NFPA No.

35

ORGANIC COATINGS MANUFACTURE 1970

$1.00

NATIONAL FIRE PROTECTION ASSOCIATION
International
60 Batterymarch Street, Boston, Mass. 02110

4M-6-70-WP-FP
Printed in U.S.A.

Official NFPA Definitions

Adopted Jan. 23, 1964: Revised Dec. 9, 1969. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations or that which is advised but not required.

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*Among the laboratories nationally recognized by the authorities having jurisdiction in the United States and Canada are the Underwriters' Laboratories, Inc., the Factory Mutual Research Corp., the American Gas Association Laboratories, the Underwriters' Laboratories of Canada, the Canadian Standards Association Testing Laboratories, and the Canadian Gas Association Approvals Division.

LISTED: Equipment or materials included in a list published by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

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AUTHORITY HAVING JURISDICTION: The organization, office or individual responsible for "approving" equipment, an installation, or a procedure.

Statement on NFPA Procedures

This material has been developed in the interest of safety to life and property under the published procedures of the National Fire Protection Association. These procedures are designed to assure the appointment of technically competent Committees having balanced representation from those vitally interested and active in the areas with which the Committees are concerned. These procedures provide that all Committee recommendations shall be published prior to action on them by the Association itself and that following this publication these recommendations shall be presented for adoption to the Annual Meeting of the Association where anyone in attendance, member or not, may present his views. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

Standard for the

Manufacture of Organic Coatings

NFPA No. 35 — 1970

1970 Edition of No. 35

This 1970 edition of Standard for the Manufacture of Organic Coatings was developed by the NFPA Sectional Committee on Coating Manufacture, approved by the Flammable Liquids Correlating Committee, and adopted by the Association at its Annual Meeting, May 18-22, 1970. It supersedes the 1964 edition.

Origin and Development of No. 35

The Standard on Lacquer Manufacturing Plants, the predecessor text covering this subject, was originally developed by the NFPA Manufacturing Hazards Council. Following the discontinuance of this Council by the Association, jurisdiction over this standard was given to the NFPA Committee on Flammable Liquids.

The Committee decided to greatly expand the scope of the publication to include the manufacture of all flammable organic coatings. In 1963 this greatly expanded text was officially adopted as a recommended practice. In 1964 the text was revised, but the same format was maintained. The 1970 edition reflects a major change in format from a recommended practice to a standard. Additionally, numerous changes have been made in the text to reflect the developments within the organic coating manufacturing industry.

Committee on Flammable Liquids

Correlating Committee

Paul C. Lamb, *Chairman,*
140 Dwight Place, Englewood, N. J. 07631

Miles E. Woodworth,† *Secretary,*
National Fire Protection Assn., 60 Batterymarch St., Boston, Mass. 02110

W. S. Brooks, Western Actuarial Bureau.

Roger D. Freriks, Federation of Societies for Paint Technology

Harry W. Martin, Fire Marshals Assn. of North America.

J. Sharp Queener, National Paint, Varnish & Lacquer Assn.

E. C. Sommer, American Petroleum Institute.

E. F. Tabisz, Underwriters' Laboratories of Canada.

T. H. Wright, Worthington, Ohio.

Corresponding Members†

H. Griffiths, Walsall County Borough Council, Walsall, Staffs., England.

Dr. Ing. Gert Magnus, Mannheim, Germany.

SCOPE: To direct the activities of the eight Sectional Committees assigned to it which have primary responsibility for the development and revision of NFPA Codes, Standards, Recommended Practices, and Manuals pertaining to the storage, transportation, handling, and use of flammable and combustible liquids. This Correlating Committee shall act in an administrative and judicial capacity to establish that no conflicts exist and that satisfactory correlation is achieved among the recommendations of the Sectional Committees operating under its jurisdiction. Each report of a Sectional Committee shall be reviewed by, and a two-thirds affirmative vote secured from, the Correlating Committee before the report is submitted to an NFPA Annual Meeting. In cases where the Correlating Committee finds reason to object to a report, it shall refer the report back to the appropriate Sectional Committee with explanation as to its reasons for so doing, but shall not, itself, modify the report.

Sectional Committee on Coating Manufacture

Roger D. Freriks, *Chairman,*
The O'Brien Corp., 2001 W. Washington Ave., South Bend, Ind. 46621
(rep. Federation of Societies for Paint Technology)

Miles E. Woodworth,† *Secretary,*
National Fire Protection Assn., 60 Batterymarch St., Boston, Mass. 02110

Martin M. Brown, Commerce & Industry Ins. Co.

Royal A. Brown, National Paint, Varnish & Lacquer Assn.

G. E. Cain, National Paint, Varnish & Lacquer Assn.

Wm. R. Favinger, Fire Marshals Assn. of North America.

G. G. Fleming, Manufacturing Chemists' Assn.

Richard J. Haviland, Glidden-Durkee Div., SCM Corporation.

Charles H. Howe, Jr., Fire Protection Engineer Montgomery County, Rockville, Md.

E. F. McLaughlin, American Petroleum Institute.

William I. Morton, E. I. du Pont de Nemours & Co.

Clay B. Wade, South-Eastern Underwriters Assn.

Wm. C. Whiting, New England Insurance Rating Assn.

†Nonvoting.

SCOPE: To develop recommended practices for safety to life and property from fire and explosion in the operation of organic coating manufacturing processes.

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Standard for the

Manufacture of Organic Coatings

NFPA No. 35 — 1970

CHAPTER I. INTRODUCTION

10. Scope and Application.

101. This Standard shall:

1010. Apply to facilities and processes used for the manufacture of protective and decorative finishes or coatings for industrial, automotive, marine, transportation, institutional, household and other purposes.

1011. Apply only to those organic coatings manufacturing facilities involving flammable and combustible liquids.

1012. Prescribe reasonable measures for safety to life and property from fire and explosion in the operation of manufacturing organic coatings.

1013. Provide a means by which plant management and supervisory personnel may evaluate the hazards of operations under their jurisdiction.

1014. Provide a guide for design engineers, architects and others in planning new installations.

102. Where unique processes or unusual hazards to life and property are involved, the authority having jurisdiction may require safeguards in addition to those required by this Standard or may modify the requirements provided equivalent safety is maintained.

103. This Standard shall not apply to:

1030. Operations involving the use or application of coatings materials.

NOTE: The Standard for Spray Finishing, NFPA No. 33, and the Standard for Dip Tanks, NFPA No. 34, provide information on this subject.

1031. Storage of organic coatings in locations other than the manufacturing facility.

NOTE: The Flammable and Combustible Liquids Code, NFPA No. 30, provides information on this subject.

11. Definitions

APPROVED signifies acceptance, by the authority having jurisdiction, of design, equipment, installation or intended use.

NOTE: Devices having been tested and accepted for a specific purpose by a nationally recognized testing laboratory may be deemed to be acceptable.

CLOSED CONTAINER shall mean a container as herein defined, so sealed by means of a lid or other device, that neither liquid nor vapor will escape from it at ordinary temperatures.

CONTAINER shall mean any can, barrel or drum.

FLASH POINT shall mean the minimum temperature at which a flammable or combustible liquid will give off sufficient flammable vapors to form an ignitible mixture with air near the surface of the liquid or within the vessel used as determined by the appropriate test procedure and apparatus as specified below:

The flash point of liquids having a viscosity less than 45 SUS (Saybolt Universal Seconds) at 100°F (37.8°C) [approximately 8 centipoise at 77°F (25°C)] and a flash point below 200°F (93.4°C) shall be determined in accordance with the Standard Method of Test for Flash Point by the Tag Closed Tester, ASTM D-56-70.*

The flash point of liquids having a viscosity of 45 SUS (Saybolt Universal Seconds) or more at 100°F (27.8°C) [approximately 2 centipoise at 77°F (25°C)] or a flash point of 200°F (93.4°C) or higher shall be determined in accordance with the Standard Method of Test for Flash Point by the Pensky-Martens Closed Tester, ASTM D-93-70.*

HOT WORK shall mean welding (gas or electric), burning or any work requiring or producing heat, flame, sparks, or electric current.

INERT GAS shall mean any gas which is nonflammable, chemically inactive, and noncontaminating for the use intended and oxygen deficient to the extent required.

NOTE: See Standard for Inerting for Fire and Explosion Prevention, NFPA No. 69.

INERTING shall mean the use of an inert gas to render the atmosphere of an enclosure or within equipment substantially oxygen-free or to reduce the oxygen content to a point at which combustion cannot take place.

LIQUID shall mean, for the purpose of this Standard, any material which has a fluidity greater than that of 300 penetration asphalt

*Available from American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103.

when tested in accordance with ASTM Test for Penetration for Bituminous Materials, D-5-65* (approximately equal to a viscosity of less than 60,000 poise when tested in accordance with ASTM Standard Method of Test for Rheological Properties of Non-Newtonian Materials, D-2196-68*). When not otherwise identified, the term liquid shall include both flammable and combustible liquids.

FLAMMABLE LIQUIDS shall mean any liquid having a flash point below 140°F (60°C) and having a vapor pressure not exceeding 40 pounds per square inch (absolute) (2068.6 mm) at 100°F (37.8°C).

Flammable liquids shall be divided into two classes as follows:

Class I liquids shall include those having flash points below 100°F (37.8°C) and may be subdivided as follows:

Class IA shall include those having flash points below 73°F (22.8°C) and having a boiling point below 100°F (37.8°C).

Class IB shall include those having flash points below 73°F (22.8°C) and having a boiling point at or above 100°F (37.8°C).

Class IC shall include those having flash points at or above 73°F (22.8°C) and below 100°F (37.8°C).

Class II liquids shall include those having flash points at or above 100°F (37.8°C) and below 140°F (60°C).

COMBUSTIBLE LIQUIDS shall mean any liquid having a flash point at or above 140°F (60°C) and shall be known as Class III liquids.

NOTE: This classification does not apply to:

(1) Liquids without flash points that may be flammable under some conditions, such as certain halogenated hydrocarbons and mixtures containing petroleum fractions and halogenated hydrocarbons,

(2) Mists, sprays or foams.

NOTE: The volatility of liquids is increased when they are heated. When heated to temperatures equal to or higher than their flash points, Class II and Class III liquids shall be subject to the applicable requirements for Class I or Class II liquids.

UNSTABLE (REACTIVE) LIQUID shall mean 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.

MONOMERS shall mean unsaturated organic compounds, containing a reactive group, which polymerize by themselves or with other monomers to produce polymers. These monomers may be

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liquids (styrene, ethyl acrylate), gases (butadiene, vinyl chloride), or solids (acrylamide), and exhibit the same flammability characteristics that would be expected of any organic compound with their physical constants. These monomers represent an additional hazard because of the exothermic heat that would be evolved if uncontrolled polymerization occurred.

NITROCELLULOSE shall mean a nitrated cellulose (cotton linters or wood pulp) with a nitrogen content ranging from 10.5 percent to 12.4 percent. It is a fibrous, granular, cubed or flake-like material wetted with 20 to 30 percent alcohol or other organic liquid having a flash point not lower than 30°F. Nitrocellulose may also be wetted with 20 to 25 percent water.

ORGANIC COATINGS shall mean liquid mixtures of binders such as alkyd, nitrocellulose, acrylic, or oil, and flammable and combustible solvents such as hydrocarbon, ester, ketone, or alcohol, which when spread in a thin film convert to a durable protective and decorative finish. These mixtures may contain pigments.

ORGANIC PEROXIDES shall mean those organic compounds which are identified by their active oxygen (-O-O-) being combined with the organic radical. This group of reactive chemicals are derivatives of hydrogen peroxides in which one or both hydrogen atoms are replaced by a hydrocarbon or heterocyclic or acid radical. Some peroxides are heat and shock sensitive and are known as "potentially explosive chemicals." Examples of such peroxides are benzoyl peroxide and methyl ethyl ketone peroxide.

PORTABLE SHIPPING TANK shall mean any container having a liquid capacity in excess of 60 U.S. gallons and not exceeding 660 U.S. gallons which is readily movable from place to place either with or without special handling equipment and which is not permanently attached to its transporting vehicle.

SAFETY CAN shall mean an approved container, of not more than five gallons capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure.

VAPOR PRESSURE shall mean the pressure, measured in pounds per square inch absolute exerted by a volatile liquid as determined by the "Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method)," (ASTM D323-58).*

*Available from American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103.

12. Existing Plants

1210. Existing plants, equipment, buildings, structures and installations for the manufacture of organic coatings and involving the use of flammable and combustible liquids which are not in strict compliance with the terms of this Standard may be continued in use provided these do not constitute a distinct hazard to life or adjoining property. The authority having jurisdiction will make this determination.

CHAPTER II. LOCATION OF PLANTS AND BUILDINGS

20. Location

2010. An organic coating manufacturing operation shall not be conducted in the same building with other occupancies. Operations incidental to or in connection with organic coating manufacturing shall not be classed as "other occupancies."

2020. An organic coating manufacturing operation shall be located so that it is accessible from at least two sides for the purpose of fire control.

2030. Where topographical conditions are such that flammable and combustible liquids may flow from the organic coating manufacturing operation so as to constitute a fire hazard to other facilities, drainage shall be provided as covered in 31.

2040. A maximum of 1,100 gallons of flammable or combustible liquids may be located adjacent to buildings located on the same premises and under the same management provided that:

(a) The buildings are devoted principally to the handling and storing of flammable or combustible liquids and the exterior walls have a fire resistance of at least two hours with no openings vertically or within 10 feet horizontally of such storage.

(b) Where quantity stored exceeds 1,100 gallons, or provisions of (a) cannot be met, a minimum distance of 10 feet between buildings and nearest container of flammable or combustible liquid shall be maintained.

21. General Layout and Design

2110. Congestion shall be avoided in planning an organic coatings manufacturing operation.

2120. Research laboratories, general offices, and storage areas preferably should not be in the same building housing manufacturing operations. If these facilities are in the same building, they shall be cut off from the manufacturing operations by a wall or partition having a fire resistance rating of at least two hours, and openings shall be equipped with approved fire doors.

2130. Areas where unstable liquids are handled or processed shall be cut off from the remainder of the plant by a wall having a fire resistance rating of at least two hours and openings equipped with approved fire doors.

2140. The location of each processing vessel shall be based upon its flammable or combustible liquid capacity. Processing vessels shall be located, with respect to distances to lines of adjoining

property which may be built upon, in accordance with Table 1, except when the processing plant is designed in accordance with 2150.

Table 1

Processing Vessels with Emergency Relief Venting to Permit Pressure	Stable Liquids	Unstable Liquids
Not in excess of 2.5 psig	Table 2*	2½ times Table 2*
Over 2.5 psig	1½ times Table 2*	4 times Table 2*

*Double distances where protection for exposure is not provided. Protection for exposures shall mean fire protection for structures on property adjacent to tanks. When acceptable to the authority having jurisdiction, such structures located (1) within the jurisdiction of any public fire department or (2) within or adjacent to plants having private fire brigades shall be considered as having adequate protection for exposures.

Table 2

Capacity Vessel Gallons	Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building
275 or less	5	5
276 to 750	10	5
751 to 12,000	15	5
12,001 to 30,000	20	5
30,001 to 50,000	30	10

2150. The distances required in 2140 may be waived when the vessels are housed within a building and the exterior wall facing the line of adjoining property which may be built upon is a blank wall having a fire resistance rating of not less than two hours. When Class IA or unstable liquids are handled, the blank wall shall have explosion resistance in accordance with good engineering practice. The balance of the building shall be designed in accordance with 34.

CHAPTER III. BUILDING CONSTRUCTION

30. General Construction

3010. Buildings shall be of fire-resistive or noncombustible construction without load bearing walls and without basements or pits. The first floor shall be at or above the grade to permit water drainage and vapor diffusion.

3020. It is recommended that manufacturing buildings be limited to two stories in height and preferably they should be one story or one story with mezzanine.

3030. It is recommended that raw material and finished stock storage buildings be confined to one story in height. These areas shall be detached or cut off from manufacturing buildings by construction having a fire resistance rating of at least two hours, and openings shall be equipped with approved fire doors.

3040. Internal partitions, where used, shall not interfere with ventilation and exit facilities and be of noncombustible construction.

3050. In multistory buildings, stairways and elevators shall be enclosed by walls having a fire resistance rating of at least two hours and be equipped with approved fire doors.

3060. Each manufacturing room shall have at least two exits, well separated, one of which shall be directly to the outside. Access to all exits shall be kept clear, and doors shall open in the direction of exit. Door fastenings shall be equipped with panic hardware. Supervisory management offices, change and locker rooms located in the manufacturing buildings shall be provided with adequate exits.

NOTE: See the Life Safety Code, NFPA No. 101.

31. Drainage

3110. Drainage facilities shall be provided to direct flammable and combustible liquid leakage and fire protection water to a safe location away from the building, any other items of important value, or adjoining property. This may require pitched floors with drains, curbs, scuppers, impounding basins, or special drainage systems. Traps and special ditch construction may be needed to control the spread of fire where drainage is by an open plant ditch serving other plant areas and possibly offering some fire exposure.

NOTE: The Standard for Water Spray Fixed Systems, NFPA No. 15, provides information on this protection.

3120. Emergency drainage systems may contain flammable and combustible liquids. If connected to public sewers or discharged into public waterways, they shall be equipped with traps or separator pits designed to pass water and retain the flammable liquid.

32. Heating

3210. Heating in hazardous areas, if required, shall be provided by indirect means. Ignition sources such as open flames, or electrical heating elements, except units approved for Class I, Group D, locations, shall not be used within the hazardous area.

33. Ventilation

3310. Enclosed buildings in which flammable liquids are processed or handled shall be continuously, mechanically ventilated at a rate not less than one cubic foot per minute per square foot of solid floor area during operating hours and shut-down time. This shall be accomplished by exhaust fans taking suction at floor levels and discharging to a safe location outside the building. The feasibility of natural ventilation may be investigated. Provision shall be made for introduction of noncontaminated intake air in such a manner that all portions of solid floor areas will be subject to a continuous, uniformly distributed movement of air.

3320. Additional local ventilation may be needed for control of health hazards. Such ventilation, if provided, may be utilized for up to 75 percent of the recommended ventilation in Section 3310. Ventilation shall be arranged to include all pits or other low points where flammable vapors may collect.

NOTE: The Standard for Blower and Exhaust Systems, NFPA No. 91, provides information on this subject.

34. Explosion Venting

3410. Structures in which Class I liquids, unstable liquids, or finely divided flammable solids are processed shall be provided with explosion venting by one or more of the following methods:

(a) Open air construction,
(b) Lightweight noncombustible walls and roof,
(c) Lightweight noncombustible wall panels and roof hatches,
(d) Windows of the explosion relief type.

3420. Enclosures shall be vented according to the nature of the materials processed and the type structure. Small enclosures where the whole area may contain an explosive mixture need to be vented more generously than larger areas where only a portion may contain an explosive mixture.

3430. In the selection of suitable venting, the following factors should be considered:

(a) Strength of structure or enclosure,
(b) The maximum explosion pressure,
(c) The position of the vents with respect to the origin of potential explosions,

(d) The bursting strength of the vent closure, or the minimum pressure required to open the vent closure if movable as a whole.

NOTE: The Guide for Explosion Venting, NFPA No. 68, provides information on this subject.

35. Electrical Equipment

3510. All electrical wiring and equipment shall be installed and maintained in accordance with nationally recognized good practice.

NOTE: The National Electrical Code, NFPA No. 70, provides information regarding such installations.

3520. Where Class I liquids are exposed to the air, the design of equipment and ventilation of buildings should be such as to limit the Class I, Division 1, location to the interior of equipment and the "immediate vicinity" of pumps or equipment locations such as dispensing stations, sand mills open centrifuges, plate and frame filters, opened vacuum filters, change cans, and the surfaces of open equipment. Immediate vicinity means a zone extending from the vapor liberation point 20 feet horizontally in all directions and vertically from the floor to a level 6 feet above the highest point of vapor liberation.

3530. All locations not covered by 3520 where Class I liquids are handled should be Class I, Division 2. However, if the flash point of the liquid processed is 100°F or above and its temperature is not raised above its flash point during processing, general purpose electrical equipment is satisfactory though care should be used either in locating or enclosing electrical apparatus to prevent hot metal from falling into open processing equipment.

NOTE: The accidental release of heated flammable and combustible liquids or unheated Class I liquid may, if sufficient quantities are involved, generate vapors to the extent that the entire building and possibly a zone surrounding it must be considered a Class I, Division 2, location.

3540. Where the provisions of Paragraph 3520 would require the installation of explosion-proof switch gear, general purpose electrical equipment, including switch gear, may be used if located in a nonclassified area or installed in a room which is maintained under positive pressure with respect to the classified area. All conduits running from classified to nonclassified areas shall be sealed with a sealing condulet. Air for pressurization shall be taken from a location where entrainment of flammable vapor is improbable.

CHAPTER IV. PROCESS EQUIPMENT AND OPERATIONS

40. Transfer of Flammable and Combustible Liquids

4010. As far as practical, processes involving the use of flammable and combustible liquids should be carried out in closed systems of equipment, containers and piping.

4020. The transfer of large quantities of flammable and combustible liquids shall be through piping by means of pumps. Except as required in process equipment, gravity flow shall not be used.

4030. The use of compressed air or water as a transferring or displacement medium shall be prohibited.

4040. Pumps shall be selected for the flammable and combustible liquid used, the working pressures and the structural stresses to which they may be subjected.

4050. Where solvents are pumped from storage to points of use, an emergency switch shall be provided in the processing areas at the normal exit door and at the pumps to shut down all pumps in case of fire.

4060. The dispensing of Class I solvents from drums shall preferably be by means of an approved drum pump. However, gravity dispensing from drums is permitted when an approved self-closing faucet and bung vent for flammable and combustible solvents is used.

4070. Open containers shall be covered when being transported from one place to another.

41. Piping, Valves and Fittings

4110. All piping, valves and fittings in flammable or combustible liquid service shall be designed for the working pressures and structural stresses to which they may be subjected. They shall be of steel or other material approved for the service intended. The use of cast iron valves, fittings and pipe shall be avoided.

4120. Valves shall be of an indicating type to show whether open or closed such as a plug or ball valve. Such valves shall be mounted in a manner such that vibration will not cause them to open.

4130. Terminal valves on remote pumping systems shall be of the spring-loaded self-closing type. It is desirable that the pump operation be controlled by the valve operation.

4140. Piping systems shall be substantially supported and protected against physical damage.

4150. Piping should be run on racks aboveground. The use of trenches, tunnels, stair or elevator towers for flammable and combustible liquid piping should be avoided. If trenches are necessary or unavoidable, they shall be covered with grating trench covers.

Trenches shall be filled with sand or bulkheaded at frequent intervals.

NOTE: See Figure A-4060(2) of Water Spray Fixed Systems for Fire Protection, NFPA No. 15, for use of grating trench covers.

4160. Piping shall be pitched to avoid trapping of liquids, or suitable drains shall be provided. Approved flexible connectors may be used where vibration exists or where frequent movement is necessary. Approved hose may be used at dispensing stations.

4170. Solvent piping entering equipment such as mixers and kettles should either terminate near the bottom of the equipment or discharge against the side of the vessel and be bonded to the equipment.

4180. Piping should be coded.

NOTE: Identification of Piping Systems ANSI A13.1, provides information on color coding. Suggested colors in ANSI A13.1 are (a) Fire Protection Equipment — red; (b) Dangerous Materials — yellow (or orange); (c) Safe Materials — green (or white, black, gray, aluminum); (d) Protective Materials — blue; (e) Extra Valuable Materials purple. See Recommended System for the Identification of the Fire Hazards of Materials, NFPA No. 704M.

4190. Before being placed in service, all piping shall be free of leaks when hydrostatically tested to not less than 1½ times the working pressure. Pressure shall be maintained for a minimum of 30 minutes.

42. Kettles, Reactors and Vessels

4210. Open Fire Resin Cooking

4211. Portable kettles are preferred. Adequate fire protection based on inert gases or dry chemical should be provided. Water shall be avoided.

4212. Although process kettles may be open, closed kettles should be used where practical because of their greater safety and ability to contain a fire.

4213. Open fire kettles shall be located in an outside area, provided with a protective roof, or in a separate building of noncombustible construction, or separated from other areas by means of a wall or partition having a fire resistance rating of two hours and openings equipped with approved fire doors. Adequate stacks or other fume disposal system shall be provided to eliminate the fumes or vent them to a safe location.

4214. Thinning or reducing operations where portable kettles are used shall be performed in a well ventilated area removed from the open fires and equipped with an adequate vapor removal sys-

tem. Preferably the hot liquid from either a portable or set kettle should be pumped into the closed set thinning vessel which contains the reducing solvent. This thinning vessel shall be agitated and equipped with a vented condenser which should be supplied with an adequate cooling medium and be capable of handling the vapors formed. A water jacket on the thinning vessel for cooling is preferable.

4220. Closed Set Kettles and Thin-down Tanks

4221. Closed kettles involving the use of solvents are preferably heated by a heat transfer medium whose vaporizer or heat producing equipment should be remotely located from the process area or otherwise safeguarded as outlined in 4222.

4222. If kettles are self-contained units, either heated by direct fired units or radiant heated units, the following safeguards shall be provided:

(a) The fire box shall be instrumented to shut down fuel in case of flame-out to prevent explosions within. For fuel safety controls see the Standard for Ovens and Furnaces, NFPA No. 86A.

(b) The external area under the kettle where the fire box or furnace is located shall be completely sealed from the process area, particularly the operating floor, to prevent any spills from being ignited. Particular precautions should be taken to prevent flammable vapors from entering the air inlet to avoid flashback. The exhaust of the hot combustion gases from the fire box shall be piped or ducted away from process area to prevent its igniting flammable materials due to spills or upsets in process. Under no circumstances shall any combustible material be stored in the furnace room, nor shall the room contain any piping of flammable materials except those connected to the kettle or fire box as part of the process.

(c) The process kettle shall be provided with a high temperature limit switch.

(d) The set kettle shall be provided with a rupture disc located as close as possible to the vessel in case the normal vent becomes inoperative. The discharge piping from the rupture disc shall be directed to a blow-down tank or to a safe location.

4223. The agitator on the thinning tank shall be in operation before the hot material is dropped from the kettle.

43. Dispersion Equipment

4310. Two-roll mills or other mills operating with close clearances and which are used for the processing of flammable and heat sensitive materials, such as nitrocellulose, shall be located in a detached building or in a noncombustible structure without other

occupancy. The amount of nitrocellulose or other flammable material brought into the area shall be no more than that required for a batch. A manually operated water spray system with an adequate number of heads shall be provided for mill protection.

4320. For the protection of roller mill operators, it is desirable to have an emergency shutoff at each end of the mill, within easy reach, so that the mill can be stopped if any part of the operator's clothes or body becomes caught in the mill or if the mill should catch fire.

4330. Open mills, such as roller mills, shall be provided with adequate ventilation.

4340. High-speed Dispersers

4341. In a multiple tank installation, the disperser mast shall be equipped with a positive locking device. The mast and tanks shall be bonded and grounded. Covers for the tanks may be permanent or removable. If partial covers are used, a guard shall be installed over or near the open portion of the tank as an operator safeguard.

4350. Pebble Mills and Steel Ball Mills

4351. Each mill shall be grounded.

4352. Before adding solvents to the mill, it should be inerted. If a high-pressure cylinder is used to supply the inert gas, it shall be equipped with a reducing valve to add the inert gas at low pressure.

4353. Pressurizing of pebble and steel ball mills to unload should be avoided if possible. Inert gas shall be used for discharging the contents of a steel ball or pebble mill by pressure if needed. Air pressure shall not be used. Excessive gas pressure shall be avoided by providing a relief valve set to relieve at a pressure not to exceed the design pressure of the mill. As low a pressure as practical shall be used.

44. Mixers and Mixing Tanks

4410. Mixers should be of the enclosed type. Open type mixers shall be provided with properly fitted covers. Such covers should be made of a nonferrous, spark-resistant material. Hinged covers or openings in covers should be held in an off-balance position by means of a metal cable attached to a fusible link located on the underside of the cover.

4420. Where gravity flow is used, a shutoff valve shall be installed as close as practical to the vessel being unloaded, and a control valve shall be provided near the end of the discharge pipe. A bond shall be provided between the discharging piping and the receiving container.

45. Filling Operations

4510. In multistory operations, filling is generally performed on the first floor with the main processing done in set or portable tanks on the second floor. If the organic coating is discharged by gravity in this operation, a third heat-actuated valve should be considered in addition to the two required in 4420.

4520. In single-story operations, the filling is preferably performed in an area separated from the main processing area by a wall having a fire resistance rating of at least two hours, and all openings shall be equipped with approved fire doors.

4530. Empty and filled containers shall be stored outside the filling area to reduce congestion, improve housekeeping and reduce the flammable material in the area.

CHAPTER V. MATERIAL STORAGE AND HANDLING

50. Tank Car and Tank Vehicle Unloading and Loading

5010. Tank vehicle and tank car loading or unloading facilities shall be separated from aboveground tanks, warehouses, other plant buildings or nearest line of adjoining property which may be built upon by a distance of 25 feet for Class I liquids and 15 feet for Class II and Class III liquids, measured from the nearest position of any fill stem. Buildings for pumps or shelters for personnel may be a part of the facility. Operations of the facility shall comply with appropriate portions of Section 62, Loading and Unloading Facilities, of the Flammable and Combustible Liquids Code, NFPA No. 30.

NOTE: For information on tank vehicles, see the Standard for Tank Vehicles for Flammable and Combustible Liquids, NFPA No. 385. See also TC-4, Unloading Flammable Liquids from Tank Cars, published by the Manufacturing Chemists' Association, Inc.*

51. Flammable and Combustible Liquid Storage

5110. The storage of flammable or combustible liquids in tanks shall be in accordance with the applicable provisions of Chapter II, Tank Storage, of the Flammable and Combustible Liquids Code, NFPA No. 30.

5120. If the storage of flammable or combustible liquids in outside aboveground or underground tanks is not practical because of temperature considerations or production considerations, tanks may be permitted inside of buildings or structures in accordance with the applicable provisions of Chapter II, Tank Storage, of the Flammable and Combustible Liquids Code, NFPA No. 30.

5130. Storage tanks inside of buildings shall be permitted only in areas at or above grade which have adequate drainage and are separated from the processing area by construction having a fire resistance rating of at least two hours.

NOTE: This is not intended to prevent processing equipment from containing flammable or combustible liquids in such quantities as are essential to daily operations.

5140. The storage of flammable or combustible liquids in portable shipping tanks or containers shall be in accordance with the applicable provisions of Chapter IV, Container and Portable Tank Storage, of the Flammable and Combustible Liquids Code, NFPA No. 30.

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*Available from Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave., N.W., Washington, D.C. 20036.

52. Industrial Trucks

5210. Power operated industrial trucks that are approved and designated as EX shall be used in areas where flammable vapors exist under normal operating conditions in quantities sufficient to produce ignitible mixtures (Class I, Division 1, Group D electrical classification).

NOTE: Reference should be made to the National Electrical Code, NFPA No. 70, for additional information on the interpretation of the electrical classifications referred to herein and to the Standard for Industrial Trucks, NFPA No. 505, for an explanation of the designations of industrial trucks.

5220. Power operated industrial trucks that are approved and designated as EX, EE or DY shall be used in areas where Class I liquids and their vapors are normally confined within a closed system or container from which the liquid or vapor can escape only in the event of accidental rupture or breakdown of such equipment (Class I, Division 2, Group D electrical classification).

5230. Power operated industrial trucks that are approved and designated as GS, LPS, DS, ES, EX or EE shall be used in areas where Class I liquids are stored in sealed containers.

5240. Power operated industrial trucks that are approved and designated as EX shall be used in areas where combustible dusts are or may be in suspension in the air continuously, intermittently or periodically under normal operating conditions in quantities sufficient to produce ignitible mixtures (Class II, Division 1, Group G electrical classification).

5250. Power operated industrial trucks that are approved and designated as EE, EX, ES, GS, LPS, DY, or DS shall be used in areas where combustible dusts are present but not normally in suspension in the air and will not be thrown into suspension in the air by the normal operation of equipment in sufficient quantities to produce ignitible mixtures but where deposits of such dust may be ignited by arcs or sparks originating in the truck (Class II, Division 2, Group G electrical classification).

53. Storage of Finished Product

5310. Finished products that are flammable and combustible shall be stored outside of buildings, in a separate building, or in a separate room cut off from the processing area by a wall or partition having at least a two-hour fire resistance rating, and openings shall be equipped with approved fire doors. The storage of finished products shall be in closed containers or in tanks in accordance with nationally recognized good practice.

NOTE: The Flammable and Combustible Liquids Code, NFPA No. 30, provides information on such storage.

5320. Except for custom tinting, flammable and combustible liquids shall not be dispensed, blended or otherwise exposed in an area used for the storage of finished product.

54. Container Storage

5410. Empty containers previously used for flammable and combustible liquids may be potentially dangerous. Drum plugs should be replaced, and all containers should be removed to a well detached, outside location and if not cleaned on the premises, removed from the plant as soon as practical.

5420. Full containers stored outside should be kept a safe distance from buildings or other exposures. The area shall be free of grass, weeds, and underbrush. See 2040 for additional information.

NOTE: See the Flammable and Combustible Liquids Code, NFPA No. 30.

55. Portable Shipping Tanks

5510. In-plant Transportation and Storage

5511. The storage of portable shipping tanks shall be in accordance with Chapter IV of the Flammable and Combustible Liquids Code, NFPA No. 30.

5512. Full or part-full portable shipping tanks may be stacked two high, providing they are of the "nesting" design.

5513. All materials handling equipment used for transporting or lifting portable shipping tanks shall be of ample capacity to lift or transport the full load safely.

5514. Floors of buildings and shipping docks shall be structurally able to carry the wheel loads resulting from transporting full portable shipping tanks by means of materials handling equipment.

5520. Discharging Portable Shipping Tanks

5521. The contents of portable shipping tanks may be discharged by three methods:

(a) The material may be pumped from the top. The portable shipping tanks may or may not have a bottom valve. The pump, pipelines, hoses or other containers or tanks shall be bonded and grounded.

(b) The material may be pumped from the valve at the bottom of the portable shipping tank. The pump, pipelines, hoses or other containers or tanks shall be bonded and grounded.

(c) The material may be discharged by gravity from the valve at the bottom of the portable shipping tank. The portable shipping tank, pipelines, hoses and receiving vessel shall be bonded and grounded.

5522. The discharge outlet from the portable shipping tank shall be equipped with a spring-actuated fusible link valve or a dead man valve.

5523. Portable shipping tanks shall not be pressure unloaded.

5530. Filling Portable Shipping Tanks

5531. Portable shipping tanks may be filled by gravity or pump. When filling through an open manhole, bonding shall be provided between the filling pipe and the portable shipping tank.

CHAPTER VI. SPECIAL HAZARDS

60. Nitrocellulose

6010. Hazards

6011. Nitrocellulose is a flammable material with a variable burning rate. It is easily ignited and burns with a rapid intensity if allowed to become completely dry. The burning rate decreases depending on whether it is wetted with a flammable liquid or water.

6012. When nitrocellulose burns, toxic gases such as oxides of nitrogen and carbon monoxide are evolved. Personnel should avoid exposure to these gases.

6020. Handling

6021. The dragging or pushing of drums on hard surfaces shall be avoided because of possible frictional heat.

6022. Drums should be moved by means of a two-wheel hand truck fitted with a nonferrous "grab" to hold the top of the drum. A power-driven industrial lift truck of the approved type may also be used as defined in 52.

6023. Drums shall not be dropped. If there is a difference in elevation, use a wooden skid and always keep the drum under control.

6024. The handling equipment shall not drop, puncture or damage the drums.

6030. Storage

6031. Nitrocellulose should be stored in a separate building or in a room cut off by construction having a fire resistance rating of at least two hours and openings equipped with approved fire doors. The nitrocellulose storage area should be used for no other purpose. If electrical equipment is necessary in such a room or building, it should be installed in accordance with the National Electrical Code for Class I, Division 2, locations.

6032. If the plant area is adequate for well detached storage, a suitable structure would be a roofed shed constructed of noncombustible material and sided on two sides to protect against the direct rays of the sun. This would provide an adequate and well ventilated structure for the storage of drums of nitrocellulose.

6033. Nitrocellulose shall be stored only in closed containers. Drums or other containers of nitrocellulose shall not be opened in the main storage building but at the point of use or other location set aside for the purpose.

6034. Drums shall be stored in an upright position with a lid on top and should not be tiered more than two high.

6035. If for some reason nitrocellulose is spilled in the storage area, it shall be promptly wetted with water, and such material shall be disposed of properly by burning in the open at a suitable detached location.

6036. Nitrocellulose should be stored in such a manner that the stock can be rotated to assure the oldest material is used first.

6040. Process Area

6041. The amount of nitrocellulose brought into the operating area should not exceed that required for a shift.

6042. The retaining ring holding the drum cover in place shall be removed by the use of a suitable spark-resistant wrench. If necessary to fork or scoop the material out of a barrel, spark resistant tools shall be used.

6043. Any nitrocellulose which may be spilled on the floor or elsewhere shall be promptly swept up, put into a pail of water, and removed at the end of the day or shift and disposed of properly.

6044. After emptying, drums should be wiped clean with a rag or cloth, the cover should be replaced, and the sealing ring tightened. Rags, after use, should be placed in a covered waste container, wet down with water, and disposed of daily.

6050. Waste Disposal

6051. Sweepings and other waste nitrocellulose should be placed in a covered metal container and wet down with water immediately. Dispose of the waste material by burning in a safe, isolated location. Do not burn in a boiler fire box, incinerator, or other confined equipment. Burning should only be conducted in accordance with Federal, state, and/or local regulations regarding pollution.

6060. Fire Protection

6061. Water is an effective fire extinguishing medium for nitrocellulose and should be used in large quantities.

6062. Exposure of drums of nitrocellulose to heat will cause vaporization of the wetting medium resulting in an increase in pressure which may cause release of the drum lid. Fire fighters should keep out of range when encountering such situations and avoid breathing fumes given off by burning nitrocellulose.

61. Monomers

6110. Hazards

6111. Monomers may be liquids, solids, or gases. They are reactive chemicals and present special hazards because of their chemical composition. They are usually highly flammable, and their vapors, which are normally heavier than air, can form explosive

vapor-air mixtures. They usually contain an inhibitor to prevent self-polymerization. At elevated temperatures, such as fire exposure, polymerization may take place. If this occurs in a closed container, a violent rupture may occur.

6112. Monomer vapors are usually toxic, and personnel should avoid exposure to them at all times. Adequate ventilation is mandatory.

6113. Suppliers should be contacted for advice concerning the storage, handling and use of specific monomers.

6120. Process and Handling

6121. Precautions in handling of monomers should parallel those outlined for flammable liquids. Since vapors can be more toxic, the need for adequate ventilation and the availability of respiratory protection for emergencies is of the utmost importance.

6122. For specific information on explosion venting and structural design requirements for areas involved with handling of monomers, refer to 21 (General Layout and Design) and 34 (Explosion Venting) in this Standard.

6130. Storage — Liquids and Gases

6131. Aboveground monomer storage tanks should be located in a remote area. Topography and diversionary diking should be used to drain spilled monomer from the storage tank area and to prevent exposure from fires in other flammable liquid storage tanks. Where drainage is impracticable, liquid monomer storage tanks should be surrounded with an individual dike to contain the monomer in the event of a large leak or overflow. In cases of diversionary diking, an impounding basin is usually required to provide effective fire containment and minimize contamination problems.

NOTE: The Flammable and Combustible Liquids Code, NFPA No. 30, specifies locations for storage and drainage and diking methods.

6132. Piping should preferably be welded with flanges at selected locations to permit access for cleaning. Monomers should be individually piped to prevent contamination which may promote polymerization.

6133. Monomer storage tanks should have a normal vent without flame arrestor (see note in NFPA No. 30 under 2147) and a separate emergency vent. The emergency vent should be designed on the basis of the effects of heat or gas resulting from polymerization or self-reactivity.

6134. Some monomers are sensitive to temperature extremes. The storage tank should be provided with a means to control the

temperature. Water spray, cooling coils, reflective paints, overhead cover, or insulation are all methods which can be used.

6135. Since monomers are reactive chemicals having inhibitors to prevent reaction in storage, the strength of these inhibitors should be checked periodically to make sure they are at a safe level. Some systems, such as hydroquinone in styrene, lose their effectiveness to inhibit polymerization under certain time and temperature conditions.

6136. Some monomers are not highly flammable and can be stored under an air atmosphere. Others, which have low flash points (Class I liquids), may be stored under an inert gas atmosphere to minimize polymer formation and improve fire safety.

6137. Materials of construction for tanks, pipelines, pumps, and auxiliary equipment should conform to the recommendation of the supplier of the monomer.

6140. Storage — Solid

6141. Solid monomers may be shipped in drums or bags. Normally solid monomers are not subject to self-polymerization unless they are liquefied or subjected to elevated temperatures. Storage therefore should be at ambient temperature, isolated, where drums and bags will not be damaged, and free from any possibility of contamination with reactive chemicals or moisture.

6150. Waste Disposal

6151. All quantities of monomers or waste material contaminated with monomers should be disposed of by removal to a safe, open area and burned. Federal, state and local regulations regarding health and pollution shall be observed.

6152. When a waste disposal problem arises as a result of a major spill or equipment rupture, only properly protected personnel should remain in the area.

6160. Fire Protection

6161. Fires involving monomers can generally be controlled and extinguished using dry powder, water fog, proper type foam and carbon dioxide. The use of water fog and foam should be avoided when electrical equipment is involved.

6162. Self-contained respiratory equipment should be used to avoid exposure to toxic vapors.

62. Organic Peroxides

6210. Organic peroxides are considered to be "unstable" chemicals and present a serious problem in safe handling. They are powerful oxidizing agents and react violently with reducing agents

and some on exposure to heat or shock. Only general details can be offered here, and the authority having jurisdiction shall be consulted wherever these materials are to be used.

6220. In general organic peroxides should be stored in cool locations. In very hot weather artificial cooling may be necessary to prevent decomposition of the peroxide. In cold climates artificial heat may be necessary to prevent the formation of shock sensitive crystals. For example, acetyl peroxide (25 percent solution in dimethyl phthalate) should not be exposed to temperatures above 90°F, violent decomposition may occur above 122°F, and shock sensitive crystals may be formed below 17°F.

NOTE: Further information may be found in Hazardous Chemicals Data, NFPA No. 49, and AIA Research Report No. 11, Fire and Explosion Hazards of Organic Peroxides.*

6230. The storage of organic peroxides should be isolated from flammable and combustible liquid storage, any important building, or line of adjoining property that may be built upon. Large quantity storage of organic peroxides in highly populated areas should be avoided.

6240. The size of the package containing the organic peroxide should be selected so that, as nearly as practical, full packages are utilized at one time thus minimizing exposure to personnel and contamination of the product. Any peroxide spilled should be promptly cleaned up and disposed of as recommended by the supplier.

6250. The hazards incident to the storage and use of organic peroxides may be materially reduced when protected by a standard automatic sprinkler system.

*Available from American Insurance Association, 85 John St., New York, N. Y. 10038.

CHAPTER VII. FIRE PROTECTION

70. Ignition Sources

7010. There are places in some operations where there is metal-to-metal contact, such as the lids of mixers, change cans or nozzles contacting steel drums. In order to minimize the possibility of a struck spark hazard, one of the metal surfaces (such as the nozzles or lids) should be nonferrous.

7020. When electrical equipment is repaired or replaced, caution should be exercised to assure that the integrity of the area electrical classification is maintained in accordance with 35.

7030. Relocation, redirection or replacement of fittings and piping may negate previous bonding and/or grounding arrangements. Piping installations made under any maintenance activity should conform to 40, 41 and 71.

7040. Open flames and direct-fired heating devices shall be prohibited in areas where flammable vapor-air mixtures may exist.

7050. Smoking shall be prohibited except in designated safe areas.

71. Static Electricity

7110. All equipment such as tanks, machinery and piping, where an ignitible mixture may be present shall be bonded and connected to a ground. The bond or ground or both shall be physically applied or should be inherently present by the nature of the installation. For static purposes, this electrically conductive path shall not have a resistance of more than one million ohms.

NOTE: The Recommended Practice on Static Electricity, NFPA No. 77, provides information on this subject.

7120. Electrically isolated sections of metallic piping or equipment shall be bonded to the other portions of the system or grounded to prevent external ignition hazards.

7130. Bonding need not be required when loading or unloading tank cars and tank vehicles through closed connections. When loading or unloading through open connections the tank vehicle shall be bonded to the receiving system.

7140. When a flammable mixture is transferred from one portable container to another a bond shall be provided between the two containers, one of which shall be grounded.

7150. A bond or ground shall be composed of suitable conductive materials having adequate mechanical strength, corrosion resistance and flexibility for the service intended. No. 10 AWG wire is the minimum size which shall be used and should be uninsulated.