Report of Committee on Flammable Liquids
Correlating Committee

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Englewood, NJ

Martin F. Henry, Secretary
National Fire Protection Association
(Nonvoting)

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Donald M. Johnson, San Bruno, CA
Rep. Western Oil & Gas Assn.
F. Owen Kubias, SCM/Glidden
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Technical Committee on
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Arthur A. Krawetz, Phoenix Chemical Laboratory Inc.
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Harry H. McIntyre, Harry McIntyre Assoc.
Paul G. Sikoris, Frank B Hall & Co. of NJ
Jack S. Snyder, Merck & Co., Inc.
R. I. Spencer, Industrial Risk Insurers
Pat R. Wrigley, Nat'l Petroleum Refiners Assn.

Alternates

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Technical Committee on
Liquid Fuel Burning Equipment

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Richard A. Daniels, Ralph Gerdes & Assoc., Inc.
Robert B. Greener, Public Fuel Service Inc.
Rep. Petroleum Marketers Assn. of America
Richard A. Gross, Industrial Risk Insurers
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Technical Committee on
Manufacture of Organic Coatings

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Alternates

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(Alternate to Steel Tank Institute)
Rudolph C. White, American Petroleum Institute
(Alternate to W. C. Jackson)

This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

The Report of the Committee on Flammable Liquids is presented for adoption in 6 parts.


Part II of this Report has been submitted to letter ballot of the Technical Committee on Liquid Fuel Burning Equipment which consists of 9 voting members. The ballot was in two segments. The first segment concerned itself with Proposal 31-22 of the Report. Seven members voted affirmatively, and 2 voted negatively (Messrs. Hogan and Connors).

Mr. Hogan's reason for the negative vote indicated that he would submit substantiation on the matter in the form of a public comment at the appropriate time.

Mr. Connors negative vote indicated that, in his opinion, all portable kerosene heaters and stoves should be vented by means of an approved chimney or vent.

The second segment of Part II dealt with the remainder of the Report, and all 9 members voted affirmatively.

Part II of this Report has also been submitted to letter ballot of the Correlating Committee on Flammable Liquids which consists of 8 voting members; all of whom voted affirmatively.


Part III of this Report has been submitted to letter ballot of the Technical Committee on Manufacture of Organic Coatings which consists of 6 voting members; of whom 5 voted affirmatively, and 1 ballot was not returned (Mr. Roy).

Part III of this Report has also been submitted to letter ballot of the Correlating Committee on Flammable Liquids which consists of 8 voting members; all of whom voted affirmatively.

Part IV of this Report, was prepared by the Technical Committee on Tank Leakage and Repair Safeguards and proposes for adoption amendments to NFPA 327-1982, Standard for the Installation of Oil Burning Equipment. NFPA 327-1982 is published in Volume 1 of the 1985 National Fire Codes and in separate pamphlet form.

Part IV of this Report has been submitted to letter ballot of the Technical Committee on Tank Leakage and Repair Safeguards which consists of 15 voting members; of whom 11 voted affirmatively, and 4 ballots were not returned (Messrs. Hasselback, Killmar, Sharp and Wrigley).

Part IV of this Report has also been submitted to letter ballot of the Correlating Committee on Flammable Liquids which consists of 8 voting members; all of whom voted affirmatively.
Part V of this Report was prepared by the Technical Committee on Tank Leakage and Repair Safeguards and proposes for adoption amendments to NFPA 328-1982, Recommended Practice for the Control of Flammable and Combustible Liquids and Gases in Manholes, Sewers, and Similar Underground Structures. NFPA 328-1982 is published in Volume 7 of the 1985 National Fire Codes and in separate pamphlet form.

Part V of this Report has been submitted to letter ballot of the Technical Committee on Tank Leakage and Repair Safeguards which consists of 15 voting members; of whom 11 voted affirmatively, and 4 ballots were not returned (Messrs. Hasselback, Killmar, Sharp and Wrigley).

Part V of this Report has also been submitted to letter ballot of the Correlating Committee on Flammable Liquids which consists of 8 voting members; all of whom voted affirmatively.


Part VI of this Report has been submitted to letter ballot of the Technical Committee on Tank Leakage and Repair Safeguards which consists of 15 voting members; of whom 11 voted affirmatively, and 4 ballots were not returned (Messrs. Hasselback, Killmar, Sharp and Wrigley).

Part VI of this Report has also been submitted to letter ballot of the Correlating Committee on Flammable Liquids which consists of 8 voting members; all of whom voted affirmatively.
PART I

321-1 - (I-2 Footnote): Accept
SUBMITTER: Technical Committee on Classification and Properties of Flammable and Combustible Liquids
RECOMMENDATION: Revise footnote to "Flash Point" as follows:
"Certain solutions of liquids in water may exhibit a flash point under the standard closed-cup test procedures but will not burn and will even extinguish a fire. To assist in the identification of such solutions the following ASTM standards, developed through the consensus standards procedures of that society may be used: ASTM D4207, Standard Test Method for Sustained Burning of Low Viscosity Liquid Mixtures by the Wick Test, and ASTM-4206 Standard Test Method for Sustained Burning of Liquid Mixtures by the Setashflash Tester (Open Cup). Liquid mixtures that do not sustain combustion for a specified time at a specified temperature are considered not to sustain burning. These tests provide additional data for determining proper classification and handling of such mixtures. In a confined space such mixtures still could create a flammable vapor-air mixture depending to a large extent upon the amount of flammable material in the mixture and the quantity of the spill."
SUBSTANTIATION: This will help to clarify which tests might be used in providing exemptions of certain liquids exhibiting flash points from regulations.
COMMITTEE ACTION: Accept.

321-2 - (I-2 Footnote (New)): Accept
SUBMITTER: Technical Committee on Classification and Properties of Flammable and Combustible Liquids
RECOMMENDATION: Insert a new additional footnote under "Flash Point" as follows:
(3) ASTM E502, Standard Test Method for Selection and Use of ASTM Standards for the Determination of Flash Point of Chemicals by Closed Cup Methods, covers the determination of the flash point of liquid and solid chemical compounds flashing from below 16°F to 700°F (−10 ° to 370°C). The results obtained are discussed along with possible sources of error and factors that might cause interference.
SUBSTANTIATION: This is a summary of good practice in using closed-cup flash point equipment with considerable information on the significance of the flash point test and possible interferences.
COMMITTEE ACTION: Accept.

321-3 - (I-2): Accept
SUBMITTER: Technical Committee on Classification and Properties of Flammable and Combustible Liquids
RECOMMENDATION: Under the listed Flash Point methods, amend (a) to read as follows:
(a) The flash point of a liquid having a viscosity below 5.5 cSt at 104°F (40°C) or below 9.5 cSt at 77°F (25°C) shall be determined in accordance with ASTM D-56, Standard Method of Test for Flash Point by the Tag Closed Tester. Cut-back asphalts, those liquids which tend to form a surface film and materials which contain suspended solids are excluded from study by ASTM D-56-B2 even if they otherwise meet the viscosity requirements.
Amend (b) to read:
(b) The flash point of a liquid having a viscosity of 5.5 cSt or more at 104°F (40°C) or 9.5 cSt or more at 77°F (25°C) or a flash point of 200°F (93.4°C) or higher shall be determined in accordance with ASTM D-93, Standard Test Method for Flash Point by the Pensky-Martens Closed Tester.
Delete (c), ASTM D-3243, and reletter subsequent test methods as appropriate.
SUBSTANTIATION: These changes bring NFPA 321 into conformity with current ASTM test methods.
COMMITTEE ACTION: Accept.

321-4 - (I-2): Accept
SUBMITTER: Technical Committee on Classification and Properties of Flammable and Combustible Liquids
RECOMMENDATION: Under definition of Flash Point, subsection (e) delete the words "specific Setashflash Methods exist (CF ASTM D 324–77 .... components)" and insert "ASTM D 3278 is specifically required" in place of the deleted words.
SUBSTANTIATION: ASTM D 3243 has been withdrawn.
COMMITTEE ACTION: Accept.

321-5 - (I-2): Accept
SUBMITTER: Technical Committee on Classification and Properties of Flammable and Combustible Liquids
RECOMMENDATION: Update the ASTM Methods as follows:
ASTM D-56-79 to ASTM D-56
ASTM D-3282-70 to ASTM D-3282
ASTM D-3282-70 to ASTM D-3278
ASTM D-323-79 to ASTM D-323
ASTM D-86-78 to ASTM D-86
SUBSTANTIATION: These are editorial changes.
COMMITTEE ACTION: Accept.

321-6 - (I-3.4 (New)): Accept
SUBMITTER: Technical Committee on Classification and Properties of Flammable and Combustible Liquids
RECOMMENDATION: Establish a new Section I-3.4 as follows:
I-3.4 Comparative Classification of Liquids.
Agency NFPA
DOT Flammable Class I Below 100°F (37.8°C)
Combustible Class II 100°F to 200°F (37.8°C to 93.3°C)
Class IIIA 200°F to 350°F (93.3°C to 176.7°C)
UN Flammable Class I Below 140°F (60°C)
SUBSTANTIATION: In the Committee's opinion, this table will be helpful and useful to the Code-user.
COMMITTEE ACTION: Accept.
PART II

31- 1 - (1-1.1 and 1-1.2): Accept
SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment
RECOMMENDATION: In 1-1.1 delete the phrase "except internal . . . . . weed burners". Establish a new 1-1.2 to read:
1-1.2 This standard does not apply to internal combustion engines, oil lamps, and portable devices such as blow torches, melting pots, and weed burners.
SUBSTANTIATION: This constitutes an editorial clarification.
COMMITTEE ACTION: Accept.

31- 2 - (Figure 1B): Accept
SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment
RECOMMENDATION: Delete the asterisk in the note adjacent to the figure.
SUBSTANTIATION: This is editorial. The asterisk has no significance.
COMMITTEE ACTION: Accept.

31- 3 - (1-6.1(a), (b), (c)): Accept
SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment
RECOMMENDATION: Change the (a), (b), (c) format to a direct statement, as follows:
1-6.1 All oil-fired appliances other than direct-fired heaters, listed kerosene stoves, and listed portable kerosene heaters, shall be chimney connected except as provided in Section 1-B.
SUBSTANTIATION: This is an editorial clarification.
COMMITTEE ACTION: Accept.

31- 4 - (Not Specified): Accept in Principle
SUBMITTER: Frederic M. Blum, Wynnewood, PA
COMMITTEE ACTION: Accept in Principle.

31- 5 - (1-8.2): Accept
SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment
RECOMMENDATION: Change 1-8.2 to read as follows:
1-8.2 Direct Vent Appliances. Direct vent appliances shall be listed in accordance with their listing and the manufacturer's instruction.
SUBSTANTIATION: This change is appropriate, and in fact is editorial in nature, since the definition had been changed in a previous edition to direct-vent appliance sealed combustion appliance.
COMMITTEE ACTION: Accept.

31- 6 - (1-10.3): Accept
SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment
RECOMMENDATION: In the second sentence, insert the word "to" between "pressure" and "15 psi"; and change the "15 psi" to read "15 psig".
SUBSTANTIATION: These are editorial corrections.
COMMITTEE ACTION: Accept.

31- 7 - (Not Specified): Accept in Principle
SUBMITTER: Frederic M. Blum, Wynnewood, PA
RECOMMENDATION: Add a paragraph to require all oil-fired appliances to be fitted with an in-line, replaceable-element filter on the oil supply line.
SUBSTANTIATION: The oil pump strainer (or equivalent rotary chopper-filter) and the filter built into the oil nozzle are not fine enough to remove the finest sediment and sludge, nor can they remove water. Over time, the nozzle can become clogged, leading to soot production and consequent puffbacks; flue pipe and chimney clogging; diminished heating system efficiency; and fire hazards.
COMMITTEE ACTION: Accept in Principle.

31- 8 - (2-1.2.3(a)): Accept
SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment
RECOMMENDATION: In 2-1.2.3(a), add a final reference as follows:
SUBSTANTIATION: Making reference to this standard is appropriate in that it recognizes glass-fiber tanks in underground usage, and maintains consistency with NFPA 30, Flammable and Combustible Liquids Code.
COMMITTEE ACTION: Accept.

31- 9 - (2-1.2.3(c) (New)): Accept
SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment
RECOMMENDATION: Establish a new 2-1.2.3(c) to read:
SUBSTANTIATION: Reference to this standard provides coverage to tanks that are suitable for the service and maintains consistency with NFPA 30, Flammable and Combustible Liquids Code.
COMMITTEE ACTION: Accept.

31-10 - (2-1.2.3, 2-3.1.3, 2-4.4, 2-6.1): Reject
SUBMITTER: A. G. Meyers, Clemmer Industries Ltd.
RECOMMENDATION: The following paragraphs are suggested for changes to include the ULC standards:
2-1.2.3 Tanks shall be used under substantially atmospheric pressure shall be built in accordance with approved standards of design. Atmospheric tanks may be built in accordance with:
The NFPA 31 Committee sees no compelling reason to cite a counterpart to NFPA 31. CSAB 139 is certainly a good Canadian standard on oil burning equipment that is is a Canadian standard on oil burning equipment that is a counterpart to NFPA 31. CSAB 139 is certainly a good standard and is used in Canada, and it makes references to the relevant Canadian standards and specifications. The NFPA 31 Committee sees no compelling reason to cite the Canadian standards, since references can never be all-inclusive, and listing of too many references might render NFPA 31 unwieldy for use. There are many worthwhile standards developed in other countries as well, and it would be impractical to list all of them.

31-11 - (2-1.2.4): Accept
SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment
RECOMMENDATION: Correct the reference from 2-1.23(a) to 2-1.23(b).
COMMITTEE ACTION: Accept.

31-12 - (2-2.1): Accept
SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment
RECOMMENDATION: After the reference to UL 58, add additional references to UL 1316 and to ASTM D-4021.
COMMITTEE ACTION: Accept.

31-13 - (2-2.4): Accept
SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment
RECOMMENDATION: Revise section 2-2.4 to read as follows:
2-2.4 Tanks and their piping shall be protected by either:
(a) A properly engineered, installed and maintained cathodic protection system in accordance with recognized standards of design, such as:
   (b) Corrosion resistant materials of construction such as special alloys, fiber glass reinforced plastic, or fiber glass reinforced plastic coatings, or equivalent approved system. Selection of the type of protection to be employed shall be based upon the corrosion history of the area and the judgment of a qualified engineer.
The authority having jurisdiction may waive the requirements for corrosion protection where evidence is provided that such protection is not necessary.
(See API Publication 1615-1979, Installation of Underground Petroleum Storage Systems, for further information.)
SUBSTANTIATION: This revision is made in order to achieve consistency with NFPA 30, Flammable and Combustible Liquids Code.
COMMITTEE ACTION: Accept.
COMMITTEE ACTION: Reject.

COMMITTEE COMMENT: The wording in this sentence of 2-6.7.2 is identical with, and is an extraction from, NFPA 30, Flammable and Combustible Liquids Code. In the Committee's opinion, it should remain as is to be consistent with NFPA 30. In addition, the Submitter offers no substantiation to support his contention on weak roof-to-shell seams.

31-19 - (2-6.7.2): Accept

SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment

RECOMMENDATION: In 2-6.7.2, add a new sentence at the end to read: "Design methods which will provide a weak roof-to-shell seam construction are contained in API 650, Welded Steel Tanks for Oil Storage, and UL 142, Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids."

SUBSTANTIATION: This addition will bring NFPA 31 into consistency with NFPA 30, Flammable and Combustible Liquids Code.

COMMITTEE ACTION: Accept.

31-20 - (3-3.3): Accept

SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment

RECOMMENDATION: Change the reference from "3-3.6 and Section 3-8" to read "3-3.6 or Section 3-8".

SUBSTANTIATION: This is an editorial change.

COMMITTEE ACTION: Accept.

31-21 - (Table 4-1): Accept

SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment

RECOMMENDATION: In Table 4-1 under "Form III, last line, change "II, IV, and IV" to read "II, IV, and V".

SUBSTANTIATION: This is an editorial change.

COMMITTEE ACTION: Accept.

31-22 - (Not Specified): Reject

SUBMITTER: Alfred J. Hogan, IAFC, Inc.

RECOMMENDATION: Add a paragraph as follows:

"Liquid fuel burning heaters may be used when they are:
1. Listed by a nationally recognized testing agency.
2. Permanently connected to an approved chimney or vent."

SUBSTANTIATION: A serious fire problem exists with liquid fuel burning heaters being located too close to combustibles and in means of egress. As the use of this means of heating has increased, so have the statistics of deaths, injuries and extensive property losses as compiled by the U.S. Consumer Product Safety Commission, ISFSI, and the Citizens Committee for Fire Prevention. This proposal is made in the interest of life safety from fire and is supported by the Auxiliary Heating Committee of the Fire Marshals Association of North America, ISFSI, and IAFC.

COMMITTEE ACTION: Reject.

COMMITTEE COMMENT: No section of the Code is cited by the Submitter. This phrase "liquid fuel burning heaters" is not defined as a code term or entity, and this makes it somewhat unclear as to the intent of the submission. Based on the Submitter's substantiation, it appears that the intent is to prohibit all devices that are portable. If the proposal were to be accepted as stated, a major conflict would be created within the code, and especially with Chapter 5 which deals with portable heaters. Use of the phrase "nationally recognized testing laboratory" is also, in the Committee's opinion, inappropriate, since there is no broadly recognized definition of the term. It should be noted that Section 1-3 of NFPA 31 already indicates that all oil-burning equipment shall be approved, so the authority having jurisdiction is empowered by the Code to accept or reject heating devices, and Section 3-3 indicates that devices that are listed may be considered as meeting the requirements of the standard.

A further difficulty is that commercial and industrial type units come under the scope of this standard, and are often approved without benefit of a listing; and many other types of appliances such as portable construction heaters and industrial direct-fired heaters, are not designed for chimney or vent connection and acceptance of the proposal would preclude the use of these appliances. In addition, guidance for proper and safe use of portable heaters would be lost to the Code user, since they are covered in Chapter 5. Even with installed heaters, combustible material can be placed too close to heating devices.

It is the Committee's opinion that oil burning equipment should be approved, and the Code now provides for that approval. The Code addresses equipment that is not required to be chimney-connected, and it is not our intent to cease addressing that important subject.

31-23 - (5-1.2.1)): Accept

SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment

RECOMMENDATION: Change the first sentence to read:

"Kerosene and oil stoves and portable kerosene heaters shall be equipped with a primary safety control, or be inherently constructed to prevent abnormal discharge of fuel at the burner in case of ignition failure or flame extinction."

SUBSTANTIATION: The wick type kerosene heater, which is the most prevalent, does not require a primary safety control to stop the flow of oil in case of flame failure, nor would this be technically feasible. The oil flow in a wick fed device will automatically and inherently cease when the flame is extinguished due to the nature of capillary action. It should be remembered too that the wick is the only means of fuel transfer from the reservoir at the bottom of the heater to the combustion chamber above.

There are some wickless type portable kerosene heaters, however, that employ a vaporized fuel process where a primary safety control should be, and is, required.

COMMITTEE ACTION: Accept.

31-24 - (5-1.6.1): Accept

SUBMITTER: Technical Committee on Liquid Fuel Burning Equipment

RECOMMENDATION: Establish a new 5-1.6.1 as follows, and renumber present 5-1.6.1 and following sections accordingly:

5-1.6.1 Portable kerosene heaters shall be listed.

SUBSTANTIATION: There are heaters in the marketplace that now require listing for sale or use of portable kerosene heaters.

COMMITTEE ACTION: Accept.
PART III

35-1 - (1-6): Accept
SUBMITTER: Technical Committee on Manufacture of Organic Coatings
RECOMMENDATION: Replace present section with new
6-1.1: Nitrocellulose is a flammable material. Its burning rate varies depending on its wetting agent and degree of dryness.
(a) Solvent-wet nitrocellulose, wet with flammable liquids such as alcohol and toluene, has the same degree of hazard as the flammable wetting agent. The burning rate is similar to the wetting agent alone.
(b) Water-wet nitrocellulose is difficult to ignite and, once ignited, is slower burning than solvent-wet nitrocellulose.
(c) Plasticized nitrocellulose. A colloidal, chip or similar-particle-type nitrocellulose plasticized with not less than 18 percent by weight plasticizer has a different physical form and flammability hazard from solvent- or water-wet nitrocellulose.
(d) Dry nitrocellulose. Nitrocellulose containing less than the minimum wetting agents described above.
SUBSTANTIATION: The definition of nitrocellulose as written does not completely identify the product. As an example, plasticized nitrocellulose, which was not included in the present definition, has a different degree of hazard as the flammable wetting agent. The burning rate is similar to the wetting agent alone.
COMMITTEE ACTION: Accept.

35-2 - (6-1.1.1): Accept
SUBMITTER: Technical Committee on Manufacture of Organic Coatings
RECOMMENDATION: Replace present section with new
6-1.1.1: Nitrocellulose is a flammable material. Its burning rate varies depending on its wetting agent and degree of dryness.
(a) Solvent-wet nitrocellulose, wet with flammable liquids such as alcohol and toluene, has the same degree of hazard as the flammable wetting agent. The burning rate is similar to the wetting agent alone.
(b) Water-wet nitrocellulose is difficult to ignite and, once ignited, is slower burning than solvent-wet nitrocellulose.
(c) Plasticized nitrocellulose burns very intensely and is a more serious fire hazard than solvent wet nitrocellulose.
(d) Dry nitrocellulose burns rapidly and with intense heat and shall be avoided in all operations.
SUBSTANTIATION: This proposed substitution includes plasticized nitrocellulose and better describes the flammability of the different types of nitrocellulose.
COMMITTEE ACTION: Accept.

35-3 - (6-1.2.3): Accept
SUBMITTER: Technical Committee on Manufacture of Organic Coatings
RECOMMENDATION: Revise 6-1.2.3 to read as follows:
6-1.2.3 Drums shall not be dropped. If there is a difference in elevation, the handling equipment shall not drop, puncture or damage the drums. Always keep drums under control.
SUBSTANTIATION: The addition of "Always keep drums under control" is just an added caution for proper handling.
COMMITTEE ACTION: Accept.

35-4 - (6-1.3.1(a)): Accept
SUBMITTER: Technical Committee on Manufacture of Organic Coatings
RECOMMENDATION: Revise 6-1.3.1(a) to read as follows:
6-1.3.1 Nitrocellulose shall be stored only in approved DOT closed containers. Before storing drums, make sure their closures are tight in order to prevent loss of wetting agent by evaporation.
6-1.3.7 Heat should be avoided in the storage area, where heat is necessary, the building should be equipped with low-pressure steam or hot-water radiators. These shall be so located as to avoid contact with the drums of nitrocellulose under any circumstances. Overheating of drums by direct contact with hot surfaces or by storage in an overheated environment may cause pressure buildup in the drums and eventual release of the lid.

35-5 - (6-1.3.1(b) and (c)): Accept
SUBMITTER: Technical Committee on Manufacture of Organic Coatings
RECOMMENDATION: Revise 6-1.3.1(b) as follows:
(b) On a detached pad or in a detached noncombustible structure such as a roofed shed, located as shown in Table 6-1.3.1. A sprinkler system providing a density of 0.35 gpm per sq ft (1.3 L/min) is recommended but not mandatory. If, however, the recommended sprinkler system is provided, the distances in Table 6-1.3.1 can be reduced by one-half.

Table 6-1.3.1

| Wet Nitrocellulose Distance* of Property Line or Nearest Important Building |
|---------------------------|-----------------------------|
| (Dry Weight) | Nearest Important Building |
| Pounds | Feet (Meters) |
| Up to 1,000 | 50 (15) |
| 1,000-5,000 | 75 (23) |
| 5,000-10,000 | 100 (30) |
| 10,000-25,000 | 125 (38) |
| 25,000-50,000 | 150 (45) |
| Over 50,000 | As Approved by Authority Having Jurisdiction |

*Note: If sprinkler protection is provided as recommended in 6-1.3.1(b) as well as the other recommendations in Section 6-1.3, the distances shown can be reduced by one-half.

Delete 6-1.3.1(c).

SUBSTANTIATION: The proposed table is based on a standard developed by the New Jersey Bureau of Engineering and Safety. Many years of experience indicate that the distances are both reasonable and safe. The table will help users with a better guide for storing various quantities of nitrocellulose. With these revisions to paragraphs (a) and (b), paragraph (c) is no longer needed, nor is it applicable.
COMMITTEE ACTION: Accept.

35-6 - (6-1.3.6, 6-1.3.7 and 6-1.3.8 (New)): Accept
SUBMITTER: Technical Committee on Manufacture of Organic Coatings
RECOMMENDATION: Add new sections 6-1.3.6, 6-1.3.7 and 6-1.3.8 as follows:
6-1.3.6 Nitrocellulose shall be stored only in approved DOT closed containers. Before storing drums, make sure their closures are tight in order to prevent loss of wetting agent by evaporation.
6-1.3.7 Heat should be avoided in the storage area, where heat is necessary, the building should be equipped with low-pressure steam or hot-water radiators. These shall be so located as to avoid contact with the drums of nitrocellulose under any circumstances. Overheating of drums by direct contact with hot surfaces or by storage in an overheated environment may cause pressure buildup in the drums and eventual release of the lid.
6-1.3.8 The storage area shall be marked with a readily visible sign identifying the material and its hazard — i.e., "NITROCELLULOSE - FLAMMABLE - KEEP HEAT, SPARKS, AND FLAME AWAY."

SUBSTANTIATION: Section 6-1.3.6 offers an additional caution to warn against the potential for nitrocellulose drying out if the lids are not in place and tightened on the drums. Sections 6-1.3.7 and 6-1.3.8 are self-explanatory, and, in the opinion of the Committee, should add to safe handling. COMMITTEE ACTION: Accept.

35-7 (6-1.4.1): Accept
SUBMITTER: Technical Committee on Manufacture of Organic Coatings
RECOMMENDATION: Revise 6-1.4.1 to read as follows:
6-1.4.1 The amount of nitrocellulose brought into the operating area shall be kept to a minimum and not exceed that required for a shift. Drums should remain closed until ready for use. When only part of a drum is used, the lid and ring should be replaced immediately and the ring tightened.

SUBSTANTIATION: The emphasis on keeping the lids on the drums is in order to reduce the potential for the drying of nitrocellulose.
COMMITTEE ACTION: Accept.

35-8 (6-1.4.3): Accept
SUBMITTER: Technical Committee on Manufacture of Organic Coatings
RECOMMENDATION: Revise 6-1.4.3 to read as follows:
6-1.4.3 Any nitrocellulose which may be spilled on the floor where it shall be promptly wet down with water, swept up, and put into a pit or covered metal container which contains water. The material should be removed at the end of the day or shift and disposed of properly (see 6-1.5.1).

SUBSTANTIATION: Since solvent can evaporate from spilled nitrocellulose, it should be wetted with water prior to being swept up.
COMMITTEE ACTION: Accept.

35-9 (6-1.4.5 and 6-1.4.6): Accept
SUBMITTER: Technical Committee on Manufacture of Organic Coatings
RECOMMENDATION: Add a new 6-1.4.5 and 6-1.4.6 as follows:
6-1.4.5 Since there is always danger of ignition of nitrocellulose or its solvents, diluents or solutions from struck sparks, frictional heat, flame, or static electricity, care shall be taken to eliminate these sources of ignition.
6-1.4.6 Solvent wet and plasticized nitrocellulose are free-flowing materials which can generate static electricity while being poured from the drum. To prevent hazardous accumulations of static charges, drums, containers, rings of fiber drums and vessels shall be bonded and grounded during transfer operations.

SUBSTANTIATION: In the Committee’s opinion, these additions are self-explanatory but necessary precautionary provisions that should be included in the Code.
COMMITTEE ACTION: Accept.

35-10 (6-1.5.1): Accept
SUBMITTER: Technical Committee on Manufacture of Organic Coatings
RECOMMENDATION: Revise 6-1.5.1 to read as follows:
6-1.5.1 Sweepings and other small quantities of waste nitrocellulose shall be wet down with water and placed in a covered metal container. Dispose of the waste material by burning in a safe, isolated location or denitrating in an agitated, 5 percent sodium hydroxide aqueous solution in a well ventilated area. Disposal shall not be by burning in a boiler fire box, incinerator, or other confined equipment. Burning shall only be conducted in accordance with federal, state, or local regulations regarding pollution.

SUBSTANTIATION: The addition of the disposal method recommending 5 percent sodium hydroxide gives the user an alternative for disposing of waste quantities, and is based on extensive experience and testing.
COMMITTEE ACTION: Accept.

35-11 (6-3.1): Accept in Part
RECOMMENDATION: Change last sentence to read:
"Only general details can be offered here, and the suppliers shall be consulted whenever these materials are to be used."

SUBSTANTIATION: The supplier is a more appropriate source of information on organic peroxides than the authority having jurisdiction.
COMMITTEE ACTION: Accept in Part.

7-2.1 All equipment such as tanks, machinery and piping where a flammable mixture may be present shall be bonded and connected to a ground.

RECOMMENDATION: Amend 7-2.1 to read:
7-2.1 All equipment such as tanks, machinery and piping where a flammable mixture may be present shall be bonded and connected to a ground. The bond or ground or both shall be physically applied or shall be inherently present by the nature of the installation. For static dissipation purposes, this electrically conductive path shall not have a resistance of more than 25 ohms to ground.

SUBSTANTIATION: NPCA Scientific Circular No. 803, Generation and Control of Static Electricity, and NFPA 77, Recommended Practice on Static Electricity, provide information on this subject.

COMMITTEE ACTION: Accept in Part.

The first sentence, which substitutes the word "flammable" for the word "ignitable" is acceptable as an editorial change. The remainder of the proposal is rejected by the Committee, and shall remain as presently written in the Code.

COMMITTEE COMMENT: The Committee agrees that the supplier is an appropriate source of information on organic peroxides, but the authority having jurisdiction should not be excluded from the consulting procedure.

COMMITTEE ACTION: Accept in Part.

SECONDARY RESOLUTION: The Committee is convinced that this recommendation, and the Committee is convinced that the one million ohm value should remain.

COMMITTEE ACTION: Accept.
PART IV

327-1 - (I-1): Accept
SUBMITTER: Technical Committee on Tank Leakage and Repair Safeguards
RECOMMENDATION: In line 1, change "are recommended for" to read "concern themselves with".
SUBSTANTIATION: This is an editorial change. Use of the word "recommended" may appear to be misleading, since NFPA 327 is a standard procedure.
COMMITTEE ACTION: Accept.

327-2 - (I-2): Accept
SUBMITTER: Technical Committee on Tank Leakage and Repair Safeguards
RECOMMENDATION: Update referenced standards and develop a new chapter to include appropriate referenced standards.
SUBSTANTIATION: This is in keeping with established NFPA style and procedures.
COMMITTEE ACTION: Accept.

327-3 - (I-3): Accept
SUBMITTER: Technical Committee on Tank Leakage and Repair Safeguards
RECOMMENDATION: Under definition of "Liquids (b) Flammable Liquid" insert "2068 mm Hg" following "40 lb per sq in."
SUBSTANTIATION: This is editorial, and is consistent with NFPA 30, Flammable and Combustible Liquids Code.
COMMITTEE ACTION: Accept.

327-4 - (I-3): Accept
SUBMITTER: Technical Committee on Tank Leakage and Repair Safeguards
RECOMMENDATION: Insert definition of "Unstable Liquid" as follows:
Unstable (Reactive) Liquid. A liquid which in the pure state or as commercially produced or transported will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shock, pressure or temperature.
SUBSTANTIATION: Subsection 2-1.3 of NFPA 327 mentions unstable or reactive materials, and so a definition should be included. This definition is the same as that used in NFPA 30, Flammable and Combustible Liquids Code.
COMMITTEE ACTION: Accept.

PART V

328-1 - (Appendix B (New)): Accept
SUBMITTER: Technical Committee on Tank Leakage and Repair Safeguards
RECOMMENDATION: Establish an Appendix section to include referenced publications, and update such references as needed.
SUBSTANTIATION: This is in keeping with established NFPA procedure and style.
COMMITTEE ACTION: Accept.

328-2 - (Appendix B): Accept
SUBMITTER: Technical Committee on Tank Leakage and Repair Safeguards
SUBSTANTIATION: Many of the incidents listed are decades old. In addition, the Committee feels that the Appendix does not serve a useful purpose relative to the recommended practice. Information on such incidents can be obtained from NFPA upon request.
COMMITTEE ACTION: Accept.

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2-2.1.1 Daily Procedures. At the beginning of each business day (or shift), tank volume should be manually measured using a gage stick and a calibration chart to convert the tank level into gallons. This gaging operation should be carried out with great care to insure maximum accuracy. Opening meter totalizer readings should also be recorded for each dispenser.

When liquid is added to the underground tank, the tank volume should be gaged both before and after the delivery. The operator should also check for the presence of water using a water finding paste on the end of the gage stick. This should be done on a daily basis as part of the opening routine as well as immediately after any fill. Water which is detected should be accounted for in the inventory procedures and any significant accumulation (i.e., greater than 1/2 in.) should be promptly removed.

At the close of the business day (or the end of the shift), tank volume should again be gaged and meter totalizer readings recorded. The differences between the opening and closing totalizer readings is changes for the inventory period. All readings which are recorded as part of this procedure should be kept in a safe location and retained for a minimum of one year. Detailed instructions covering tank gaging, meter calibration checks and recordkeeping are contained in the American Petroleum Institute Publication 1621.

2-2.1.2 Daily Reconciliation. Inventory reconciliation consists of comparing the measured closing inventory to the "book inventory" which is obtained by adding deliveries and subtracting sales and on site usage from the measured opening inventory. Due to variables inherent in the process, this reconciliation will rarely balance exactly to the gallon and small daily "over" or "short" figures are to be expected. The calculated variance should be carried forward each day with the new over or short figure added (algebraically) to that of the previous day. Using this technique, the operator is able to identify trends over time; daily fluctuations tend to cancel out over the long term.

2-2.1.3 Inventory Reviews. The operator of an underground tank system storing flammable or combustible liquids should review his daily inventory records once a week. He should be concerned with small but growing daily losses or sudden unexplained changes from the established pattern. Either of these symptoms could indicate a potential leak.

For a facility which stores more than one variety of similar liquid (such as motor or heating fuel), the operator should compare inventory records for the various tank systems. This will mitigate the effect of temperature induced errors on the inventory and accounting. Since the impact of temperature should be roughly the same, a significant difference in the inventory variance from one product to the next may indicate a leak. The first step in investigating this would be to check the meter calibrations on the support system.

At the end of each month, the operator should again review his daily inventory accounting. A cumulative shortage which is greater than 0.5 percent of the system throughput for the month may suggest a leak. The operator should look closely to see if the negative variance is a one-time fluctuation or if there is a consistent negative trend throughout the inventory period. As a further means of detecting leaks using inventory control, "action numbers" have been developed which equate the cumulative number of daily inventory shortages with the probability of leakage (US EPA, 1984). The "action numbers" indicate what number of shortages (or average losses) constitute a significant trend and thus a potential problem.

2-2.2 Tanks Without Metered Dispensing. For these systems, the inventory review is complicated by the fact that all withdrawals can only be measured by gaging the tank. Tank levels should be accurately gaged and recorded before and after any input or withdrawal. To determine if the storage system is losing liquid, the operator should compare the volume before an input or withdrawal with the measured volume after the previous input or withdrawal. This loss or gain figure for each period of tank inactivity should
be carried forward and a cumulative variance maintained by adding the gain or subtracting the loss from the previous number. Since tank gaging errors are completely random, they should tend to cancel out from one measurement to the next. A consistent and increasing negative or positive trend indicates a potential leak which should be investigated.

References

COMMITTEE ACTION: Accept in Part.

Following subsection 4-3.1 a reference will be made "(See Appendix C for a description of inventory control procedures)"; and following subsection 3-2.2(e), a reference will be made "(See Appendix C)". The material submitted will be established as a new Appendix C, but with some changes to the submitted text, as follows: The title will read "Inventory control Procedures"; Section 2-1 of the text entitled "General" will be deleted; the last subsection 3-2.2.1 will be changed by deleting the last two sentences that deal with action numbers; following the last paragraph, change the word "References" to read "For additional information on the subject, see the following".

COMMITTEE COMMENT: The Committee agrees that it would be appropriate to have wording on inventory control, but feels it belongs in an Appendix section rather than in a Chapter. The revisions to the submission are editorial in nature.

COMMITTEE ACTION: Accept in Part. (Log #8)

SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.

RECOMMENDATION: Revise 4-1.3 as follows:
4-1.3 One or more of these preliminary tests would be particularly desirable if precise Precision test equipment is not immediately available. If such equipment is available, time and labor costs may be reduced by immediately making a Precision Test. Language should agree with 1983 Precision Test Section 4-3.10.

COMMITTEE ACTION: Accept.

Delete the word "precise" and capitalize "Precision Test". Also, in 4-1.2, on the last line, delete the word "precise" before "Precision Test".

COMMITTEE COMMENT: The Committee agrees with the Substantiation, but has made editorial changes for better reading.
329-8 - (4-2.4): Accept
SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.
RECOMMENDATION: Revise 4-2.4 as follows:
4-2.4 Temperature change may falsely indicate a loss. The volume of petroleum products is highly sensitive to temperature change. A drop of one degree Fahrenheit will shrink 1,000 gal (3785L) of gasoline by 0.7 gal (2.2L). This may at first seem small but consider a typical example. In the spring, the ground will still be relatively cool from the preceding cold weather, while liquids stored and transported aboveground may be relatively warm.

SUBLATION: Update to agree with new data presented in Figure 2 of Chapter IV.
COMMITTEE ACTION: Accept.

329-9 - (4-2.5): Accept
SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.
RECOMMENDATION: Revise 4-2.5 as follows:
4-2.5 A typical underground storage tank may handle 20,000 gal (75,700 L) in one month. If, on the average, the liquid cooled 5°F (2.8°C) after delivery, stock records will show a loss of 0.7 X 20 = 70 gal (265L). Ten degrees cooling would appear as a 140 gal (530L) loss for 20,000 gal (75,700L) handled, and 280 gal (1,060L) loss for 40,000 gal (151,400L) handled. Obviously a temperature increase would have the opposite effect and could actually conceal a physical loss.

SUBSTATION: Update to agree with data presented with Figure 2 of Chapter IV.
COMMITTEE ACTION: Accept.
COMMITTEE COMMENT: The Committee agrees with the Submitter, and adds one word for editorial clarification.

329-10 - (4-3.1.5 (New)): Accept in Part
SUBMITTER: Richard P. Wilkinson, Veeder-Root
RECOMMENDATION: Establish a new Section 4-3.1.5 as follows:
4-3.1.5 When acceptable to the authority having jurisdiction, in-tank monitoring systems that incorporate gauging equipment may be used to accomplish inventory control and leak detection.

SUBSTATION: Testing leaks and lines for leakage can be more easily accomplished if an underground storage system is equipped with automatic tank gauging equipment. Automatic gauges are designed to measure fluid levels more precisely than traditional “dip stick” methods and can therefore provide more accurate inventory records. These systems also often provide leak detection features which can help in determining the source of a leak. This type of equipment is relatively new and has not been previously included as part of NFPA 329.

COMMITTEE ACTION: Accept in Part.
COMMITTEE COMMENT: This action accepts in-tank monitoring as feasible for inventory control, but not as an alternate to the Precision Test.

329-11 - (4-3.6.1): Accept in Part
SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.
RECOMMENDATION: Revise as follows:
4-3.6 Hydrostatic Test of Piping.
4-3.6.1 Isolate the piping and conduct a hydrostatic pressure test at 150 percent of the anticipated discharge pressure of the system, but not less than 5 psi (34.48 kPa) per minute. If the pressure drops more than 5 psi (260 mm Hg) per minute, it indicates the probability of entrained air. Any pressure drop less than 5 psi (260 mm Hg) per minute is inclusive as it may be caused by cooling. If the test continues to indicate a leak, appropriate action must be taken.

SUBSTATION: 50 psi was originally set for the test based on its being 150 percent times the typical discharge pressure of a remote/submersible pumping system at a service station which is usually 30-35 psi. Since every line has different operating pressures, the 5 psi is not appropriate in all circumstances, the intent is 150 percent as proposed and as is the case in NFPA 30, Section 3-7.

Time factor is necessary to provide guidance for how long the test needs to be conducted.
COMMITTEE ACTION: Accept in Part.
Rewrite 4-3.6 and place it in the text as 4-3.5.
Have present 4-3.5 removed.
4-3.5 Hydrostatic Test of Piping.
4-3.5.1 Isolate the piping and conduct a hydrostatic pressure test at 150 percent of the maximum anticipated pressure of the system, but not less than 5 psi per sq in. (34.48 kPa) gauge at the highest point of the system. The test shall be maintained for at least 10 minutes. If the pressure drops, it indicates the possibility of a leak in the piping and it is recommended that a volumetric test be performed. It should be noted that a loss of liquid pressure can be attributed to the following: a line leak; a decrease in liquid temperature in the line; piping distortion due to the liquid pressure; or entrapped vapor in the piping. Accumulated liquid loss during a volumetric test of more than 0.05 gallons per hour due to the liquid pressure, entrapped air. Any pressure drop less than 5 psi (260 mm Hg) per minute is inclusive as it may be caused by cooling. If the test continues to indicate a leak, appropriate action must be taken.
COMMITTEE ACTION: Accept in Part.
Rewrite 4-3.6 and place it in the text as 4-3.5.
Have present 4-3.5 removed.
4-3.5 Hydrostatic Test of Piping.
4-3.5.1 Isolate the piping and conduct a hydrostatic pressure test at 150 percent of the maximum anticipated pressure of the system, but not less than 5 psi per sq in. (34.48 kPa) gauge at the highest point of the system. The test shall be maintained for at least 10 minutes. If the pressure drops, it indicates the possibility of a leak in the piping and it is recommended that a volumetric test be performed. It should be noted that a loss of liquid pressure can be attributed to the following: a line leak; a decrease in liquid temperature in the line; piping distortion due to the liquid pressure; or entrapped vapor in the piping. Accumulated liquid loss during a volumetric test of more than 0.05 gallons per hour due to the liquid pressure, entrapped air. Any pressure drop less than 5 psi (260 mm Hg) per minute is inclusive as it may be caused by cooling. If the test continues to indicate a leak, appropriate action must be taken.
COMMITTEE ACTION: Accept in Part.
Rewrite 4-3.6 and place it in the text as 4-3.5.
Have present 4-3.5 removed.
4-3.5 Hydrostatic Test of Piping.
4-3.5.1 Isolate the piping and conduct a hydrostatic pressure test at 150 percent of the maximum anticipated pressure of the system, but not less than 5 psi per sq in. (34.48 kPa) gauge at the highest point of the system. The test shall be maintained for at least 10 minutes. If the pressure drops, it indicates the possibility of a leak in the piping and it is recommended that a volumetric test be performed. It should be noted that a loss of liquid pressure can be attributed to the following: a line leak; a decrease in liquid temperature in the line; piping distortion due to the liquid pressure; or entrapped vapor in the piping. Accumulated liquid loss during a volumetric test of more than 0.05 gallons per hour due to the liquid pressure, entrapped air. Any pressure drop less than 5 psi (260 mm Hg) per minute is inclusive as it may be caused by cooling. If the test continues to indicate a leak, appropriate action must be taken.
COMMITTEE ACTION: Accept in Part.
Rewrite 4-3.6 and place it in the text as 4-3.5.
Have present 4-3.5 removed.
4-3.5 Hydrostatic Test of Piping.
4-3.5.1 Isolate the piping and conduct a hydrostatic pressure test at 150 percent of the maximum anticipated pressure of the system, but not less than 5 psi per sq in. (34.48 kPa) gauge at the highest point of the system. The test shall be maintained for at least 10 minutes. If the pressure drops, it indicates the possibility of a leak in the piping and it is recommended that a volumetric test be performed. It should be noted that a loss of liquid pressure can be attributed to the following: a line leak; a decrease in liquid temperature in the line; piping distortion due to the liquid pressure; or entrapped vapor in the piping. Accumulated liquid loss during a volumetric test of more than 0.05 gallons per hour due to the liquid pressure, entrapped air. Any pressure drop less than 5 psi (260 mm Hg) per minute is inclusive as it may be caused by cooling. If the test continues to indicate a leak, appropriate action must be taken.
Accumulated liquid losses during a volumetric test of
Committee's wording achieves consistency with the
COMMITTEE COMMENT: more than 0.05 gallons per hour during timed
COMMITTEE ACTION: Accept.
Submitter's substantiation. Addition of the
volumetric test be performed. It should be noted that
of a leak in the piping and it is recommended that a
observe any pressure drop" is to be deleted.
pressure, seat the check valve, turn off the pump and
restoration may indicate a leak in the piping.
pressure from remote pump).

RECOMMENDATION: Revise as follows:
4-3.7 Discharge Pipe Line Testing (pipe under
pressure to the dispensing equipment operates under
pressure. A leak in this line will cause rapid loss of
pressure after the pump is turned off. This can be
checked using the procedure described in Section 4-3.6
or if not practical, in the following manner.

SUBSTANTIATION: The preferable procedure is to test
the system at 150 percent of its maximum operating
pressure as described in 4-3.6 to assure that if
weaknesses exist they are discovered.

COMMITTEE ACTION: Accept.
Change the reference from subsection 4-3.6 to read
4-3.5 in the last sentence, in light of Committee
Action on 329-11.

329-14 - (4-3.6.5) (New): Accept
SUBMITTER: Technical Committee on Tank Leakage and
Repair Safeguards
RECOMMENDATION: Renumber subsection 4-3.5 as
subsection 4-3.6. (See action on 329-11.) Establish a
new 4-3.6.5 to read:

4-3.6.5 A liquid volumetric pressure test can be
performed on a suction line by connecting to the exit
port of the air eliminator, or other appropriate
fitting. This connection will permit pressure to be
applied to the suction piping from the pump to the
check valve. In this test, the hydrostatic pressure
should not exceed 15 psi in order to prevent damage to
the pump.

COMMITTEE ACTION: Accept.
COMMITTEE COMMENT: This new section explains how a
liquid volumetric test can be performed. The subject
was not covered in previous editions, and the Committee
feels that it should be described.

329-15 - (4-3.7.2): Accept in Part
SUBMITTER: Joyce A. Rizzo, Hunter Environmental
Services, Inc.

RECOMMENDATION: Revise 4-3.7.2 as follows:

4-3.7.2. . . Start the pump, note the maximum
pressure, seat the check valve, turn off the pump and
observe any pressure drop. The test shall be
maintained for at least 10 minutes . . .

SUBSTANTIATION: The 25 to 35 psi is specific to
service station applications and can be misleading.

The time factor is necessary to provide guidance for
how long the test needs to be conducted.

COMMITTEE ACTION: Accept in Part.
In the present 4-3.7.2, all wording after "and
observe any pressure drop" is to be deleted.
After the Submitter's last sentence, include the
following wording:

"If the pressure drops, it indicates the possibility
of a leak in the piping and it is recommended that a
volumetric test be performed. It should be noted that
a loss of liquid pressure can be attributed to the
following: a line leak; a decrease in liquid
temperature in the line; piping distortion due to the
liquid pressure; or entrapped vapor in the piping.
Accumulated liquid losses during a volumetric test of
more than 0.05 gallons per hour during timed
restoration may indicate a leak in the piping."

COMMITTEE COMMENT: The Committee agrees with the
Submitter's substantiation. Addition of the
Committee's wording achieves consistency with the
wording on hydrostatic test of piping.

329-16 - (4-3.7.3): Accept
SUBMITTER: Technical Committee on Tank Leakage and
Repair Safeguards
RECOMMENDATION: Renumber 4-3.7.3 as 4-3.8, and number
all subsequent sections accordingly.

SUBSTANTIATION: This is an editorial correction.
COMMITTEE ACTION: Accept.

329-17 - (4-3.10.1): Reject
SUBMITTER: George Lomax, Heath Consultants
RECOMMENDATION: I propose that we fix the 0.050 gallon
per hour loss rate for tanks that are 10,000 gallons in
size and smaller; change use this as a basis for the
loss rate criteria on larger tanks. For example:
Loss rate per gallon for a 10,000 gallon tank
= 0.050 = 0.000005 gallons per hour per gallon.
10,000

Apply the above equation to a 39,000 gallon tank, and
we have an acceptable loss rate as follows:
Acceptable loss rate for a 39,000 gallon tank
= 0.000005 X 39,000 = 0.195 gallons per hour.

SUBSTANTIATION: Since we have seen the installation of
larger fuel storage tanks and an increased demand in
the industrial sector for testing of large chemical and
fuel oil storage tanks, the loss rate criteria of 0.050
gallons per hour is extremely small when we consider
the co-efficients of expansion with which we are
sometimes dealing. For example, if we consider a
50,000 gallon tank of ethyl acetate with a co-efficient
of expansion of 0.00079 per degree, a thermal change in
this tank of one-thousandths of a degree represent
an increase or decrease in product volume of 0.0395
gallons. Therefore, to certify a tank under these
conditions as being tight under the 329 criteria, an
uncompensated temperature shift of less than two
one-thousandths of a degree will cause us to fail the
tank.

A historical review of the technology we are
presently using for testing underground storage tanks
shows that the original design criteria was for tanks
that average 6,000 gallons in size. We know that we
can test tanks larger than 6,000 gallons. However, as
the tank gets larger, the margin of error based on
thermal accuracy becomes smaller.

COMMITTEE ACTION: Reject.
COMMITTEE COMMENT: Sections 4-3.10.2 and 4-3.10.3
offer latitude to the tester. The criterion has been
widely accepted by most authorities, and was
established for the technology employed.

329-18 - (4-3.10.1): Reject
SUBMITTER: Rudy White, American Petroleum Institute
RECOMMENDATION: In paragraph 1, a proposal is made to
qualify the precision test criterion of 0.05 gal/hr to
the size of tank being tested.

SUBSTANTIATION: A problem exists when one tries to
apply the 0.05 gal/hr criterion to larger tanks.
Current state-of-the-art precision testing equipment is
not able to meet the NFPA criterion for these tanks.
As a result, large tank owners and the precision
testing industry are unable to determine and apply an
appropriate technological standard for leak testing.

COMMITTEE ACTION: Reject.
COMMITTEE COMMENT: See action on 329-17.

329-19 - (4-3.10.2): Accept
SUBMITTER: Rudy White, American Petroleum Institute
RECOMMENDATION: A proposal is made to add the
following sentence to the end of the paragraph:
"Precision tests should be performed by qualified
technical personnel."
SUBSTANTIATION: Competent technical personnel are often required to operate new and increasingly sophisticated precision testing devices now on the market. It is in the best interest of the tank owner and the precision testing industry to assure that human error in conducting such tests is minimized. NFPA, in recommending a defined precision test, has a responsibility to inform the consumer of the prerequisites of conducting such a test.

COMMITTEE COMMENT: The Committee agrees with the Submitter's substantiation, and feels that the addition of the Committee's wording will serve even better to achieve the Submitter's purpose.

COMMITTEE ACTION: Accept.

Also, add the words "experienced in the use of the test method and in the interpretation of data produced".

COMMITTEE COMMENT: The Committee agrees with the Submitter's substantiation, and feels that the addition of the Committee's wording will serve even better to achieve the Submitter's purpose.

COMMITTEE ACTION: Accept.

SUBMITTER: Edward C. Nieshoff, Owens-Corning Fiberglas

RECOMMENDATION: Change the existing 4-3.10.4 to 4-3.10.5 and insert the following as a new 4-3.10.4:

"Double wall tanks, which are being required in some areas, introduce the need for alternate approaches to the precision test. The annular space in these tanks can be tested by using a pressure type monitor. There are three types of continuous pressure monitors: vacuum, air pressure, and hydrostatic pressure. The pressure is applied to the cavity between the inner and outer walls of the double-wall tank."

SUBSTANTIATION: (a) The existing code was written prior to the recent rapid development of the double-wall tank market.

(b) The requirement for double-wall tanks already exists in some areas and new environmental regulations are expected to broaden their use in the near future.

(c) This code change offers double wall tank manufacturers the opportunity to develop systems that will offer a continuous precision test to both inner and outer tank wall.

(d) It also informs Code officials of the alternate methods available to perform precision test on double wall tanks.

COMMITTEE ACTION: Reject.

COMMITTEE COMMENT: In the Committee's opinion, the proposal change does not meet the criteria of Section 4-3.10.3 which specifies that it deals with complete underground storage and handling equipment, rather than just the tank.

COMMITTEE ACTION: Accept in Part.

SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.

RECOMMENDATION: Revise 4-3.11.3 as follows:

"Temperature measurement must include a method for averaging any differences in temperature with depth. Temperature measurement must include a method for averaging any differences in temperature throughout the tank."

SUBSTANTIATION: It is suggested that a specific rate not be used since an infinite number of circumstances exist in the combinations of tank product, ground and product added temperatures.

COMMITTEE ACTION: Accept in Part.

Delete 4-3.11.5 in its entirety. In 4-3.11.2, start the section with the words "For example, ". Also, delete Figure 3 entirely, and revise 4-3.11.4 as follows:

"Double wall tanks, which are being required in some areas, introduce the need for alternate approaches to the precision test. The annular space in these tanks can be tested by using a pressure type monitor. There are three types of continuous pressure monitors: vacuum, air pressure, and hydrostatic pressure. The pressure is applied to the cavity between the inner and outer walls of the double-wall tank."

SUBSTANTIATION: (a) The existing code was written prior to the recent rapid development of the double-wall tank market.

(b) The requirement for double-wall tanks already exists in some areas and new environmental regulations are expected to broaden their use in the near future.

(c) This code change offers double wall tank manufacturers the opportunity to develop systems that will offer a continuous precision test to both inner and outer tank wall.

(d) It also informs Code officials of the alternate methods available to perform precision test on double wall tanks.

COMMITTEE ACTION: Reject.

COMMITTEE COMMENT: In the Committee's opinion, the proposal change does not meet the criteria of Section 4-3.10.3 which specifies that it deals with complete underground storage and handling equipment, rather than just the tank.

COMMITTEE ACTION: Accept in Part.

SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.

RECOMMENDATION: Revise as follows:

4-3.11.5 Temperature measurement must include a method for averaging any differences in temperature with depth. Temperature measurement must include a method for averaging any differences in temperature throughout the tank."

SUBSTANTIATION: It is suggested that a specific rate not be used since an infinite number of circumstances exist in the combinations of tank product, ground and product added temperatures.

COMMITTEE ACTION: Accept in Part.

Delete 4-3.11.5 in its entirety. In 4-3.11.2, start the section with the words "For example, ". Also, delete Figure 3 entirely, and revise 4-3.11.4 as follows:

"Double wall tanks, which are being required in some areas, introduce the need for alternate approaches to the precision test. The annular space in these tanks can be tested by using a pressure type monitor. There are three types of continuous pressure monitors: vacuum, air pressure, and hydrostatic pressure. The pressure is applied to the cavity between the inner and outer walls of the double-wall tank."

SUBSTANTIATION: (a) The existing code was written prior to the recent rapid development of the double-wall tank market.

(b) The requirement for double-wall tanks already exists in some areas and new environmental regulations are expected to broaden their use in the near future.

(c) This code change offers double wall tank manufacturers the opportunity to develop systems that will offer a continuous precision test to both inner and outer tank wall.

(d) It also informs Code officials of the alternate methods available to perform precision test on double wall tanks.

COMMITTEE ACTION: Reject.

COMMITTEE COMMENT: In the Committee's opinion, the proposal change does not meet the criteria of Section 4-3.10.3 which specifies that it deals with complete underground storage and handling equipment, rather than just the tank.

COMMITTEE ACTION: Accept in Part.

SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.

RECOMMENDATION: Revise as follows:

4-3.11.5 Temperature measurement must include a method for averaging any differences in temperature with depth. Temperature measurement must include a method for averaging any differences in temperature throughout the tank."

SUBSTANTIATION: It is suggested that a specific rate not be used since an infinite number of circumstances exist in the combinations of tank product, ground and product added temperatures.

COMMITTEE ACTION: Accept in Part.

Delete 4-3.11.5 in its entirety. In 4-3.11.2, start the section with the words "For example, ". Also, delete Figure 3 entirely, and revise 4-3.11.4 as follows:

"Double wall tanks, which are being required in some areas, introduce the need for alternate approaches to the precision test. The annular space in these tanks can be tested by using a pressure type monitor. There are three types of continuous pressure monitors: vacuum, air pressure, and hydrostatic pressure. The pressure is applied to the cavity between the inner and outer walls of the double-wall tank."

SUBSTANTIATION: (a) The existing code was written prior to the recent rapid development of the double-wall tank market.

(b) The requirement for double-wall tanks already exists in some areas and new environmental regulations are expected to broaden their use in the near future.

(c) This code change offers double wall tank manufacturers the opportunity to develop systems that will offer a continuous precision test to both inner and outer tank wall.

(d) It also informs Code officials of the alternate methods available to perform precision test on double wall tanks.

COMMITTEE ACTION: Reject.

COMMITTEE COMMENT: In the Committee's opinion, the proposal change does not meet the criteria of Section 4-3.10.3 which specifies that it deals with complete underground storage and handling equipment, rather than just the tank.
SUBSTANTIATION: Not all precision tests for tanks require overfilling. For those that do not, piping and associated product handling equipment can be precision tested separately using hydrostatic tests or other means. This fact may require changes in the definition of a precision test i.e. "It should detect a leak anywhere in the complete underground storage and handling equipment." (Sec. 4-3.10.3)  
COMMITTEE ACTION: Accept in Principle.  
COMMITTEE COMMENT: See the action on 329-23.

329-25 - (4-3.12.5): Accept  
SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.  
RECOMMENDATION: Add after Figure 6: "The precision test method employed should be able to clearly indicate the effects of tank end deflection and other provide a means of compensation or elimination of the effects."  
SUBSTANTIATION: Consideration should be given to eliminating the data in Table 6 since it does not include the time factor for the deflection. Since the absolute volume must be related to the test time or period of leak rate determination in order to be useful. The suggested language offers more advice as to what to look for. Also, see attachment.  
NOTE: Supporting material available for review at NFPA Headquarters.  
COMMITTEE ACTION: Accept.  
COMMITTEE COMMENT: Insert the word "possible" between "the" and "effects" in line 2.

329-26 - (4-3.12.6 and 4-3.18 (New)): Accept in Part  
SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.  
RECOMMENDATION: Renummer 4-3.12.6 to 4-3.18 and revise as follows:  
4-3.18 In summary, major factors must be accounted for in the Precision Test to determine the presence or absence of a leak in an underground liquid storage facility.  
1. Leak detection accuracy.  
2. The temperature change of the liquid in that period of time.  
3. The complete tank and piping system is to be included in the test.  
4. The movement of tank ends as pressure is increased.  
5. Water Table.  
6. Vapor Pockets.  
7. Evaporation.  
SUBSTANTIATION: Addition of variables and reformat.  
COMMITTEE ACTION: Accept in Part.  
COMMITTEE COMMENT: Add new 4-3.18 or as editorially appropriate and delete 4-3.12.6.  
4-3.18 In summary, major factors must be accounted for in the Precision Test to determine the presence or absence of a leak in an underground liquid storage facility.  
1. The temperature change of the liquid in that period of time.  
2. The movement of tank ends as pressure is increased.  
4. Entrapped vapor.  
5. Evaporation.  
COMMITTEE COMMENT: The Committee does not agree that the numbers 1 and 3 are factors that should be included in the summary, but does accept the fact that 4-3.12.6 should be renumbered as 4-3.18 and it should be expanded.

329-27 - (4-3.13): Accept in Principle  
SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.  
RECOMMENDATION: Revise to read as follows:  
4-3.13 The Effects of Water Table.  
As stated in Section 4-3.9, there are many instances where water may enter a tank system. Methods to handle a high water table in the area around a tank system are:  
1. Determine water table level.  
2. Be able to detect in leaks as well as out leaks.  
3. Measure water levels in tanks.  
4. Compensate for water pressure by increasing pressure of product level to assure out-leak.  
SUBSTANTIATION: Effects of water table on tank testing are well known and should be addressed in NFPA 329.  
COMMITTEE ACTION: Accept in Principle.  
COMMITTEE COMMENT: Establish a new 4-3.13 to read:  
4-3.13 The Effect of Subsurface Water Table.  
4-3.13.1 The level of the water table adjacent to the tank being tested must be determined. Calculate the pressure against the bottom of the tank caused by the height of the water table. Compensate via elevation of the product level for this water table to effectively establish a dry soil condition.  
SUBSTANTIATION: We refer to this at Heath Consultants as the "Four Pound Rule," or the "Four Pound Pressure Advantage." When we consider the hydrostatic pressures applied from two sources: The first being the weight of the product in the tank; and the second being the weight of subsurface water outside of the tank. It is often assumed that water around the tank bottom and sides will cause water to appear inside the tank as an indication of a leak. Should the leak be minor, a small corrosion hole or a series of small corrosion holes, it is very possible water will not enter the tank but gasoline will leak out. This fact has to do with the surface tension of gasoline versus water. Gasoline will leak through a smaller corrosion hole where water will not.  
With this in mind, we recommend the test operator determine the level of the water table adjacent to the tank being tested. Calculate the pressure against the bottom of the tank caused by the height of the water table; and compensate via elevation of the product level for this water table. The goal is to establish a dry soil condition.  
COMMITTEE ACTION: Accept in Principle.  
COMMITTEE COMMENT: See action on proposal 329-27.

329-28 - (4-3.13 and 4-3.13.1): Accept in Principle  
SUBMITTER: George Lomax, Heath Consultants  
RECOMMENDATION: Establish a new 4-3.13 and renumber present 4-3.13 accordingly.  
4-3.13 The Effect of Subsurface Water Table.  
4-3.13.1 The level of the water table adjacent to the tank being tested must be determined. Calculate the pressure against the bottom of the tank caused by the height of the water table. Compensate via elevation of the product level for this water table to effectively establish a dry soil condition.  
SUBSTANTIATION: We refer to this at Heath Consultants as the "Four Pound Rule," or the "Four Pound Pressure Advantage." When we consider the hydrostatic pressures applied from two sources: The first being the weight of the product in the tank; and the second being the weight of subsurface water outside of the tank. It is often assumed that water around the tank bottom and sides will cause water to appear inside the tank as an indication of a leak. Should the leak be minor, a small corrosion hole or a series of small corrosion holes, it is very possible water will not enter the tank but gasoline will leak out. This fact has to do with the surface tension of gasoline versus water. Gasoline will leak through a smaller corrosion hole where water will not.  
With this in mind, we recommend the test operator determine the level of the water table adjacent to the tank being tested. Calculate the pressure against the bottom of the tank caused by the height of the water table; and compensate via elevation of the product level for this water table. The goal is to establish a dry soil condition.  
COMMITTEE ACTION: Accept in Principle.  
COMMITTEE COMMENT: See action on proposal 329-27.

329-29 - (4-3.13 and 4-3.17 (New)): Accept  
SUBMITTER: Joyce A. Rizzo, Hunter Environmental Services, Inc.  
RECOMMENDATION: Renummer to 4-3.13 to 4-3.17.  
SUBSTANTIATION: Reformat due to addition of new sections.  
COMMITTEE ACTION: Accept.  
COMMITTEE COMMENT: This is an editorial reorganization. Renummer as appropriate as the last section in Chapter 4.
Accept in Part 4-3.14 Test Level. The level at which a test is conducted should be standardized in order to assure that the results obtained from various methods are correlatable. There are three things to consider in setting test level of a Test Method:

1. As stated in Section 4-3.10.3 the complete underground storage and handling equipment must be included in the test.
2. As stated in Section 4-3.12, the raising of product level above tank top can cause tank end deflection.
3. As stated in Section 4-3.13, Figure 7, there are minimum levels which are necessary to overcome the effects of water table.

Based on all of these factors, Figure 7 should be used as the guideline for setting test level since it sets the maximum level necessary to address all three factors and minimize the pressure on the tank system.

SUBSTANTIATION: Introduction.

The 0.05 GPH detection criterion established by NFPA 329 does not set an allowable leak rate for an underground storage system, but instead, defines the required accuracy of the test method employed to determine the leak rate of the system. However, the accuracy statement has the effect of setting an allowable leak rate for a storage system because corrective action is recommended only when the measured leak rate is greater than 0.05 GPH.

The Effect of Test Level on the Accuracy of a Test Method.

A leak may be enhanced by increasing the pressure of fluid in the tank in the vicinity of the leak. This increased pressure may be achieved by increasing the level of the product in the system. For any given leak in a system, the leak rate of the system will increase in direct proportion to the level of product in the system. In theory then, a leak of any size may be detected simply by raising the test level to a point where a small leak becomes a large leak.

However, there are several practical concerns which impose limitations on this approach.

The problem of greatest concern, as currently addressed by NFPA 329, Section 4-1.4.4 is that "Excessive pressures or tests by nonrepresentative liquids may indicate leaks where none existed or conceal leaks where one, in fact, exists." This risk is especially great in older systems where corrosion has occurred.

There are mechanical limitations on the level to which product may be raised.

Safety is reduced when large volumes of flammable or otherwise dangerous liquid are maintained above grade during a test. In addition, spills can become more frequent.

The thermal volume change of the product above grade may be different than the thermal volume change of the product below grade creating an error in the temperature compensation of test results. The loss of accuracy caused by this error may negate any improvement in test sensitivity.

According to the present language in NFPA 329, Section 4-1.4, "Liquid handling equipment should be tested in a condition as close as possible to normal operating conditions." The tanks in a storage system do not normally operate under extreme overfill conditions.

Excessive, abnormal pressures may cause additional tank end deflections. This may introduce additional error in the leak rate measurement thus eliminating any benefits gained from increased test sensitivity.
The NFPA precision test guidelines could be significantly improved by addressing the question of the selection of the level of test for various tank environment conditions. Because tank environmental conditions vary from tank to tank, and from day to day and because each method of tank test is different, test level selection is difficult to specify. However, specific environmental conditions may be addressed and their effects on leak detection recognized. In addition, the tradeoff between the detection of very small leaks by increasing the test level and the risk of creating new leaks by this increased test level should be recognized and addressed.

The Effect of the Water Table Level on the Selection of Test Level

When the water table is above the bottom of the tank, it will have a very definite effect on the type of leak found and on the magnitude of the leak. When the water table level is below that of the leak, product will leak out of the system at a rate proportional to the size (area) of the leak, the level of the product in the system, and the permeability of the soil which surrounds the leak. When the water table is above the leak, the water exerts a pressure which affects both the rate of leakage, and the direction of the leak.

If a tank with a leak immersed in water is considered analogous to a manometer having water in one leg, and fluid of a given density in the other leg, the level at which the water and the fluid balance one another (zero leak rate) may be calculated. In addition, the direction of the leak (into the tank system or out of the system) may be determined. The analogy is valid regardless of the elevation of the leak in the system. This analogy does not take into account the effect of the permeability of the soil in the vicinity of a leak.

Figure 7 shows the relation between the level of the water table above the tank bottom, the level of the product in the system above the tank bottom, and the density of the product expressed as degrees API. For a given product density and water table level, the product level may be determined which balances the inward pressure of the water. Tests conducted at this balance point will not indicate a leak. Tests conducted below this point will indicate a leak into the system; tests conducted above this point will indicate a leak out of the system. As the distance between the test level and the balance point level increases, either above the balance point, or below the balance point, the sensitivity of the test increases.

A test method which is capable of detecting both a leak into a system and out of a system is adequate to detect leaks in a storage system when the water table is above the bottom of the tank. However, tests performed at a level near the balance point may not measure a leak rate greater than 0.05 GPH. A test method which will only detect leak rates out of a system must be performed at a product level above the balance point.

The test should be performed at a level a sufficient distance from the balance point, to insure that a leak which is detectable if the water table was not present is detectable when the water table is present.

COMMITTEE ACTION: Reject.

COMMITTEE COMMENT: The wording suggested would have an impact on all tank testing methods, and tank testing methods are not, and cannot be, standardized. It would be too restrictive to some techniques that are now accepted and in use.

Substantiation: Evaporation is a significant variable that is not presently addressed in NFPA 329.

COMMITTEE ACTION: Accept in Principle.

Establish a new 4-3.15 as follows:

4-3.15 Effects of Evaporation. Some liquids, especially highly volatile liquids, have high rates of evaporative losses if their surfaces are exposed. The Precision Test method employed should be able to indicate clearly the possible effects of evaporative losses and compensate for them.

COMMITTEE COMMENT: The Committee agrees to including a section on evaporation and feels that its wording will be suitable to meet the needs of the user of NFPA 329 in language that is consistent with similar sections.