluoride, inhibited applicable to shippers. The material in current Note 17 applicable to tank construction would be addressed for vinyl fluoride, inhibited within proposed section 179.102-4.

*Section 173.315.* The proposals would provide for the shipment of ethane, ethane-propane mixtures and hydrogen chloride, anhydrous in insulated MC-331 cargo tanks. These materials can presently be shipped in cargo tanks only under exemption. Proposed revisions to paragraphs (c) and (h) establish outage and gauging device requirements for tanks containing these materials.

*Section 173.316.* This section would be extensively revised. Presently it applies only to liquefied hydrogen and to shipments in both tank cars and cylinders. As proposed this section would provide requirements for all cryogenic liquids permitted to be shipped in cylinders, i.e., argon, nitrogen, oxygen and hydrogen. Various paragraphs in this section would establish general requirements, requirements for pressure controlling valves, and specification cylinder requirements and filling limits for each commodity. A range of fill densities for all the commodities except hydrogen would be permitted, based on various pressure control valve settings.

*Section 173.318.* This totally new section proposes shipper requirements for cryogenic liquids in cargo tanks. Many of the provisions in this section are the result of successful past practices with shipments under exemption, other reflect requirements applicable to existing nonregulated cryogenic cargo tanks. The provisions in this section establish general requirements; safety relief device requirements; weight of lading requirements (to be established either by weighing or by the use of authorized gauging device); a two percent outage requirement; a temperature of lading requirement to ensure that the tank will not vent within its marked holding time; and maximum permitted filling densities. Argon, hellum, nitrogen, oxygen, carbon monoxide, hydrogen, methane and natural gas would be authorized for shipment in an MC 338 cargo tank and a range of maximum permitted filling densities is provided depending on the setting of a pressure control device.

*Section 173.319.* This new section proposes requirements for cryogenic liquids in tank cars. Currently section 173.316(a)(1) sets forth shipper requirements for hydrogen, the only cryogenic liquid now authorized by regulation for shipment in tank cars. It is proposed to move the current 173.316 requirements for hydrogen to this section, and to authorize the tank car shipment of ethylene. This section would (1) set forth general requirements primarily involving loading, (2) require at least 0.5 percent outage and an absolute pressure in the annular space of less than 75 microns of mercury, (3) require the temperature of the cryogenic liquid at the time of filling be such that the tank will not vent in less than the holding time established pursuant to section 179.400-4, and (4) establish the maximum permitted filling density and maximum start-to-discharge pressure for the two commodities.

*Section 173.320.* Argon, helium, nitrogen and oxygen transported in packages such that the pressure will not exceed 25.3 psig (i.e. nonpressurized) are proposed to be excepted from the packaging requirements of the Hazardous Materials Regulations applicable to cryogenic liquids. This section sets out the general exception and then indicates those requirements from which these materials are not excepted.

*Section 174.25.* A minor change is proposed to reflect the new term "oxygen, cryogenic liquid."

*Section 174.67.* Paragraph (a) would be amended to correct a mistake. Currently only section 174.200 is referenced whereas all of subpart F of Part 174 should be.

*Section 174.83.* Paragraph (b) would be revised to add tank cars carrying flammable cryogens to those transporting explosive A or poison gas and which may not be cut off in motion, coupled with excessive force or struck by any car moving under its own momentum.

*Section 174.204.* It is proposed to extend the existing delivery requirements applicable to tank cars containing anhydrous ammonia, liquefied hydrocarbon gas and liquefied petroleum gas to apply to cars containing cryogenic liquids as well.

*Section 176.76.* Paragraph (h) would be added to require that a cryogenic liquid in a cargo tank aboard a vessel must be in Specification MC 338 tank, even if the cryogenic liquid is nonflammable and nonpressurized and generally excepted from container requirements by section 173.320. Also valves, fittings or piping (exclusive of the tank itself) which come in contact with lading would not be allowed to be made of aluminum on an MC 338 tank carrying any cryogenic liquid aboard a vessel. Finally, this provisions requires the time between loading and unloading of the cargo tank to not exceed the marked rated holding time calculated pursuant to section 178.338-9(c).

*Section 177.816.* The MTB is proposing that the driver of each vehicle used to transport a flammable cryogenic liquid in a cargo tank receive formal training at least every 24 months. Included would be training pertaining to requirements of the Hazardous Materials Regulations applicable to flammable cryogenic liquids; requirements of the Federal Motor Carrier Safety Regulations applicable to drivers; the properties and potential hazards of the flammable cryogenic liquids being transported; instructions on the operating characteristics, emergency features and loading limitations of the transport vehicle; and the procedures to be followed in case of acci-

dent or other emergency. It is proposed that written records of training be kept and that the driver by issued a certificate of training. Recognizing the potential risks presented by flammable cryogenic liquids when they are transported in large quantities in cargo tanks, the MTB believes the proposed training requirements are appropriate and necessary.

*Section 177.818.* For the same reasons stated in section 177.816, the MTB is proposing that special instruction be carried with the shipping papers on each vehicle transporting a flammable cryogenic liquid in a package exceeding 125 gallons water capacity. The special instructions would include general precautions, manual venting instructions, emergency procedures, and the names and telephone numbers of persons to be contacted in case of emergency or accident.

*Section 177.824.* Paragraph (e) would be revised to cover the MC 338 cargo tank in this retest requirements section. The proposal references the detailed testing requirements set forth in the MC 338 specification.

*Section 177.825.* A registration requirement for carriers of flammable cryogenic liquids is proposed, similar to that proposed in section 173.5 for shippers of flammable cryogenic materials. The reasons and authority for the proposed registration requirements are the same for both sections.

*Section 177.840.* This section would be revised to provide carrier requirements for the transportation of cryogenic liquids. Paragraph (h) would require drivers to be knowledgeable in the handling of the cryogenic material being transported, to manually vent under certain conditions, and to log, for each shipment, the cargo tank pressure at various specified times. Paragraph (i) would require the time between loading and unloading of the tank at its intended delivery point to not exceed the one-way travel time calculated under section 178.338-9(c) and for distribution service modified by paragraph (j) of this section. Paragraph (j) would explain how to determine one-way travel time for cargo tanks in distribution service. Paragraph (k) would set out the requirements that must be met before a cryogenic cargo tank would be considered empty. Paragraph (l) would require a specified breathing apparatus for drivers of vehicles transporting carbon monoxide, cryogenic liquid.

*Section 178.57-13.* This section would be revised to reference paragraphs (b) and (c) of section 173.316. This corrects the present situation under which pressure controlling valve requirements in 173.316 are not referenced in the 4l specification and also reflects the fact that the requirements in present paragraph (b)(2) of section 173.304 are proposed to be incorporated in section 173.316.

*Section 178.337-11.* It is proposed to have the existing MC 331 discharge opening requirements applicable to flammable liquids, flammable compressed gas and anhydrous ammonia made applicable to hydrogen chloride, anhydrous for which bulk shipment would be authorized under this notice.

*Section 178.338.* This section proposes a cargo tank specfication, MC 338, for the carriage of cryogenic liquids. This specification was also contained in the ANPRM in substantially the same form in which it is presently presented. The following paragraphs explain how the tank specification that appears in this notice differs from the one that appeared int he ANPRM.

Section 178.338-1 is reworded to provide a more orderly description of the cargo tank and its design factors and form. Insulation requirements are now described in terms of a performance standard.

Aluminum is now excluded from the requirement for impact testing in section 178.338-2 due to its ductility at low temperatures.

In section 178.338-3, Note 1 of paragraph (b) has been deleted and its contents are now part of the text of paragraph (b).

Paragraph (f) of Section 178.338-4 requires full penetration on nozzle to shell and nozzle to head welds.

There has been only minor rewording of section 178.388-5 and a change to note a referenced section's new location in this proposal.

Tanks constructed of certain materials are excepted from the manhole requirement in section 178.338-6. Also, this section now specifies a location requirement for the manhole.

Paragraph (a) of section 178.338-7 limits the product drainage requirements to tanks intended to carry products that are flammable. The rest of the section is reworded for clarity.

In Section 178.338-8, the wording is clarified and various section number references have been corrected. Also, for a pressure-building coil, this section now requires that a valve at the liquid connection to the coil must be provided.

In section 178.338-9, devoted to holding time, a number of changes have taken place. The use of a cryogenic liquid other than nitrogen is now allowed in performing the holding time test. An optional holding time test is permitted for tanks made to the same design as a tank that has been subjected to the full holding time test. The term "marked rated holding time" is introduced, which permits a tank, based on its intended use and possible economic benefits to the operator, to have its specification plate marked with a lesser holding time than the tank is successfully tested for. A revised and more relaxed one-way travel time definition is provided for tanks with a marked rated holding time in excess of 72 hours.

Paragraph (d) is added to section 178.338-10 and requires that every part of the loaded cargo tank must be at least 14 inches above level ground (exclusive of wheel assemblies).

The reference in paragraph (c) of section 178.338-11 to poisonous ladings has been removed since none of the cryogens proposed to be authorized for the MC 338 tank are poisonous.

There is only minor rewording to section 178.338-12.

Paragraph (f) of section 178.338-13 in the ANPRM, which referenced section 178.338-18(c) regarding design weight of lading used in determining loadings, is deleted.

In section 178.338-14, the ANPRM requirement in the second sentence of paragraph (a)(4) is removed since it merely describes how to carry out the first sentence and is unnecessary. The second sentence of paragraph (c) in the ANPRM is now contained in section 178.338-7(b).

The cleanliness standard in section 178.338-15 now requires that tanks constructed for oxygen service be cleaned in accordance with Compressed Gas Association Pamphlet G-4.1 entitled "Cleaning Equipment for Oxygen Service."

The ANPRM's restriction on the use of the pneumatic test to certain applications is removed from section 178.338-16. Also, for tanks constructed in accordance with Part UHT of the ASME Code, it is now required for pneumatic test, as well as hydrostatic tests, that the test pressure be twice the design pressure. The ANPRM's provision for weld inspection using specified nondestructive testing other than radiography is removed. It is proposed that all welds on the cargo tank shell or heads be radiographed.

Corrections are made to the references in section 178.338-17.

Section 178.338-18 is reworded to more clearly establish the separate nameplate and specification plate requirements.

Section 178.338-19 now requires that the manufacturer furnish, beside the tank manufacturers data report, a photograph, pencil rub or other facsimile of the nameplate and specification plate. The section is also reworded to more clearly indicate the requirements if a tank is manufactured in two or more stages.

*Section 179.102.* This section sets forth special commodity requirements for pressure tank car tanks.

Section 179.102-4 deals with vinyl fluoride, inhibited and the proposed changes would incorporate construc-

tion details now improperly in Note 17 to the Table in section 173.314, establish a cold temperature requirement for cars to be used to transport this material, require specific types of steel and impact tests for construction, raise the lowest possible pressure setting of the safety vent, require certain specified appurtenances and finally, have the adequacy of the insulation determined on performance oriented basis rather than solely on an engineering standard basis.

*Section 179.102-7.* This new section sets forth special commodity requirements for hydrogen chloride, anhydrous. Presently, this material cannot be shipped in bulk, except under exemption. This section would be based on the requirements currently in the exemptions. Many of the requirements would be similar to those proposed for vinyl fluoride, inhibited.

*Section 179.400.* This section would be restructured to be more performance standard oriented rather than engineering standard oriented and rearranged in logical sequence to progress from the conception of the tank to final construction.

*Section 179.401.* This section would be revised to delete the DOT 113A175-W car which is believed to be obsolete and to add the DOT 113C120-W car. This section also incorporates the use of the DOT 113C120-W car for ethylene service. Heretofore cryogenic ethylene has only been permitted to be shipped in bulk under exemption.

Primary drafters of this document are A. J. Mallen, A. I Roberts, P. H. Seay, Jr., of the Materials Transportation Bureau; D. W. Morrison and D. B. Goodman of the Bureau of Motor Carrier Safety, Federal Highway Administration; W. H. Black of the Federal Railroad Administration; and D. G. Ortez of the Office of Chief Counsel, Research and Special Programs Administration.

In consideration of the foregoing, it is proposed to amend Parts 171, 172, 173, 174, 176, 177, 178, and 179 of Title 49 Code of Federal Regulations as follows:

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

1. § 171.1 would be revised to read as follows:

§ 171.1 Purpose and Scope.

This subchapter prescribes the requirements of the Department of Transportation governing—

(a) The transportation of hazardous materials by, and their offering to—

(1) Carriers by rail car, aircraft and vessel;

(2) Interstate or foreign carriers by motor vehicle; and

(3) Intrastate carriers by motor vehicle so far as this subchapter relates to—

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

(b) The manufacture, fabrication, marking, maintenance, reconditioning, repairing, or testing of a package or container which is represented, marked, certified, or sold for use in such transportation as specified in paragraph (a) of this section.

2. In § 171.7 paragraph (d)(2) would be revised; and paragraphs (d)(3)(vi), (d)(5)(viii) would be added to read as follows:

§ 171.7 Matter incorporated by reference.

* * * * *

(d) * * *

(2) AAR Specifications for Tank Cars means the 1977 edition of the "Association of American Railroads Specification for Tank Cars."

(3) * * *

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

* * * * *

(5) * * *

(viii) Book of ASTM Standards, Part 4, entitled "ASTM Standards and Tentatives Relating to Structural Steel Concrete Reinforcing Steel, Pressure Vessel Plate, Steel Rails, Wheels, and Tires; Bearing Steel; Steel Forgings," 1978 edition.

* * * * *

3. In § 171.8 definitions for "filling density" and "standard cubic foot" would be added in alphabetical sequence to read as follows:

§ 171.8 Definitions and abbreviations.

* * * * *

"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)(1), Table Note 1.

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

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

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

* * * * *

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

* * * * *

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

4. In § 172.101 the Hazardous Materials Table would be amended as follows:

[4910-60-C]

§ 172.101 Hazardous Materials Table.

§ 172.101

| (1) */ w/ A | (2) Hazardous materials descriptions and proper shipping names | (3) Hazard class | (4) Labels(s) required (if not excepted) | (5) Packaging (a) Exception | (5) Packaging (b) Specific requirements | Maximum net quantity in one package (a) Passenger carrying aircraft or railcar | Maximum net quantity in one package (b) Cargo only aircraft | (7) Water shipments (a) Cargo vessel | (7) Water shipments (b) Passenger vessel | (7) Water shipments (c) Other requirement |
|---|---|---|---|---|---|---|---|---|---|---|
| | (Delete) | | | | | | | | | |
| | Argon, liquid pressurized | Nonflammable gas | Nonflammable gas | none | 173.304 | Forbidden | 300 pounds | 1, 3 | 1, 3 | |
| | Hydrogen, Liquefied | Flammable gas | Flammable gas | none | 173.316 | Forbidden | Forbidden | | | Forbidden |
| | Hydrogen chloride | Nonflammable gas | Nonflammable gas | 173.306 | 173.304 | Forbidden | 300 pounds | 1 | 4 | |
| | Nitrogen, pressurized liquid | Nonflammable gas | Nonflammable gas | none | 173.304 | Forbidden | 300 pounds | 1, 3 | 1, 3 | |
| | Oxygen, pressurized liquid | Nonflammable gas | Oxidizer | none | 173.304 | 150 pounds | 300 pounds | 1, 2 | 1, 2 | Stow separate from acetylene. Do not overstow with other cargo. |
| | (Change) | | | | | | | | | |
| | Ethane | Flammable gas | Flammable gas | 173.306 | 173.304 173.315 | Forbidden | 300 pounds | 1, 2 | 4 | Stow away from living quarters. |
| | Hydrochloric acid; anhydrous. See Hydrogen chloride, anhydrous. | | | | | | | | | |

| (1) | (2) | (3) | (4) | (5) Packaging | | Maximum net quantity in one package | | (6) Vessel shipments | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Hazardous materials descriptions and proper shipping names | Hazard class | Labels(s) required (if not excepted) | (a) Exceptions | (b) Specific requirements | (a) Passenger carrying aircraft or railcar | (b) Cargo only aircraft | (a) Cargo vessel | (b) Passenger vessel | (c) Other requirement |
| | (Add) | | | | | | | | | |
| | Argon, cryogenic liquid | Nonflammable gas | Nonflammable gas | 173.320 | 173.314<br>173.318 | 100 pounds | 300 pounds | 2 | 1 | |
| | Carbon monoxide, cryogenic liquid | Flammable gas | Flammable gas | None | 173.318 | Forbidden | Forbidden | 2 | 3 | Stow away from living quarters. |
| | Ethane- propane mixtures | Flammable gas | Flammable gas | None | 173.315 | Forbidden | Forbidden | 2 | 3 | Stow away from living quarters. |
| | Ethylene, cryogenic liquid | Flammable gas | Flammable gas | None | 173.315<br>173.319 | Forbidden | Forbidden | 2 | 3 | Stow away from living quarters |
| | Helium, cryogenic liquid | Nonflammable gas | Nonflammable gas | 173.320 | 173.318 | 100 pounds | 300 pounds | 2 | 1 | 6 |
| | Hydrogen, cryogenic liquid | Flammable gas | Flammable gas | None | 173.316<br>173.318<br>173.319 | Forbidden | Forbidden | 2 | 3 | |
| | Hydrogen chloride, anhydrous | Nonflammable gas | Nonflammable gas | 173.320 | 173.314<br>173.316<br>173.315 | Forbidden | 240 pounds | 1 | 1 | Stow away from foodstuffs and living quarters. |
| | Methane, cryogenic liquid | Flammable gas | Flammable gas | None | 173.318 | Forbidden | Forbidden | 2 | 3 | Stow away from living quarters. |
| | Natural gas, cryogenic liquid. | Flammable gas | Flammable gas | None | 173.318 | Forbidden | Forbidden | 2 | 3 | Stow away from living quarters. |
| | Nitrogen, cryogenic liquid | Nonflammable gas | Nonflammable gas | 173.320 | 173.316<br>173.318 | 100 pounds | 300 pounds | 2 | 1 | |
| | Oxygen, cryogenic liquid | Nonflammable gas | Oxidizer | 173.320 | 173.316<br>173.318 | Forbidden | Forbidden | 2 | 3 | Stow separate from flammables. Do not overstow with other cargo. |

[4910-60-M]

5. In § 172.203 paragraph (g)(3) would be 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 notation "DOT 113A" or "DOT 113C" as appropriate and the statement, "DO NOT HUMP OR CUT OFF CAR WHILE IN MOTION."

* * * * *

**§ 172.328 [Amended]**

5a. In § 172.328 the introductory text of paragraph (c) would be amended by removing the word "compressed" in the third line.

6. In § 172.504(a) Table 2 would be revised as follows:

**§ 172.504 General placarding requirements.**

(a) * * *

TABLE 2

| If the motor vehicle, rail car, of 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 |
|---|---|
| Class C explosives | Flammable.[1] |
| Nonflammable gas | Nonflammable gas. |
| Nonflammable gas (Chlorine) | Chlorine.[6] |
| Nonflammable gas (Fluorine) | Poison. |
| Nonflammable gas (Oxygen, cryogenic liquid) | Oxygen. |
| Flammable gas | Flammable gas. |
| Combustible liquid | Combustible.[2 3] |
| Flammable liquid | Flammable. |
| Flammable solid | Flammable solid[4] |
| Oxidizer | Oxidizer. |
| Organic peroxide | Organic peroxide. |
| Poison B | Poison. |
| Corrosive material | Corrosive.[5] |
| Irritating material | Dangerous. |

[1] Applies only to a Class C explosive required to be labeled with an EXPLOSIVE C label.

[2] COMBUSTIBLE placard required only when a material classed as a combustible liquid is transported in a packaging having a rated capacity of more than 110 gallons, a cargo tank, or a tank car.

[3] A FLAMMABLE placard may be used on a cargo tank and portable tank during transportation by highway and vessel.

[4] Except when offered for transportation by vessel, FLAMMABLE placard may be displayed in place of a FLAMMABLE SOLID placard except when a DANGEROUS WHEN WET label is specified for the material in § 172.101. (See Table 1 this section).

[5] See § 173.245(b) of this subchapter for authorized exceptions.

[6] CHLORINE placard required only for a packaging having a rated capacity of more than 110 gallons; the NON-FLAMMABLE GAS placard for packagings having a rated capacity of 110 gallons or less.

* * * * *

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

7. The Table of Sections to Part 173 would be amended by revising the entry for § 173.316; and adding entries for §§ 173.5, 173.318, 173.319 and 173.320 to read as follows:

* * * * *

173.5 Shippers registration statement; flammable cryogenic liquids.
173.316 Cryogenic liquids in cylinders.
173.318 Cryogenic liquids in cargo tanks.
173.319 Cryogenic liquids in tank cars.
173.320 Exceptions for certain cryogenic liquids in cylinders, portable tanks, cargo tanks and tank cars.

* * * * *

8. § 173.5 would be added to read as follows:

**§ 173.5 Shippers 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 after the dates and under the conditions specified in paragraph (b) of this section unless he has on file a registration statement with, and has received an acknowledgement thereof from, the Office of Operations and Enforcement, Materials Transportation Bureau. The registration statement must contain the following:

(1) Name of shipper.

(2) Principal place of business.

(3) Location where flammable cryogenic liquids are offered for transportation including transportation by private carriage.

(4) 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.

(5) The serial number of each portable 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.

(b) A registration statement containing the information required by paragraph (a) of this section must be filed:

(1) Initially between January 1 and February 28, 1980, and

(2) Between January 1 and February 28 of each even year after 1980.

The initial statement is not required to contain information relative to operations that occurred more than 90 days prior to the date of the statement. Operations initiated between the filing intervals specified in this paragraph are not subject to the registration requirements of this section until the end of the next required filing period.

* * * * *

9. In § 173.29 paragraph (f)(3) would be added to read as follows:

**§ 173.29 Empty packagings, portable tanks, cargo tanks, and tank cars.**

* * * * *

(f) * * *

(3) Except for certain tank cars the quantity of any remaining gas, other than an atmospheric gas, in a tank previously used to transport a cryogenic liquid, may not vent under normal conditions of transportation (see § 179.400-4(a)(2)).

10. In § 173.31 paragraphs (a)(6) and (c)(13) would be added; Retest Table I which appears after paragraph (d)(4), would be amended and moved to immediately follow paragraph (c)(13); footnotes to Retest Table I would be revised to read as follows:

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

(a) * * *

(6) Each holder of an exemption issued before (effective date of amendment), that authorizes the transportation of a cryogenic liquid in a tank car, shall examine the tank car to determine if it meets the requirements of the appropriate class DOT-113 car and, if practicable, modify, re-rate, and re-mark the tank car according to the proper specification before (date—2 years from the effective date of the amendment). If a tank car currently in use under exemption cannot be modified to specification requirements, the exemption holder shall advise the Associate Director for Hazardous Materials Regulation before (date 12 months from the effective date of the amendment), giving the reasons why the tank car cannot be so modified.

* * * * *

(c) * * *

(13) *Special retest requirements for class DOT-113 tank car tanks.*

(i) The pressure retest of the Class 113A car is not required, however, each shipment must be monitored to determine the average daily pressure rise in the tank. If the average daily pressure rise during any shipment exceeds 3 psi per day in the tank the car must be retested prior to any subsequent shipment.

(ii) When a retest is performed, the absolute pressure in the annular space of a loaded 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 of the following alternative retests:

(A) *Pressure rise retest:* The pressure rise in the tank may not exceed 5 psi.

(B) *Evaporation rate retest:* The evaporation rate determined by test of a loaded car may not exceed 120 percent of the maximum heat transfer

specified in § 179.401-1 of this subchapter.

(iii) A car must be removed from service and corrective action taken if any one of the retest results is not in accordance with the requirements of paragraph (c)(13)(ii) of this section.

(iv) Each frangible disc must be replaced every 12 months and the replacement date stenciled on cars near the safety relief valve information.

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

RETEST TABLE I

| Specification | Retest interval years | | | | | 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 | Safety relief valve | Tank | Start to discharge | Vapor tight |
| Delete | | | | | | | |
| DOT-113A60W | (a) | (a) | (a) | 5 | (a) | 30 | 24 |
| DOT-113A175W | (a) | (a) | (a) | 5 | (a) | 115 | 95 |
| Add | | | | | | | |
| DOT-113A60W | (*) | (*) | (*) | 5 | (*) | (*)30 | (*)24 |
| DOT-113C120W | (*) | (*) | (*) | 5 | (*) | (*) 75 | (*) 60 |

* * * * *

* See paragraph (c)(13) of this section for retest requirements for Class DOT-113 cars.

* * * * *

11. In § 173.33 paragraphs (a) and (b) would be revised; paragraphs (d) would amended 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 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) apply.

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:

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

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

(b) Cargo tank qualification as 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, 178.338 of this subchapter), with this section, and with the inspection, retests, and marking requirements of § 177.824 of this subchapter.

(1) 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 | September 2, 1967 |
| MC 301 | June 12, 1961 |
| MC 302, MC 303, MC 304, MC 305, MC 310, MC 311 | September 2, 1967 |
| MC 330 | May 15, 1967 |

(2) Each holder of an exemption issued before (effective date of amendment), that authorized the transportation of a cryogenic liquid in a cargo tank, shall examine the cargo tank to determine if it meets the requirements of Specification MC 338 and, if practical, modify, re-rate, and re-mark the tank according to this specification before (date—two years from the effective date of this amendment).

(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 for each design. Subsequent cargo tanks manufactured to the same design if not individually tested must have the optional test regimen (see § 178.338-9(b)(1)) of this subchapter performed during the first shipment. 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 hazardous material may be used to establish an equivalent holding time for other authorized hazardus materials.

(iii) If a cargo tank covered by an exemption cannot be modified to specification requirements, the exemption holder shall advise the Associate Director for Hazardous Materials Regulation before (date 12 months from the effective date of the amendment), giving the reasons why the cargo tank cannot be so modified.

* * * * *

(d) A Specification MC 330, MC 331, or MC 338 (§§ 178.337, 178.338 of this 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 safety 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 cryogenic liquid must be examined after each shipment to ascertain that the actual holding time is not significantly different from the marked rated holding time shown on the certification plate. 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 is less than 90 percent of the marked rated holding time shown on the specification plate (§ 178.338-18(b) of this subchapter), the tank may not be refilled with any cryogenic liquid until it is repaired to restore it to the marked rated holding time value or it is marked with the current value of the rating holding time.

(iii) For a cargo tank in distribution service of a cryogenic liquid, see § 177.840(k) of this subchapter.

(2) Each tank (less fittings) must be subjected to an internal pressure of at least one and one-half times the design pressure (maximum allowable working pressure or re-rated pressure) of the tank. The internal pressure may

be hydraulically or pneumatically generated. If a pneumatic test is used, the entire surface of all joints under pressure must be coated with a solution of soap and water, or other suitable material for the purpose of detecting leaks through the presence of foaming or bubbling. Other equally sensitive methods for determining leaks may be used. 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.

* * * * *

12. In § 173.300, paragraphs (f), (g) and (h) would be redesignated paragraphs (g), (h) and (i) respectively; a new paragraph (f) would be added; redesignated paragraph (h) would be revised 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.) and other than a gas offered for transportation and transported as a compressed or liquefied compressed gas in accordance with this subchapter.

* * * * *

(h) *Filling density.* The term "filling density" shall designate the percent ratio of the weight of gas in a container to the weight of water that the container will hold at 60° F. (One pound of water equals 27.737 cubic inches at 60° F.)

For example, for a liquefied petroleum gas of 0.504/0.510 specific gravity, a 100-pound cylinder holds 238.1 pounds of water and the filling density is 42 percent; therefore the amount of gas permitted is 0.42X238.1 or 100 pounds. For cryogenic liquids, the definition of filling density in § 173.316(c)(1) applies to a cylinder; the definition in § 173.318(f)(1) applies to a cargo tank; and the definition in § 173.319(d)(1), applies to a tank car.

* * * * *

13. In § 173.304 the text of paragraph (a)(2) preceding the table, would be revised; paragraph (a)(2) table would be amended by deleting the entries "Argon, pressurized liquid," "Nitrogen, pressurized liquid" and "Oxygen, pressurized liquid;" and changing the entry: "Hydrogen chloride" to "Hydrogen chloride, anhydrous;" the introductory text of paragraph (b) would be revised 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),(b), § 173.301(j) (see notes following table) |
|---|---|---|
| (Delete) | | |
| Argon, pressurized liquid | 115 | DOT-4L200. |
| Nitrogen, pressurized liquid | 68 | DOT-4L200. |
| Oxygen, pressurized liquid | 96 | DOT-4L200. |
| Hydrogen chloride | 65 | DOT3A1800; DOT3AA1800, DOT3AX1800; DOT3AAX1800, DOT3, DOT3T1800; and DOT3E1800. |
| (Add) | | |
| Hydrogen chloride, anhydrous. | 65 | DOT3A1800; DOT3AA1800; DOT3AX1800; DOT3AAX1800; DOT3; DOT3T1800; and DOT3E1800. |

(b) *Filling limits.* (See § 173.301(f)). For a liquefied compressed gas the liquid portion of the contents at 130° F. must not completely fill the container.

* * * * *

4. In § 173.314 paragraph (c) preceding the table would be revised; the table in paragraph (c) would be amended; note 17 to the table in paragraph (c) would be revised; paragraph (g) would be redesignated paragraph (h); a new paragraph (g) would be added to read as follows:

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

* * * * *

(c) *Authorized gases, filling densities, tank cars.* A compressed gas being transported in a tank car must be loaded and transported 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) |
|---|---|---|
| (Add) | | |
| Hydrogen chloride, anhydrous | 89.0 maximum to 80.1 minimum at maximum 80 psig, when offered for transportation. | DOT-105A600W, Note 17. |
| (Revise) | | |
| Vinyl fluoride, inhibited | 59.6 maximum to 53.6 minimum at maximum 105 psig, when offered for transportation. | DOT-105A600W, Note 17. |

* * * * *

NOTE 17: See paragraph (g) of this section.

* * * * *

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

(1) The shipper shall notify the Bureau of Exposives 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) Tank cars containing hydrogen chloride, anhydrous must have the auxiliary valve closed during transportation of the tank car (see § 179.102-17(d)).

* * * * *

15. In § 173.315 the text of paragraph (a) would be revised; the table in paragraph (a) would be amended; Note 11 to the table in paragraph (a), and paragraph (c) would be revised; the table in paragraph (h) would be amended to read as follows:

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

(a) *A compressed gas* to be 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 cargo tank or a portable tank as provided in §§ 173.32 and 173.33 and this section (for marking requirements see §§ 172.326 and 172.328(d) of this subchapter) as follows:

| Kind of gas | Maximum permitted filling density | | Specification container required | | Pounds per square inch gage[1] |
|---|---|---|---|---|---|
| | Percent by Weight (see Note 1) | Percent by volume (see par. (f) of this section) | Type (see Note 2) | Minimum design pressure (psig) | |
| Ethane | | 51 See par. (c) of this section | MC-331 | 100 (See Note 11) | 20 |
| | | 50 ....do | do | 100 (See Note 11) | 40 |
| | | 49 ....do | do | 100 (See Note 11) | 70 |
| | | 47 ....do | do | 100 (See Note 11) | |
| Ethane-propane, mixtures | | See par. (c) of this section | MC-331 | 275 (See Note 11) | |
| Hydrogen chloride, anhydrous | | 10.3 See Note 7 | MC-331 | 100 (See Note 11) | |
| | | 91.6 ....do | do | 300 (See Note 11) | |
| | | 86.7 ....do | do | 450 (See Note 11) | |

[1] Pressure control valve setting. Maximum start to discharge pressure.

NOTE 11: MC 330 or MC 331 cargo tanks must be insulated. Cargo tanks must meet all of the following requirements. Each tank must be designed for a service temperature no warmer than the liquefaction temperature of the hazardous material to be shipped herein and must comply with the low-temperature requirements of the ASME Code. The maximum allowable transportation distance before venting will occur, must be that normally accomplished within the holding time of the cargo tank as loaded with an added margin of 100 percent of the normal travel time. However, if the normal travel time exceeds 24 hours, the maximum allowable transportation distance before venting will occur may be that normally accomplished within the holding time of the cargo tank with an added margin of 24 hours. Before transportation in an empty condition each cargo tank having previously transported a hazardous material must have been drained and vented or blown down sufficiently so that there will be no venting during movement of the empty tank.

* * * * *

(c) The loading of liquefied gases 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 degees F. if the tank is lagged, nor at 115 degrees F. if the tank is unlagged, except that this requirement shall be waived for:

(1) Tanks containing carbon dioxide or nitrous oxide which are required to be equipped with suitable pressure controlling devices may be loaded to a level corresponding to 95 percent of the volumetric capacity of the tank, or

(2) Tanks containing ethane; ethane-propane, mixtures; or hydrogen chloride, anhydrous filled to allow at least two percent outage below the inlet of the safety relief valve or pressure controlling valve under conditions of incipient opening, with the tank in a level attitude.

(h) * * *

| Kind of gas | Permitted gauging device |
|---|---|
| (Add) | |
| Ethane | Rotary tube; adjustable slip tube; fixed length dip tube. |
| Ethane-propane, mixtures. | Rotary tube; adjustable slip tube; fixed length dip tube. |
| Hydrogen chloride, anhydrous. | None. |

* * * * *

16. § 173.316 would be 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 oxygen or any flammable lading must be made of steel.

(4) A valve or fitting with internal moving or abrading parts that may come in contact with oxygen in the cryogenic liquid form or any flammable cryogenic liquid may not be made of aluminum.

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

(6) Each safety relief device must be installed and located so that the cooling effect of the contents will not prevent effective operation of the device.

(7) The weight of lading in a cylinder may not exceed the design weight marked on the cylinder.

(b) *Pressure controlling valves.* Each cylinder containing a cryogenic liquid must have a pressure controlling valve that is:

(1) Sized and set to limit the pressure in the cylinder to no more than one and one-fourth times the marked service pressure, if the insulation provided is other than a vacuum,

(2) Sized and set to limit the pressure in the cylinder to at least 15 psi lower than one and one-fourth times the marked service pressure, if the insulation provided is a vacuum,

(3) Designed and installed so that accumulation of frost will not prevent its operation, and

(4) Designed and installed so that it will prevent the cylinder from becoming liquid full.

(c) *Specification cylinder requirements and filling limits.*

Specification 4L (§ 178.57 of this subchapter) cylinders are authorized for the shipment of the following named cryogenic liquids:

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

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

| Pressure control valve setting | Maximum permitted filling density (Percent by weight) | | |
|---|---|---|---|
| Maximum start to discharge pressure(psig) | Argon | Nitrogen | Oxygen |
| 45 | 133 | 76 | 108 |
| 75 | 130 | 74 | 105 |
| 105 | 127 | 72 | 103 |
| 170 | 122 | 70 | 100 |
| 230 | 119 | 69 | 98 |
| 295 | 115 | 68 | 96 |
| 360 | 113 | 65 | 93 |

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

| Column 1 | Column 2 |
|---|---|
| Service temperature | minus 423° F. or colder. |
| Maximum filling density based on cylinder capacity at minus 423° F. | 6.7 percent. |
| The pressure controlling valve must be designed and set to limit the pressure in the cylinder to not more than. | 17 psig. |

(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 of each head or valve protection band in letters at least one-half inch high as follows: "VENT RATE" "SCFH" with the stars repalced by figures signifying the SCF of hydrogen venting rate per hour.

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

17. § 173.318 would be 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.

(3) The jacket covering the insulation on a tank used to transport a cryogenic liquid must be:

(i) Made of steel if the cryogenic liquid is to be transported by vessel (See § 173.320(d) and § 176.76(h)(1) of this subchapter); or

(ii) Made of steel if the cryogenic liquid is oxygen or a flammable material.

(4) A valve or fitting with moving or abrading parts or any piping, that may come in contact with oxygen in the cryogenic liquid form or any flammable cryogenic liquid may not be made of aluminum.

(b) *Safety relief devices.*

(1) *General requirements.*

(i) Each tank must be protected by a primary system of one or more spring loaded safety relief valves, and except for 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 of any structural part of the vehicle. For carbon monoxide service the secondary system must be comprised of one or more safety relief valves in place of the frangible discs.

(ii) The rated relieving capacity for each safety relief valve and each frangible disc must be as determined by the flow formulas contained in paragraphs 4.3.4 of CGA Pamphlet S-1.2.

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

(iv) Each safety relief device must be installed to have direct communication with the vapor space of the tank, at the midlength of the top centerline.

(v) Each connection to a safety relief device must be of sufficient size to provide the required rate of discharge through the safety relief device.

(vi) No shut-off valve may be installed between a safety relief device and the tank, except when two or more safety relief values 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 provide the required relief capacity through at least one safety relief valve and at least one frangible disc at all times.

(vii) any shut-off valve or device that interferes with the pressure control valve must be designed so that the cargo tank may not be operated for transportation purposes when the pressure control valve is inoperative.

(viii) Each safety relief device 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.

(ix) Each safety relief device must be so installed and located that the cooling effect of the contents will not prevent effective operation of the device.

(2) *Capacity and performance.*

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

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

(iv) The primary system of safety 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 tank pressure not exceeding 120 percent of the tank design pressure.

(v) Each primary safety relief valve must be set to start-to-discharge at a pressure no higher than 110 percent of the tank design pressure.

(vi) The secondary system of safety 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) *Safety 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 safety 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-inches 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 safety relief devices and pressure controlling devices.*

(i) In addition to the required safety relief devices, a cargo tank may be equipped with one or more pressure controlling devices.

(ii) In addition to the required safety relief devices, a cargo tank may be equipped with one or more frangible discs set to function at a pressure not over two times nor less than one and one half times the design pressure of the tank.

(5) *Tank inlet, outlet and safety relief device markings.*

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

(ii) Each safety relief valve must be plainly and permanently marked with the pressure in psig at which it is set to discharge, the actual rate of discharge of the device in SCF per minute (SCFM), and the manufacturer's name or trade name and catalog number. The marked start-to-discharge 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.

(c) *Weight of lading requirements.* The maximum weight of a cryogenic liquid in the tank must be determined by weighing or by use of liquid level gauging devices 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)(6) of this subchapter), and the appropriate maximum permitted filling density 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.* When a cargo tank is offered for transportation, at least two percent outage must be provided below the inlet of the safety relief valve or pressure controlling valve under conditions of incipient opening, with the tank in a level attitude.

(e) *Temperature.* A cryogenic liquid must be loaded into a cargo tank at a temperature sufficiently cold that the lower pressure setting of the pressure control valve or the required safety relief valve will not be reached in less time than the marked rated holding time specified in § 178.338-9(c) of this subchapter.

(f) *Specification MC 338 (§ 178.338 of this subchapter) tank motor vehicle* is authorized for the shipment of the following cryogenic liquids subject to the following additional requirements:

(1) For purpose 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 = 231 cubic inches at 60° F. and weighing 8.32828 pounds).

(2) *Argon, helium, nitrogen, or oxygen* 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) | | | |
|---|---|---|---|---|
| | Argon | Helium | Nitrogen | Oxygen |
| 26 | | 12.5 | | |
| 30 | 129 | do | 74 | 105 |
| 40 | | do | | |
| 50 | | do | | |
| 55 | 125 | do | 71 | 102 |
| 60 | | do | | |
| 80 | | do | | |
| 85 | 121 | do | 99 | |
| 100 | | do | | |
| 105 | | do | 67 | |
| 120 | | do | | |
| 140 | | do | | |
| 145 | 115 | do | 64 | 94 |
| 180 | | do | | |
| 200 | 110 | do | 61 | 91 |
| 250 | 106 | do | 57 | 87 |
| 275 | 105 | do | 56 | 86 |
| 325 | 101 | | 53 | 83 |
| Design service temperature | 320(F) | −452F | −320F | −320F |

(3) *Carbon monoxide, hydrogen (minimum 95 percent parahydrogen), ethylene, methane or natural gas* 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) | | | |
|---|---|---|---|---|
| | Carbon monoxide | Ethylene | Hydrogen | Methane or natural gas |
| 13 | | | 6.6 | |
| 15 | 75.0 | | 6.6 | 40.5 |
| 17 | 74.0 | | 6.5 | |
| 20 | | 53.5 | | 40 |
| 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 |

PRESSURE CONTROL VALVE SETTING OR RELIEF VALVE SETTING—Continued

| Maximum start—to discharge pressure (psig) | Maximum permitted filling density (percent by weight) | | | |
|---|---|---|---|---|
| | Carbon monoxide | Ethylene | Hydrogen | Methane or natural gas |
| 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 | | |
| 235 | 56.0 | | | |
| Design service temperature | −320F | −255F | −423F | −320F |

18. § 173.319 would be added to read as follows:

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

(a) *General requirements.*

(1) A tank car containing a 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 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 beyond the limits specified by paragraph (b)(2) of this section. In either case the weight must also be checked by use of proper scales after disconnection of the loading line.

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

(4) A tank car may not be loaded with any 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) of this Part).

(iv) unless it is marked with the name of contents (§ 172.101 of this subchapter) in accordance with the requirements of § 172.330 of this subchapter or as otherwise approved by the Department.

(b) When a tank car is offered for transportation:

(1) at least 0.5 percent outage must be provided below the inlet of the safety relief or pressure controlling 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 cryogenic liquid must be loaded into a tank car at a temperature sufficiently low that the lower pressure setting of the pressure control valve or the required safety relief valve will not be reached in less than the time determined under in § 179.400-4(a) of this subchapter.

(d) A Class 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=231 cubic inches at 60° F. and weighing 8.32828 pounds).

(2) Ethylene or hydrogen (minimum 95 percent parahydrogen) 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 | Hydrogen |
| 17 | 6.6 | |
| 75 | 51.5 | |
| Maximum pressure when offered for transportation | 10 psig | |
| Design service temperature | −260 F | −423 F |
| Specification | 113 C120 W | 113A60 W |

19. § 173.320 would be added to read as follows:

**§ 173.320 Cryogenic liquids; exceptions.**

Argon, helium nitrogen and oxygen, cryogenic liquids, in cylinders, portable tanks, cargo tanks, and tank cars, constucted and thermally protected so that the pressure in such packagings will not exceed 25.30 psig under ambient temperature conditions during transportation (exluding loading and unloading operations), are not subject to the requirements of this subchapter except:

(a) Sections 171.15 and 171.16 pertaining to the reporting of incidents. The release of a material covered by this section is not a reportable incident if the release is through a pressure controlling device installed on a:

(1) Specification 4L cylinder and set at a pressure in accordance with section 173.316(b)(2); or a

(2) Portable tank, cargo tank, and tank car and set at pressure no higher than 25.30 psig;

(b) Part 172;

(c) Section 173.6 and Part 175 pertaining to transportation on board aircraft; and

(d) Part 176 pertaining to transportation on board vessels (see section 176.76(h)).

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**PART 174—CARRIAGE BY RAIL**

20. The Table of Sections to Part 174 would be amended by revising the entry for § 174.204 as follows:

(Sec. 174.204 Tank car delivery of gases, including cryogenic liquids.

21. In § 174.25(a), the table would be amended by changing the entry: "Oxygen (liquefied)" to "Oxygen, cryogenic liquid" as follows:

**§ 174.25 Additional information of way bills, switching orders and other billings.**

(a) * * *

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

22. § 174.67 the introductory test of paragraph (a) would be revised to read as follows:

**§ 174.67 Tank car unloading.**

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

* * * * *

23. In § 174.83 paragraph (b) would be revised to read as follows:

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

* * * * *

(b) Any Class DOT 113 tank car placarded "FLAMMABLE GAS" and any car placarded "EXPLOSIVE A" or "POISON 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.

24. In § 174.204 the heading, and paragraph (a)(2) would be revised to read as follows:

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

(a) * * *

(2) Except for DOT-106A or 110A type cars (§ 179.300 or § 179.301 of this subchapter), a tank car containing anhydrous ammonia, liquefied hydrocarbon gas or liquefied petroleum gas and having interior pipes for liquid and gas discharge valves equipped with check valves, or a tank car containing a flammable cryogenic liquid, 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. Such cars may also be stored on a private track or on carrier tracks designated by the carrier for such storage (see § 171.8 of this subchapter).

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**PART 176—CARRIAGE BY VESSEL**

25. In § 176.76, paragraph (h) would be 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 vessel the packaging must be designed and filled so that:

(1) Any cryogenic liquid being transported in a cargo tank on board a vessel, 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. In addition, the requirements of § 173.318(a)(4) of this subchapter apply to a cargo tank containing any cryogenic liquid.

(2) The elapsed time between the loading of a cargo tank with a cryogenic liquid and the subsequent unloading of the cryogenic liquid from the cargo tank at its final destination may not exceed the marked rated holding time (MRHT) as calculated in § 178.338-9(c) of this subchapter.

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**PART 177—CARRIAGE BY PUBLIC HIGHWAY**

26. In Part 177 Table of contents, §§ 177.816 and 177.840 would be revised; and §§ 177.818 and 177.825 would be added to read as follows:

Sec.
177.816 Training.

* * * * *

177.818 Special instructions; cryogenic liquids.

* * * * *

177.825 Carrier's registration statement; flammable cryogenic liquids.

* * * * *

177.840 Compressed gases including cryogenic liquids.

27. In Part 177, Section 177.816 would be added to read as follows:

§ 177.816 Training.

(a) *Applicability.* No person may transport a flammable cryogenic liquid in a cargo tank on a public highway unless the person has provided, and the driver has received, the training specified in this section.

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

(1) Provide the required training in written form;

(2) Provide the required training at the time of initial employment of the driver and on a recurrent basis at least once every 24 months;

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

(i) Requirements in the Subchapter applicable to cryogenic liquids;

(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 material being transported;

(iv) The operation of the type 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 of the training and certificate of training required by this section shall be retained in the drivers qualification file (see § 391.51 of this title) for as long as the driver is employed by that person and for three years thereafter. A person using a driver who is not a regularly employed driver for that person (see § 395.2(f) of this title) shall retain a copy of that driver's certificate of training as prescribed in paragraph (d) of this section.

(d) *Certificate of training.* Each person providing the training required by this section shall complete in duplicate a certificate of training. The copy of the certificate shall be retained in the driver's qualification file and the original shall be furnished to the driver. The driver shall have the certificate on his person while operating a motor vehicle subject to this section. The certificate of training shall include the following information—

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

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

(3) The name and address of the person providing the training; and

(4) The hazard class and proper shipping name of material for which the training was provided.

28. In part 177, § 177.818 would be added to read as follows:

§ 177.818 Special instructions; cryogenic liquids.

A driver of a motor vehicle transporting a cryogenic liquid in a package exceeding 125 gallons water capacity, and each carrier using such a vehicle shall ensure that 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.

29. In § 177.824 paragraph (a)(1) would be amended by changing the first two lines to read, "Each cargo tank, except Specification MC 330, MC 331, and MC 338 cargo tanks". . . ; paragraph (e) would be 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 and 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 in accordance with § 178.338-16(a) of this subchapter and be in compliance with § 173.33 of this subchapter.

30. § 177.825 would be added to read as follows:

§ 177.825 Carrier's registration statement; flammable cryogenic liquids.

(a) No carrier may transport a flammable cryogenic liquid in a portable tank or a cargo tank after the dates and under the conditions specified in paragraph (b) of this section unless he has on file a registration statement with, and has received an acknowledgement thereof from, the Office of Operations and Enforcement, Materials Transportation Bureau. The registration statement must contain the following:

(1) Name of carrier.

(2) Principal place of business.

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

(4) A listing, by name of manufacturer and vehicle identification number, of each cargo tank used by the carrier to transport flammable cryogenic liquids and the name of each flammable cryogenic liquids transported in the cargo tank.

(b) A registration statement containing the information required by paragraph (a) of this section must be filed:

(1) Initially between January 1 and February 28, 1980, and

(2) Between January 1 and February 28 of each even year after 1980.

The initial statement is not required to contain information relative to operations that occurred more than 90 days prior to the date of the statement. Operations initiated between the filing intervals specified in this paragraph are not subject to the registration requirements of this section until the end of the next required filing period.

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

§ 177.840 Compressed gases; cryogenic liquids.

(a) * * *

(2) *Cylinders for hydrogen, cryogenic liquid.* Specification DOT-4L cylinders containing hydrogen, cryogenic liquid must be transported on a motor vehicle with an open body which is equipped with a suitable rack or support having a means to hold the cylinder upright when subjected to an acceleration of at least 2 "g" in any horizontal direction.

(i) The combined total of the hydrogen venting rates as marked on the cylinders on one motor vehicle must not exceed 60 SCF per hour.

(ii) Any motor vehicle transporting a cylinder containing hydrogen, cryogenic liquid may not enter a tunnel.

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

* * * * *

(h) The driver of a motor vehicle transporting a cryogenic liquid in a package exceeding 125 gallons of water capacity shall be knowledgeable in the handling of that specific lading. He shall take precautions to avoid delay during transportation that could cause an excessive pressure rise or other undesirable condition. If unforeseen conditions cause an excessive pressure rise, he shall manually vent the tank at a remote and safe location. For each shipment, the driver shall record the cargo tank pressure at the start of each trip, immediately before and after any manual venting, at least once every five hours, and at the destination point for the lading.

(i) Except for a cargo tank in distribution service (peddle run), the elapsed time required between the loading of a cargo rank with a cryogenic liquid and the subsequent un-

loading of that tank at its intended delivery point may not exceed the one-way travel time calculated in accordance with § 178.338-9(c) of this subchapter.

(j) For a cargo tank in distribution service (peddle run), the one-way travel time computed in accordance with § 178.338-9(c) of this subchapter, must be reduced by one-half.

(k) Each cargo tank containing a cryogenic liquid (other than of atmospheric gas) except one in use in distribution service, must be completely drained of liquid contents at destination and must be vented to atmospheric pressure before it is considered empty and not subject to the regulations for a cargo tank transporting a cryogenic liquid.

(l) A carrier of carbon monoxide as a cryogenic liquid must provide each driver with a National Institute of Occupational Safety and Health approved self-contained air breathing apparatus catalogue number 461704 Model 401 air mask, pressure demand type manufactured by the Mine Safety Appliance Co., or equivalent.

## PART 178—SHIPPING CONTAINER SPECIFICATIONS

32. The Table of Sections to Part 178 would be amended by adding an entry for § 178.338 to read as follows:

Sec. 178.338 Specification MC 338; insulated cargo tank.

33. Paragraph (a) of § 178.57-13 would be revised to read as follows:

**§ 178.57-13 Safety devices and pressure control valves.**

(a) Each cylinder must be equipped with safety devices and pressure control valves as prescribed in § 173.34(d), and paragraphs (b) and (c) of § 173.316 of this subchapter as appropriate.

34. § 178.337-11 the introductory text of paragraph (c) would be 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 3/4 inch diameter and equipped with a valve having an integral excess flow valve, each liquid or vapor discharge opening in a tank used for a flammable liquid, flammable compressed gas, anhydrous ammonia or hydrogen chloride, anhydrous must be equipped with a remotely controlled internal shut-off valve. However, on any liquid or vapor discharge opening of less than 1-1/4 inches diameter, 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 be in conformance with the following requirements:

* * * * *

35. § 178.338 would be 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(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 not be less than 25 psig nor more than 500 psig. To determine the permissable thickness 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 15 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 of the lading to be transported (see § 173.318 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 cargo tank must allow washing of all interior surfaces by the normal sloshing 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 safety 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. A cargo tank which is so insulated must be marked, "INSULATION FOR OXYGEN SERVICE" in accordance with § 178.338-18(b) when it is used to transport oxygen.

(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 |
|---|---|---|
| Stainless Steel | 18 gauge | 20 gauge. |
| Low Carbon Mild Steel | 12 gauge | 14 gauge. |
| Aluminum | 0.125 inch | 0.100 inch. |

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

(1) The cylindrical portion of the jacket between stiffening rings must have a critical collapsing pressure of at least 30 psi as determined by the formula:

$$P_c = 2.6E(t/D)^{2.5}/(L/D) - 0.45(t/D)^{0.5}$$

where:

$P_c$ = Critical collapsing pressure, in psi;
E = Modulus of elasticity of jacket material, in psi;
t = Minimum thickness of jacket material, in inches.
D = Outside diameter of jacket, in inches; and
L = Distance between stiffening ring centers, in inches. The heads are considered as stiffening rings located one-third the head depth from the head tangent line.

(2) If stiffening rings are used in designing the cylindrical portion of the jacket for external pressure, each ring must be attached to the jacket by fillet welds on each side of the ring. Outside stiffening ring attachment welds must be continuous. Inside ring attachment welds may be intermittent. When intermittent welds are used, the total length of welds on each

side of the ring must be at least one-third of the jacket circumference. Where a closed section is used, it must be continuously welded on the outside of each leg. A portion of the jacket may be included when calculating the moment of inertia of the ring. The effective width of jacket plate, W, on each side of the attachment to the ring is given by the formula:

$$W=0.78(Rt)^{0.5}$$

where:

R=Outside radius of the jacket, in inches, and
t=Plate thickness of the jacket, in inches.

(i) Where a stiffening ring consists of a closed section having two webs attached to the jacket, the jacket plate between the webs may be included up to the limit of twice the value of W as defined above. The flange of the section is subject to the same limitation, with W based on R and t 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, (the maximum width of jacket plate which may be considered effective is 4W).

(ii) Each stiffening ring must have a minimum moment of inertia as determined by either of the following formulae:

$$I=1.05D^2L/E$$
$$I'=1.38D^2L/E$$

where:

I=Required moment of inertia of the stiffener itself about a centroidal axis parallel to the jacket axis, in inches to the fourth power;
I'=Required moment of inertia of the combined section of stiffener and effective width of jacket plate about a centroidal axis parallel to the jacket axis, in inches to the fourth power;
D=Outside diameter of the jacket, in inches;
L=One-half the distance from the centerline of the stiffening ring to the next line of support on one side, plus one half the distance from the centerline of the stiffening ring to the next line of support on the other side of the stiffening ring, both measured parallel to the axis of the jacket, (a line of support is either a stiffening ring meeting the requirements of this paragraph or a circumferential line on a head at one-third the depth of the head from the head tangent line), in inches; and
E=Modulus of elasticity of the stiffener material, in psi.

(3) The jacket head, shell and ring thickness must be based on a 7.5 psi minimum external design pressure per paragraph UG-33 of the ASME Code.

(4) 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 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 with 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 as required by Section VIII of 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. 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 retained for at least five years by the fabricator and made available to any representative of the Department of Transportation.

§ 178.338-3 Metal thickness.

(a) The metal thickness of the tank must be as required by the ASME Code and paragraph (b) of this section. Metal thickness less than 3/16 inch 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 thickness less than 1/8 inch 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 stress due to external vacuum and internal pressure and other causes including direct tensile stress due to a rearward acceleration force equal to twice the static weight; tensile stress due to the bending moment of a rearward acceleration force equal to twice the static weight applied at the road surface, and tensile flexure stress due to three times the static weight, in psi; and
$S_s$ = The vectorial sum of the shear stresses in the plane in question, including direct vertical shear due to three times the static vertical loading, direct lateral shear due to a lateral accelerative force equal to twice the static weight, and torsional shear due to a lateral accelerative force equal to twice the static weight, applied at the road surface, 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 paragraphs (b) and (c) of this section.

§ 178.338-4 Joints.

(a) All joints in the tank, and in the jacket if evacuated, must be as required by 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 annually, in accordance with Section IX of the ASME Code. In addition to the essential variables set forth therein, the following must also be considered: number of passes, thickness of plate, heat input per pass, and manufacturer's identification of rod and flux. The number of passes, thickness of plate, and heat input per pass may not vary more than 25 percent from the procedure for welder qualification. Records of the qualification must be retained for at least five years by the tank manufacturer and be made available upon request to representatives of the Department of Transportation 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.

(c) 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 provided 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.

With the exception of tanks constructed of SA-240 series 300 stainless steel; SB-209 series 3,000 and series 5,000 aluminum; or SA-353, SA-535 Type I, nickel alloy steels, each tank constructed in accordance with Part UHT of the ASME Code and any tank of greater than 3,500 gallons water capacity must be provided with a manhole conforming to paragraph UG-46 (g)(1) and other requirements of the ASME Code. The jacket must either be provided with means of entrance and exit through the manhole, or marked to indicate the manway location on the tank. The location of the manhole must be at the rear or on the rear head of the tank.

§ 178.338-7 Openings.

(a) The liquid product discharge opening of each tank intended for flammable ladings must provide for complete drainage of the liquid contents.

(b) With the exception of gauging devices; thermometer wells; and safety relief, manual vent, and pressure control valves or devices; each opening in the tank must be closed at or inside the jacket or within the protective housing prescribed in § 178.338-10(b) with a plug, cap, bolted flange, or plate; or provided with a valve conforming to the requirements of §§ 178.338-b and 178.338-11, as appropriate.

(c) If the leakage of a single valve, except a safety 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 tank design pressure must be provided outboard of such valve.

§ 178.338-8 Safety relief devices, piping, valves, and fittings.

(a) *Safety relief devices.* Each tank safety relief device must be designed, constructed, and marked for a rated pressure equal to or exceeding the tank design pressure at the coldest temperature expected to be encountered (see § 173.318(b) of this subchapter).

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

(1) All piping, valves, and fittings shall be as prescribed in §§ 178.33(f) and 173.318(b) of this subchapter.

(2) Each valve must be designed, constructed, and marked for a rated pressure equal to or exceeding the tank design pressure, at the coldest temperature expected to be encountered.

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

(4) All piping 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 as close to the tank as practicable to prevent the loss of vapor 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 before the pressure of the contents, under equilibrium conditions, reaches the level of the lowest pressure control valve setting.

(b) The test to determine holding time must be performed by charging the tank with a cryogenic liquid having a boiling point at atmospheric pressure equivalent to the coldest design service temperature of the tank. The tank must be charged to its maximum permitted filling density with that liquid at a temperature corresponding to its boiling point at atmospheric pressure. The cargo tank together with its contents must then be exposed to ambient temperature.

(1) *Optional test regimen.* 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 time of manufacture. However, subsequent cargo tanks made to the same design must be performance tested during the first trip. The results of this test must agree within 10 percent of the original test. This performance test must be performed in accordance with §§ 173.33(d)(1)(ii) and 177.840(h) of this subchapter.

(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.

(c) The tank pressure and ambient temperature must be recorded at 3-hour intervals, until the pressure level of the contents reaches the pressure at which the lowest pressure relieving device is set to open. This total time lapse in hours shall be noted "measured holding time at —° F. average temperature." The measured holding time must be adjusted to an equivalent holding time for the intended commodity at an average ambient temperature of 85° F. to establish the rated holding time (RHT). The marked rated holding time (MRHT) may not exceed the established RHT. The MRHT is converted to the "one-way travel time" (OWTT) by the formulae:

(1) OWTT=MRHT-24 equal to 72 hours.
(2) OWTT=MRHT-48 for tanks with an MRHT greater

where:

OWTT=One-way travel time, in hours, and
MRHT=Marked rated holding time, in hours.

§ 178.339-10 Collision damage protection.

(a) All valves, fittings, safety relief devices, and other accessories to the tank proper must be installed within the motor vehicle framework or within a suitable collision resistant guard or housing, and appropriate ventilation must be provided. Safety relief devices must be protected so that in the event of the upset of the vehicle onto a hard surface, their opening will not be prevented and their discharge will not be restricted.

(b) The protective devices or housings and their attachments to the vehicle structure must be designed to withstand static loading in any direction in which they 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 weight of the tank and attachments, when the tank is filled with the lading. 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 metal at least 3/16-inch thick or other material of equivalent strength.

(c) Each tank motor vehicle must be provided with at least one rear bumper designed to protect the tank and piping in the event of a rear end collision. The bumper design must transmit the force of the collision directly to the chassis of the vehicle. The rear bumper and its attachments to the chassis must be designed to withstand a load equal to twice the weight of the

loaded 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 tank or within 30 horizontal degrees thereof. The rear bumper dimensions must meet the requirements of § 393.86 of this title and must extend vertically to a height adequate to protect all valves and fittings located at the rear of the tank from damage that could cause loss of lading.

(d) Every part of the loaded cargo tank and any associated valve or 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 filling and discharge line must be provided with a shu-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 filling and discharge line on a cargo tank intended for service transporting a flammable lading must be provided with a remotely controlled shut-off valve normally operated by air, gas or hydraulic pressure, or mechanical means. If pressure from a reservoir or from an engine-driven pump or compressor is used for opening this valve, the control must be of fail-safe design, spring-biased to stop the admission of such pressure. Unless the jacket is 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 or flange. If the jacket is evacuated, the seat of the valve must be inside the jacket, in the jacket opening, nozzle or flange, or in a companion flange bolted to the nozzle or flange.

(1) On a cargo tank with a capacity in excess of 3,500 gallons of water, each internal 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. Fusible elements may not have a melting point exceeding 250° F. 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 internal 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 manual means, and may also contain thermal means, for closing the remote controlled shut-off valves. One means may be used to close more than one remotely controlled valve.

**§ 178.338-12 Yield section.**

The design or installation of each valve, damage to which could result in loss of liquid or vapor, must incorporate a yield 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 yield section or breakage groove.

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

(a) A cargo tank that is not permanently attached to or integrated with a vehicle chassis must be secured by turnbuckles or other equally efficient devices that will draw the cargo tank down tight on the frame without introducing any undue concentration of stresses. Anchors, stops, or other means must be provided to prevent relative motion between the cargo tank and the vehicle chassis when the vehicle is in operation, and must be installed so as to be readily accessible for inspection and maintenance.

(b) A tank motor vehicle constructed so that the cargo tank constitutes, in whole or in part, the structural members 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 with a load-bearing jacket mounted on a frame must be 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 outer shells, and cargo tank support attachments to an outer shell head, 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 a 2 "g" longitudinal and lateral loading and three times the static weight in vertical loading (see Appendix G of the ASME Code). The effects of fatigue must be considered in the calculations.

(c) When a cargo tank support is attached to the head of a tank or jacket the stresses imposed on the head must be provided for as required in paragraph (b) of this section.

(d) 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 thickness must be at least ¼-inch, or the thickness of the tank or jacket material if less, and shall, in any case, be no thicker than that of 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 performed 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.

(e) When a tank is supported within the jacket by structural members, these members must be designed to withstand minimum static loadings of one and one-half vertical upward, two lateral and longitudinal, and three vertical downward times the weight of the tank, under any condition of loading, using a safety factor of four, based on the ultimate strength of the material used at the coldest temperature to which the members will be subjected. When load rings in the jacket are used for supporting the tank, they must be designed to carry the fully loaded tank at the above specified static loadings, plus external pressure.

**§ 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 in accordance with the loading pressure, to provide a minimum of two percent outage below the inlet of the pressure control valve or safety 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 may be used as a primary control for filling; other gauging devices, except gauge glasses, may be used but not as a 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 gauging device or trycock line is used, it must consist of a pipe or tube of smaller 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 start-to-discharge pressure of the safety relief valve or pressure control valve, whichever is less.

(c) *Orifices.* All openings for dip tube gauging devices, drycock 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 contaminants must be removed prior to final closure of the manway or the tank. Chemical or solvent cleaning with a material compatible with the intended 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 in accordance with the following:

(1) *Hydrostatic test.* The hydrostatic 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.

(2) *Pneumatic test.* The pneumatic test may be used in place of the hydrostatic test. Due regard for protection of all personnel should be taken due to the potential hazard involved in a pneumatic test. The pneumatic 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. The pneumatic test pressure in the vessel 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.

(b) *Weld inspection.* All welds in or on the cargo tank shell or heads shall be radiographed in accordance with the ASME Code. A tank which has been subjected to examination by the magnetic particle method, the liquid penetrant method, or any method involving a material deposit on the interior tank surface may not be used for oxygen service.

(c) *Defect repair.* All cracks and other defects found must be repaired in accordance with the repair procedures prescribed by the ASME Code. The welder and the welding procedure must be qualified in accordance with the ASME Code. If any cutting is done by other than mechanical means, the cutter, the welder, and the combination of cutting and welding must be so qualified. After repair, the tank must again be post-weld heat-treated, if such heat treatment was previously performed, and the repaired areas must again be tested.

(d) A 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 in § 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 safety relief device or pressure controlling 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 attached by welding, brazing, or riveting to the jacket on the right side near the front, or at the control station, in a position to be 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 No. (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) Marked rated holding time——hours and name of cryogen (MRHT—— hrs., name of cryogen); and

(9) Maximum weight of lading for which designed——pounds (Max. Net Wgt.——lbs.).

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

(d) The jacket must be plainly marked on the right side near the front, in letters, at least two inches high on a contrasting background "One-way Travel Time——hrs.," with the blank filled in according to the results of the computation prescribed in § 178.338-9(c).

§ 178.338-19 Certification.

(a) The manufacturer of a cargo tank vehicle shall furnish with the completed vehicle at or before the time of delivery, the tank manufacturer's data report required by the ASME Code, a photograph, pencil rub, or other facsimile of the plates required by paragraphs (a) and (b) of § 178.338-18, and a certificate bearing the manufacturer's vehicle serial number stating that the completed tank vehicle conforms to all applicable require-

ments 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 succeeding manufacturer at or before the time of delivery a cerfificate covering the particular operation performed by that manufacturer. The cerificate 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 asociated with the tank. Each certificate must be signed by an official of the manufacturing firm responsible for the portion of the complete tank vehicle represented thereby, such as basic tank fabrication, insulation, jacket, or piping.

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

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**PART 179—SPECIFICATIONS FOR TANK CARS**

36. The Table of Sections to Part 179 would be amended by revising the entries 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.

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37. In § 179.102, § 179.102-4 would be revised; § 179.102-17 would be added to read as follows:

**§ 179.102 Special commodity requirements for pressure tank car tanks.**

* * * * *

**§ 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 or colder than minus 50°F.

(b) All plates for the tank, manway nozzle, and anchor must be made of steel complying with ASTM Specification A516, Grade 70; ASTM Specification A537, Grade B; or AAR Specification TC128, Grade B of AAR Specifications for Tank Cars, Appendix M. Impact specimens must be Type A Charpy V-notch as shown in ASTM Specification A370 and must meet the impact requirements at or colder than minus 50° F. The ASTM specifications referred to are found in the Book of ASTM Standards, Part 4 (see § 171.7(d)(5)(iv) of this subchapter). Production welded test plates prepared as required by W4.00 of AAR Specifications for Tank Cars, Appendix W, must include impact test specimens of weld metal and heat affected zone, prepared and tested in accordance with W9.00 of AAR Specifications for Tank Cars, Appendix W, and these must meet the same impact requirements as the plate material at or colder than minus 50°F.

(c) Insulation must be of approved material and must be self-extinguishing.

(d) The tank must be equipped with one safety relief valve, set for the start-to-discharge pressure listed in § 179.101-1 and one safety vent of approved design, set to function at a pressure less than the tank test pressure, but not less than 78 percent of the tank test pressure. 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 piped 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 must be installed.

(g) A gaging device is not required but may be installed. Fixed length dip tubes may be used for gaging.

(h) A pressure gage must be installed.

(i) Aluminum, cooper, 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) The fillet welds between the tank anchor and tank shell may not have internal voids or discontinuities. These welds must be examined by radioscopy or other non-destructive testing technique to ensure that they do not have internal voids or discontinuities.

* * * * *

**§ 179.102-17 Hydrogen chloride, anhydrous.**

Each tank car used to transport hydrogen chloride, anhydrous must comply with the following special requirements:

(a) The tank car must comply with Specification DOT-105A600W and be designed for loading at or colder than minus 50 degrees F.

(b) All plates for the tank car tank, manway nozzle, and anchor must be made of steel complying with the ASTM Specification A516, Grade 70; ASTM Specification A537, Grade B; or AAR Specification TC128, Grade B of AAR Specifications for Tank Cars Appendix M. Impact specimens must be Type A charpy V-notch in ASTM Specification A370 and must meet the impact requirements at or colder than minus 50 degrees F. The ASTM specifications referred to are found in the Book of ASTM Standards, Part 4 (see § 171.7(d)(5)(iv) of this subchapter). Production welded test plates prepared as required by W4.00 of AAR Specifications for Tank Cars, Appendix W, must include impact test specimens of weld metal and heat affected zone, prepared and tested in accordance with W9.00 of AAR Specifications for Tank Cars, Appendix W, and these must meet the same impact requirements as the plate material at or colder than minus 50 degrees F.

(c) Insulation must be of approved material and must be self-extinguishing.

(d) Safety relief valves must be monel trimmed and equipped with a frangible disc of silver, or teflon 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 piped outside the protective housing.

(e) Loading and unloading valves must be Hastelloy B or C or monel trim 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 must be installed.

(g) A gaging device is not required but may be installed. Fixed length dip tubes may be used for gaging.

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

(i) All gaskets must be teflon, teflon jacketed, or of 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) The fillet welds between the tank anchor and tank shell may not have internal voids or discontinuities. These welds must be examined by radioscopy or other non-destructive testing techniques to ensure they do not have internal voids or discontinuities.

* * * * *

38. Subpart F would be 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 specifications applicable to cryogenic liquid tank car tanks.**

**§ 179.400-1 General.**

Tanks built to these specifications must comply with §§ 179.400 and 179.401.

**§ 179.400-2 Approval.**

See § 179.3 for approval procedure.

**§ 179.400-3 Type.**

(a) Tanks built to these specifications must consist of an inner container suitably supported within an outer shell. The tank car must be equipped with piping systems for vapor venting, transfer of lading and with safety relief devices, controls, gages and valves prescribed herein.

(b) The annular space must be evacuated and contain a suitable insulation. Tanks must be circular in cross section, with heads designed concave to pressure. The out of roundness of the cylindrical portion of the inner and outer shell may not be greater than that permitted in Section VIII, Division 1, Paragraph UG-80 of the ASME Code.

**§ 179.400-4 Insulation system and holding time.**

(a) The insulation system must:

(1) provide 30 days of holding time as determined by testing, or

(2) provide 12 days of holding time as determined by testing and such a car must be equipped with an approved device to prevent discharge of a gas mixture exceeding 50% of the lower flammability limit to the atmosphere under normal conditions of storage or transportation.

(b) The holding time test will measure the time elapsed before the pressure of the contents under equilibrium conditions reaches the level of the lowest pressure control valve setting.

(c) The test to determine holding time must be performed by charging the tank car with a cryogenic liquid having a boiling point at atmospheric pressure equivalent to the coldest design service temperature of the tank. The tank must be charged to its maximum permitted filling density with that liquid at a temperature corresponding to its boiling point at atmospheric pressure. The rail car together with its contents must then be exposed to ambient temperature.

(d) The tank pressure and ambient temperature must be recorded at 3-hour intervals, until the pressure level of the contents reaches the pressure at which the lowest pressure relieving device is set to open. This total time lapse in hours shall be noted "measured holding time at —°F. average temperature." The measured holding time must be adjusted to the equivalent holding time for the intended commodity at an average ambient temperature of 90° F. to establish the rated holding time.

(e) Insulating material must be approved and must be self-extinguishing.

(f) If the insulation consists of a powder having a tendency to settle, the entire top of the cylindrical portion of the inner container must be insulated with a layer of glass fiber insulation of 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.

(g) The outer shell must be provided with fittings to permit effective evacuation of the annular space between the outer shell and the inner container.

(h) Connections must be provided for a vacuum gage of approved design to indicate the absolute pressure in the annular space. The gage, if not portable, must be mounted in a position where it will be readily visible to an operator. The connection for a portable gage must be easily accessible.

**§ 179.400-5 Materials.**

(a) High-alloy steel plate of 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, rivet, steel structural shape and carbon steel plate used to fabricate the outer shell and heads must be as specified in AAR Specifications for Tank Cars, Appendix M.

(c) Specimens for the required impact tests of plate material and weld material used for the inner container and appurtenances must be taken from the welded test plate. The specimens must be subjected to the tests prescribed and satisfy the results specified in AAR Specifications for Tank Cars, Appendix W, at a temperature no warmer than the boiling point of the lading at atmospheric pressure.

**§ 179.400-6 Bursting and buckling pressure.**

(a) The minimum required bursting pressure of the inner container is listed in § 179.401-1.

(b) The outer container of the required evacuated insulation system must be designed in accordance with § 179.400-7(d) in addition to the design loads and stresses specified in Section AAR.23 of the AAR Specifications for Tank Cars. Such designs and calculations must include the loadings and stresses transferred to the outer container through the support system.

**§ 179.400-7 Thickness of plates.**

(a) The minimum wall thickness, after forming, of the inner container and the 2:1 ellipsodial heads for the inner container must be that specified in § 179.401-1, or that calculated by the following formula; whichever is greater:

$$t = Pd/2SE$$

Where:

d = inside diameter, in inches;
E = 0.9 welded joint efficiency; except E = 1.0 for seamless heads; P = minimum required bursting pressure, in psi;
S = minimum tensile strength of plate material, in psi, as prescribed in AAR Specifications for Tank Cars, Appendix M, Table M1;
t = minimum thickness of plate after forming, in inches.

(b) The minimum wall thickness, after forming, of the 3:1 ellipsoidal heads for the inner container must be that specified in § 179.401-1, or that calculated by the following formula; whichever is greater:

$$t = 1.83\ Pd/2SE$$

Where:

d = inside diameter, in inches;
E = 0.9 welded joint efficiency; except E = 1.0 for seamless heads;

P=minimum required bursting pressure, in psi;
S=minimum tensile strength of plate material, in psi, as prescribed in AAR Specifications for Tank Cars, Appendix M, Table M1;
t=minimum thickness of plate after forming, in inches.

(c) The minimum wall thickness, after forming, of a flanged and dished head for the inner container 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:

L=main inside radius of dished head, in inches;
E=0.9 welded joint efficiency; except E=1.0 for seamless heads;
P=minimum required bursting pressure, in psi;
S=minimum tensile strength of plate material, in psi, as prescribed in AAR Specifications for Tank Cars, Appendix M, Table M1;
r=inside knuckle radius, in inches;
t=minimum thickness of plate after forming, in inches.

(d) For the outer container the wall thickness after forming of the shell and heads must be not less than 7/16 inch. The annular space is to be evacuated, and the cylindrical portion of the outer shell 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:

$$P_c=2.6E(t/D)^{5/2}/(L/D)-0.45(t/D)^{0.5}$$

Where:

$P_c$=Critical collapsing pressure, in psi (37.5 psi minimum);
E=modulus of elasticity of shell material, in psi;
t=minimum thickness of shell material after forming, in inches;
D=outside diameter of shell, in inches;
L=distance between stiffening ring centers, in inches. (The heads may be considered as stiffening rings located 1/3 of the head depth from the head tangent line).

(e) If stiffening rings are used in designing the cylindrical portion of the outer shell for external pressure, they must be attached to the shell 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 1/3 of the circumference of the tank. The maximum space between welds may not exceed eight times the outer tank wall thickness.

(1) A portion of the outer shell may be included when calculating the moment of inertia of the ring. The effective width of shell plate on each side of the attachment of the stiffening ring is given by the following formula:

$$W=0.78Rt^{0.5}$$

Where:

W=width of shell effective on each side of the stiffening ring, in inches;
R=outside radius of the outer shell, in inches;
t=plate thickness after forming of the outer shell, in inches.

(2) Where a stiffening ring is used that consists of a closed section having two webs attached to the outer shell, the shell plate between the webs may be included up to the limit of twice the value of "W" as defined above. The outer flange of the closed section 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 shell plate which may be considered effective is 4W).

(3) The stiffening ring must have a moment of inertia large enough to support the critical collapsing pressure as determined by either of the following formulae:

$$I=0.035D^2LP_c/E$$

$$I'=0.046D^2LP_c/E$$

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 amount of inertia of combined section of stiffening ring and effective width of shell plate about the centroidal axis parallel to the vessel axis, in inches to the fourth power
D=outside diameter of the outer shell, 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 the stiffening ring. Both distances are measured parallel to the axis of the vessel, in inches. A line of support is:

(i) A stiffening ring which meets the requirements of this paragraph, or
(ii) A circumferential line of a head at one-third the depth of the head from the tangent line;

$P_c$=critical collapsing pressure, in psi (37.5 psi minimum);
E=modulus of elasticity of stiffening ring material in psi.

(4) Where loads are applied to the outer shell or to stiffening rings from the support system used to support the inner container within the outer shell, 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.

(f) A sump of siphon bowl may be in the bottom of the inner container shell if:
(1) it is formed directly into the shell, or is formed and welded to the shell and is of weldable quality metal that is compatible with the tank shell;
(2) the stress in any orientation under any condition does not exceed the circumferential stress in the inner tank shell designed in accordance with § 179.400-7(a); and
(3) the wall thickness is not less than that specified in § 179.401-1.

**§ 179.400-8 Tank heads.**

(a) Tank heads of the inner container and outer shell must be of approved contour, and must be flanged and dished or ellipsoidal.
(b) Flanged and dished heads must have:
(1) A main dish radius not greater than the outside diameter of the straight flange;
(2) An inside radius not less than 6 percent of the outside diameter of the straight flange; and
(3) A knuckle radius not less than 3 times the head thickness.

**§ 179.400-9 Welding.**

(a) Except for a closure of an access opening and a maximum of two circumferential closing joints in the cylindrical portion of each outer container, each joint of an inner container, outer container and appurtenance must be a fusion-welded double-welded butt joint.
(b) The closure for an access opening, and the circumferential closing joint in the cylindrical portion of an outer container including a head to shell joint, may be a single-welded butt joint using a backing strip on the inside of the joint.
(c) Each joint must be in accordance with the requirements of AAR Specifications for Tank Cars, Appendix W.
(d) Each welding procedure, welder and fabricator must be approved.

**§ 179.400-10 Postweld heat treatment.**

(a) Postweld heat treatment of the inner container is not required.
(b) The cylindrical portion of the outer shell, with the exception of the circumferential closing seams, must be postweld heat treated in accordance with the requirements of AAR Specifications for Tank Cars, Appendix W. Any item to be welded to this portion of the outer shell must be attached before postweld heat treatment. Welds securing the inner container support system to the outer shell, connections at piping penetrations, closures for access openings, and the tank heads at each end of the shell need not be postwelded heat treated when it is not practicable due to final assembly procedures.

(c) When cold formed heads are used on the outer shell they must be heat treated before welding to the shell if postweld heat treatment is not practicable due to assembly procedures.

§ 179.400-11 Support system for inner container.

(a) The inner container must be supported within the outer shell by a support system of approved design. The system and its areas of attachment to the outer shell must have adequate strength and ductibility at operating temperatures to support the inner container when filled with the lading to any level incident to transportation.

(b) The support system must be designed to be capable of supporting, without yielding, impact loads producing accelerations of the following magnitudes and directions when the inner container 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 container and outer shell must be permanently bonded to each other electrically, by either the support system, piping, or a separate electrical connection of approved design.

§ 179.400-12 Cleaning of inner container.

The interior of the inner container and all lines connecting with it must be thoroughly cleaned and dried prior to use. Proper precautions must be taken to avoid contamination of the system after cleaning.

§ 179.400-13 Radioscopy.

Each longitudinal and circumferential joint of the inner container and each longitudinal and circumferential double-welded butt joint of the outer shell must be examined the entire length in accordance with the requirements of AAR Specifications for Tank Cars, Appendix W.

§ 179.400-14 Access to inner container.

(a) The inner container 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 container. 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.

§ 179.400-15 Inner container piping.

(a) *Product lines.* The piping system for vapor and liquid phase transfer and venting must be made from 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 shell, car structures, trucks or safety appliances. Suitable provision 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 practical to the outer shell, plus a secondary closure that is liquid and gas tight. This 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 practical to the inner shell. Any loading and unloading line must be vacuum jacketed between the outer shell and the shut-off valve. The shut-off valve must also be vacuum jacketed.

(2) *Vapor phase line.* A vapor phase line must connect to the inner container and must be of sufficient size to permit the safety relief devices specified in § 179.400-17 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 shell, plus a secondary closure that is liquid and gas tight. This 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 may 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 vessel 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 container to facilitate unloading the liquid lading must be approved.

§ 179.400-16 Test of inner tank.

(a) After all items to be welded to the inner container have been welded in place, the inner container 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 container must hold the prescribed pressure for a period of not less than ten minutes without leakage or evidence of distress. 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) Calking 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.

§ 179.400-17 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 must be of approved materials that will effectively seal the valve stem without causing difficulty of operation.

(3) Each control valve and shut-off 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. The following gaging devices must be provided:

(1) *Liquid level gage.* Connections must be provided for a liquid gage of approved design to indicate the quantity of liquified lading within the inner container. A gage must be mounted where it will be readily visible to an operator during transfer operations or storage. The connection for a portable gage must be readily accessible.

(2) *Fixed length dip tube.* A fixed length dip tube, with a manually operated shut-off valve located as close as practicable to the outer shell, must be provided. 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 tank and within four feet of the transverse center line of the tank.

(3) *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 shell, must be provided. The gage must indicate the vapor pressure within the inner container 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.

§ 179.400-18 Safety relief devices.

(a) The tank must be provided with safety 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 shell, car structure, trucks and safety appliances. Vent or weep holes in safety relief devices are prohibited. All main safety relief devices must discharge to the outside of the protective housings in which they are located. This requirement does not apply to small safety relief valves installed to protect isolated sections of lines between the final valve end closure.

(b) *Materials.* Materials used in safety relief devices must be suitable for use at the temperature of the lading and otherwise compatible with the lading in the liquid and vapor phases.

(c) *Inner container.* Safety relief devices for the inner container must be attached to piping connected to the vapor phase of the inner container and mounted so as to remain at ambient temperature prior to operation. The inner container must be equipped with one or more safety 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, paragraph A8.06(a).

(2) *Safety relief valve.* The safety relief valve must:

(i) be set-to-discharge at the pressure specified in § 179.401-1, and

(ii) meet the requirements of AAR Specifications for Tank Cars, Appendix A, paragraph A8.07(b).

(3) *Installation of safety vent and safety relief valve.*

(i) *Inlet piping.* The opening through all piping and fittings between the inner tank and its safety relief devices must have at least the area of the safety relief device inlet, and the flow characteristics of this upstream system must be such that the pressure drop will not reduce the relieving capacity below that required or adversely affect the proper operation of the safety relief device.

When the required relief capacity is met by the use of multiple safety relief devices which are placed on one connection, the inlet internal cross-sectional area of this connection must be at least equal to the combined inlet areas of the safety relief devices connected to it, and in all cases must be sufficient to provide the required flow capacity.

(ii) *Outlet piping.* The size of the discharge lines must be at least the same as the safety relief device outlet and must not reduce the relieving capacity below that required to properly protect the inner tank. When the required relief capacity is met by use of multiple safety 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 safety devices.

(iii) Duplicate safety devices may be used when an approved 3-way selector valve is installed to provide for relief through either duplicate safety relief device. The 3-way valve must be included in the mounting required by AAR Specifications for Tank Cars, Appendix A, paragraph A6.02(h), when conducting the flow capacity test on the safety vent required by AAR Specifications for Tank Cars, Appendix A, paragraph A6.01(a). Flow capacity tests must be performed with the 3-way valve at both of the extreme positions as well as at the mid-position to ascertain that the flow capacity requirements of AAR Specifications for Tank Cars, Appendix A, paragraph A8.07(a) are met.

(iv) An alternate safety relief valve, set as required in § 179.401-1, may be used in lieu of the safety vent, provided it meets the flow capacity requirement of 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.

C. Prevent accumulation of foreign material in the vent system.

(4) *Evaporation control.* The routine release of vaporized lading must be controlled with a pressure controlling and mixing device or prevented as specified in § 179.400-4. The pressure controlling device must be set to start-to-discharge at a pressure not greater than that specified in § 179.401-1, and must have sufficient capacity to limit the pressure within the inner container 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.

(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 device setting but less than the safety relief valve setting, the design must be such that the safety interlock will not affect the discharge path of the safety relief valve 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 shell.* The outer shell must be provided with a suitable system to prevent buildup of annular space pressure in excess of the external pressure for which the inner container was designed, but not to exceed 16 psig. 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 provide 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 installed.

§ 179.400-19 Test of safety relief valves.

Each valve must be tested with air or gas for compliance with § 179.401-1 before being put into service.

§ 179.400-20 Protective housings.

All valves, gages, closures and safety relief valves, with the exception of secondary relief valves for the protection of isolated piping, must be enclosed within protective housings. 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. They 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 safety valve operation. The enclosures must be operable by personnel wearing heavy gloves and must incorporate provisions for locks or seals. Protective housings and their covers must be constructed

of metal not less than 0.119 inch in thickness.

**§ 179.400-21 Operating instructions.**

All valves and gages must be clearly identified with corrosion-resistant nameplates. A plate of corrosion-resistant material bearing directions or 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 its various gauges, control valves and safety relief devices clearly identified and located.

**§ 179.400-22 Stamping.**

(a) A tank that complies with all specifications requirements must have plainly and permanently stamped into the metal near the center of the head of the outer shell at the "B" end of the car, in letters and figures at least ⅜-inch high, the following information in the following order:

| | Example of Required Stamping |
|---|---|
| Specification | DOT-113A60W |
| Minimum loading temperature. | Minus 423°F. |
| Inner container | Inner container |
| Material | ASTM A240-304 |
| Shell thickness | Shell 3/16 inch |
| Head thickness | Head 3/16 inch |
| Inside diameter | ID 107 inch |
| Tank builders initials | ABC |
| Date of original test and initials of party conducting original test. | 00-0000GHK |
| Water capacity | 00000 lbs. |
| Outer shell | Outer shell |
| Car assembler (if other than tank builder). | DEF |
| Material | ASTM A515-70 |
| Tank builders initials | XYZ |

(b) Any marking, stenciling or stamping on the shell or heads of the inner container 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 shell at the "B" end of the car.

**§ 179.400-23 Stenciling.**

The outer shell of the tank must be stenciled as follows:

(a) the date on which the frangible disc was replaced and the initials of the party making the replacement must be stenciled on the outer shell in letters and figures at least 1½ inch high.

(b) The name of the hazardous material for which the tank was designed must be stenciled in letters at least 4 inches high with at least a ⅝-inch stroke. The separation between each letter must be at least ¾-inch diameter. The markings must be affixed to both sides of the outer shell so as to be readily visible when viewed from each side of the tank car.

(c) The minimum loading temperature and maximum lading weight must be stenciled in letters and figures at least 1½ inches high adjacent to the hazardous material stencil.

(d) The water capacity must be stenciled in pounds net at 60°F. with the tank at its coldest operating temperature after deduction for the volume above the inlet to the safety relief device or pressure controlling valve, structural members, baffles, piping, and other appurtenances inside the tank, in letters and figures at least 1½ inches high.

(e) Each side of the tank car must be stenciled, letters at least 1½ inches high with the statement, "DO NOT HUMP OR CUT OFF WHILE IN MOTION."

(f) The outer shell must be stenciled in letters at least 1½ inches high with the statement, "vacum jacketed" below the tank classification.

**§ 179.400-24 Certificate of construction.**

See § 179.5.

40. § 179.401 would be revised 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 container and its appurtenances are as follows:

| DOT specification | 113A60W | 113C120W |
|---|---|---|
| Lading Temperature (Minimum °F.) | −423 | −155 |
| Material | § 179.400-5 | § 179.400-5 |
| Impact Tests (Weld and Plate Material) | § 179.400-5(c) | § 179.400-5(c) |
| Impact Test Values | § 179.400-5(c) | § 179.400-5(c) |
| Maximum Heat Transfer (Btu Per Day Per Lb. of Water Capacity Max.) (see § 179.400-4). | 0.097 | 0.4121 |
| Bursting Pressure, psi | 240 | 300 |
| Minimum Plate Thickness, Shell (see § 179.400-7(a)) | 3/16 | 3/16 |
| Heads (see § 179.400-7(a), (b), and (c)) | 3/16 | 3/16 |
| Test Pressure, psi (see § 179.400-16) | 60 | 120 |
| Safety Vent Bursting Pressure (Max. psi) | 60 | 120 |
| Safety Relief Valve Start-to-Discharge pressure, psi (±3 psi) | 30 | 75 |
| Safety Relief Valve Vapor Tight Pressure (Min. psi) | 24 | 60 |
| Safety Relief Valve Flow Rating Pressure (Max. psi) | 40 | 85 |
| Alternate Safety Relief Valve Start-to-Discharge Pressure, psi (±3 psi). | — | 90 |
| Alternate Safety Relief Valve Vapor Tight Pressure (Min. psi) | — | 72 |
| Alternate Safety Relief Valve Flow Rating Pressure (Max. psi) | — | 100 |
| Pressure Control Device | 17 | |
| Start-to-Vent (Max. psi) | § 179.400-18(c)(4) | § 179.400-18(c)(4) |
| Relief Device Discharge Restrictions | § 179.400-18 | § 179.400-18 |
| Transfer Line Insulation | § 179.400-15 | § 179.400-15 |

AUTHORITY: (49 U.S.C. 1803, 1804, 1808; 49 CFR 1.53; 49 CFR Part 1 App. A. and 49 CFR Part 106, App. A, paragraph (a)(4)).

NOTE—The Materials Transportation Bureau has determined that the proposals in this notice if implemented would not result in a major economic impact under the terms of Executive Order 12044 and DOT implementing procedures (43 FR 9583). A regulatory evaluation is available in the public docket.

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