DEPARTMENT OF TRANSPORTATION
MATERIALS TRANSPORTATION BUREAU
WASHINGTON, D.C. 20590

[49 CFR Parts 173, 179]

[Docket No. HM-144; Notice No. 76-12]

TRANSPORTATION OF HAZARDOUS MATERIALS

Shippers; Specification for Pressure Tank Car Tanks

As a result of a series of serious railroad accidents involving pressure tank cars transporting hazardous materials, the Materials Transportation Bureau is considering amending Parts 173 and 179 of the Hazardous Materials Regulations to modify the specifications for uninsulated pressure tank car tanks (112 and 114 specifications) so as to improve design and construction of new and existing cars.

BACKGROUND

On March 15, 1976, a "Petition for Advance Notice of Proposed Rulemaking * * * to amend 49 CFR Part 179, Subpart C; 49 CFR Part 173; Docket No. HM-125, Notice 75-4; and Docket No. HM-109, Amendment Nos. 173-83 and 179-5" was submitted to the Bureau by the Railway Progress Institute Committee on Tank Cars. The petitioner (representing the five principal tank car builders and lessors in the United States: [illegible] Industries, General American [illegible]sportation Corporation, North [illegible]erican Car Corporation, Pullman [illegible]easing Company and Union Tank Car Company) stated that: This petition requests significant changes in the regulations which will improve the safety of transportation of flammable compressed gases and anhydrous ammonia in railroad tank cars.

The petition seeks the following:

A. Amendment of 49 CFR Part 179 to add specifications for two new DOT class tank cars. These cars would be "thermally" shielded counterparts of DOT Class 112A and 114A cars. Thermal shield systems could be of any type (e.g., coating or insulaton with jacket) that qualifies thermally. If a jacket is used, a ½-inch thick jacket head would be used in lieu of a tank head shield.

B. Amendment of 49 CFR Part 173 to authorize the use of these two new specification tank cars for the transportation of all products currently authorized in 112A and 114A tank cars.

C. Amendment of 49 CFR 173.314 to prohibit the transportation of flammable gases and anhydrous ammonia:

1. In DOT Class 112A and 114A tank cars built after the date the specifications proposed in "A" are published, and

2. In DOT Class 112A and 114A tank cars after six years from the date that the specifications proposed in "A" are published.

D. Withdrawal of Docket HM-125 which proposed to prohibit new con[illegible]ction of DOT Class 112A and 114A [illegible]k cars.

E. Amendment of the tank head shield specifications (49 CFR 173.314 and 179.-100-23):

1. To extend the date for equipping Class 112A and 114A tank cars with such shields from December 31, 1977, to December 31, 1979;

2. To delete the requirements for head shields in DOT Class 112A and 114A tank cars built new after the date that the two specifications proposed in "A" are published; and

3. To modify certain of the head shield design requirements.

Several other interested persons have addressed one or more of these subjects in commenting on notices of proposed rulemaking (particularly in HM-109 and HM-125), or in related correspondence. In establishing this new Docket and issuing this notice of proposed rulemaking, the Bureau intends to consolidate its rulemaking activity for pressure tank cars that pertain to upgrading the existing specifications 112 and 114 to improve their design and construction. After this has been accomplished, Docket HM-125 proposing to prohibit new construction of 112A and 114A tank cars will be terminated.

Pressure tank cars transporting hazardous materials have been involved in accidents and caused concern since the adoption of the first "pressure" specification on January 1, 1918. However, since 1969 there has been a growing concern due to an increase in the number of pressure tank cars involved in derailments during which they have lost their lading under violent, catastrophic conditions. According to information reported to the Department, from January 1, 1969, through December 31, 1975, there have been 519, 112 and 114 pressure tank cars in derailments of which 168 lost some, or all of their lading. These occurrences have caused 18 deaths, 832 injuries, and 45 major evacuations involving more than 40,000 persons.

As a result of analyzing these accidents, the National Transportation Safety Board (NTSB) has issued several recommendations regarding pressure tank cars used to transport hazardous materials, particularly liquefied flammable gases. On October 6, 1969, the NTSB issued Recommendation NTSB-69-R-29 which called for prototype tank cars to be throughly tested under the full scope of accident conditions known to be encountered in service and for the development and implementation of suitable regulations to correct any identified deficiencies.

On January 24, 1971, the NTSB issued Recommendation NTSB-71-R-9 calling for a revision of the specifications for the construction of new tank cars. Other NTSB recommendations have been issued recommending that existing and new pressure tank cars be upgraded to provide a greater level of safety.

Considerable research has been performed by the Department through the Federal Railroad Administration in conjunction with the U.S. Army Ballistics Research Laboratory, the Association of American Railroads, the Railway Progress Institute and the Railroad Tank Car Safety Research and Test Project Committee, in analyzing the problem of puncture and rupture of pressure tank cars involved in an accident environment. Twenty-five reports have been written and placed in the Public Docket. Most of these reports can be obtained from the National Technical Information Service (NTIS), Springfield, Virginia 22151. A list of these reports is in Appendix A to this notice.

Additional references to research performed concerning pressure tank car problems is contained in Railroad Research Information Service Special Bibliography dated October 1976, pages 351-379 (PB-258-066).

Due to the catastrophic nature of accidents involving pressure tank cars, the Bureau believes that promulgation of improved design and construction standards for new cars and for retrofitting such improvements on existing cars at the earliest opportunity is essential to assure safety. Based upon the results of the research programs being conducted by the Federal Railroad Administration and industry, performance standards for puncture resistance from impacts and thermal protection from fire exposure are being proposed in this Notice.

PROPOSAL

A new § 179.105 entitled "Special Requirements for Specification 112 and 114 Tank Cars" is proposed to be added in Part 179 of the regulations. This section provides new specifications for improving the safety of these tank cars. It contains a requirement that within six months after the effective date of the final rule, all new specification 112 and 114 tank cars are to be built equipped with "shelf couplers," a tank head puncture resistance system, a thermal protection system and a safety relief valve of adequate capacity to protect each thermally insulated tank.

Previously built specifications 112 and 114 tank cars shall be required to be similarly equipped in accordance with the following schedule:

1. Either shelf couplers or a tank head puncture resistance system within one year after the effective date of the rule;

2. Notwithstanding "1", shelf couplers within two years after the effective date of the rule; and

3. Thermal protection and tank head puncture resistance systems with adequate safety relief valve capacity within four years after the effective date of the rule.

In order to assure compliance with the

requirements for thermal protection and head puncture resistance within the four-year period, it is further proposed that each car owner be required, as a minimum, to so equip its previously built 112 and 114 tank cars in accordance with a prescribed schedule. This schedule requires that 20 percent of each owner's tank cars be equipped during the first year, 30 percent the second year, 30 percent the third year and the final 20 percent the fourth year. This schedule takes into account production start-up problems during the first year when arrangements must be made for shop space and production techniques must be refined. In addition, it recognizes the difficulties likely to be experienced during the fourth year of locating, removing from service, and re-equipping the remaining cars in the fleet which traditionally have been the most difficult to locate and remove from service. The end result would be that after four years, all previously built 112 and 114 tank cars used to transport compressed gases would be equipped with shelf couplers, a tank head puncture resistance system, an adequate relief valve and a thermal protection system.

Thermal Protection

Analyses of accidents involving uninsulated pressure tank cars by both the Federal Railroad Administration and industry (including shippers, tank car builders and railroads) recognize the need to establish a standard for thermal protection. The Federal Railroad Administration in cooperation with the industry conducted pool fire tests at the U.S. Army Ballistics Research Laboratory at White Sands, New Mexico. Also, at a torch facility located at the Pueblo Test Center, extensive testing was conducted to obtain thermal evaluation of numerous promising thermal protection candidates in several forms. Both small plate sample and full scale tank cars were subjected to the torching environment. Based on these tests, information is available to specify a performance standard for thermal protection for pressure tank cars. In proposed § 179.105–4, two tests are specified for qualifying thermal protection systems. One is a pool fire for a time period of 100 minutes, and the other is a torch fire for 30 minutes.

Calculations based on the results of full scale pool fire tests conducted at White Sands, New Mexico, indicate that all of the liquid lading in a thermally protected tank having a nominal capacity of 33,600 gallons will be vented when exposed to a pool fire of 100 minutes duration. Previous experimental tests and computations have shown that the severity of a failure is directly related to the amount of liquid lading present at the time of failure. If no liquid lading remains, the possibility of rupture is remote. Accordingly, 100 minutes has been selected as the duration for the pool fire test to qualify proposed thermal insulation systems, and a description of the qualifying test procedure is included. Evidence indicates that systems incorporating "coating" of insulating materials or insulating materials encased in a steel jacket can qualify under this test procedure. Likewise, based upon torching tests conducted at the Pueblo Test Center, a torch fire test requirement is specified. During the Pueblo Tests it was calculated that a tank car will empty its liquid contents within 30 minutes through a hole in its shell, resulting from the pentration and withdrawal of a coupler head. For this reason, 30 minutes has been selected as the prescribed minimum duration of the torch test.

A simulated torch fire test is described as are methods for qualifying proposed thermal insulation systems in the torching environment. Again, tests indicate that systems incorporating a "coating" of insulating materials and insulating materials encased in a steel jacket can qualify and are available for use.

Tank Head Puncture Protection

Another major area of concern to the Bureau has been protection of tank heads from punctures, particularly punctures caused by vertical disengagement of couplers on adjacent cars. Proposed § 179.105–5 establishes criteria for protecting the tank head from puncture. These criteria are based upon analyses of accidents and impact tests involving tank head punctures in which tank cars loaded close to their rail load limit of 263,000 pounds have impacted at speeds of up to 18 miles per hour.

Three options are proposed to afford adequate tank head puncture resistance:

1. Installation of a protective head shield system that meets the requirements of existing § 179.100–23;

2. Installation of a specified steel jacket head having a minimum thickness of ½ inch; or

3. A tank head puncture resistance system with the capability of withstanding specified impacts without loss of lading based upon a performance requirement.

Couplers

Impact tests recently performed by the Federal Railroad Administration at the Pueblo Test Center have demonstrated that the use of shelf couplers in addition to the application of tank head puncture resistance systems, effectively lessens the possibility of tank punctures by constraining vertical disengagements of couplers or causing a coupler head to break away thereby preventing it from acting as a ram. The retrofit schedule for head puncture resistance systems for previously built cars is proposed to extend over a four-year period. The Bureau believes that the impact resistance that can be realized from the relative ease of application of shelf couplers can and should be achieved much more quickly. For this reason, proposed § 179.105–6 would require the installation of specifically designated shelf E couplers, F top shelf couplers, or other couplers approved by the Federal Railroad Administrator, within one year on 112 and 114 tank cars not equipped with head shields. In this connection, the Bureau notes that in August 1974 the Association of American Railroads petitioned for a requirement that shelf couplers be applied to all 112 and 114 pressure tank cars within one year.

Safety Relief Valves

Tests conducted by the Federal Railroad Administration indicate that existing safety relief valves installed on insulated 112 and 114 tank cars may provide sufficient relief capacity under extreme fire accident conditions. However, these tests have demonstrated that if thermal protection is applied to a tank, the existing valves provide sufficient relief capacity. Section 179.105–7 would require that newly built and retrofitted cars having thermal protection be equipped with the same capacity safety relief valves currently required on non-insulated 112 and 114 tank cars.

Marking Requirements

Section 179.105–8 provides revised stencilling requirements for indentifying 112 and 114 tank cars equipped with thermal protection systems. The Bureau believes this is necessary to assist in identifying cars equipped with thermal and tank head puncture resistance systems and the type of systems applied.

Tank Car Approval

The regulations proposed in this notice do not contain any requirement for "approval" by the AAR Committee on Tank Cars as do many of the existing Part 179 provisions, since the Bureau believes the addition of thermal protection and tank head puncture protection can be properly achieved by compliance with the proposed standards without the imposition of "approval" requirements.

Canadian Tank Cars

In § 179.105–1, paragraph (c) is be[ing] proposed to require that after four y[ears] after the effective date of the final r[ule] 112 and 114 tank cars built to specifi[ca]tions promulgated by Canadian Transport Commission (formerly the Board of Transport Commissioners for Canada) and used to transport compressed gases in the United States must also be equipped in accordance with the same special requirements as United States built and owned specification 112 and 114 tank cars. Because of the catastrophic consequences of accidents involving 112 and 114 tank cars, the Bureau believes that all such cars used in the United States to transport compressed gases must be equipped as proposed in this notice within four years after the effective date of the rule.

Part 173

A revision to § 173.31(a)(3) is proposed so as to enable new and retrofitted 112 and 114 tank cars stencilled with "T" and "J" to be used in the same manner as corresponding tank cars stencilled "A" and "S."

In § 173.314, the Table in paragraph (c) has a Note 23 which now provides that after December 31, 1977, 112 and 114 tank cars used to transport compressed gases must be equipped with protective head shields. The Bureau proposes to modify this requirement so as to require either protective head shields or shelf couplers on these cars within one year after the effective date of the final rule. If the tank car has head shields, shelf couplers are required to [be] installed within two years after the [ef]fective date. Also, the change would [re]quire all such tank cars to be equipped with thermal protection and tank head

ncture resistance systems within four rs after the effective date.

In order to maintain editorial consistency between the new proposed § 179.105 requirements and existing requirements in other sections of Part 173 and 179, the Bureau will issue conforming changes in §§ 173.8, 179.5, 179.14, 179.100–4, 179.100–15, 179.100–21, 179.101–1, and 179.103 in the final rule.

The Bureau has evaluated this proposal in accordance with the policies of the Department of Transportation as published in the April 16, 1976, issue of the FEDERAL REGISTER (41 FR 16200) and believes that the proposed changes in this notice will result in substantial reductions in property loss and damage, and are otherwise warranted from the standpoint of public safety.

The estimated minimum capital investment necessary to implement the requirements proposed in this notice relative to existing tank cars is $5,000 per tank car. This figure does not include the installation of head shields since they are presently required by an earlier amendment to § 173.314. For new tank cars, the minimum cost is estimated to be $4,200 in additional capital investment per car, based on an estimated 500 new cars that will be placed into service each year. Therefore, the minimum cost of implementing the requirements proposed in this notice will be $100,000,000 for the estimated 20,000 existing tank cars to be retrofitted and the additional annual investment for 500 new cars will be $100,000 (current dollars). Based on use data, the average annual sum of capital to be invested over the four-year period would be $27,100,000 if the minimum requirements proposed herein are adopted.

On the benefit side, the Bureau believes that the foregoing costs will be offset not only by reductions in the number of accidents involving property loss and damage, but also by the magnitude of dollar losses sustained. This does not take into account the social benefits—and to the extent they can be quantified, the economic benefits—in public safety that will be derived by significantly reducing the number of deaths, injuries and evacuations that have characterized the accident experience of 112/114 tank cars in the past. Accident data for calendar years 1969–1975 indicates that 519 tank cars were involved in derailments and 168 of these cars lost some or all of their lading. These occurrences resulted in 18 deaths, 832 injuries and 45 major evacuations involving more than 40,000 persons. Four of these accidents resulted in losses estimated as totaling more than $100,000,000.

Interested persons are invited to give their views on this proposal. Communications should identify the docket number and be submitted to the Section of Dockets, Office of Hazardous Materials Operations, Department of Transportation, Washington, D.C. 20590. It is requested that five copies of all comments be submitted.

Communications received on or before uary 13, 1977, will be considered before final action is taken on this proposal. All comments received will be available for examination by interested persons at the Office of Hazardous Materials Operations, Room 6500, Trans Point Building, 2100 Second Street, SW., Washington, D.C., both before and after the closing date for comments.

Representatives from the technical staff of the Federal Railroad Administration will conduct a public briefing concerning the tank car research and development activities upon which these proposals are based. The public briefing will begin at 2:00 p.m., December 8, 1976, in Room 2230, Nassif Building (DOT Headquarters) at 7th and D Streets, SW., Washington, D.C. It is not the purpose of the briefing to receive views and comments on the merits of the proposals made in this notice.

In consideration of the foregoing, it is proposed to amend Parts 173 and 179 as follows:

PART 173—SHIPPERS—GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS

1. Section 173.31 paragraph (a)(3) would be revised to read as follows:

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

(a) * * *

(3) Unless otherwise specifically provided in this Part 173 when class DOT-105AW, 105ALW, 106A, 109A-ALW, 110AW, 111A, 112AW, or 114AW tank car tanks are prescribed, the same class tanks having higher marked test pressures than those prescribed may also be used. When class DOOT-111AW1 tank car tanks are prescribed, class 111AW3 tank cars tanks may also be used. When class DOT-112A tank car tanks are prescribed, classes DOT-112S, 112T, and 112J tanks having equal or higher marked test pressures than those prescribed may also be used. When class DOT-114A tank car tanks are prescribed, classes DOT-114S, 114T, and 114J tanks having equal or higher marked test pressures than those prescribed may also be used.

* * * * *

2. Section 173.314 paragraph (c) Table, Note 23 would be revised to read as follows:

§ 173.314 Requirements for compressed gases in tank cars.

* * * * *

(c) * * *

NOTE 23.—Specification 112 and 114 tank cars built before (six months after effective date) used for transportation of compressed gases must be equipped with: Either protective head shields or shelf couplers after (one year after effective date), shelf couplers after (two years after effective date); and thermal protection and tank head puncture resistance systems after (four years after effective date). See § 179.105 of this subchapter for other special requirements.

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PART 179—SPECIFICATIONS FOR TANK CARS

3. Section 179.105 would be added to read as follows:

§ 179.105 Special requirements for specifications 112 and 114 tank cars.

§ 179.105–1 General.

(a) Subject to the requirements of this Part, tanks built under specifications 112 and 114 must meet the requirements of §§ 179.100, 179.101 and when applicable, §§ 179.102 and 179.103.

(b) Notwithstanding the provisions of §§ 179.3, 179.4 and 179.6, AAR approval is not required for changes in or additions to specifications 112 and 114 tank cars necessary to comply with this section.

(c) Notwithstanding the provisions of § 173.8 of this subchapter, specifications 112 and 114 tank cars manufactured to specifications promulgated by the Canadian Transport Commission that are not equipped as described in this section may not be used to transport compressed gases in the United States after (four years after effective date).

§ 179.105–2 New cars.

(a) Each specification 112 and 114 tank car built after (six months after effective date) shall be equipped with:

(1) A thermal protection system that meets the requirements of § 179.105–4;

(2) A tank head puncture resistance system that meets the requirements of § 179.105–5;

(3) A safety relief valve that meets the requirements of § 179.105–7; and

(4) Notwithstanding the provisions of § 179.14, the car shall be equipped with a coupler restraint system that meets the requirements of § 179.105–6.

(b) Each specification 112 and 114 tank car shall be stenciled as prescribed in § 179.105–8.

§ 179.105–3 Previously built cars.

(a) Each specification 112 and 114 tank car built before (six months after effective date) shall be equipped as follows:

(1) After (effective date), it shall be equipped with a safety relief valve that meets the requirements of § 179.105–7.

(2) After (one year after effective date), it shall be equipped with either—

(i) A tank head puncture resistance system that meets the requirements of § 179.105–5; or

(ii) Notwithstanding the requirements of § 179.14, a coupler restraint system that meets the requirements of § 179.105–6.

(3) After (two years after effective date) it shall be equipped with a coupler restraint system that meets the requirements of § 179.105–6.

(4) After (four years after effective date) it shall be equipped with a thermal protective system and a tank head puncture resistance system that meet the requirements of §§ 179.105–4 and 179.105–5, respectively, and be stenciled as prescribed in § 179.105–8.

(b) Each tank car owner shall equip each of its specification 112 and 114 tank cars built before (six months after effective date) with a thermal protective system and a tank head puncture resistance system that meet the requirements of §§ 179.105–4 and 179.105–5, respectively, in accordance with the following schedule:

(1) At least 20 percent of those cars owned on (one year after effective date) must be so equipped by that date;

(2) At least 50 percent of those cars owned on (two years after effective date) must be so equipped by that date;

(3) At least 80 percent of those cars owned on (three years after effective date) must be so equipped by that date, and

(4) All of those cars owned on (four years after effective date) must be so equipped by that date.

§ 179.105–4 Thermal protection.

(a) *Performance standard.* Each specification 112 and 114 tank car shall be equipped with a thermal protection system that prevents the release of any of the car's contents (except release through the safety relief valve) when subjected to:

(1) A pool fire for 100 minutes, and

(2) A torch fire for 30 minutes.

(b) *Test verification.* Compliance with the requirements of paragraph (a) of this section shall be verified by testing the thermal protection system in accordance with the test procedures prescribed in paragraphs (c) and (d) of this section and the analysis required by paragraph (e) of this section. A complete record of each test verification shall be made, retained and, upon request, made available for inspection and copying by authorized representatives of the Department.

(c) *Simulated pool fire test.* (1) A pool fire environment shall be simulated in the following manner:

(i) The source of deflagration of the simulated pool fire shall be a hydrocarbon fuel. The flame temperature from the simulated pool fire shall be at 1600° F.±100° F. throughout the duration of the test.

(ii) An uninsulated square steel plate with thermal properties equivalent to tank car steel shall be used. The plate dimensions shall be not less than one foot by one foot by nominal ⅜-inch thick. The plate shall be instrumented with not less than nine theromcouples to record the thermal response of the plate. The thermocouples shall be attached to the surface not exposed to the simulated pool fire. The surface of plate shall be divided into nine equal squares and a thermocouple placed in the center of each square.

(iii) The pool fire simulator shall be constructed in a manner that results in total flame engulfment of the front surface of the bare plate. The apex of the flame shall be directed at the center of the plate.

(iv) The steel plate holder shall be constructed ia such a manner that the only heat transfer to the back side of the plate is by heat conduction through the plate and not by other heat paths.

(v) Before the plate is exposed to the simulation pool fire, none of the temperature recording devices shall indicate the plate temperature in excess of 100° F. nor less than 32° F.

(vi) A minimum of two thermocouples devices shall indicate 800° F. after not less than 12 minutes nor more than 14 minutes of simulated pool fire exposure.

(2) A thermal insulation system shall be tested in the simulated pool fire environment described in paragraph (c) (1) of this section in the following manner:

(i) The thermal insulation system shall cover a steel plate identical to that used to simulate a pool fire under paragraph (c) (1) (ii) of this section.

(ii) The back of the steel plate shall be instrumented with not less than nine thermocouples placed as described in paragraph (c) (1) (ii) of this section to record the thermal response of the steel plate.

(iii) Before exposure to the pool fire simulation, none of the thermocouples on the thermal insulation system/steel plate configuration shall indicate a plate temperature in excess of 100° F. nor less than 32° F.

(iv) The entire outside surface of the thermal insulation system shall be exposed to the simulated pool fire.

(v) A pool fire simulation test shall run for a minimum of 100 minutes. The thermal insulation system shall retard the heat flow to the steel plate so that none of the thermocouples on the back of the steel plate indicates a plate temperature in excess of 800° F.

(vi) A minimum of three consecutive successful simulation fire tests shall be performed for each thermal insulation system.

(d) *Simulated torch fire test.* (1) A torch fire environment shall be simulated in the following manner:

(i) The source of deflagration of the simulated torch shall be a hydrocarbon fuel. The flame temperature from the simulated torch shall be 2200° F.±100° F. throughout the duration of the test. Torch velocities shall be 40 miles per hour±10 miles per hour throughout the duration of the test.

(ii) An uninsulated square steel plate with thermal properties equivalent to tank car steel of dimensions not less than four feet by four feet by nominal ⅜-inch thick shall be instrumented with not less than nine thermocouples to record the thermal response of the plate. The thermocouples shall be attached to the surface not exposed to the simulated torch. The surface of the plate shall be divided into nine equal squares and a thermocouple placed in the center of each square.

(iii) The steel-plate holder shall be constructed in such a manner that the only heat transfer to the back side of the plate is by heat conduction through the plate and not by other heat paths. The apex of the flame shall be directed at the center of the plate.

(iv) Before exposure to the simulated torch, none of the temperature recording devices shall indicate a plate temperature in excess of 100° F. or less than 32° F.

(v) A minimum of two thermocouples shall indicate 800° F. in a time of 4.0±0.5 minutes of torch simulation exposure.

(2) A thermal insulation system shall be tested in the simulated torch fire environment described in paragraph (d) (1) of this section in the following manner:

(i) The thermal insulation system shall cover a steel plate identical to that used to simulate a torch fire under paragraph (d) (1) (ii) of this section.

(ii) The back of the steel plate shall be instrumented with not less than nine thermocouples placed as described in paragraph (d) (1) (ii) of this section to record the thermal response of the steel plate.

(iii) Before exposure to the simulated torch, none of the thermocouples on the thermal insulation system steel p' configuration shall indicate a plate t perature in excess of 100° F. nor less t. 82° F.

(iv) The entire outside surface of the thermal insulation system shall be exposed to the simulated torch fire environment.

(v) A torch simulation test shall be run for a minimum of 30 minutes. The thermal insulation system shall retard the heat flow to the steel plate so that none of the thermocouples on the back of the steel plate indicates a plate temperature in excess of 800° F.

(vi) A minimum of two consecutive successful torch simulation tests shall be performed for each thermal insulation system.

(e) *Analysis.* The analysis required by paragraph (b) of this section must verify that the entire surface of the tank car, including discontinuous structures (e.g., stub sills, protective housings, etc.), complies with the requirements of paragraph (a) of this section.

§ 179.105–5 Tank head puncture resistance.

(a) *Performance standard.* Each specification 112 and 114 tank car shall be capable of sustaining, without loss of contents, coupler-to-tank head impacts within the area of the tank head described in § 179.100–23 at relative car speeds of 18 miles per hour when:

(1) The weight of the impact car is at least 263,000 pounds;

(2) The impacted tank car is cou to one or more "backup" cars which h a total weight of at least 480,000 poun and the hand brakes are applied on the first car; and

(3) The impacted tank car is pressurized to at least 100 psi.

(b) *Test verification.* Compliance with the requirements of paragraph (a) of this section shall be verified by full scale testing or by the alternate test procedures prescribed in paragraph (c) of this section. However, protective head shields that meet the requirements of § 179.-100–23 or full tank head jackets that are at least ½-inch thick and made from steels specified in § 179.100–23 (a) (1), comply with the requirements of paragraph (a) of this section, need not be verified by testing.

(c) *Tank head puncture resistance test.* A tank head resistance system shall be tested under the following conditions:

(1) The ram car used shall weigh at least 263,000 pounds, be equipped with a coupler and duplicate the condition of a conventional draft sill including the draft yoke and draft gear. The coupler will protrude from the end of the ram car so that it will be the leading location of perpendicular contact with the standing tank car.

(2) The impacted test car will be loaded with water at six percent outage with internal pressure of at least 100 psi and coupled to one or more "backup" cars which have a total weight of 480,000 pounds with hand brakes applied on the first car.

(3) At least two separate tests wil conducted with the coupler on the v tical center line of the ram car. One tes will be conducted with the coupler at a height of 21 inches ±1 inch above the

top of the sill, the other test will be conducted with the coupler height at 31 inches ±1 inch above the top of the sill. If the combined thickness of the tank head and any additional shielding material at any position over the area described in § 179.100-23 is less than the combined thickness on the vertical centerline of the car, a third test shall be conducted with the coupler positioned so as to strike the thinnest point.

(4) One of the following test procedures shall be applied:

Minimum weight of ram car plus attached cars (pounds):	Minimum velocity of impact (miles per hour)	Restriction
263,000	18	1 ram car only.
343,000	16	1 ram car or 1 ram car plus 1 rigidly attached car.
686,000	14	1 ram car plus 1 or more rigidly attached cars.

(5) A test is successful if there is no visible leak from the standing tank car within one hour after impact.

§ 179.105-6 Coupler vertical restraint system.

(a) *Performance standard.* Each specification 112 and 114 tank car shall be equipped with couplers capable of sustaining without disengagement or material failure, vertical loads of at least 200,000 pounds applied in upward and downward directions in combination with buff loads of from 2,000 to 725,000 pounds, when coupled to cars equipped with couplers that do and do not have this capability.

(b) *Test verification.* Except as provided in paragraph (c) of this section, compliance with the requirements of paragraph (a) of this section shall be achieved by:

(1) Verification testing of the coupler vertical restraint system in accordance with paragraph (d) of this section; and

(2) Approval of the Federal Railroad Administrator.

(c) The following classes of couplers have been approved by the Federal Railroad Administrator and need not be verified by the testing requirements in paragraph (b) of this section:

(1) E top and bottom shelf couplers designated by the Association of American Railroads' Catalog No. SE60CHT or SE60CHTE; or

(2) F top shelf couplers designated by the Association of American Railroads' Catalog No. F70CHTX or F70CHTEX.

(d) *Coupler vertical restraint tests.* A coupler vertical restraint system shall be tested under the following conditions:

(1) The test coupler shall be tested with one coupler system that complies with the performance standard prescribed in paragraph (a) of this section, and with another system that does not comply.

(2) The testing apparatus shall simulate the performance of coupler/draft gear systems, and may not interfere with coupler failure or otherwise inhibit failure due to force applications.

(3) The test shall be conducted as follows:

(i) A minimum of 200,000 pounds vertical downward load shall be applied continuously for at least five minutes to the test coupler head simultaneously with the application of a normal 2,000-pound buff load, and again stimultaneously with the application of a nominal 725,000 pound buff load;

(ii) The procedures prescribed in paragraph (c)(3)(i) of this section shall be repeated with a minimum vertical upward load of 200,000 pounds;

(iii) A minimum of three consecutive successful tests shall be performed for each load combination prescribed in paragraphs (d)(3)(i) and (d)(3)(ii) of this section. A test is successful when a vertical disengagement of material failure does not occur during any of the prescribed load combinations.

§ 179.105-7 Safety relief valves.

Notwithstanding the provisions of § 179.105-4, each 112 and 114 tank car shall be equipped with safety relief valves that meet the requirements of Appendix A of the AAR Specifications for Tank Cars. However, the relieving or discharge capacity shall be calculated in accordance with Section A8.01 of Appendix A for compressed gases in noninsulated tanks.

§ 179.105-8 Stenciling.

(a) Each 112 and 114 tank car that is equipped with a thermal protection system enclosed in a metal jacket shall have the letter "J" substituted for the "A" & "S" in the specification marking.

(b) Each 112 and 114 tank car that is equipped with a nonjacketed thermal protection system shall have the letter "T" substituted for the "A" and "S" in the specification marking.

(49 U.S.C. 1803, 1804, 1808; 49 CFR 1.53(e) and paragraph (a)(4) of App. A to Part 102)

The Materials Transportation Bureau has determined that this document does not contain a major proposal requiring preparation of an Inflation Impact Statement under Executive Order 11821 and OMB Circular A-107 or an environmental impact statement under the National Environmental Policy Act (42 U.S.C. 4321 et. seq.).

Issued in Washington, D.C., on November 19, 1976.

DR. C. H. THOMPSON,
Acting Director, Office of Hazardous Materials Operations.

APPENDIX A—RESEARCH REPORTS

1. Bullerdiek, W. A., Vassalo, F. A., Adams, D. E., and Mathesis, C. W., "A Study to Reduce the Hazards of Tank Car Transportation," Report No. FRA-RT-71-74, Calspan Corporation, November 1970 (PB-199-154).

2. Everett, J. E. and Phillips, E. A., "Hazardous Materials Tank Cars—Tank Head Protective Shield or Bumper Design," Report No. FPA-RP-72-01, Association of American Railroads, August 1971 (PB-202-624-1).

3. Levine, D. and Dancer, D., "Fire Protection of Railroad Tank Cars Carrying Hazardous Materials—Analytical Calculations and Laboratory Screening of Thermal Insulation Candidates," Report No. MOLTR-72-142, U.S. Naval Ordinance Lab, July 1972 (AD-747974).

4. Adams, D. E., Bullerdiek, W. A., Pattern, J. S., and Vassalo, F. A., "Cost Benefit Analysis of Head Shields for 112A/114A Series Tank Cars," Report No. FRA-OR&D 75-34, Calspan Corporation, March 1974 (PB-241298/AS).

5. Anderson, C., Townsend, W., and Zook, J., "Railroad Tank Car Fire Test: Test No. 6," Report No. FRA-OR&D 75-36, U.S. Army Ballistics Research Laboratories, August 1973 (PB-241-207).

6. Anderson, C., Townsend, W., Zook, J., Wright, W., and Cowgill, G., "Railroad Tank Car Fire Test: Test No. 7," Report No. FRA-OR&D 75-37, U.S. Army Ballistics Research Laboratories, December 1973 (PB-241-145).

7. Graves, K. W., "Development of a Computer Program for Modeling the Heat Effects on a Railroad Tank Car," Report No. FRA-OR&D 75-33, Calspan Corporation, January 1973 (PB-241-365).

8. Anderson, C. and Norris, E. B., "Fragmentation and Metallurgical Analysis of Tank Car RAX 201" Report No. FRA-OR&D 75-30, U.S. Army Ballistics Research Laboratories, April 1974 (PB-241-254).

9. Anderson, C., Townsend, W., Zook, J., and Cowgill, G., "The Effects of a Fire Environment of a Rail Tank Car Filled with LPG," Report No. FRA-OR&D 75-31, U.S. Army Ballistics Research Laboratories, September 1974 (PB-241-358).

10. Townsend, W., Anderson, C., Zook, J., and Cowgill, G., "Comparison of Thermally Coated and Uninsulated Rail Tank Cars Filled with LPG Subjected to a Fire Environment," Report No. FRA-OR&D 75-32, U.S. Army Ballistics Research Laboratories, December 1974 (PB-241-702/AS).

11. Adams, D. E., "Cost/Benefit Analysis of Thermal Shielded Coatings Applied to 112A/114A Series Tank Cars," Report No. FRA-OR&D 75-39, Calspan Corporation, December 1974 (PB-241-295/AS).

12. National Academy of Sciences, "Pressure Relieving Systems for Marine Cargo Bulk Liquid Containers (sponsored by the United States Coast Guard)," 1973.

13. Konvacs, F. and Honti, G., "Secondary Heat Effect on LPG Storage Spheres in Case of Fire," Loss Prevention and Safety Promotion in the Process Industries, pp. 385-404, Elsevier Scientific Publishing Company; 1974

14. "Phase II Report on Effects of Fire on LPG Tank Cars," Report No. RA-11-1-5, Railway Progress Institute, Association of American Railroads, 1971.

15. Hohenemser, K. H., Diboll, W. B., Yin, S. K., and Szabo, B. A., "Computer Simulation of Tank Car Head Puncture Mechanisms," Report No. FRA-OR&D 75-23, Washington University, February 1975 (PB-250-409/AS).

16. Hicho, G. E. and Brady, C. H., "Hazardous Materials Tank Cars—Evaluation of Tank Car Shell Construction Material," Report No. FRA-OR&D 75-46, National Bureau of Standards, September 1970 (PB-250-607/AS).

17. Interrante, C. G., and Hicho, G. E., "Metallurgical Analysis of a Steel Shell Plate Taken from a Tank Car Accident near South Byron, New York, Report No. FRA-OR&D 75-47, National Bureau of Standards, October 1971 (PB-250-063/AS).

18. Interrante, C. G., Hicho, G. E., and Harne, D. E., "A Metallurgical Analysis of Five Steel Plates Taken from a Tank Car Accident Near Crescent City, Illinois, Report No. FRA-OR&D 75-48, National Bureau of Standards, March 1972 (PB-250-530/AS).

19. Interrante, C. G., Hicho, G. E., and Harne, D. E., "A Metallurgical Analysis of Eleven Steel Plates Taken from a Tank Car Accident Near Callao, Missouri," Report No. FRA-OR&D 75-49, National Bureau of Standards, September 1972 (PB-250-544/AS).

20. Interrante, C. G., Hicho, G. E., and Early, J. G., "Analysis of Findings of Four Tank Car Accident Reports," Report No. FRA-OR&D 75-50, National Bureau of Stand-

ards, January 1975 (PB-251-097/AS).

21. Interrante, C. G., and Early, J. G., "A Metallurgical Investigation of a Full Scale Insulated Rail Tank Car Filled with LPG Subjected to a Fire Environment," Report No. FRA-OR&D 75-52, National Bureau of Standards, January 1975 (PB-250-587/AS).

22. Schalit, L., Schneyer, G., Toor, J., and Laird, D., "Development of Analytical Fire Models," Report No. FRA-OR&D 75-53, Systems Scientific Software, October 1974 (PB-250-731/AS).

23. Townsend, W. and Markland, R., "Preparation of the BRL Tank Car Torch Facility at the DOT Transportation Test Center, Pueblo, Colorado," Report No. FRA-OR&D 76-72, U.S. Army Ballistics Research Laboratories, September 1975 (PB-251-151/AS).

24. Adams, D. E., Bullerdiek, W. A., and Vassalo, F. A., "Rail Hazardous Material Tank Car Design Study," Calspan Report No. ZL-5226-D-4., April 1975.

25. Wesson and Associates, Inc., "Relative Costs of Installed Coating Systems." Contract No. DAADOS-76-C-0059, September 1976.

Copies of most of these reports can be obtained from the National Technical Information Service (NTIS), Springfield, Virginia 22151. They are identified by the NTIS accession number which has been included in parenthesis at the end of each listing.

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