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

[Docket No. HM-144; Amdt. Nos. 173-108, 179-19]

PART 173—SHIPPERS—GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS

PART 179—SPECIFICATIONS FOR TANK CARS

Shippers; Specification for Pressure Tank Car Tanks

AGENCY: Materials Transportation Bureau, DOT.

ACTION: Final rule.

SUMMARY: As a result of a series of serious railroad accidents involving certain uninsulated pressure tank cars transporting hazardous materials these amendments are issued in the interest of safety.

1. Existing and newly built specification 112 and 114 tank cars used to transport flammable gases such as propane, vinyl chloride and butane are required to have both thermal and tank head protection. Newly built cars are to be so equipped starting on January 1, 1978, while existing cars are to be retrofitted over a four-year period ending on December 31, 1981.

2. Existing and newly built specification 112 and 114 tank cars used to transport anhydrous ammonia are required to have tank head protection (such as a head shield) installed. Cars built after December 31, 1977, must be so equipped. Previously built cars are to be retrofitted with tank head protection over a four-year period ending on December 31, 1981.

3. All specification 112 and 114 tank cars, regardless of the hazardous lading being transported, are to be equipped with special couplers designed to resist coupler vertical disengagements. These couplers are to be installed on cars built after December 31, 1977 and retrofitted on all previously built cars by July 1, 1979.

EFFECTIVE DATE: These regulations become effective on October 19, 1977.

ADDRESS: All written comments received in this proceeding are available for examination during regular business hours in room 6500, Transpoint Building, 2100 Second Street, SW., Washington, D.C.

FOR FURTHER INFORMATION CONTACT:

William F. Black, Office of Safety, Federal Railroad Administration (202-426-2748).

SUPPLEMENTARY INFORMATION: These amendments are the result of the joint efforts of the Federal Railroad Administration (FRA) and the Materials Transportation Bureau (the Bureau). In accordance with internal DOT procedures, the FRA has developed the substantive provisions of these amendments for review and issuance by the Bureau. Accordingly, further information concerning substantive provisions of these amendments may be obtained from the above contact.

Background Information

On November 19, 1976, as a result of a series of serious railroad accidents involving uninsulated pressure tank cars (built to specifications 112 and 114) transporting hazardous materials, the Materials Transportation Bureau issued a Notice of Proposed Rulemaking, Docket No. HM-144; Notice No. 76-12 (41 FR 52324). The purpose of that Notice was to elicit public comment on a proposed rule to improve the design and construction of new and existing 112 and 114 tank cars. Specifically, the Notice proposed that a new Section 179.105 entitled "Special Requirements for Specification 112 and 114 Tank Cars" be added to Part 179 of the regulations. This section would prescribe new specifications for improving the safety of these cars. The Notice would have required that all newly built 112 and 114 tank cars, be 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.

Also, the Notice proposed that existing 112 and 114 tank cars be retrofitted according to the following schedule:

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

2. Notwithstanding "1," shelf couplers be installed 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 be installed within fours years after the effective date of the rule.

In order to assure compliance with the requirements for thermal protection and tank head puncture resistance within the four-year period, an annual completion schedule was also proposed.

The reasons for these proposals were discussed in considerable detail in the Notice. Interested persons were invited to participate in the rulemaking proceeding through the submission of written comments. Fifty-three submissions were received and have been fully considered by the Bureau in the development of this final rule.

Subsequent to the issuance of the Notice, three serious railroad accidents occurred involving 112 and 114 tank cars.

On November 26, 1976, at Belt, Montana, the Burlington Northern, Inc., had a train derailment. Two persons were killed, six persons were seriously injured and fifteen others were treated for injuries when twenty-four freight cars derailed. One of the derailed cars was CGTX 64226, a 112A tank car, loaded with approximately 31,000 gallons of propane. The tank sustained a tank head puncture, began to release its contents and subsequently ruptured. A second 112A tank car, CGTX 64141, loaded with butane was subjected to the fire environment. Approximately two hours after the accident this tank car ruptured from the heat exposure.

On February 20, 1977, in Dallas, Tex., an Atchison, Topeka and Santa Fe Railway freight train derailed. In the derailment, UTLX 38355, a 112A tank car loaded with 32,437 gallons of propane, sustained a tank head puncture near the base of the head. The escaping propane ignited and the resulting torching flame impinged upon and heated GATX 97359, another 112A tank car, which contained 30,321 gallons of isobutane. After about forty minutes of fire impingement, GATX 97359 exploded violently. The tank separated into three major parts. Fortunately, no injuries resulted from this accident, but the estimated third-party damage has been set at $3,500,000.

On March 16, 1977, at Love, Ariz., an Atchison, Topeka and Santa Fe Railway train derailed. Eight propane laden tank cars were involved:

ACFX 17359—112A340W.
ACFX 17355—112A340W.
RTMX 3515—105A300W.
ACFX 17358—112A340W.
RTMX 3487—105A300W.
RTMX 3526—105A300W.
RTMX 3532—105A300W.
RTMX 3492—105A300W.

All RTMX tank cars had ½-inch jacket heads and insulation.

ACFX 17359 sustained a puncture in the "belly" of the tank. The spilled contents burned. ACFX 17355 ruptured as a result of flame impingement. RTMX 3515 sustained a tank head puncture caused by a wheel cutting through the jacket head and the tank head. The contents ignited and burned. ACFX 17358 sustained a small head puncture. The contents spilled out through this hole and burned; also burning of contents occurred at the safety relief valves. RTMX 3487 which was exposed to fire impingement burned its contents at the safety relief valve. The tank did not rupture; the contents were released through the safety relief valve. The remaining three tank cars, RTMX 3526, 3532 and 3492, sustained no appreciable fire damage.

In the opinion of the Bureau, the tank head punctures sustained by CGTX 64226 at Belt, Montana, and UTLX 38355 at Dallas, Tex., would have been prevented had these cars been equipped with a tank head puncture resistance system. If neither tank car tank head had been punctured, there would have been no spill of product, no fire, and no resulting tank ruptures. No loss of life, nor serious injury would have occurred at Belt, Mont., and very little third-party property damage would have ensued at Dallas, Tex.

The Love, Ariz., accident is more difficult to analyze. The estimated speed at the time of the derailment was 48 miles per hour. The tank tear in ACFX 17359 occurred in the tank shell; tank head protection would not have prevented this tank puncture. ACFX 17355 ruptured due to heat exposure while RTMX 3487 did not rupture. It released its contents

through its safety relief valve. Insulation appears to have assisted RTMX 3487 in resisting the adverse affects of fire exposure. Although RTMX 3515 was equipped with a ½-inch jacket head, it sustained a tank head puncture. The high derailing speed of 48 miles per hour appears to have given sufficient energy to a car wheel so that it could puncture both the ½-inch jacket head and the tank head. However, since much of the wheel's energy was dissipated in penetrating the jacket head, it is the Bureau's opinion that the ½-inch steel jacket kept the tank head hole to a minimum. This reduced the amount of fire in the area of this car.

As a result of analyzing comments received, two significant changes have been made in the final rule.

1. Specification 112 and 114 tank cars used to transport hazardous liquids (such as flammable or poisonous liquids) and nonflammable gases other than anhydrous ammonia (such as "fluorocarbon" gases), need only be equipped with shelf couplers. Such cars will continue to be designated as 112A/114A tank cars.

2. Specification 112 and 114 tank cars used to transport anhydrous ammonia need only be equipped (or retrofitted) with a tank head puncture resistance system and shelf couplers; thermal protection is not required. Such cars will be designated as 112S/114S tank cars. Several other changes have been made in the final rule. These changes and comments are discussed in the "Section by Section Analysis" which follows.

Section by Section Analysis

SECTION 173.31 QUALIFICATION, MAINTENANCE, AND USE OF TANK CARS

The purpose of amending paragraph (a)(3) is to authorize the use of classes DOT-112T and 112J tank cars having equal or higher marked test pressure when classes DOT-112A and 112S are prescribed, and similarly to authorize the use of classes DOT-114T and 114J tank cars having equal or higher marked test pressures when classes DOT-114A and 114S are prescribed. No specific comments on this change were received; the amendment is being adopted as proposed.

In the notice of proposed rulemaking, §§ 179.105-2(a) (4) and 179.105-3(a) (1) and (2) would require that each newly built 112 and 114 tank car be equipped and each previously built 112 and 114 be retrofitted, with a coupler restraint system. Furthermore, the Notice proposed that such a system be retrofitted within one year on cars not equipped with tank head puncture resistance systems and within two years on all other 112 and 114 cars. The requirement for retrofitting existing cars has been placed in a new paragraph (a)(5) of § 173.31 so as to clearly indicate that it applies to all 112 and 114 tank cars no matter how used, while newly built tank car requirements remain in § 179.105-2(a)(4).

Several comments were received indicating that it appeared that under the proposal most 112 and 114 tank cars would have to be retrofitted with a coupler retraint system within one year and that it was doubtful that the application of approximately 40,000 shelf couplers (two per tank car) could be accomplished in one year. The Bureau agrees and the retrofit period has been extended to June 30, 1979.

SECTION 173.314 REQUIREMENTS FOR COMPRESSED GASES IN TANK CARS

Currently, note 23 to the table in paragraph (c) states:

> Specification 112A or 114A tank cars used for transportation of compressed gases must be equipped with protective head shields after December 31, 1977. See § 179.100-23 for head shield specification.

Note 23 appears in the Table after specifications 112 and 114 for anhydrous ammonia and flammable gases (such as butadiene, LPG, vinyl chloride, etc.). The notice proposed to change this requirement to:

> * * * 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) * * *

The final rule separates the requirements for 112 and 114 tank cars used to transport flammable compressed gases from those used to transport anhydrous ammonia. These requirements are being placed in two notes. Note 23 requires specification 112 and 114 tank cars used for the transportation of flammable compressed gases to be equipped with thermal protection and tank head puncture resistance systems by January 1, 1982.

Note 24 covers anhydrous ammonia cars. Many commenters indicated thermal protection did not appear to be necessary to improve safety on 112 and 114 tank cars transporting nonflammable compressed gases such as "fluorocarbons" and anhydrous ammonia. The Bureau concurs, particularly since accident records maintained by the Federal Railroad Administration show no incidents of thermal rupture of a 112/114 tank car when transporting nonflammable compressed gases. However, due to the toxicity of anhydrous ammonia and the fact that FRA accident records show deaths and injuries caused by the tank head puncture of 112/114 tank cars transporting anhydrous ammonia, new Note 24 requires installation of tank head puncture resistance systems (such as headshields) by January 1, 1982, for 112/114 tank cars transporting anhydrous ammonia. However, tank head puncture resistance systems are not required on cars used to transport other nonflammable compressed gases.

SECTION 179.105 SPECIAL REQUIREMENTS FOR SPECIFICATION 112 AND 114 TANK CARS

This new section sets forth the new requirements for newly built and for retrofitting previously built 112 and 114 tank cars.

SECTION 179.105-1 GENERAL

This new section sets forth three requirements:

1. Tanks built under specification 112 and 114 must meet the requirements of §§ 179.100, 179.101 and when applicable §§ 179.102 and 179.103.

2. AAR approval is not required for changes in nor additions to specifications 112 and 114 tank cars necessary to comply with § 179.105.

3. 112 and 114 tank cars built to specifications promulgated by the Canadian Transport Commission that are not equipped as described in § 179.105 may not be used to transport compressed gases in the United States after December 31, 1981.

No comments were received pertaining to "1" or "3," but many comments were received regarding deletion of "AAR Approval ("2")."

Commenters requested that approval by the AAR Committee on Tank Cars be required for changes in or additions to 112/114 tank cars necessary to comply with § 179.105. It was stated that the railroad "Interchange Rules" require a "Certificate of Construction" before a tank car may move in interchange service. Modifications and additions would still be required to be approved by the Committee. In addition, many commenters expressed belief that the Committee's expertise is essential to assure that modifications to these tank cars are performed properly.

The Bureau recognizes that the existing car owner/rail carrier approval system which is set forth in the AAR "Interchange Rules" may be continued by the AAR Tank Car Committee and that its approval for interchange may, therefore, be required by industry for all additions, modifications and repairs performed to comply with § 179.105. However, the Bureau does not believe that this approval need be imposed by regulation. These standards adopted for improved tank car safety are augmented by specific design criteria (such as specified couplers, head shield designs and thermal protection system), thereby affording tank car owners sufficient guidance to perform the modifications and additions required by this rule. For these reasons, the Bureau has deleted the requirement for AAR Tank Car Committee approval in this rule.

SECTION 179.105-2 NEW CARS

The notice proposed that all 12 and 114 tank cars built after six months after the effective date be equipped with:

1. A thermal protection system (§ 179.105-4);

2. A tank head puncture resistance system § 179.105-5);

3. A safety relief valve meeting the requirements of § 179.105-7; and

4. A coupler restraint system (§ 179.105-6).

Based upon comments received, the Bureau has decided to establish three types of 112 and 114 tank cars. This decision has been alluded to earlier in this preamble. Accordingly, § 179.105-2 has been revised as follows:

1. Newly built 112A and 114A tank cars are authorized to transport hazardous liquids and nonflammable compressed gases, other than anhydrous ammonia. Each is required to be equipped with a coupler restraint system that meets the requirements of § 179.105-6.

2. Newly built 112S and 114S tank cars are authorized to transport anhydrous ammonia as well as commodities authorized to be transported in 112A/114A tank cars. Each is required to be equipped with a tank head puncture resistance system that meets the requirements of § 179.105-5 as well as a coupler restraint system that meets the requirements of § 179.105-6.

3. Newly built 112T, 112J, 114T and 114J tank cars are authorized to transport flammable and non-flammable compressed gases including anhydrous ammonia, and hazardous liquids. Each is required to be equipped with all four safety measures: Thermal protective system (§ 179.105-4), tank head puncture resistance system (§ 179.105-5), coupler restraint system (§ 179.105-6) and a safety relief valve that meets the requirements of § 179.105-7.

Several commenters suggested that the use of a coupler restraint system such as "shelf couplers" and the perpetuation of FRA Emergency Order No. Five would obviate the need for installation of a tank head puncture resistance system FRA Emergency Order No. Five orders railroad carriers to handle 112 and 114 tank cars not equipped with head shields which are transporting flammable compressed gases in switch yards by "shoving to rest." It was issued as a result of three serious rail switching accidents in which tank cars not equipped with head shields sustained tank head punctures as a result of overspeed impacts. Release of the flammable gas lading and subsequent ignition caused deaths, injuries and substantial property damage. The intent of the Emergency Order was to provide an interim safety measure until all 112 and 114 tank cars transporting flammable gases were equipped with tank head shields (January 1, 1978), and not be applied permanently.

As a result of testing performed at the Transportation Test Center, Pueblo, Colo., it has been demonstrated that for some overspeed switching impacts, shelf couplers will prevent some tank head punctures. For other impacts under differing conditions, shelf couplers were not effective in preventing tank head puncture, but head shields were effective and did prevent punctures. And, under certain test impact conditions involving more than one tank car, a combination of both shelf couplers and head shields were needed to prevent tank head puncture. These test results were summarized at the FRA public briefing held on December 8, 1976.

Tank head punctures occur in train derailments as well as in switching mishaps. Emergency Order No. Five has no effect on train derailment conditions. Therefore, the Bureau has concluded that for tank cars carrying anhydrous ammonia and flammable gases, both a coupler restraint system and a tank head puncture resistance system are necessary to prevent tank puncture in derailments as well as in switch yard accidents. However for tank cars carrying products having less volatility such as hazardous liquids, and gaseous products having non-toxic nonflammable properties, the consequence of puncture and product release is not as serious. Therefore, the application of a coupler restraint system will afford adequate public safety. When both a tank head puncture resistance system and a coupler restraint system are applied to all 112 and 114 tank cars used to transport flammable gases, the need for Emergency Order No. Five will end.

179.105-3 PREVIOUSLY BUILT CARS

In the notice of proposed rulemaking, the Bureau proposed that previously built (existing) 112 and 114 tank cars be retrofitted in a four-year time period with a thermal protective system and a tank head puncture resistance system.

Based upon comments received, the Bureau has modified this requirement. The rule requires a tank head puncture resistance system to be retrofit installed on 112S, 112T, 112J, 114S, 114T and 114J tanks cars, but this system is not required on 112A and 114A tank cars. Likewise, thermal protection must be retrofit installed on 112T, 112J, 114T and 114J tank cars, but it is not required on 112A, 112S, 114A and 114S tank cars.

As proposed in the Notice, a coupler restraint system is required to be retrofit installed on all 112 and 114 tank cars by July 1, 1979; for clarity this requirement is stated in § 173.31(a)(5) as well as § 179.105-3(a).

Each car owner is required to install thermal protection and tank head puncture resistance systems in conformance to the following schedule:

1. "Lead time" until January 1, 1978
2. Twenty percent of cars owned by January 1, 1979.
3. Fifty percent of cars owned by January 1, 1980.
4. Eighty percent of cars owned by January 1, 1981.
5. All cars owned by January 1, 1982.

Many commenters said that they believed that this schedule did not provide adequate time to perform a retrofit installation program of this magnitude. Several requested a six-month "lead time;" essentially this has been granted. Several requested a retrofit schedule of a five, or six-year time period, in lieu of the proposed four-year period. This extended retrofit time period was carefully considered by the Bureau. However, due to the serious catastrophic consequences which can result from a single accident involving uninsulated, non-head shielded tank cars transporting flammable compressed gases, or involving non-head shielded tank cars transporting anhydrous ammonia, the Bureau believes that it is imperative to have retrofit installation completed as soon as is practicable.

Other factors evaluated by the Bureau in making this decision were:

1. Current regulations contained in § 173.314(c) require head shield installation by January 1, 1978. This requirement is now being phased in over an additional 4-year period.

2. Anhydrous ammonia cars (112S and 114S) will not require thermal protection, thus reducing the magnitude of the retrofit program.

3. Cars for "fluorocarbon gases" and hazardous liquids (112A and 114A) will not require thermal protection nor tank head protection, thus likewise reducing the magnitude of the retrofit program.

For these reasons, the 4-year schedule has been retained.

SECTION 179.105-4 THERMAL PROTECTION

The purpose of this section is to establish performance standards and also testing procedures to verify compliance with these performance standards for thermal protection systems to be applied to 112T, 112J, 114T and 114J tank cars. This section contains six paragraphs:

(a) Performance standard;
(b) Test verification;
(c) Simulated pool fire test;
(d) Simulated torch fire test;
(e) Analysis; and
(f) Exterior tank color.

Paragraph (a) in the Notice proposed a requirement that:

> 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.

Several commenters suggested that the "performance standards" be replaced by "test requirements" or "qualification tests," or supplemented by "design specifications." These comments pertained not only to thermal protection but also to tank head puncture resistance (§ 179.105-5) and, to a lesser extent, to "coupler restraint" (§ 179.105-6). The Bureau has considered those options but still believes that the performance standards are the best approach because they provide incentives for innovation. Also, the requirement that tank cars covered by these specifications retain the level of protection specified throughout their service life, eliminates the need for detailed maintenance procedures.

The performance standards prescribed are individual requirements which must be demonstrated under simulated pool and torch fire environments. It is not intended that an undamaged tank car be capable of withstanding a 100-minute pool fire and a 30-minute torch fire; and, to satisfy these requirements, one insulated test plate need not be subjected to both tests. Compliance may be achieved by subjecting an insulated test plate to the pool fire test and a similar test plate equipped with the same thermal protection system to the torch fire test. A tank car having an acceptable thermal system which is involved in a severe accident in which the tank and the system sustain considerable physical damage may not be capable of surviving a 100-minute pool fire and a 30-minute torch fire. The thermal protection system may not eliminate all tank car ruptures, but when properly maintained most thermal ruptures will be prevented. Damaged or deteriorated systems must be repaired or replaced before the cars is again used.

Several commenters recommended that additional fire testing and in-service testing of thermal protection systems be conducted before final rulemaking. The Bureau recognizes that additional testing can always be said to provide additional data, but it does not concur in the need for additional testing in this case. The Bureau believes that the extensive series of fire tests conducted by FRA and RPI/AAR demonstrate not only the utility and practicality of a thermal shield system, but also provide sufficient data for reliable cost projections. Furthermore, the Bureau believes that the successful in-service use of thermal shields to protect aerospace hardware and stationary compressed gas tanks, in addition to considerable railroad tank car experience, demonstrate the reliability of several competitive types of thermal shields. The Accelerated Life Test (ALT) program, being conducted by FRA, RUI/AAR, and several shippers, has provided adequate evidence that at least four reliable thermal shield systems are readily available (see discussion below). The Bureau has sought to achieve

a condition of adequate protection at minimum cost and sees no reason why additional thermal shield systems cannot be developed.

Most commenters indicated that the extensive testing programs conducted by FRA with the assistance of the RPI/AAR were beneficial in analyzing the problems encountered with uninsulated pressure tank cars and developing solutions to these problems. However, one commenter offered the opinion that DOT sponsored tank car tests were not run to gather information regarding a wreck environment, but were designed to make the tank car look bad in support of some preconceived theories. This commenter used as an example the White Sands Missile Range fire tests which were purported to be "about as far from a wreck environment as could be devised." The Bureau does not agree with this assessment and believes that the tests conducted were reasonable (although not necessarily conservative) simulations of tank car accident scenarios. It should be noted that the time to rupture of an uninsulated tank car in a White Sands test was 24 minutes, whereas in analyzing rail accidents, the RPI/AAR has found that in at least twenty-three instances, the times required to rupture tank cars engulfed in accidental fire were less than 24 minutes. The Bureau, therefore, feels that these fire tests were reasonable simulations of wreck environments.

A similar comment was that the two full-scale fire tests conducted at White Sands were run under controlled conditions and yet variables were not controlled. Several instances were cited. The commenter stated that in the non-insulated test the car contained 3,200 gallons more propane than the car in the thermally coated test and that the initial propane temperature was lower in the thermally coated test than in the uninsulated test. The Bureau has analyzed these differences and has concluded that they did not significantly affect the test results and that the differences were partially compensating. For example, a greater initial volume of propane in the thermally coated test would have increased the time to rupture and conversely, a higher initial propane temperature would have decreased the time to rupture. The commenter noted that the propane composition was not reported for the thermally coated test. On the basis of the temperature-pressure data at the start of each test, the Bureau has concluded that there was no significant difference in the propane used in the two tests. Also, the "commercial propane" used in both tests was supplied from the same source. The commenter noted that in the uninsulated test, the temperatures and pressures reported do not match the temperatures and pressures expected. The Bureau has reviewed the temperature-pressure data from the uninsulated test and has concluded that the experimental pressure-temperature data correlate reasonably well with theoretical data. The commenter mentioned that in both tests pure propane temperature-pressure relationships were used to estimate missing data ignoring important factors of superheat, supercooling, compressibility, and the influence of impurities. The Bureau has reviewed the effects mentioned and has concluded that the procedures used in both tests were adequate.

One commenter criticized the quality of some of the reports listed in Appendix A of Notice No. HM-144. To support his position, the commenter used several quotes from "Reference 9" of the Notice. The Bureau does not concur with the assessment of this commenter and believes that the quotes used are taken out of context. For example, the commenter used the following quote from "Reference 9," page 39, first paragraph under B: "Unfortunately, no useful liquid level data were recorded." This quote only referred to direct liquid level measurements. This report also described an indirect method that was used to measure liquid level. Another misleading quote was from "Reference 9," page 39, third paragraph under VI.A: "One or more sign reversals occurred in the recorded emf values during the test, indicating that the data recorded are not reliable." This latter quote was only in reference to a particular, small group of thermocouples. The majority of thermocouples did not experience any sign reversals and were reliable.

Paragraph (b) in the Notice established the method of verifying by testing that the thermal protection system meets the performance standard. Several commenters noted that the Bureau did not identify thermal systems which are deemed acceptable and do not require further testing. The commenters recommended that either a list of approved thermal systems be presented or sufficient time be allowed for the testing of new systems. The Bureau believes there is merit to these comments. Accordingly, the following list specifies thermal protection systems that do not require test verifications under § 179.105-4(b) based upon successful simulation testing conducted by FRA. This list is not intended to be all inclusive, and systems that may be submitted to the Bureau in the future and which are shown to meet the test specifications in § 179.105-4 will also be excepted from the test verification. Information concerning the systems listed below as well as any which may be excepted from verification in the future, is available for inspection in the Docket Section, Room 6500, Transpoint Building, 2100 Second Street, SW., Washington, D.C. 20590.

1. One inch minimum thickness Deltaboard (12 pounds per cubic foot, 15 pounds per cubic foot) encased in an 11-gauge steel jacket. Manufacturer, (Deltaboard) Rockwell Manufacturing Company, Leeds, Alabama.

2. The tank car external surface is prepared by sandblasting to remove all existing paint, primer, grease and loose material. 2 mils (dry) of Thermolag primer-351 are applied to the clean surface. 165 mils (dry) of Thermolag 330-1 subliming compound is next applied to the primed surface. 5 mils (dry) of Thermolag topcoat 350 is applied to the subliming coating. Manufacturer TSI-Inc., St. Louis, Missouri.

3. The tank car external surface is prepared by sandblasting to remove all existing paint, primer, oil, grease, and loose materials. 3 mils (dry) of primer (Military Standard MIL-P-52192B) are applied to the clean surface. Chicken wire (1" hexagonal, 22 gauge) is next attached to the primed surface. 180 mils (dry) of Chartek 59 thermal coating is then applied. 3 mils (dry) of a topcoat (AMBERCOAT 75) is then applied. Manufacturer (Topcoat)-Ameron, Brea, California. Manufacturer (Chartek 59), Avco, Lowell, Massachusetts.

4. The tank car external surface is prepared by sandblasting to remove all existing paint, primer, grease and loose material. .7 mils (dry) of primer (a 1:1 ratio by volume of 513-003 base component and 9110x350 activator component) is applied to the clean surface. 235 mils (dry) of thermal shield coating (a nominal 5:1 ratio by volume of 821x359 base component and 9110x407 activator component) is next applied to the primed surface. 2 mils (dry) of topcoat (a 2:1 ratio by volume of 821x317 base component and 9110x376 activator component) is applied to the thermal shield material. Manufacturer, De Soto, Inc., Des Plaines, Illinois.

Paragraph (c) proposed a testing simulation for the "pool fire" performance standard. This paragraph prescribed in detail the pool fire test environment and the method of testing the thermal protection system in that environment. In a similar manner, paragraph (d) proposed a testing simulation for the "torch fire" performance standard. The torch fire test environment and the method of testing in that environment were specified. Many comments were submitted about both proposals.

Several commenters have questioned the availability of facilities for conducting the thermal performance tests. It should be noted that the Transportation Test Center facility is available under stipulated user agreements for conducting any of the prescribed tests in § 179.-105-4. Interested parties should contact the Transportation Test Center Director for information on use of the facility. The test facility is not unique; it uses standard components and technology. Thus, it is the Bureau's belief that the test facility and the test procedures themselves can be readily duplicated.

Some commenters requested a reduction in the pool fire time criteria on the basis that tank cars do not fail at 800° F. but fail at a higher temperature, e.g. 1050°F. In addition, some commenters contend that the 100-minute figure for pool fires is not theoretically consistent with the 30-minute requirement for the torch fire environment. In setting forth performance standards for thermal protection systems in terms of both pool fire and torch fire exposure criteria, the Bureau intended to ensure that the thermal protection system would retain the required thermal capacity with a safety factor over the range of exposures encountered. The pool fire environment, which involves interactive safety relief valve action and more extensive exposure of the tank car exterior, is considered the prime performance requirement. The 100-minute, 800° F. stipulations provide safety margins. Both full scale and simulated pool fire tests have shown that there are available thermal protection systems which can meet this pool fire criteria. Given the fundamental pool fire performance standards, the torch fire requirement is designed to ensure the adequacy of the thermal protection system in another commonly encountered, but not necessarily more severe fire environment. The Bureau does not feel that it is necessary to increase the torch resistance time in order to be theoretically consistent with the pool fire time specifications. The total performance stand-

ard is composed of the two fire environment elements and the Bureau is convinced that when viewed as a whole, the requirements not only adequately cover the scope of experienced exposures but can be met by several currently available products.

One commenter agreed with the 40 plus or minus 10 mph flame velocity requirement for the torch fire test for nonjacketed systems, but contended that it was not necessary for steel jacketed systems. The Bureau stipulated the torch fire criteria to include evaluation of erosive effects as the commenter rightfully concluded. The Bureau sees no reason why it should prejudge how a jacketed and a nonjacketed system might differ, and accordingly the specifications treat all systems equally. Each must successfully withstand the same environment and be tested under identical conditions.

Several commenters have recommended that smaller plate sizes be allowed for testing thermal protection systems. One commenter also requested that small circular plates be allowed. The Bureau's intent in requiring large test specimens is to evaluate an entire thermal shield system, including attachments. By requiring these plates, the phenomena of edge effects, inhomogeneities, heat paths due to attachment requirements, etc., are minimized.

Paragraph (e) requires that the entire tank car surface be analyzed to assure that it will achieve the performance standards for thermal protection.

Some commenters requested a clarification of what analysis is required by this paragraph. Several commenters suggested that certain structures (e.g., ladders) be exempted from this requirement. One commenter requested that a maximum of 350 square inches be exempted from this requirement. The Bureau's intent in requiring this analysis is to ensure that those portions of the tank car shell that are not covered by the thermal protection system do not pose an unacceptable safety hazard. In other words, there must be equivalent thermal resistance in these areas. In calculating the thermal resistance in these areas, the structural strength of the tank and attachments may be used to demonstrate adequate thermal resistance.

One commenter recommended that the requirement in § 179.101-1(a), Note 4, for white paint on specifications 112 and 114 compressed gas tank cars be eliminated if thermal protection systems are installed. The Bureau agrees. Paragraph (g) has been added to § 179.105-4 and it states that 112 and 114 tank cars equipped with thermal protection need not be painted white.

SECTION 179.105-5 TANK HEAD PUNCTURE RESISTANCE

The purpose of this section is to establish performance criteria and testing standards to verify compliance with the performance criteria for tank head puncture resistance systems to be applied to 112S, 112T, 112J, 114S, 114T and 114J tank cars. The section consists of three paragraphs:

(a) Performance standard;
(b) Test vertification; and
(c) Tank head puncture resistance test.

Paragraph (a) in the notice proposed a requirement that each tank car 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 (approximately the lower half of the head) at relative car speeds of 18 miles per hour.

These test conditions were developed as a result of analyzing accident data compiled by the Federal Railroad Administration which was used in promulgating MTB Docket HM-109, Tank Head Shields. Also, data derived from coupler impact tests at the Transportation Test Center were used in verifying the specific test criteria.

Several commenters stated that they questioned the need for tank head protection on shelf coupler-equipped tank cars. The Bureau does not concur; its reasons have been set forth under the discussion of § 179.105-2.

Paragraph (b) requires test verification by full-scale testing to the performance standard or by use of the "alternate test procedures" set forth in (c). However, test verification is not required if the car owner elects to install:

1. Protective head shields (§ 179.100-23); or
2. Full tank head jackets of at least ½-inch steel.

One commenter discussed MTB Docket HM-109; notice 75-3, which proposed to permit a hand brake bracket to pass through a hole in the head shield so that the bracket could be mounted on the tank head rather than on the shield. The Bureau withdrew that notice on the basis of comments indicating that the requirement for adding a ⅜-inch thick steel pad on the tank head to support the bracket would be costly and the bracket reinforcement would locally rigidize the area. This could cause poor tank steel impact resistance. The Bureau has not re-opened this matter in this docket since it was disposed of in Docket HM-109.

Likewise, commenters suggested certain changes to the specific head shield specifications contained in § 179.100-23. The Bureau believes that these suggestions, which were raised in one form or another under proceedings in HM-109, were adequately handled in that docket.

Paragraph (c) describes the test protocol to be followed in verifying a tank head puncture resistance system. One commenter questioned the requirement that the coupler of the ram car be perpendicular to the impacted car upon impact. This commenter contended that in reality, the ram car coupler would usually be at a lesser angle and in most cases would strike the impacted car a glancing blow. The Bureau agrees that the ram car coupler will often be at a lesser angle to the impacted car in actual impacts. However, impacts can occur (and indeed have been observed in the FRA/RPI/AAR Switchyard Impact Program) in which the ram car coupler is perpendicular to the impacted car. Since the perpendicular impact is the most severe situation, the Bureau believes it should be used in the test procedure. Also, having the ram car coupler strike the impacted car at some other angle would unduly complicate both conducting the test and interpreting the data.

SECTION 179.105-6 COUPLER VERTICAL RESTRAINT SYSTEM

In the notice, § 179.105-6 proposed standards and specifications for coupler vertical restraint systems. The purpose of such systems is to resist vertical disengagement of coupled couplers so as to reduce tank head puncture. The section has been somewhat reorganized in this rule from the way that the paragraphs were published in the notice, but the basic content remains the same. These paragraphs are captioned:

(a) Performance standard;
(b) Test certification and approval (entitled test verification in the notice);
(c) Coupler vertical restraint tests (proposed as paragraph (d) in the notice); and
(d) Listing of approved couplers (proposed as paragraph (c) in the notice).

Most commenters endorsed the proposal to apply a coupler restraint system to 112 and 114 tank cars. Several suggested that § 179.14 entitled *Tank Car Couplers* be revised to include "E-shelf" and "F-shelf" couplers in the list of couplers approved by the Federal Railroad Administrator. Since the notice did not address couplers on all tank cars (§ 179.14) but rather was limited to couplers on 112 and 114 tank cars, this suggestion is not being adopted in this proceeding. However, it is being considered by the FRA and the Bureau and may be adopted in the future.

Some commenters questioned the use of buff loads in the required testing. They indicated that it is a less severe test of the coupler's ability to avert coupler disengagement than a test without buff loads. Some commenters have also questioned the extreme difficulty in conducting tests with the required buff loads in existing facilities. In requiring buff loads, it was the Bureau's intent to insure that introduction of potentially higher levels of vertical loads in combination with the range of feasible buff loads did not produce other undesirable failures. The 2,000-pound buff load was meant to provide full buff engagement of the couplers while the vertical strength was tested. The intent of the specified 725,000-pound buff application with vertical loading was to insure that the coupler would not fail as a result of the combination of stresses. The Bureau is satisfied that the lower level buff load will adequately test the vertical restraint system and sees no reason to enter into testing requirements of other portions of the coupler system in this specification, particularly in view of the difficulty in applying the higher levels of buff loading in conjunction with the vertical loads testing. Accordingly, paragraphs 179.105-6(a) and (c)(3) have been revised.

In accordance with information furnished by the AAR, F-top shelf couplers are designated SF70CHT and SF70CHTE in this amendment.

SECTION 179.105-7 SAFETY RELIEF VALVES

Section 179.105-7 in the notice proposed to require the relieving or discharge capacity of safety relief valves on thermally protected cars to be at least the same as on non-insulated tank cars. The effect of this proposal would have been to permit existing safety relief valves to be retained on cars retrofitted with thermal protection and to require

the same safety relief valve capacity on newly built 112 and 114 thermally protected tank cars.

Several commenters recommended the development of a formula which takes into account the insulating effect of thermal protection. Other commenters either thought that the valve size could be reduced with increases in thermal protection or wanted an explanation of the Bureau's thinking to assist design engineers.

The Bureau, after a thorough reexamination, has confirmed that the proposed safety relief valve requirement is correct for the *minimum* thermal protection requirements of the specification. This safety relief valve requirement is consistent with the 100-minute, 800° F pool fire performance standard and other overall system considerations in protecting the tank car from premature rupture. In response to the commenter concerns, the Bureau is permitting a modified sizing equation to reflect the contribution of additional or higher thermal insulation properties of the cars covered under this specification. The application of a modifying factor to the established uninsulated tank equations, prescribed in section A6.01 of Appendix A of the "AAR Specifications for Tank Cars," supports the previously published result at the minimum required thermal insulation level, and further allows determination of appropriately reduced safety relief capacities at higher than minimum levels of thermal protection.

Thus, the rule permits a reduction in the safety relief valve capacity on a thermally insulated car in proportion to the total number of minutes the tank is protected in the pool-fire test as related to the 100-minute standard. However, owners may continue to use the current safety relief valves on retrofitted and on newly built cars if they so desire.

SECTION 179.105-8 STENCILING

Mandatory stenciling reflecting the installation of tank head puncture resistance and thermal protection systems is prescribed in § 179.105-8. The rule differs from the notice in that the provision is retained for 112S and 114S tank cars, e.g., 112 and 114 tank cars equipped with a tank head puncture resistance system, but not equipped with a thermal protection system.

Several commenters suggested that instead of using alternative letters in place of the "A" in the specification (in other words instead of using 112J in lieu of 112A to indicate a 112 car having jacketed thermal insulation), the Bureau use new specification numbers such as 122A and 124A. The Bureau has not adopted this suggestion. Since head shield equipped cars are required to be stenciled 112S and 114S, and over 600 cars have been so stenciled, the Bureau believes that continuation of this system to embrace thermal protection systems is logical. New specification numbers would necessitate additional regulatory wording in § 173.31 as well as in other sections of Part 179, for example, § 179.-100. The use of differing letters indicating specific applied systems will accomplish the same identification function in an easier manner.

Some commenters stated that the "A" is a "spacer" and persons do not expect to obtain information from this letter. Tank car specification 103 and proposed specification 113 use letters to denote information about the car design. For example, a DOT103CW tank car has a stainless steel tank and a proposed DOT113C120W tank car is designed to be capable of handling cold temperature product loadings such as encountered with liquefied natural gas.

For these reasons, the stenciling system proposed in the notice is being retained along with the current requirement for 112S and 114S stenciling.

Discussion of Other Comments

SPECIFICATION 105 TANK CARS

Several commenters mentioned that many DOT specification 105 tank cars are used to transport the same products as are transported in 112 and 114 tank cars. The commenters believe that the 105 tank car may not have as good thermal and tank head puncture resistance protection as is being specified for the 112T/J and 114T/J cars. This matter is beyond the scope of this docket. Therefore, the Bureau will consider the matter of safety standards for specification 105 tank cars and may initiate rulemaking in the future.

TANK CAR STEEL

One commenter stated that a report by Dr. W. S. Pellini entitled, "Fracture Properties of Tank Car Steels—Characterization and Analysis" was not part of the references cited in the notice of proposed rulemaking. The report was not included because the report was not available to the Bureau at the time of the publication of the notice. However, the views of Dr. Pellini were known to the Bureau and were used in evaluating the overall tank car problem. On February 24, 1975, Dr. Pellini gave a presentation on tank car steels to representatives of DOT and industry. Also, on several occasions Dr. Pellini has discussed his views on tank car steels with DOT staff members. Based upon the work conducted by the National Bureau of Standards, the Battelle Columbus Laboratories, and Dr. Pellini, the Bureau concluded that existing tank car steels, are adequate. Accordingly, the Bureau did not propose any change to existing tank car steel specifications in this proceeding.

DOCKET HM-125

As was indicated in the notice, with the promulgation of standards and specifications upgrading existing specification 112 and 114 so as to improve design and construction, the Bureau will withdraw notice No. 75-4, under Docket HM-125.

ECONOMIC IMPACT

Several commenters took exception to the estimated cost projections stated in the notice. The principal objection was the use of minimum imposed costs rather than maximum possible costs. The use of minimum costs is considered to be the only practicable means for calculation of the economic impact of a rule. Any other calculations would of necessity be based on the anticipated decisions of car owners as to the options they choose to comply with the rule. However, the costs for protective head shields are included as suggested by several commenters even though they were required by an earlier rule (Amendment No. 179-15, 39 FR 27572, July 30, 1974). Also, updated information on the costs for couplers and the purging of cars has been used in the revised calculations. Adjustments have also been made to take into account that certain of the requirements proposed in the notice are not included in this rule.

The implementation of this rule will require a cash outlay of $107.9 million in 1976 dollars.

The following summarizes the per unit tank car investment costs of the rule and the number of tank cars thought to be affected.

Car type and utilization	Additional protection	Minimum cost	Number of tank cars
(112T/J, 114T/J) flammable gases, anhydrous ammonia, nonflammable gases, hazardous liquids.	Thermal, head, and couplers.	$6,900	15,300
(112S, 114S) anhydrous ammonia, nonflammable gases, hazardous liquids.	Head and couplers.....	1,900	2,700
(112A, 114A) nonflammable gases, hazardous liquids.....	Couplers.....	500	2,000

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—public safety that will be derived by significantly reducing the number of deaths, injuries and evacuations that have characterized the accident experience of 112 and 114 tank cars. Since 1969, more than 500 of these tank cars have been involved in derailments of which more than 170 of these cars lost some or all of their lading. These occurrences resulted in 20 deaths, 855 injuries, and 45 major evacuations involving more than 40,000 persons. Four of these accidents resulted in estimated losses of more than $100,-000,000.

The Bureau considers that the requirements set forth in this rule represent a cost-effective solution to the safety problems presented by 112 and 114 tank cars over the past several years.

In addition to the substantive matters discussed above, the Bureau has also made several editorial changes to certain

regulatory language proposed in the Notice for the purpose of clarity. These changes in language, unless discussed as part of a substantive provision, do not alter the requirements of any proposal made in the Notice and adopted herein.

Primary drafters of this document are William F. Black, Leavitt A. Peterson, Edward F. Conway, Jr. (Chief Counsel's Office) of the Federal Railroad Administration, Alan I. Roberts and Joseph S. Nalevanko of the Materials Transportation Bureau, and George W. Tenley, Jr. of the Office of the Assistant General Counsel for Materials Transportation Law.

In consideration of the foregoing, Parts 173 and 179 of Title 49 Code of Federal Regulations are amended as follows:

1. In § 173.31 paragraph (a)(3) is revised; paragraph (a)(5) is added to read as follows:

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

(a) * * *

(3) Unless otherwise specifically provided in this Part—

(i) When class DOT-105A, 105AL, 106A, 109A-AL, 110A, 111A, 112A, 112S, 112T, 112J, 114A, 114S, 114T, or 114J tank car tanks are prescribed, the same class tanks having higher marked test pressures than those prescribed may also be used.

(ii) When class DOT-111AW1 tank car tanks are prescribed, class 111AW3 tank car tanks may also be used.

(iii) 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.

(iv) When class DOT-112S tank car tanks are prescribed, classes DOT-112T and 112J tanks having equal or higher marked test pressures than those prescribed may also be used.

(v) 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.

(vi) When class DOT-114S tank car tanks are prescribed, classes DOT-114T, and 114J tanks having equal or higher marked test pressures than those prescribed may also be used.

* * * * *

(5) After June 30, 1979, each specification 112 and 114 tank car built before January 1, 1978, must be equipped with shelf couplers in accordance with § 179.105–6 of this subchapter.

* * * * *

2. In § 173.314 paragraph (c) Table Note 23 is revised and reference thereto in Column 3 opposite Anhydrous ammonia is deleted; Note 24 is added and reference thereto is made in Column 3 opposite Anhydrous ammonia in the space provided by the deletion of Note 23 as follows:

§ 173.314 Requirements for compressed gases in tank cars.

* * * * *

(c) * * *

Kind of gas	Maximum permitted filling density, note 1 (in percent)	Required tank car [1]
Anhydrous ammonia	50.5	DOT-106A500-X, note 7.
	57.9	DOT-105A300W.
	57.6	DOT-112A400-F, 112A340-W, 111A340-W, notes 15 and 24.
	58.8	DOT-112A400-F, 112A340-W, 111A340-W, notes 15 and 24.

[1] See sec. 173.31(a) (2) and (3).

* * * * *

NOTE 23.—After Dec. 31, 1981, each specification 112 and 114 tank car built before Jan. 1, 1978, used for the transportation of flammable compressed gases must be equipped with thermal protection and tank head puncture resistance systems in accordance with sec. 179.105 of this subchapter.

NOTE 24.—After Dec. 31, 1981, each specification 112 and 114 tank car built before Jan. 1, 1978, used for the transportation of anhydrous ammonia must be equipped with a tank head puncture resistance system in accordance with sec. 179.105 of this subchapter.

* * * * *

3. Section 179.105 is added immediately following § 179.104 to read as follows:

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

§ 179.105–1 General.

(a) In addition to the requirements of this section, each tank car built under specification 112 and 114 must meet the applicable requirements of §§ 179.100, 179.101, 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, after December 31, 1981, each specification 112 and 114 tank car manufactured to specifications promulgated by the Canadian Transport Commission that is not equipped as described in this section may not be used to transport compressed gases in the United States.

§ 179.105–2 New cars.

(a) Each specification 112A and 114A tank car built after December 31, 1977, shall be equipped with a coupler restraint system that meets the requirements of § 179.105–6.

(b) Each specification 112S and 114S tank car built after December 31, 1977, shall be equipped with:

(1) A coupler restraint system that meets the requirements of § 179.105–6; and

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

(c) Each specification 112T, 112J, 114T, and 114J tank car built after December 31, 1977, shall be equipped with:

(1) A coupler restraint system that meets the requirements of § 179.105–6;

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

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

(4) A safety relief valve that meets the requirements of § 179.105–7.

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

§ 179.105–3 Previously built cars.

(a) After June 30, 1979, each specification 112 and 114 tank car built before January 1, 1978, shall be equipped with a coupler restraint system that meets the requirements of § 179.105–6.

(b) Each tank car built before January 1, 1978, required to meet specification 112S and 114S, shall be equipped with a tank head puncture resistance system in accordance with the requirements of paragraph (d) of this section and § 179.105–5, and he stenciled as prescribed in § 179.105–8.

(c) Each tank car built before January 1, 1978, required to meet specification 112J, 112T, 114J, and 114T, shall:

(1) Be equipped with a thermal protective system that meets the requirements of § 179.105–4;

(2) Be equipped with a tank head puncture resistance system that meets the requirements of § 179.105–5;

(3) Be equipped with a safety relief valve that meets the requirements of § 179.105–7; and

(4) Comply with paragraph (d) of this section.

(5) Be stenciled as prescribed in § 179.105–8.

(d) Each tank car owner shall equip its tank cars which are subject to paragraphs (b) and (c) of this section in accordance with the following schedule:

(1) At least 20 percent of those cars owned on January 1, 1979, must be so equipped by that date;

(2) At least 50 percent of those cars owned on January 1, 1980, must be so equipped by that date;

(3) At least 80 percent of those cars owned on January 1, 1981, must be so equipped by that date; and

(4) All of those cars owned on January 1, 1982, must be so equipped by that date.

§ 179.105–4 Thermal protection.

(a) *Performance standard.* Each specification 112T, 112J, 114T, and 114J 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.* Except as provided in paragraph (c) of this section,

compliance with the requirements of paragraph (a) of this section shall be verified by testing and analyzing the thermal protection system in accordance with paragraphs (d), (e), and (f) 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) *Excepted systems* The Department maintains a list of thermal protection systems which comply with the requirements of paragraphs (d) and (e) of this section and which are excepted from the test verification requirement of paragraph (b) of this section. Information necessary to equip tank cars with one of these systems, is available in the Section of Dockets, Room 6500, Trans Point Building, 2100 Second Street SW., Washington, D.C. 20590

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

(i) The source of the simulated pool fire shall be a hydrocarbon fuel. The flame temperature from the simulated pool fire shall be at 1,600° F plus-or-minus 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 $\frac{5}{8}$-inch thick. The plate 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 pool fire, and shall be divided into nine equal squares with 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 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

(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 (d)(1) of this section in the following manner:

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

(ii) The uninsulated side 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 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 insulated 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 uninsulated side 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

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

(i) The source of the simulated torch shall be a hydrocarbon fuel. The flame temperature from the simulated torch shall be 2,200° F plus-or-minus 100° F throughout the duration of the test Torch velocities shall be 40 miles per hour plus-or-minus 10 miles per hour 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 four feet by four feet by nominal $\frac{5}{8}$-inch thick. The plate 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, and shall be divided into nine equal squares with 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 plus-or-minus 0.5 minutes of torch simulation exposure

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

(i) The thermal insulation system shall cover one side of a steel plate identical to that used to simulate a torch fire under paragraph (e)(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 (e)(1)(ii) of this section to record the thermal response of the steel

(iii) Before exposure to the simulated torch, 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 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 uninsulated side 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

(f) *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.

(g) *Exterior tank color* Notwithstanding the provisions of § 179.101-1(a) Table, Note 4, each specification 112 and 114 tank car equipped with thermal protection that complies with the requirements of paragraph (a) of this section need not be painted white.

§ 179.105–5 Tank head puncture resistance.

(a) *Performance standard.* Each specification 112S, 112T, 112J, 114S, 114T, and 114J 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 coupled to one or more "backup" cars which have a total weight of at least 480,000 pounds 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 $\frac{1}{2}$-inch thick and made from steels specified in § 179.100–23(a)(1) 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 shall protrude from the end of the ram

car so that it is the leading location of perpendicular contact with the standing tank car.

(2) The impacted test car shall 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 shall be conducted with the coupler on the vertical centerline of the ram car. One test shall be conducted with the coupler at a height of 21 inches, plus-or-minus one-inch, above the top of the sill; the other test shall be conducted with the coupler height at 31 inches, plus-or-minus one-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 velocity of impact (in miles per hour)	Restriction
Minimum weight of ram car plus attached cars (in pounds):		
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 2,000 pounds, when coupled to cars equipped with couplers that do have this vertical restraint capability, and cars equipped with couplers that do not have this vertical restraint capability.

(b) *Test verification and approval.* Except as provided in paragraph (d) of this section, compliance with the requirements of paragraph (a) of this section shall be achieved by verification testing of the coupler vertical restraint system in accordance with paragraph (c) of this section, and approval of the Federal Railroad Administrator.

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

(1) The test coupler shall be tested with: A mating coupler (or simulated coupler) having only frictional vertical force resistance at the mating interface; a mating coupler (or simulated coupler) having the capabilities described in paragraph (a) of this section.

(2) The testing apparatus shall simulate the vertical coupler performance at the mating interface and may not interfere with coupler failure or otherwise inhibit failure due to force applications and reactions.

(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 nominal 2,000-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 (c)(3)(i) and (c)(3)(ii) of this section. A test is successful when a vertical disengagement or material failure does not occur during any of the prescribed load combinations.

(d) *Listing of approved couplers.* The following classes of couplers have been approved by the Federal Railroad Administrator and need not be verified by the testing requirements of paragraph (c) 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. SF70CHT or SF70CHTE.

§ 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 non-insulated tanks. If the thermal protection demonstrates that in a pool fire simulation the thermocouples on the back of the steel plate do not indicate a plate temperature in excess of 800 F. for a time period exceeding 100 minutes, the relieving or discharge capacity may be reduced in proportion to the ratio of 100 minutes to the total time in minutes of the steel plate required to exceed 800°F. by at least one thermocouple.

§ 179.105-8 Stenciling.

(a) Each 112 and 114 tank car that is equipped with a tank puncture resistance system as specified in § 179.105-5 shall have the letter "S" substituted for the "A" in the specification marking.

(b) 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" and "S" in the specification marking.

(c) Each 112 and 114 tank car that is equipped with a non-jacketed 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).)

NOTE.—The Materials Transportation Bureau has determined that this document does not contain a major proposal requiring the preparation of an Economic 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 September 9, 1977.

JOHN J. FEARNSIDES,
Acting Director,
Materials Transportation Bureau.

[FR Doc.77-26774 Filed 9-14-77;8:45 am]