NFPA No.
34
File: 30 Series
Flammable Liquids

Standards for
DIP TANKS
Containing
Flammable or Combustible Liquids

JUNE
1952

Price: Twenty-five Cents*

NATIONAL FIRE PROTECTION ASSOCIATION
International
60 Batterymarch St., Boston 10, Mass.

*Discount for quantities

4M-6-52 R. S.

Printed in U.S.A.

National Fire Protection Association

INTERNATIONAL

Executive Office: 60 Batterymarch St., Boston 10, Mass.

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes over a hundred and seventy-five national and regional societies and associations and over fourteen thousand individuals, corporations, and organizations. Membership in the National Fire Protection Association is open to any society, corporation, firm or individual interested in the protection of life or property against loss by fire.

This pamphlet is one of a large number of publications on fire safety issued by the Association. The standards prepared by the technical committees of the National Fire Protection Association and adopted in the conventions of the Association, are intended to prescribe reasonable measures for minimizing fire losses. All interests concerned have opportunity through the National Fire Protection Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

COMMITTEE ON FINISHING PROCESSES.

J. W. MORRIS, JR., *Chairman,*
South-Eastern Underwriters Assn., Atlanta.

T. H. BACON,
Canadian Underwriters' Association.
C. A. BADEAU,
National Electrical Mfrs. Assn.
GEORGE M. HOMEWOOD,
National Paint, Varnish and Lacquer Association.
F. C. HUNTINGTON,
Improved Risk Mutuals.
GEORGE J. MALLOY,
Travelers Fire Insurance Co.
W. S. MARSH,
Factory Mutual Engineering Division.
A. R. MILLER,
Factory Insurance Assn.
H. H. ALLEN MORRIS,
Assn. of Casualty and Surety Companies.
F. G. NENTWIG,*
Director of Fire Prevention, Fisher Body Detroit Div.
T. J. OCASEK,*
Rollins Burdick Hunter Co.
FRANK R. PITT,
National Spray Painting and Finishing Association.
M. K. ROUSE,
Pacific Fire Rating Bureau.
CARL J. SETZER,
Ohio Inspection Bureau.
G. E. STECHER,*
Weehawken, N. J.
P. R. WESLEY,
Western Acturial Bureau.

*Serving in a personal capacity in accordance with Par. 11-b-2 of the Regulations on Technical Committee Procedure.

This standard was prepared by the Committee on Finishing Processes and adopted by the Association in annual meeting on June 12, 1952. It supersedes the standard adopted by the Association in 1940 (revised 1946) as printed in National Fire Codes, Volume I, 1951 and in Pamphlet No. 34 printed by the National Board of Fire Underwriters, dated May 1941. The 1952 text contains a complete rearrangement of subject matter with more specific details of the requirements for electrical equipment, greater emphasis on preventing the overflow of flammable dip tank contents in the event of fire and more details on ventilation. For history of prior editions dating back to 1913 see National Fire Codes, Vol. I, Flammable Liquids, Gases, Chemicals and Explosives. For record of official NFPA actions, see NFPA Proceedings.

STANDARDS FOR DIP TANKS CONTAINING FLAMMABLE OR COMBUSTIBLE LIQUIDS. (NFPA NO. 34).

Scope.

1. These Standards apply to operations in which articles or materials are passed through contents of tanks, vats or containers of flammable or combustible liquids, including coating, finishing, treating and similar processes.

2. These Standards outline practical minimum requirements to obtain reasonable safety under average contemplated conditions. Where special industrial processes such as saturating machines for roofing felt, etc., are involved, the authority having jurisdiction may modify these Standards or require additional safeguards in accordance with the principles on which these Standards are based.

3. Ovens and dryers which may be used in connection with dip tanks are covered in other Standards (see NFPA Standards for Class A Ovens and Furnaces, NFPA Pamphlet No. 86).*

4. These Standards do not apply to dip tanks containing non-combustible liquids.

5. For suggested safeguards of salt baths for heat treatment of metals see Research Report No. 2 (1946) of the National Board of Fire Underwriters.**

NOTE: An outline of the general principles useful in determining means to reduce the fire and explosion hazards incident to dipping operations, together with a summary of the major mandatory requirements and illustrations of suggested arrangements are contained in the APPENDIX to these Standards.

*This and other NFPA publications mentioned herein available from the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.
**This and other NBFU publications mentioned herein available from the National Board of Fire Underwriters, 85 John St., New York 38, N. Y.

CONTENTS.

Chapter 1.

DEFINITIONS.

101. DIP TANK—For the purpose of these standards a "dip tank" shall mean a tank, vat or container of flammable or combustible liquid in which articles or materials are immersed for the purpose of coating, finishing, treating or similar processes.

102. NONCOMBUSTIBLE—For the purpose of these standards a noncombustible liquid shall mean a liquid such as water or carbon tetrachloride, the vapors of which will not ignite and burn under the most severe conditions contemplated.

103. VAPOR AREA—For the purpose of these standards a "vapor area" shall mean any area containing dangerous quantities of flammable vapors in the vicinity of dip tanks, their drain boards or associated drying, conveying or other equipment, during operation or shut down periods. The authority having jurisdiction may determine the extent of the vapor area, taking into consideration the characteristics of the liquid, the degree of sustained ventilation, and the nature of the operations.

NOTE 1. A vapor area is created by the exposed surface of a liquid when the temperature of the liquid is equal to or above its flashpoint. Hence a liquid with a flashpoint of 110 degrees F. (closed cup) may create a vapor area without the application of artificial heat when used in a very warm atmosphere. When artificial heat is applied to a liquid having a flashpoint well above the maximum contemplated atmospheric temperature, automatic arrangements to properly limit the liquid temperature will assist in preventing the formation of a vapor area.

NOTE 2. When unenclosed dipping operations involve highly volatile liquids or large exposed surfaces, either in an open tank or on dipped materials, the vapor area may extend to all portions of the room in which the process is located. When, however, operations are provided with adequate continuous ventilation the vapor area may extend only a limited distance.

NOTE 3. The information in Chapter 4 and Appendix C of NFPA Standards for Class A Ovens and Furnaces (NFPA Pamphlet No. 86) may be of assistance in determining the adequacy of ventilation necessary to prevent the formation or limit the extent of a vapor area under the many variable conditions encountered in dipping operations.

NOTE 4. A controlled vapor concentration not exceeding 25% of that required to produce a lower explosive limit mixture may be considered as not dangerous from fire or explosion. In many cases a further reduction in vapor concentration is needed to prevent toxic effect on workmen. Where conditions of the rate of vapor-air movement are not subject to change, approved vapor testing equipment may be of assistance in establishing the extent of a vapor area.

Chapter 2.

LOCATION OF PROCESSES.

201. Dip tanks should preferably be located in detached one-story sprinklered buildings of fire-resistive construction or on the ground floor of similar buildings in an area well separated or cut off by fire-resistive walls or partitions from other occupancies.

When located in buildings of other than fire-resistive construction, it is advisable that combustible unsprinklered ceilings over dipping operations be protected by materials having not less than 30 minutes fire resistance rating.

202. The floor of process areas should be so waterproofed, curbed and drained to a point of safe discharge as to safeguard property below or in the vicinity against damage by overflow of flammable liquids or by water, in the event of fire. (For suggestions for waterproofing floors, see NFPA Standards No. 92.)

203. Because of the possible accumulation of flammable vapors, dip tanks should not be located in basements.

204. Dip tank operations should be so located that in the event of fire originating at the equipment, freedom of egress and access will not be impaired.

Chapter 3.

VENTILATION.

301. Vapor areas as defined in Section 103 shall be limited to the smallest practical space by maintaining a properly designed system of mechanical ventilation arranged to move air from all directions towards the vapor area origin and thence to a safe outside location. Ventilating systems shall conform to NFPA Standards for Blower and Exhaust Systems (NFPA Pamphlet No. 91).

NOTE 1. The proper design of a ventilating system may involve a separate engineering problem for each installation. Although the characteristics of liquids used in dip tank operations differ widely, most vapors from volatile liquids in use are heavier than air and, without controlled ventilation, may form explosive air-vapor strata at locations remote from the liquid of their origin. In order to properly ventilate a room containing dipping operations, all portions of the enclosure must be considered and air inlets as well as air outlets to the enclosure must be controlled as to location and capacity.

NOTE 2. When drying dipped articles or materials, it is practical to maintain sufficient air velocity over their surface to keep the surrounding atmosphere below the explosive range of the evaporating solvent.

302. Required ventilating systems shall be so arranged that the failure of any ventilating fan shall automatically stop any dipping conveyor system. (See also Section 409.)

303. When a required ventilating system serves associated drying operations utilizing a heating system which may be a source of ignition, means shall be provided for pre-ventilation before heating system can be started; the failure of any ventilating fan shall automatically shut down the heating system; and the installation shall otherwise conform to NFPA Standards for Class A Ovens and Furnaces (NFPA Pamphlet No. 86).

Chapter 4.

CONSTRUCTION OF DIP TANKS.

401. Dip tanks, including drain boards if provided, shall be constructed of substantial noncombustible material, and their supports shall be of heavy metal, reinforced concrete or masonry. Where dip tanks extend through a floor to the story below or where the weakening of the tank supports by fire may result in the tank collapse, supports should be of material having not less than one-hour fire resistance.

402. The top of a dip tank should be not less than 6 inches above the floor of the room in which located in order to prevent water flowing into tank and overflowing contents during fire fighting.

403. If drain boards drain into dip tank they should be arranged to automatically prevent conducting water into dip tank in the event of fire. (See also Appendix C.)

404. Liquid level of dip tanks should be maintained not less than 6 inches below top of tanks to allow effective application of extinguishing agents in event of fire.

405. Overflow Pipes.

(a). Dip tanks of over 150 gallons in capacity or 10 square feet in liquid surface area shall be equipped with a properly trapped overflow pipe leading to a safe location outside buildings. Smaller dip tanks should also be so equipped, where practical. The discharge of the overflow pipe should be so located and arranged that if the entire combustible contents of dip tank is overflowed through overflow pipe by the application of water during fire fighting, property will not be

endangered. The size of the overflow pipe should be sufficient to conduct the maximum rate of flow of water expected to be applied to the liquid surface of the dip tank from automatic sprinklers or from other sources in the event of fire.

(b). Overflow pipes shall be of sufficient capacity to overflow the maximum delivery of dip tank liquid fill pipes but shall not be less than 3 inches in diameter and shall be increased in size depending upon the area of the liquid surface and the length and pitch of pipe.

(c). If the liquid surface area of dip tank (and drain board, unless drain board is arranged to positively prevent drainage into dip tank) is 75-150 square feet, diameter of overflow pipe should be not less than 4 inches; if 150-225 square feet, not less than 5 inches; if 225-325 square feet, not less than 6 inches.

(d). On large dip tanks, multiple overflow connections are preferable to a single large pipe, provided the aggregate cross sectional area is equivalent.

(e). Overflow pipes should be connected to dip tanks through a flared outlet where the accumulation of caked or dried material may clog the overflow opening.

(f). Piping connections on drains and overflow lines shall be designed so as to permit ready access for inspection and cleaning of interior.

(g). The bottom of the overflow connection shall be not less than 6 inches below the top of the tank. (See also Sections 404 and 833.)

406. Bottom Drains.

(a). Dip tanks over 500 gallons in liquid capacity shall be equipped with bottom drains automatically and manually arranged to quickly drain tank in event of fire, unless the viscosity of the liquid at normal atmospheric temperature makes this impractical. Manual operation shall be from a safely accessible location. Where gravity flow is not practicable, automatic pumps shall be required.

(b). Such drain shall be trapped and discharge to a closed properly vented salvage tank or to a safe location outside which will not endanger property.

(c). According to tank capacity the diameter of bottom drain pipe shall be not less than the following:

500 to 750 gallons—3 in.
750 to 1,000 gallons—4 in.
1,000 to 2,500 gallons—5 in.
2,500 to 4,000 gallons—6 in.
over 4,000 gallons—8 in.

(d). Where the drain line is long or of poor pitch the pipe size should be increased.

407. Salvage Tanks.

(a). Where salvage tanks are employed, pumping arrangements should be provided for the transfer of their contents; salvage tanks should not be used for storage.

(b). The capacity of salvage tank shall be greater than the capacity of the dip tank or tanks to which they are connected.

(c). Salvage tanks should preferably be located outside underground; however, subject to approval of the authority having jurisdiction they may be located inside.

408. Automatic Extinguishing Facilities.

(a). Except as noted in Section 916 (applying to hardening and tempering tanks), all dip tanks exceeding 150 gallons liquid capacity or having a liquid surface area exceeding 10 square feet shall be protected with at least one of the automatic extinguishing facilities conforming to Sections 820, 830, 840 or 850 of these Standards.

(b). Dip tanks containing a liquid with a flashpoint below 110° F. (when used in such a manner that the liquid temperature may equal or be greater than its flashpoint from artificial or natural causes) shall conform to Section 408(a) when having both a capacity of more than 10 gallons and a liquid surface area of more than 4 square feet.

(c). It is desirable that all dip tanks, irrespective of size or type of combustible or flammable liquid also conform to Section 408(a), where practical.

409. Conveyor Systems.

(a). Dip tanks utilizing a conveyor system shall be so arranged that in the event of fire, the conveyor system shall automatically cease motion and required bottom drains shall open. Conveyor systems shall automatically cease motion unless required ventilation is in full operation. (See also Section 302.)

410. Heating Dip Tank Liquids.

(a). When dip tank liquids are artificially heated, either by the dipping of heated articles or by other application of heat to the liquid, provision shall be made to prevent an abnormal temperature rise in the liquid. (See also Chapter 9, pertaining to hardening and tempering tanks.)

Chapter 5.

LIQUIDS USED IN DIP TANKS, STORAGE AND HANDLING.

501. The safeguards provided for the storage and handling of dip tank liquids having a flashpoint of below 200 degrees F. shall be not less than accepted good practice as covered in NFPA Suggested Ordinance on Flammable Liquids (NFPA Pamphlet No. 30L) nor less than NBFU Standards for the Storage, Handling and Use of Flammable Liquids (NBFU No. 30).

502. The safeguards provided for the storage and handling of dip tank liquids having a flash point (closed cup) of 200 degrees F. or higher should, where practicable, also conform to Section 501 of these Standards.

503. The use of approved, properly grounded, closed pumping systems for the supply and removal of flammable liquids in connection with dip tanks is considered safer than the handling of such liquids in portable containers. Where portable containers are used for the replenishment of flammable liquids, provision shall be made so that both the container and tank shall be positively grounded and electrically bonded to prevent static electric sparks.

504. Storage of full or empty containers within process buildings should not exceed the requirements for one operating shift.

Chapter 6.

ELECTRICAL AND OTHER SOURCES OF IGNITION.

601. There shall be no open flames, spark producing devices, or heated surfaces having a temperature sufficient to ignite vapors in any vapor area, as defined by Section 103.

602. Except as specifically permitted in Chapter 9, relating to electrostatic apparatus, electrical wiring and equipment in any vapor area (as defined by Section 103) shall be explosion proof type approved for Class I, Group D locations and shall otherwise conform to the provisions of the National Electrical Code (NFPA Pamphlet No. 70), Article 500, Class I, Division 1.

NOTE: It will be observed that the presence of ordinary infra-red drying lamps is prohibited in any vapor area (as defined by Section 103); however, their use is permitted when adequate ventilation, conforming to Section 303 is maintained in such manner that their location is not within the vapor area.

603. Unless specifically approved for locations containing both deposits of readily ignitable residues and explosive vapors, there shall be no electrical equipment in the vicinity of dip tanks or associated drain boards or drying operations which are subject to splashing or dripping of dip tank liquids, except wiring in rigid conduit or in threaded boxes or fittings containing no taps, splices or terminal connections, and except as hereinafter specifically permitted in Chapter 9, relating to electrostatic apparatus.

604. In any floor space outside a vapor area (as defined by Section 103) but within 20 feet therefrom, and not separated by tight partitions, there shall be no open flames or spark producing devices [except as specifically permitted in NFPA Standards No. 86 (Section 2033) applying to Class A Ovens] and electrical wiring and equipment shall conform to the provisions of the National Electrical Code (NFPA Pamphlet No. 70), Article 500, Class I, Division 2.

NOTE: The distance of 20 feet specified in Section 604 should be increased when abnormal conditions such as the failure of a ventilating system would be likely to spread the vapor area.

Chapter 7.

OPERATIONS AND MAINTENANCE.

701. Areas in vicinity of dip tanks shall be kept as clear of combustible stock as practical and shall be kept entirely free of combustible debris.

702. When waste or rags are used in connection with dipping operations, approved metal waste cans shall be provided and all impregnated rags or waste deposited therein immediately after use. The contents of waste cans shall be properly disposed of at least once daily at the end of each shift.

703. Periodic inspection or tests of all dip tank facilities shall be made, including covers, overflow pipe inlets and discharge,

bottom drains and valves, electrical wiring and equipment and grounding connections, ventilating facilities, and all extinguishing equipment. Any defects found shall be promptly corrected.

704. "No Smoking" signs in large letters on contrasting color background shall be conspicuously posted in the vicinity of dip tanks.

705. Conspicuous signs should be posted in the vicinity of dipping operations conveying the following warning:

NO WELDING

The use of welding or cutting equipment in, or near this area is dangerous because of fire and explosion. Welding and cutting shall be done only under the supervision of the foreman in charge.

Chapter 8.

EXTINGUISHMENT.

810. Extinguishers.

811. Areas in the vicinity of dip tanks shall be provided with manual fire extinguishers suitable for flammable liquid fires, conforming to NFPA Standards for First Aid Fire Appliances (NFPA Pamphlet No. 10).

820. Automatic Water Spray Extinguishing Systems.

821. Such systems shall conform to NFPA Standards for Water Spray Systems for Fire Protection (NFPA Pamphlet No. 15) and shall be arranged to protect tanks, drain boards and stock over drain boards.

830. Automatic Foam Extinguishing Systems.

831. Such systems shall conform to NFPA Standards for Foam Extinguishing Systems (NFPA Pamphlet No. 11) and shall also conform to the following:

832. Foam producing material selected shall be suitable for intended use, taking into account characteristics of the dip tank liquid. Alcohol, ether or ester solvents may require "alcohol type" foams. When dip tank contents include wetting agents, foam protection may be ineffective.

833. Overflow pipe shall be arranged to prevent the floating away of foam and clogging overflow pipe. This may be accomplished by either of the following:

(a) Overflow pipe may be extended through tank wall and terminated in an ell pointing downward. The bottom of the overflow pipe at the point it pierces tank wall should not be over two inches above the opening or face of the ell.

(b) Overflow pipe inlet may be provided with a removable screen of one-fourth inch mesh having an area at least twice the cross-sectional area of overflow pipe. Screens which may be clogged by dip tank ingredients shall be inspected and cleaned periodically.

834. Where the characteristics of the foam are such that it will not readily flow into corners of rectangular dip tanks, such tanks should be provided with rounded corners, except where a sufficient number of discharge outlets are provided to deliver foam into corners or where foam is distributed by overhead spray heads with spray pattern including full tank area, or, except where foam quantities delivered are greatly in excess of minimum requirements for the area.

835. Where dip tank contents are artificially heated to temperatures above 100 degrees F., increased foam delivery rates and total foam quantities may be required. Where dip tank contents are at temperatures above 212 degrees F., a boilover hazard may be created by foam system protection, especially if there is the possibility of a slug of water or unreacted foam ingredients entering the tank. When boilover is likely to occur, the area surrounding the tank should also be protected.

840. Automatic Carbon Dioxide Systems.

841. Such systems shall conform to NFPA Standards for Carbon Dioxide Fire Extinguishing Systems (NFPA Pamphlet No. 12) and shall be arranged to protect both dip tanks and drain boards and unless stock over drain boards is otherwise protected with automatic extinguishing facilities, shall also be arranged to protect such stock.

850. Dip Tank Covers.

851. Covers arranged to close automatically in the event of fire shall be actuated by approved automatic devices and shall also be arranged for manual operation.

852. Covers shall be of substantial noncombustible material or of tin-clad type with enclosing metal applied with locked joints. Covers should overlap the sides of the tank at least 1 inch and preferably have a recess or flange extending downward around

the tank when it is closed. The cover should be securely but loosely hung on hinges or guides, due provision being made for the possible accumulation of obstructions on the moving parts. Large heavy covers should be provided with counter weights where necessary to prevent injury to employees.

853. Chains or wire rope shall be used for cover support or operating mechanism where the burning of a cord would interfere with the action of a device. Combustible cord may be used elsewhere. All pulleys, catches and other such fasteners should be of metal and where possible, attached to noncombustible mountings.

854. Where drain boards return drippings to tanks, special means should be provided to permit the cover to close tightly and prevent water from sprinklers or other sources draining into dip tank in the event of fire. (Also see Section 403.)

855. Covers shall be kept closed when tanks are not in use.

NOTE: See also Appendix C for suggested arrangements of dip tank covers.

Chapter 9.

SPECIAL DIP TANK APPLICATIONS.

910. Hardening and Tempering Tanks.

NOTE: The heat treatment of metals may involve their cooling by immersion in combustible liquids. Localized overheating of the surface of the liquid at the time of immersion or the heating of the entire contents of a tank to its flashpoint can result in serious fire.

911. Except as modified in this Chapter and except for Chapters 3 and 6, all of the preceding standards for dip tanks are applicable.

912. Tanks shall be located as far as practicable from furnaces and shall not be located on or near combustible floors. Combustible stock and other combustible materials should not be stored in the vicinity of dipping operations.

913. Tanks shall be provided with a noncombustible hood and vent or other equally effective means, venting to outside of building to serve as a vent in case of fire. All such vent ducts shall be treated as flues and be kept well away from combustible roofs or materials. To facilitate removal of vapors from the process and to prevent condensate forming on roof structures, a fan of adequate capacity may be necessary. Hoods should not interfere with fire protection facilities.

914. Tanks shall be so designed that the maximum work load is incapable of raising the temperature of the cooling medium to within 50 degrees below its flashpoint, or such tanks shall be equipped with circulating cooling systems which will accomplish the same result.

915. Tanks shall be equipped with a high temperature limit switch arranged to sound an alarm when the temperature of the quenching medium reaches within 50 degrees F. below the flashpoint. If practical from an operating standpoint, such limit switches shall also shut down conveying equipment supplying work to the tank.

916. The provisions of Section 408 shall apply to tanks having a liquid surface area of 25 square feet or more or a capacity of 500 gallons or more.

917. Air under pressure shall not be used to fill or to agitate oil in tanks.

918. Drain facilities from bottom of tank may be combined with the oil circulating system or arranged independently to drain the oil to a safe location. The authority having jurisdiction should be consulted as to whether the drain valve shall be operated automatically with approved heat actuated devices or manually, and if the latter, the valve shall be operated from a safe distance.

920. Flow Coat.

921. Except as modified in this Chapter, all of the preceding standards for dip tanks apply.

922. All flow coat operations should be within an effective noncombustible enclosure, adequately vented to the outside of building.

923. All piping shall be strongly erected and rigidly supported.

924. Paint shall be supplied by direct low pressure pumping arranged to automatically shut down by means of approved heat actuated devices, in case of fire, or paint may be supplied by a gravity tank not exceeding 10 gallons in capacity.

925. The area of the sump and any areas on which paint flows should be considered the area of dip tank for the purpose of interpreting these standards.

930. Electrostatic Apparatus.

931. When installation and use of electrostatic detearing equipment is judged by the authority having jurisdiction to be

permissible, such installation and use shall conform to Chapters 1 through 8 of these Standards (except hereinafter modified), and shall also conform to the requirements of this Chapter.

932. Electrostatic apparatus and devices used in connection with paint detearing operations shall be of approved types.

933. Transformers, power packs, control apparatus, and all other electrical portions of the equipment, with the exception of high voltage grids and their connections, shall be located outside the vapor area as defined in Chapter 1 or shall conform to the requirements of Chapter 6.

934. Electrodes shall be of substantial construction, shall be rigidly supported in permanent locations and shall be effectively insulated from ground. Insulators shall be nonporous and noncombustible.

935. High voltage leads to electrodes shall be effectively and permanently supported on suitable insulators, and shall be effectively guarded against accidental contact or grounding. An automatic means shall be provided for grounding and discharging any accumulated residual charge on the electrode assembly or the secondary circuit of the high voltage transformer when the transformer primary is disconnected from the source of supply.

936. A space shall be maintained between goods being deteared and electrodes or conductors of at least twice the sparking distance. A suitable sign stating the sparking distance shall be conspicuously posted near the assembly.

937. Goods being deteared using this process are to be supported on conveyors. The conveyors shall be so arranged as to maintain safe distances between the goods and the electrodes at all times. All goods shall be so supported as to prevent any swinging or movement which would reduce the clearance to less than specified in Section 936.

938. This process is not approved where goods being deteared are manipulated by hand. Special approval must be obtained for such operations.

939. Electrostatic apparatus shall be equipped with automatic controls which will operate without time delay to disconnect the power supply to the high voltage transformer and to signal the operator under any of the following conditions:

(a). Stoppage of ventilating fans or failure of ventilating equipment from any cause.

(b). Stoppage of the conveyor carrying goods past the high voltage grid.

(c). Occurrence of a ground or of an imminent ground at any point on the high voltage system.

(d). Reduction of clearance below that specified in Section 936.

940. Adequate fencing, railings or guards shall be so placed about the equipment that they, either by their location or character or both, assure that a safe isolation of the process is maintained from plant storage or personnel. Such railings, fencing and guards shall be of conducting material, adequately grounded, and should be at least 5 feet from processing equipment.

941. Signs designating the process zone as dangerous as regards fire and accident should be posted.

942. Electrode insulators shall be kept clean and dry.

943. Detearing area shall be ventilated by exhausting adequate air from the area as specified in Chapter 3.

944. All areas for detearing shall be protected by automatic sprinklers where this protection is available. Where this protection is not available, other approved automatic extinguishing equipment shall be provided.

945. Drip plates and screens subject to paint deposits shall be removable and shall be taken to a safe place for cleaning.

950. Other Dip Tank Applications.

951. Saturating operations for roofing felt and similar material and other special dip tank operations should conform to the applicable Sections of these Standards. The authority having jurisdiction should be consulted concerning the modification of these Standards or additional safeguards necessary for unusual dip tank applications.

APPROVED EQUIPMENT.

The National Fire Protection Association does not "approve" individual items of equipment. The standards are prepared, as far as practicable, in terms of required performance, avoiding specification of materials, devices or methods so phrased as to preclude obtaining the desired results by other means. The suitability of devices and materials for installation under these standards is indicated by the listings of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada and the Factory Mutual Laboratories test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

APPENDIX A.

General Principles.

A.1 The operation of dipping articles or materials by passing them through flammable or combustible liquid in tanks or vats usually involves hazards of fire or explosion. These hazards vary in intensity with the character and quantity of the combustible materials involved and with the manner in which the operations are conducted. The severity of the hazard depends greatly on the character and flammability of liquids and solvents employed and the articles or materials processed, on the quantities present and on the rate of evaporation, but even with small quantities the hazard is intense if highly flammable materials are employed. The greater the operations, the greater the need for secure separation and strong protective measures. Operations involving the use of low flashpoint solvents are especially hazardous; however, the use of high flashpoint liquids at elevated temperatures may create equivalent hazards.

A.2 The requirements of these Standards are based on the premise that the dangers of fire or explosion involved in operations of this nature may include the following:

(a). The readiness of ignition and possibly explosive combustion of flammable vapors evolved from the liquid surface, from the surfaces of freshly coated articles or material, or from surfaces of drain or drip boards, with the quick spread of fire.

(b). The intensity and persistence of burning of flammable liquids with the heavy generation of smoke.

(c). The spread of damage to adjacent areas and materials from flowing burning liquids because of container rupture, boilover or overflow.

Most flammable liquids being lighter than water will float on a water surface and during fire fighting operations water applied to a flammable liquid in a dip tank, may cause an overflow and result in floating burning liquid extending to remote locations.

A.3 The dangers involved in these operations may be reduced by the following provisions:

(a). The use of fire-resistant forms of construction, automatic sprinkler protection, and the separation of the operation from other operations, materials or occupancies by isolation or by fire walls, fire partitions, or curtain-boards.

(b). The safe removal or dissipation of flammable vapors and the prevention of their contact with sources of ignition such as open flames, welding and cutting operations, or glowing bodies, or static or other electrical sparks.

(c). The provision of quick acting devices for the smothering of fire on liquid surfaces and for the application of extinguishing agents on freshly coated articles or materials and drain boards together with provision for the safe confinement of overflow of flammable liquids.

(d). The use of quick acting bottom drain facilities for removal of flammable contents of dip tanks to a safe location, thus reducing the intensity and duration of fire.

(e). The education of personnel in proper operational procedures for both normal and emergency conditions and the adequate maintenance of equipment by periodic inspections, clean ing and testing.

APPENDIX B.

Major Mandatory Requirements.

B.1 Because of the almost limitless variety of arrangements of industrial processes utilizing dip tanks, the foregoing Standards are largely devoted to advisory provisions which emphasize the fundamental principles of inherent hazards and their safeguards. In order to assist in the application of these Standards, the major mandatory variations based on type of liquid and size of dip tank are summarized below:

B.2 Vapor Hazard: Dip tanks utilizing liquids with a flashpoint of less than 110 degrees F. (closed cup) when used in an atmosphere which may reach or exceed this temperature or when any dip tank liquid is heated by artificial means to a temperature which may equal or exceed its flashpoint:

(a). Mechanical ventilation to be provided. (See Chapter 3.)

(b). Open flames, spark producing devices and heated surfaces to be prohibited in any area containing flammable vapor-air mixtures. (See Chapter 6.)

(c). Dip tanks not to be located below surrounding grade where heavy vapors cannot drain to outside. (See Section 203.)

B.3 Size of Dip Tank: (Utilizing flammable or combustible liquids, irrespective of flashpoint.)

(a). Over 10 square feet in liquid surface area or over 150 gallons in capacity, to be provided with overflow pipes (See Section 405) and except as modified by Section 916, also to be provided with automatic extinguishing facilities (See Section 408). Smaller dip tanks should also be provided with automatic extinguishing facilities particularly when using low flashpoint solvents. [See Sections 408(b) and 408(c)].

(b). Over 500 gallons capacity, to be provided with bottom drains, unless viscosity of liquid at normal atmospheric temperature makes this requirement impractical. (See Section 406.)

APPENDIX C.

Illustrations of Suggested Arrangements.

NOTE: The following illustrations represent only general principles of dip tank arrangements and are not intended to cover detail design. Alternate arrangements accomplishing the same objectives are equally effective.

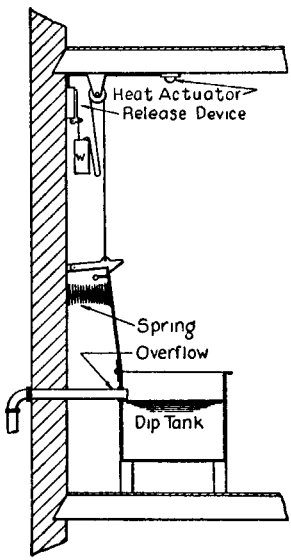

Fig. 1.
A small dip tank with an automatic cover and an overflow.

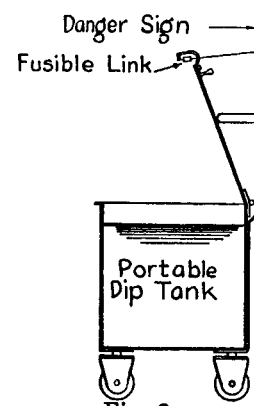

Fig. 2.
A portable tank with an automatic cover.