

NFPA®

32

Standard for
Drycleaning Facilities

2021



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NFPA® 32

Standard for

Drycleaning Facilities

2021 Edition

This edition of NFPA 32, *Standard for Drycleaning Facilities*, was prepared by the Technical Committee on Textile and Garment Care Processes. It was issued by the Standards Council on October 5, 2020, with an effective date of October 25, 2020, and supersedes all previous editions.

This edition of NFPA 32 was approved as an American National Standard on October 25, 2020.

Origin and Development of NFPA 32

This standard was originally prepared by the Committee on Flammable Liquids in cooperation with the National Association of Dryers and Cleaners in 1924 and the first edition was adopted in 1925. Amendments were adopted in 1927; completely revised editions were issued in 1936, 1944, and 1956; amendments were adopted in 1964; a completely revised edition was issued in 1970; amendments were adopted in 1972; and completely revised editions were issued in 1974 and 1979. There was a minor amendment in the 1985 edition, which was reconfirmed in 1990, and minor changes were adopted for the 1996 edition.

For the 2000 edition, general requirements for all plants, regardless of solvent in use, were moved to the front of the standard. There was better correlation of the requirements for each plant type with the relative hazards potentially present. Various protection requirements were made less stringent in cases where a plant had reduced quantities of solvent in combination with various redundant safety systems for the equipment. Requirements were added to address machine conversion to allow a machine to use another solvent, as was a common occurrence in the industry.

For the 2004 edition, additional guidance and definitions were added to better define and explain machine conversions made to allow for use of a different class of solvent.

For the 2007 edition, new options were added to allow for increasing the maximum concentration to 60 percent or below of the LEL with adequate automatic instrumentation and safety interlocks in accordance with NFPA 69. Also, new requirements were added for drycleaning using nonflammable liquefied gases in pressure vessels, including, but not limited to, carbon dioxide solvent technologies. A chapter was added for new requirements for laundry equipment in drycleaning plants.

For the 2011 edition, the technical committee added new definitions for *laundry*, *laundry dryer*, and *wet cleaning* and revised the definition of *Class IV solvents*. The requirements for employee training and the inspection frequency for fire protection systems were revised to be in accordance with NFPA 25 and requirements for boiler room separation by barrier walls in accordance with NFPA 5000 were added. The requirements for temperature control for laundry dryers to accommodate a cool-down period in order to eliminate the potential for spontaneous combustion within the dryers were also revised.

The 2016 edition of NFPA 32 was reorganized and included significant changes that established requirements based on two variables: the class of solvent and the type of equipment used. The technical committee recognized that NFPA 32 had many requirements initially established for flammable solvents and older technologies that had been retained in the document over the years. It was not always clear which requirements applied only to lower classes of solvents and older technologies. The 2016 edition reflected changes that occurred in both solvents and equipment used by the drycleaning industry that impacted safety. The requirements were less stringent for facilities that used higher classes of solvent and equipment and had built-in fire protection features than for those facilities that used lower classes of solvents and older equipment. NFPA 32 defined four “versions” of equipment, Versions I through IV, and established requirements that were based on both the version of equipment and solvent class used rather than on the solvent class alone.

The standard was reorganized to place requirements applicable to all drycleaning facilities in Chapters 4 through 6. Additional requirements, located in Chapters 7 through 9, were dependent on the lowest class of solvent used in a particular facility. Requirements in those latter chapters were dependent on the versions of equipment used within the facility. A flow chart was added as a new Annex B to direct users and AHJs to the applicable requirements. Equipment construction requirements were removed since drycleaning equipment was required to be listed, and the requirements for Class IIIA and Class IIIB were combined.

The 2016 edition also addressed emerging fire safety concerns related to the conversion of equipment and solvents. With the increasing regulation of perchloroethylene, drycleaning facilities might have decided to change to new solvents or new equipment. The 2016 edition prohibited the use of lower class solvents in existing equipment designed for higher solvent classes and required AHJ notification for any changes in solvent class. This edition also established requirements for changes within the same solvent class to ensure that the new solvent was compatible with the equipment. The solvent manufacturer was required to certify the flash point and flammable limits of the solvent under anticipated conditions of drycleaning operations and had to provide the facility with written instructions on proper use and safe handling of the solvent.

The 2021 edition has continued with the reorganization of the standard by reorganizing chapter 6. The reorganized chapter 6 now flows in a user-friendly way; requirements for the equipment and change of equipment are grouped together, and requirements for solvent and change of solvent are grouped together. Chapter 4 now has requirements for flammable and combustible liquid classification as well as their analogous solvent classification counterparts.

Dedication

The technical committee dedicates the 2021 edition of NFPA 32 to the memory of James “Jimmy” DeSanto, a former committee member who grew up working in and eventually running his father’s drycleaning plant in Illinois. Jimmy devoted his life to the industry and to helping drycleaners across the United States. Jimmy had a passion for the industry, never met a stranger, and always brought smiles and laughter to any situation.

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This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents concerned with the fire and explosion hazards of drycleaning using combustible and noncombustible solvents and the fire hazards of laundries and other textile care processes.

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2021 Edition

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A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex D.

Chapter 1 Administration

1.1 Scope. This standard shall apply to establishments herein-after defined as drycleaning facilities.

1.2 Purpose.

1.2.1 This standard prescribes safeguards intended to prevent fires and explosions, and other related hazards involving drycleaning, and associated wetcleaning, and laundry processes and to minimize the personal injury and property damage consequences of such incidents.

1.2.2 This standard includes requirements for the proper handling of chemicals and materials, but does not include requirements for disposal.

1.2.3 Requirements not specifically mentioned or referred to herein are not part of this standard.

1.3 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.3.1 Unless otherwise specified in 1.3.1.1, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard.

1.3.1.1 Any change, addition, or modification to the equipment or installation in a facility where the class of solvent, type of facility, or equipment version changes from a previous approval shall be subject to the applicable provisions of this standard.

1.3.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.3.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction and only where it is clearly evident that a reasonable degree of safety is provided.

1.4 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.4.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.4.2 The equivalent system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.5 Enforcement.

1.5.1* Plans and specifications shall be submitted to the authority having jurisdiction for examination and approval for the occupancy, in accordance with local or state requirements, before any drycleaning facility is established or constructed, before an existing facility is remodeled, or before the class of solvent or equipment version is changed.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2018 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2021 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2021 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2020 edition.

NFPA 69, *Standard on Explosion Prevention Systems*, 2019 edition.

NFPA 70®, *National Electrical Code*®, 2020 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2021 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids*, 2020 edition.

NFPA 101®, *Life Safety Code*®, 2021 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2019 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2018 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2021 edition.

2.3 Other Publications.

2.3.1 ASME Publications. American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ANSI/ASME B31.1, *Power Piping*, 2018.

Boiler and Pressure Vessel Code, 2019.

2.3.2 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*, 2016a.

ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*, 2019.

ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)*, 2015a.

ASTM D3278, *Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus*, 1996, reapproved 2011.

ASTM D3828, *Standard Test Methods for Flash Point by Small Scale Closed Cup Tester*, 2016a.

2.3.3 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

△ 2.4 References for Extracts in Mandatory Sections.

NFPA 30, *Flammable and Combustible Liquids Code*, 2021 edition.

NFPA 36, *Standard for Solvent Extraction Plants*, 2021 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2020 edition.

NFPA 70®, *National Electrical Code*®, 2020 edition.

NFPA 79, *Electrical Standard for Industrial Machinery*, 2021 edition.

NFPA 86, *Standard for Ovens and Furnaces*, 2019 edition.

NFPA 99, *Health Care Facilities Code*, 2021 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2021 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.2.7 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Additives. Any detergents, fragrances, stabilizers, boosters, or conditioners added to the solvent and used within a drycleaning or wetcleaning process or equipment to aid in textile cleaning and conditioning.

3.3.2* Blending. Any combination of solvents, other than additives, that when blended change the original physical properties to produce a new material to be employed in drycleaning equipment.

3.3.3 Bonded (Bonding). Connected to establish electrical continuity and conductivity. [70:100]

3.3.4 Combustible Liquid. An ignitable liquid that is classified as a Class II or Class III liquid. (See 4.1.2.3 and 4.1.3.3.) [30, 2021]

3.3.5* Control Equipment. Operating elements, such as relays, contactors, circuit breakers, switches, solenoids, brakes, and similar types of components, intended to govern or

perform a given function in the operation, including measuring, sensing, monitoring, protecting, and regulating of machinery. [79, 2021]

3.3.6 Cylinder (Drum). The perforated chamber, also known as a drum, basket, or wheel, in drycleaning equipment in which materials are placed to be washed, cleaned, extracted, spun, agitated, and/or dried.

3.3.7 Drum. See 3.3.6, Cylinder.

3.3.8 Drycleaning. The process of removing dirt, grease, paints, and other stains from such items as apparel, textiles, fabrics, and rugs by use of nonaqueous liquids.

3.3.9 Drycleaning Department. An area in the occupancy without walls, where drycleaning operations are conducted, including all additional areas containing solvent or solvent-handling equipment.

3.3.10 Drycleaning Room. An area of the facility with walls in which drycleaning operations are conducted, including all additional areas containing solvent or solvent-handling equipment.

3.3.11 Drycleaning Washer. See 3.3.35, Washer.

3.3.12 Dryer.

3.3.12.1 Drycleaning Dryer. A piece of equipment used to dry apparel, textiles, fabrics, and rugs that were cleaned with drycleaning solvents.

3.3.12.2 Laundry Dryer. Any equipment in which water-cleaned textiles are tumbled, agitated, and dried or deodorized while heated air circulates through the load to remove the water.

3.3.12.3 Reclaiming Dryer. A piece of equipment used to dry and reclaim solvents from textiles thereby limiting fugitive emissions.

3.3.12.4 Wetcleaning Dryer. Any equipment with a humidistat in which water-cleaned textiles are tumbled, agitated, and dried or deodorized while heated air circulates through the load to remove the water.

3.3.13 Equipment (Drycleaning Equipment). Any equipment in which textiles are immersed or non-immersed, agitated in solvent, or in which drycleaning solvent is reclaimed from textiles and/or dried.

3.3.13.1 Version I Equipment. An open system, employing combustible or noncombustible liquid, that is continuously open to the atmosphere.

3.3.13.2* Version II Equipment. An open-circuit system, employing combustible or noncombustible liquid, that releases fugitive emissions, suppresses and controls combustion, and has safety controls.

3.3.13.3* Version III Equipment. A closed-loop system, employing combustible or noncombustible liquid, that does not release emissions, prevents combustion, and has safety controls.

3.3.13.4 Version IV Equipment. A closed-loop system for noncombustible liquids that has safety controls for noncombustible liquids and does not release emissions.

3.3.14 Extract. The stage of an operating program in which solvent or water is removed from textiles in a drycleaning or wetcleaning machine by centrifugal force. Also referred to as extraction, spinning, or wringing.

3.3.15 Facility (Drycleaning Facility). An occupancy in which drycleaning and associated mercantile operations are conducted, which can include an office, a retail counter, storage rooms, garment racks and conveyors, boiler rooms, shipping and receiving areas, and a drive-up service area. The facility type is defined based on the lowest numerical class of solvent used in the equipment.

3.3.15.1* Type I Facility. Facilities employing Class I solvents.

3.3.15.2* Type II Facility. Facilities employing Class II solvents.

3.3.15.3* Type III Facility. Facilities employing Class IIIA and IIIB solvents.

3.3.15.4* Type IV Facility. Facilities employing Class IV solvents.

3.3.16 Flammable Limits. The range of concentration of a flammable gas in air within which a flame can be propagated, with the lowest flammable concentration known as the lower flammable limit (LFL) and the highest flammable concentration known as the upper flammable limit (UFL). [86, 2019]

3.3.17 Flammable Liquid. An ignitable liquid that is classified as a Class I liquid. (See 4.1.3.1.) [30, 2021]

3.3.18* Flash Point (FP). The minimum temperature of a liquid at which sufficient vapor is given off to form an ignitable mixture with the air, near the surface of the liquid or within the vessel used, as determined by the appropriate test procedure and apparatus specified in Section 4.4 of NFPA 30. [30, 2021]

3.3.19 Gallon, U.S. Standard. 1 U.S. gal = 0.833 Imperial gal = 231 in.³ = 3.785 L. [58, 2020]

3.3.20 Grounded (Grounding). Connected (connecting) to ground or to a conductive body that extends the ground connection. [70:100]

3.3.21 Hazardous Waste Container. A DOT-approved container used in drycleaning facilities for the purpose of disposing hazardous waste.

N 3.3.22* Ignitable Liquid. Any liquid or liquid mixture that has a measurable fire point. [30, 2021]

N 3.3.22.1 Fire Point. The lowest temperature at which a liquid will ignite and achieve sustained burning when exposed to a test flame in accordance with ASTM D92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*. [30, 2021]

Δ 3.3.23 Intrinsically Safe. As applied to equipment and wiring, equipment and wiring that are incapable of releasing sufficient electrical energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture. [99, 2021]

3.3.24 Laundry. The process of removing dirt and soil from items such as apparel, textiles, fabrics, and rugs by the use of water and additives.

▲ **3.3.25 Lower Explosive Limit (LEL).** See 3.3.26, Lower Flammable Limit.

● ▲ **3.3.26 Lower Flammable Limit (LFL).** That concentration of a flammable vapor in air below which ignition will not occur. Also known as the lower explosive limit (LEL). [30, 2021]

3.3.27* Solvents.

3.3.27.1 **Class I Solvent.** A liquid classified as a Class I solvent. (See 4.1.2.2.)

▲ 3.3.27.2 **Class II Solvent.** A liquid classified as a Class II solvent. (See 4.1.2.3.)

3.3.27.3 **Class III Solvent.** A liquid classified as a Class IIIA or Class IIIB solvent. (See 4.1.2.4.)

▲ 3.3.27.4 **Class IIIA Solvent.** A liquid classified as a Class IIIA solvent. (See 4.1.2.4.1.)

3.3.27.5 **Class IIIB Solvent.** A liquid classified as a Class IIIB solvent. (See 4.1.2.4.2.)

3.3.27.6* **Class IV Solvent.** A liquid classified as a Class IV solvent. (See 4.1.2.5.)

3.3.28 **Spotting (Prespotting).** The local application of a solvent or other agent for the removal of stains on textiles.

3.3.29 **Still.** An appliance that distils a solvent to remove nonvolatile residues and recover the solvent in the drycleaning process.

3.3.30* **Storage Tank.** A tank having a capacity over 227 L (60 gal) used for the storage of new or distilled solvent and which is not an integral part of drycleaning equipment.

3.3.31 **Tank.** See 3.3.30, Storage Tank.

▲ 3.3.32 **Upper Explosive Limit (UEL).** See 3.3.33, Upper Flammable Limit.

● ▲ 3.3.33* **Upper Flammable Limit (UFL).** For the purpose of this standard, that concentration of a combustible material in air above which ignition will not occur. [36, 2021]

3.3.34 **Version.** See 3.3.13, Equipment.

3.3.35 **Washer (Drycleaning Washer).** A piece of equipment used to wash and extract with a solvent.

3.3.36 **Wetcleaning.** A process for cleaning textile articles in water carried out by professionals using special technology [cleaning, rinsing, and extracting (spinning)], detergents, and additives followed by appropriate drying and restorative finishing procedures.

Chapter 4 General Facility and Materials Requirements

▲ **4.1 General.** The provisions of this chapter shall apply to the following (see Annex B):

- (1) General requirements for solvents and liquids
- (2) All types of drycleaning facilities employing all classes of solvents and all versions of drycleaning equipment

4.1.1 Equipment. Equipment requirements shall be in accordance with Chapters 5 through 10.

4.1.2 Solvents. Solvent requirements shall be in accordance with Chapters 5 and 6 and this section.

▲ **4.1.2.1** Facilities employing multiple drycleaning solvents in different solvent classes, blended or unadulterated, shall comply with the requirements for the numerically lowest class of solvent employed as defined in 3.3.27.

N 4.1.2.2 Class I solvents shall be considered Class I liquids.

N 4.1.2.3 Class II solvents shall be considered Class II liquids.

N 4.1.2.4 Class III solvents shall be considered Class III liquids.

N 4.1.2.4.1 Class IIIA solvents shall be considered Class IIIA liquids.

N 4.1.2.4.2 Class IIIB solvents shall be considered Class IIIB liquids.

N 4.1.2.5 Class IV solvents shall be considered liquids not having a flash point when tested to ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*, ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*, or other methods permitted by 4.1.4.

N 4.1.3 Classification Scheme.

N 4.1.3.1 Class I Liquids. A liquid with a closed-cup flash point below 37.8°C (100°F) shall be designated as a Class I liquid (i.e., flammable liquid), as determined by the test procedures and apparatus set forth in 4.1.4 and a Reid vapor pressure that does not exceed an absolute pressure of 276 kPa (40 psi) at 37.8°C (100°F), as determined by ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)*. [30:4.2.1.1]

N 4.1.3.2 Class II Liquids. A liquid with a closed-cup flash point at or above 37.8°C (100°F) but below 60°C (140°F) shall be designated as a Class II liquid (i.e., combustible liquid), as determined by the test procedures and apparatus set forth in 4.1.4. [30:4.2.2]

N 4.1.3.3 Class III Liquids.

N 4.1.3.3.1 A liquid with a closed-cup flash point at or above 60°C (140°F) shall be designated as a Class III liquid (i.e., combustible liquid), as determined by the test procedures and apparatus set forth in 4.1.4. [30:4.2.3.1]

N 4.1.3.3.2 Class III liquids shall be further subclassified in accordance with the following:

- (1) **Class IIIA Liquid.** A liquid that has a flash point at or above 60°C (140°F), but below 93°C (200°F).
- (2) **Class IIIB Liquid.** A liquid that has a flash point at or above 93°C (200°F).

[30:4.2.3.2]

N 4.1.4 Determination of Flash Point (FP). The flash point of a liquid shall be determined according to the methods specified in 4.1.4.1 through 4.1.4.4. [30:4.4]

N 4.1.4.1 Except as specified in 4.1.4.1.1, the flash point of a liquid having a viscosity below 5.5 centiStokes at 40°C (104°F) or below 9.5 centiStokes at 25°C (77°F) shall be determined in accordance with ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*. [30:4.4.1]

N 4.1.4.1.1 Cut-back asphalts, liquids that tend to form a surface film, and liquids that contain suspended solids shall not be tested in accordance with ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*, even if they otherwise meet the viscosity criteria. [30:4.4.1.1]

N 4.1.4.1.2 Such liquids as stated in 4.1.4.1.1 shall be tested in accordance with 4.1.4.2. [30:4.4.1.2]

N 4.1.4.2 The flash point of a liquid having a viscosity of 5.5 centiStokes or more at 40°C (104°F) or 9.5 centiStokes or more at 25°C (77°F) or a flash point of 93.4°C (200°F) or higher shall be determined in accordance with ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*. [30:4.4.2]

N 4.1.4.3 As an alternative, ASTM D3278, *Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus*, shall be permitted to be used for paints, enamels, lacquers, varnishes, and related products and their components that have flash points between 0°C (32°F) and 110°C (230°F) and viscosities below 150 Stokes at 25°C (77°F). [30:4.4.3]

N 4.1.4.4 As an alternative, ASTM D3828, *Standard Test Methods for Flash Point by Small Scale Closed Cup Tester*, shall be permitted to be used for materials other than those for which ASTM D3278 is specifically required. [30:4.4.4]

4.2 Prohibited Activities.

4.2.1 Class I Solvents. Class I solvents shall be prohibited in drycleaning equipment.

4.2.2* Change of Solvents. A change of solvents from a higher to a lower class of solvent for use in existing equipment shall be prohibited.

△ 4.2.3 Version I Equipment. Version I equipment shall be prohibited in new installations.

4.2.4 Smoking. Smoking in a drycleaning facility shall be strictly prohibited.

4.2.5 Public Operation. Drycleaning conducted by the general public shall be prohibited.

4.2.6 Wetcleaning or Laundry Dryers. Textiles cleaned with a nonaqueous solvent shall not be dried in a laundry or wetcleaning dryer.

4.3 Construction.

4.3.1 General. General building design and construction shall be in accordance with *NFPA 5000* except as modified herein.

4.3.1.1 Floors. The floors of a drycleaning department shall be of fire-resistive construction with a wearing surface of noncombustible and solvent-resistant material.

4.3.2 Vehicle Access and Location.

4.3.2.1 The drycleaning facility shall be located so that it is accessible from at least one side for **firefighting** and fire-control purposes.

4.3.2.2 The drycleaning facility shall be located in accordance with the provisions of *NFPA 5000*.

4.3.3 Means of Egress. Means of egress shall comply with the provisions of *NFPA 101* or *NFPA 5000*.

4.4 Building Services.

4.4.1 Electrical Wiring and Equipment. The electrical wiring and equipment in a drycleaning facility shall conform with the requirements of *NFPA 70*.

4.4.2 Ventilation. Ventilation of all types of drycleaning facilities shall be in accordance with all applicable codes.

4.4.2.1 Ventilation for Type II facilities shall be in accordance with Chapter 7.

4.4.3 Heating and Air Conditioning.

4.4.3.1 Air ducts shall supply gas-fired and oil-fired devices with a clean source of air for combustion from outside the building.

4.4.3.2 Drycleaning equipment shall be separated from apparatus with open flames or exposed electric heating elements by one of the following means:

- (1) Providing air intakes for combustion air
- (2) Locating exhaust vents from the equipment, if they exist, remotely from the air intakes of the apparatus

4.4.4 Solvent Containment.

4.4.4.1 Drycleaning departments shall be designed to prevent the discharge of solvents or solvent waste streams to public waterways, public sewers, or adjoining properties.

4.4.4.2 Curbs, dikes, or a special drainage system shall be required to control the migration of spilled solvent unless otherwise indicated in 4.4.4.2.1.

4.4.4.2.1 Facilities that have containment pans under the drycleaning equipment do not need further containment.

4.5 Boilers.

4.5.1 Unless located in a detached building, the boiler room shall be separated by fire barrier walls, in accordance with *NFPA 5000*, having a fire resistance rating of not less than 1 hour.

4.5.2 Doors or other openings in fire barriers shall comply with 4.5.2.1 through 4.5.2.4.

4.5.2.1 Doors in barriers required to have a fire resistance rating shall have a $\frac{3}{4}$ -hour fire protection rating and shall be self-closing or automatic-closing in accordance with 11.2.1.8 of *NFPA 5000*. [5000:8.15.3]

4.5.2.2 Openings into boiler rooms in a Type II facility using Version II or Version III equipment, or a Type III drycleaning facility using Version II equipment shall be at least 3 m (10 ft) from any openings into the drycleaning department.

△ 4.5.2.3 Boiler rooms in a Type III facility with Version III equipment shall be allowed to open directly into the drycleaning department where only Class III solvents are used in the listed equipment, provided the opening is protected in accordance with 4.5.2.1 and is at least 3 m (10 ft) from any equipment.

4.5.2.4 In facilities where different classes of solvents are employed, the requirements of the lower solvent class shall apply.

4.6 Fire Protection.

4.6.1 General. To ensure the reliable operation of fire-extinguishing systems and equipment required by this standard, such systems and equipment shall be installed, inspected, tested, and maintained in accordance with the requirements of this section.

4.6.2 Automatic Sprinkler Systems. Where required by this standard, automatic sprinkler systems shall be installed in accordance with *NFPA 13*.

4.6.3 Automatic Fire-Extinguishing Systems. Where required by this standard, automatic fire-extinguishing systems shall be carbon dioxide, dry chemical, clean agent, or water mist.

4.6.3.1 Carbon Dioxide Fire-Extinguishing Systems. Carbon dioxide fire-extinguishing systems shall comply with NFPA 12.

4.6.3.2 Clean Agent Fire-Extinguishing Systems. Clean agent fire-extinguishing systems shall comply with NFPA 2001.

4.6.3.3 Water Mist Fire-Extinguishing Systems. Water mist fire-extinguishing systems shall comply with NFPA 750.

N 4.6.3.4 Dry Chemical Fire-Extinguishing Systems. Dry chemical fire-extinguishing systems shall comply with NFPA 17.

4.6.4 Inspection, Testing, and Maintenance. Except for approved steam-injection extinguishing systems, automatic fire-extinguishing systems shall be periodically inspected, tested, and maintained in accordance with the applicable reference standard and the manufacturer's operation and maintenance procedures.

4.6.4.1 Approved steam-injection extinguishing systems shall be inspected at least annually in accordance with the manufacturer's specifications.

4.6.5 Portable Fire Extinguishers. Portable fire extinguishers shall be installed and maintained throughout the drycleaning facility in accordance with NFPA 10.

Chapter 5 General Operations and Training Requirements

5.1 General. This chapter shall apply to drycleaning and associated wetcleaning and laundering operations, training, and equipment maintenance as it relates to fire and other related hazards.

5.1.1 The operating and maintenance manuals for equipment and solvents shall be kept current and shall be available for reference and use at all times.

5.1.2 Operator training shall be specific to the equipment and solvents used in the facility and shall be consistent with safety requirements and the equipment and solvent manufacturers' recommendations.

5.2 General Operations.

5.2.1 Preparation. All items to be processed in equipment shall be searched thoroughly and all foreign materials that can pose hazards shall be removed.

5.2.2 Operating Procedures. Routine and emergency condition procedures shall be established for the following:

- (1) Equipment operation, including equipment parameters and prohibited procedures
- (2) Solvent handling
- (3) Spotting, with emphasis on proper removal of spotting agents prior to processing, if applicable
- (4) Waste handling
- (5) Lockout/Tagout procedures

5.3 Solvent and Chemical Handling.

5.3.1 Spotting.

5.3.1.1 Spotting or prespotting chemicals shall be stored in and dispensed from DOT-approved containers or safety cans as defined in NFPA 30.

5.3.1.2 Class I liquids or solvents used for spotting or prespotting shall be limited to plastic containers of not more than 0.5 L (1 pt) capacity.

5.3.2 Spotting Table Surface. The spotting table shall have a nonabsorbent surface.

5.3.3 Spotting Waste Streams. Waste streams from spotting operations shall be disposed of in a manner consistent with all applicable regulations.

5.4 Employee Training.

5.4.1* All employees shall be informed of the hazards of the processes employed in their facility and shall be trained in the proper storage, handling, use, and disposal of materials and wastes appropriate to the facility before operating drycleaning equipment or handling chemicals.

5.4.2 Hazard communication standard and employee right-to-know covering all chemicals and hazards in the facility shall be completed prior to an employee beginning work in the work area where the hazardous materials or chemicals are stored, dispensed, handled, or used.

5.4.3 The level of training to be conducted shall be consistent with the responsibilities of the persons(s) to be trained.

5.4.4 All personnel shall be instructed in the proper use, maintenance, and storage of all emergency, safety, or personal protective equipment (PPE) that they might be required to use in their normal work performance.

5.4.5 The facility owner or facility owner's representative shall be responsible for providing a training program to prepare personnel that is consistent with the type of equipment and chemical hazards involved in the facility's operation.

5.4.6 The training shall ensure that all employees are knowledgeable about the applicable safety requirements for their jobs, including the following:

- (1) Hazards of their workplace, including chemical hazards
- (2) General facility safety rules
- (3) The necessity for proper functioning or related fire and explosion protection systems
- (4) Equipment maintenance requirements and practices
- (5) Housekeeping policies and procedures
- (6) Emergency response plans and procedures
- (7) Basic PPE requirements
- (8) Start-up, shutdown, and lockout/tagout procedures
- (9) Safety data sheet (SDS) requirements

5.5 Employer Training Responsibilities.

5.5.1 The facility owner or the facility owner's representative shall verify that all employees have been trained in equipment use, spotting, and waste handling as outlined in 5.4.3.

5.5.2 All employee training shall be documented and include the method of training and the date the training was completed.

5.5.3 The facility owner or the facility owner's representative shall be responsible for retraining employees wherever changes in equipment or solvents are made and at intervals determined by the facility owner or authorized representative.

5.6 Maintenance and Housekeeping.

5.6.1 General Housekeeping. Facility employees shall be instructed in the best practices for maintaining a clean, hazard-free environment.

5.6.1.1 Pipes and other surfaces shall be kept free of lint buildup.

5.6.2 Lint and Refuse Removal.

5.6.2.1 Lint and refuse shall be removed from all collection devices, deposited in approved waste cans, and disposed of at least daily or in accordance with equipment manufacturer's instructions.

5.6.2.2 At all other times, the cover on the collection device shall remain closed.

5.6.3 Spill and Leak Prevention.

5.6.3.1 Maintenance and operating practices that help prevent leakage or unintentional escape of solvent or solvent vapors shall be followed.

5.6.3.2 Where solvent-saturated materials must be manually transferred from one piece of equipment to another, operating practices shall be designed to minimize both the solvent dripping on the floor and the vapor released.

5.6.3.3 Spilled solvent or solvent drippings from transferred garments shall be cleaned up immediately.

5.6.3.4 Cleanup materials shall be stored and disposed of in an approved manner.

5.6.4 Floor Cleaning. Drycleaning solvents and other flammable and combustible liquids shall not be used for cleaning floors.

Chapter 6 General Equipment and Solvent Requirements

6.1 General.

6.1.1 The requirements of this chapter shall apply to all drycleaning equipment and solvents.

6.1.2 All solvent in a facility and employed in drycleaning equipment shall comply with the provisions of this chapter and with the applicable requirements of Chapters 4 through 10, depending on the type of facility.

6.1.3 Equipment and solvent manufacturers and/or suppliers shall provide the facility operator with written instructions covering proper installation and safe use and operation.

6.1.4 Where installed, automatic fire-extinguishing systems for the protection of equipment shall comply with Section 4.6.

6.2 Drycleaning Equipment.

6.2.1 Equipment shall be designed, listed, and labeled for the class of solvent used.

6.2.2 Equipment shall be constructed of materials that are compatible with the solvent(s) for which the equipment is designed in accordance with 6.4.3 and 6.4.4.

6.2.3 Where required by the equipment manufacturer, equipment shall be securely attached to the floor or, if necessary, to special foundations to minimize transmission of vibration to surrounding areas.

6.2.4 All equipment shall be marked or furnished with a label affixed to the equipment indicating safe operation, warnings, and precautions and shall include the following:

- (1) Minimum allowable solvent flash point
- (2) Warnings that the equipment is not to be operated with a solvent class other than the solvent class stated
- (3) Warnings the equipment can only be operated with compatible solvents and materials
- (4) Warnings that equipment can only be operated by trained personnel

6.2.5 All solvent-handling equipment shall be constructed and maintained so as to prevent leakage.

6.2.6 Where a change in solvent class is proposed for use with existing equipment, the requirements of Section 6.4 and the applicable requirements of Chapters 4 through 10 shall apply.

6.3 Change in Version of Drycleaning Equipment in Existing Facilities.

6.3.1 The AHJ shall be notified of a proposed change in the version of equipment, in accordance with 1.5.1.

6.3.2 Where there is a change in the version of equipment, the requirements of Section 6.5 and the applicable requirements of Chapters 7 through 9 shall apply.

6.4 Solvents. (See Annex C for additional information on solvents.)

6.4.1 Flammable and combustible liquids shall be stored, handled, and used in accordance with NFPA 30.

6.4.2 Safety data sheets (SDSs) shall be available on-site for all solvents and materials used in the facility.

6.4.3 Solvents used in equipment shall not be used unless they meet one of the following requirements:

- (1) The original equipment manufacturer has provided authorization to use the solvent in the equipment as identified on the nameplate.
- (2)* The original equipment manufacturer has provided written documentation authorizing the use of the solvent in the equipment.
- (3)* A qualified testing laboratory or inspection agency concerned with product evaluations has tested the flash-point, LFL, and UFL of the solvent and provided evidence that the solvent will not change class or flammable limit when used in the drycleaning process.

6.4.4 Flash Point and Flammability Limits.

6.4.4.1* The solvent manufacturer shall be responsible for certifying the lower and upper flammability limits of the solvent under the anticipated conditions of drycleaning operations.

6.4.4.2 The solvent manufacturer shall be responsible for certifying the flash point of the solvent under the anticipated conditions of drycleaning operations.

6.4.4.3 Solvent flammability limits shall be tested by a nationally recognized testing laboratory to an applicable reference standard.

6.4.5 The solvent manufacturer or supplier shall be responsible for providing the facility operator with specific written instructions for the proper use and safe handling of the product in the workplace and for updating the instructions.

6.5 Change of Solvent.

6.5.1 Change of Solvent in a Different Class.

6.5.1.1 A change from a higher to a lower class of solvent for use in existing equipment shall be prohibited.

6.5.1.2 Where an existing facility proposes a change in solvent class for equipment, the provisions of Chapters 4 through 9 shall be met for the new class of solvent.

6.5.1.3 The AHJ shall be notified of a proposed change in solvent class, in accordance with 1.5.1.

△ 6.5.2 Change of Solvent Within the Same Class. A change of solvent within the same solvent class shall be allowed if one of the following conditions has been met:

- (1)* The original equipment manufacturer accepts the solvent for use in the machine as indicated on the nameplate.
- (2) The facility owner has written documentation for the use of the solvent in the machine by the original equipment manufacturer.
- (3) The solvent manufacturer has obtained written authorization from the equipment manufacturer for use of the solvent in the equipment.

6.5.3 Explosion Protection Equipment with explosion hazards resulting from modification of existing equipment or change in solvent class from a previous approval shall be provided with explosion protection, in accordance with NFPA 69.

Chapter 7 Type II Drycleaning Facilities

7.1* Application. This chapter shall apply to drycleaning facilities utilizing Class II solvents in Version II and Version III equipment.

7.2 Location and Construction of Facilities.

7.2.1* Separation. Type II facilities located in buildings with other occupancies shall be separated vertically and horizontally from other occupancies in accordance with Section 7.2.

7.2.1.1 Facilities employing both Version II and Version III equipment shall comply with the provisions for Version II equipment, except where the equipment of each version is separated by the use of a drycleaning room in accordance with 7.2.6.

7.2.2 Facilities Using Version II Equipment Requiring Four-Hour Construction.

7.2.2.1 Facilities employing Version II equipment shall be separated from assembly, educational, day care, health care, detention, ambulatory health care, correctional, and residential occupancies by a fire barrier having a minimum fire resistance rating of 4 hours. Openings shall have a 3-hour fire rated assembly with self-closing or automatic-closing devices except as permitted in 7.2.2.2.

7.2.2.2 In facilities where the quantity of Class II solvents in Version II equipment and storage does not exceed 568 L (150 gal), the required fire barrier shall be permitted to have a 2-hour fire resistance rating, providing the equipment incorporates an integral automatic fire-extinguishing system, is intrinsically safe, and is in a drycleaning room in accordance with 7.2.6. Openings shall have a 1½-hour fire rated assembly with self-closing or automatic-closing devices.

7.2.3 Facilities Using Version II Equipment Requiring Two-Hour Construction.

7.2.3.1 Facilities employing Version II equipment shall be separated from business, factory/industrial, mercantile, and storage-type businesses, and other similar occupancies by a fire barrier having a minimum fire resistance rating of 2 hours. Openings shall have a 1½-hour fire rated assembly with self-closing or automatic-closing devices except as permitted in 7.2.3.2.

7.2.3.2 In facilities where the quantity of Class II solvents in Version II equipment and storage does not exceed 568 L (150 gal), the required fire barrier shall be permitted to have a 1-hour fire resistance rating providing the equipment incorporates an integral automatic fire-extinguishing system, is intrinsically safe, and is in a drycleaning room in accordance with 7.2.6. Openings shall have a 1½-hour fire rated assembly with self-closing or automatic-closing devices.

7.2.4 Facilities with Version III Equipment Requiring Four-Hour Construction.

7.2.4.1 Facilities employing Version III equipment shall be separated from assembly, educational, day care, health care, detention, ambulatory health care, correctional, and residential occupancies by a fire barrier having a minimum fire resistance rating of 4 hours. Openings shall have a 3-hour fire rated assembly with self-closing or automatic-closing devices except as permitted in 7.2.4.2.

7.2.4.2 In facilities where the quantity of Class II solvents in Version III equipment and storage does not exceed 568 L (150 gal), the required fire barrier shall be permitted to have a 1-hour fire resistance rating with openings having a ¾-hour fire rated assembly with self-closing or automatic-closing devices providing the equipment incorporates an integral automatic fire-extinguishing system, and includes instrumentation, equipment, or controls that provide any one of the following:

- (1) Features that limit oxygen concentrations to less than 8 percent by volume
- (2) Features that limit solvent vapor concentration to less than 25 percent of the LEL
- (3)* Features that limit solvent vapor concentration at or below 60 percent of the LEL, where automatic instrumentation with safety interlocks is provided in accordance with NFPA 69

7.2.5 Facilities with Version III Equipment Requiring Two-Hour Construction.

7.2.5.1 Facilities employing Version III equipment, shall be separated from business, factory/industrial, mercantile, and storage-type businesses and other similar occupancies by a fire barrier having a minimum fire resistance rating of 2 hours. Openings shall have a 1½-hour fire rated assembly with self-closing or automatic-closing devices except as permitted in 7.2.5.2.

7.2.5.2 In facilities where the quantity of Class II solvents in Version III equipment and storage does not exceed 568 L (150 gal), the required fire barrier shall be permitted to have a 1-hour fire resistance rating with openings having a ¾-hour fire rated assembly with self-closing or automatic-closing devices, providing the equipment incorporates an integral automatic fire-extinguishing system, and includes instrumentation, equipment, or controls that provide any one of the following:

- (1) Features that limit oxygen concentrations to less than 8 percent by volume
- (2) Features that limit solvent vapor concentration to less than 25 percent of the LEL
- (3)* Features that limit solvent vapor concentration at or below 60 percent of the LEL, where automatic instrumentation with safety interlocks is provided in accordance with NFPA 69

7.2.6 Drycleaning Room.

7.2.6.1 Where the quantity of solvent in equipment and storage exceeds 568 L (150 gal), the room where the equipment is used shall be separated from the rest of the facility by a fire barrier having a fire resistance rating of not less than 2 hours. Openings shall have a 1½-hour fire rated assembly with self-closing or automatic-closing devices.

7.2.6.2 Doors to drycleaning rooms shall remain closed during normal operations.

7.2.6.3 A facility that constructs a drycleaning room to contain the equipment shall not be required to comply with 7.3.2 for locations outside the drycleaning room.

7.3 Building Services.

7.3.1 Heating, Ventilation, and Air-Conditioning.

7.3.1.1 Heating shall be by steam, hot water, hot oil, or refrigerant only.

7.3.1.2 The ventilation system shall have sufficient capacity to exhaust 0.3 m³/min/m² (1 ft³/min/ft²) of floor area to a safe outdoor location.

7.3.1.3 The blades or running rings of exhaust fans in ducts that exhaust Class I Division 1 or Division 2 areas shall be of nonferrous metal. Exhaust fan motors shall be constructed and installed in accordance with the applicable provisions of NFPA 70.

7.3.1.4 For drycleaning rooms, a mechanical system of ventilation with means for remote control shall be installed in accordance with NFPA 90A and NFPA 91.

7.3.1.4.1 Mechanical system of ventilation for drycleaning rooms shall serve no other room within the facility.

7.3.2 Electrical Installations. Electrical wiring and utilization equipment shall comply with the provisions of NFPA 70 for use in Class I Division 2 hazardous classified locations.

7.4 Automatic Sprinklers.

7.4.1 Facilities shall be protected throughout by an approved automatic sprinkler system in accordance with 4.6.2 except as permitted in 7.4.1.1.

7.4.1.1 Automatic sprinklers shall not be required in facilities where the quantity of Class II solvents for facilities using Version III equipment, and storage does not exceed 568 L (150 gal), providing the equipment incorporates an integral automatic fire-extinguishing system, and includes instrumentation, equipment, or controls that provide one of the following:

- (1) Features that limit oxygen concentrations to less than 8 percent by volume
- (2) Features that limit solvent vapor concentration to less than 25 percent of the LEL

- (3)* Features that limit solvent vapor concentration at or below 60 percent of the LEL, where automatic instrumentation with safety interlocks is provided in accordance with NFPA 69

7.5 Storage Tanks.

7.5.1 Tanks. Tanks shall be constructed in accordance with 21.4.2 of NFPA 30.

7.5.1.1 Tanks shall be installed in accordance with 22.5.1 and 22.5.2 of NFPA 30.

7.5.2 Tank Vents. Tank vents shall be installed and constructed in accordance with NFPA 30.

7.5.2.1 Tank vents shall not be less than 30 mm (1¼ in.) pipe size.

7.5.2.2 Where a gauge glass or sight glass is mounted on a solvent tank, it shall be protected in a way that prevents it from allowing solvent to escape.

7.5.3 Tank Capacity.

7.5.3.1 Storage tanks installed inside aboveground shall not exceed an individual capacity of 5678 L (1500 gal).

7.5.3.2 Total tank capacity inside shall not exceed 11,355 L (3000 gal).

7.5.3.3 Tanks shall be permitted to be located aboveground inside a facility that conforms to the requirements of Section 7.2, and shall be provided with secondary containment.

7.5.3.4 An inside storage tank shall be provided with a fill pipe originating outside the building.

7.5.3.5 Fill pipes shall have approved connections and permanent identification of applicable solvent.

7.5.4 Inside aboveground storage tanks shall be located as close as practicable to the equipment to which they are connected.

7.6 Interconnecting Components and Plumbing from Individual Pieces of Equipment and Tanks.

7.6.1 Underground piping, valves, and fittings shall be installed and tested in accordance with NFPA 30.

7.6.2 The aboveground piping, valves, and fittings for transfer of solvent from any storage tank to any equipment shall flow through closed circuits of iron or steel piping or through valves or fittings composed of brass or bronze.

7.6.3 Flexible hose suitable for the solvent shall be permitted as necessary for connections between vibrating and stationary equipment, and shall be visible for periodic inspection of leakage and wear.

7.6.3.1 Flexible hose shall have a rating of 50 percent above the maximum operating pressure but not less than 34 kPa [(0.3 atm) (gauge pressure of 5 psi)].

7.6.4 If a flow sight glass could, if damaged, allow the escape of solvent, then it shall be of a type not damaged by heat and shall be protected against physical damage.

7.6.5 Service pumps shall be provided to remove sludge from tanks.

7.6.5.1 The suction pipe shall be carried to the tank bottom, and the pump shall discharge to a suitable container.

7.6.5.2 In no case shall the discharge be into a sewer.

7.6.5.3 All pumps that handle solvent shall be identified for use with Class II solvents.

7.6.5.4 Pumps of the positive displacement type shall be fitted with a relief valve or bypass set to prevent pressures in excess of the working pressure of the system.

7.6.5.5 Where a continuous solvent flow circulation is maintained by means of a circulating pump, solvent coolers shall be provided to maintain a solvent temperature not to exceed 30 degrees below flash point.

7.6.5.5.1 Visual and audible alarm devices and automatic shutdown of non-safety related components shall be provided to warn the operator if solvent temperature is not maintained 30 degrees below solvent flashpoint.

7.7 Drycleaning Equipment and Stills.

7.7.1 Only steam, hot water, hot oil, or refrigerant shall be used as a source of heat for equipment.

7.7.2 Equipment with drying capabilities, reclaiming dryers, or washers with solvent heating capabilities shall be equipped with all of the following:

- (1) Automatic extinguishing systems installed and maintained in accordance with 4.6.3
- (2) Self-closing explosion hatch area equal to at least $0.22 \text{ m}^2/\text{m}^3$ ($1 \text{ ft}^2/15 \text{ ft}^3$) of cylinder volume
- (3) Hatches that open away from the operator

7.7.3 If steam is used as the source for heat, a pressure-regulating valve shall be installed in the steam supply line.

7.7.4 Stills shall be liquidtight and gastight.

7.7.4.1 Stills shall be designed for operation based on the vacuum principle.

7.7.4.2 If a relief valve is provided, it shall be equipped with a vent line extending to the outside.

7.7.4.3 Each still shall be provided with a combination vacuum and pressure gauge.

7.8* Static Electricity.

7.8.1 Storage tanks, filters, pumps, piping, ductwork, and equipment, including stills, drying cabinets, reclaiming dryers, and other equipment in the facility shall be bonded together and grounded.

7.8.2 Isolated units of equipment shall be grounded.

7.8.3* Where fabrics are transferred from one piece of equipment to another, the two pieces of equipment shall be electrically bonded together.

Chapter 8 Type III Drycleaning Facilities

8.1 Application. This chapter shall apply to drycleaning facilities utilizing Class IIIA and Class IIIB solvents in Version II or Version III equipment.

8.2 Location and Construction of Facility.

8.2.1* Type III facilities located in buildings with other occupancies shall be separated vertically and horizontally from other occupancies by a fire barrier having a minimum 2-hour fire resistance rating with self-closing or automatic-closing opening protection having a minimum $1\frac{1}{2}$ -hour fire protection rating except as permitted in 8.2.3.

8.2.2 The required fire barrier shall be permitted to be a 1-hour resistance rating with self-closing or automatic-closing opening protection having a $\frac{3}{4}$ -hour fire protection rating in facilities located in buildings protected throughout by an automatic sprinkler system installed in accordance with 4.6.2.

8.2.3 The required fire barrier shall be permitted to be a 1-hour resistance rating with self-closing or automatic-closing opening protection having a $\frac{3}{4}$ -hour fire protection rating in facilities where the quantity of Class III solvent in equipment and storage does not exceed 1250 L (330 gal) and equipment is provided with instrumentation, systems, or controls that provide any one of the features in 8.5.2.1.

8.3 Building Services.

8.3.1 Electrical Installations. Electrical equipment and wiring in Type III facilities shall be in accordance with NFPA 70 Class I Division 2, except as permitted in 8.5.2.3.2.

8.4 Automatic Sprinklers.

8.4.1 Type III facilities shall be protected throughout by approved automatic sprinkler systems installed in accordance with 4.6.2 except as permitted in 8.4.2.

8.4.2 Automatic sprinkler systems shall not be required in facilities where the quantity of Class III solvent in equipment and storage does not exceed 1250 L (330 gal) if equipment has instrumentation, systems, or controls that provide one of the features in 8.5.2.1.1.

8.5 Process and Equipment Requirements.

8.5.1 Storage Tanks. Storage tanks over 227 L (60 gal) shall be constructed and installed in accordance with NFPA 30.

8.5.1.1 In facilities located in buildings with other occupancies or without sprinklers, each aboveground tank shall have a capacity of not more than 1250 L (330 gal), and the total solvent capacity of such occupancy, including inside aboveground and underground storage tanks, shall not exceed 5000 L (1320 gal).

8.5.2 Equipment and Still Requirements.

8.5.2.1 Equipment with drying capabilities, reclaiming dryers, or washers with solvent heating capabilities shall be equipped with all of the following except as permitted in 8.5.2.1.1:

- (1) Automatic extinguishing systems installed and maintained in accordance with 4.6.3
- (2) Self-closing explosion hatch area equal to at least $0.22 \text{ m}^2/\text{m}^3$ ($1 \text{ ft}^2/15 \text{ ft}^3$) of cylinder volume
- (3) Hatches that open away from the operator

8.5.2.1.1 Automatic extinguishing systems and self-closing hatches shall not be required if the equipment has integrated instrumentation, systems, or controls that independently provide any one of the following:

- (1) Features that limit oxygen concentrations to less than 8 percent by volume
- (2) Features that limit solvent vapor concentrations to less than 25 percent of the LEL
- (3)* Features that limit solvent vapor concentration at or below 60 percent of the LEL where automatic instrumentation with safety interlocks is provided in accordance with NFPA 69

8.5.2.2 If steam is used as the source for heat, a pressure-regulating valve shall be installed in the steam supply line.

8.5.2.2.1 Stills shall be liquidtight and gastight.

8.5.2.2.2 Stills shall be designed for operation based on the vacuum principle.

8.5.2.2.3 If a relief valve is provided, it shall be equipped with a vent line extending to the outside of the building.

8.5.2.2.4 Each still shall be provided with a combination vacuum and pressure gauge.

8.5.2.3 Equipment Electrical Requirements.

8.5.2.3.1* For equipment in which solvent is heated above ambient temperatures in washing or drying to a temperature that allows the solvent vapor concentration to equal or exceed 25 percent of the LEL, the electrical equipment and wiring shall be designed in accordance with NFPA 70 Class I Division 2, except as permitted in 8.5.2.3.2.

8.5.2.3.2 Areas that contain electrical equipment and wiring shall be considered unclassified locations in accordance with NFPA 70, as long as they contain instrumentation, systems, or controls that are active in washing or drying that provide any one or combination of the following:

- (1) Features that limit oxygen concentrations to less than 8 percent by volume
- (2) Features that limit solvent vapor concentration to less than 25 percent of the LEL
- (3) Features that limit solvent vapor concentration at or below 60 percent of the LEL where automatic instrumentation with safety interlocks is provided in accordance with NFPA 69 [see A.7.2.4.2(3)]

8.5.2.3.3 Visual and audible alarm devices and automatic shutdown of non-safety related components shall be provided to de-energize equipment if its integrity has been compromised and not functioning as designed.

Chapter 9 Type IV Drycleaning Facilities

9.1 Application. This chapter shall apply to drycleaning facilities or systems utilizing Class IV solvents.

9.2 Building Services. All electrical equipment, devices, and wiring for light and power shall be installed in accordance with the requirements of NFPA 70 for ordinary locations.

9.3 Processes and Equipment.

9.3.1 General.

9.3.1.1 Equipment solvent storage and treatment tanks and all interior steel surfaces that tend to corrode if alternately exposed to solvent and air during ordinary operation shall be protected against corrosion.

9.3.1.2 Pumps, filters, or any closed containers that are ordinarily completely filled with solvent and steam coils that are immersed in solvent or that ordinarily do not tend to corrode shall be permitted to be constructed of carbon steel without corrosion protection.

9.3.2 Pumps and Piping. Pumps shall be permitted to be used for the transfer of solvent.

9.3.3 Drycleaning Equipment.

9.3.3.1 Equipment shall comply with the requirements of Section 6.2.

9.3.3.2 Atmospheric solvent stills shall be constructed to prevent hot solvent vapor from escaping into the facility.

9.3.4* Drycleaning Using Nonflammable Liquefied Gases in Pressure Vessels.

9.3.4.1 Pressure Vessel Requirements.

9.3.4.1.1* A pressure vessel that serves as a drycleaning machine and operates at a pressure greater than 1034 kPa (150 psi) shall meet all the requirements of this section.

9.3.4.1.2 Pressure vessels used for drycleaning shall be constructed in accordance with the ASME *Boiler and Pressure Vessel Code*.

9.3.4.1.3 Pressure piping and associated components shall be in accordance with ANSI/ASME B31.1, *Power Piping*.

9.3.4.2 Liquefied Gas Requirements. Storage of nonflammable liquefied gases for use in pressure vessels shall be in accordance with NFPA 55.

9.3.4.2.1 Liquefied Carbon Dioxide Requirements.

9.3.4.2.1.1* Where carbon dioxide storage tanks are installed inside buildings, a listed gas detection system with an audible local alarm shall be installed to notify building occupants if a leak of carbon dioxide occurs.

9.3.4.2.1.2 Instrumentation and controls shall be incorporated into the design of the equipment to sound an alarm and to shut down the machine where there is a system malfunction that could result in an unintentional release of carbon dioxide.

9.3.4.2.1.3 Venting from the equipment shall be to the outdoors away from any air intake to prevent re-entrainment.

9.3.4.2.1.4 Doors and hatches on the equipment shall be safety interlocked to prevent opening where pressurized above ambient pressure.

9.3.4.2.1.5 Maintenance on the equipment shall be performed by qualified trained personnel in accordance with manufacturers' recommendations.

9.3.4.2.1.6 Operators shall be trained in the procedures and precautions for start-up, shut-down, normal operations, and emergency procedures.

9.3.4.2.1.7* Appropriate warning signs shall be affixed in the area where carbon dioxide is used or stored.

Chapter 10 Laundry and Wetcleaning Equipment in Drycleaning Facilities

10.1 General. This chapter shall apply to drycleaning facilities utilizing laundry or wetcleaning equipment.

10.2 Prohibited Activities. Textiles cleaned in nonaqueous solvent shall not be dried in a laundry or wetcleaning dryer.

10.3 Processes and Equipment.

10.3.1 Location. Equipment shall be located in facilities with an intake and exhaust air exchange equal to or exceeding the air exchange required for the equipment.

10.3.2 Laundry Dryer Temperature Control. Laundry dryers, used in drycleaning facilities shall be equipped with safety controls to ensure proper temperature and cool-down of textiles prior to the equipment being unloaded. The textiles shall be cooled down in such a way that the risk of spontaneous combustion is eliminated.

10.4 Listing. Laundry-drying equipment with a load capacity greater than 0.2 m³ (7 ft³) shall be listed by a nationally recognized testing lab and approved for use exclusively with water in a commercial or industrial setting.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.5.1 Cosmetic changes to the facility that do not affect safety are not considered remodeling for the purposes of this standard.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.2 Blending. Blending does not include spotting, spotting agents, or other mixes used for pretreatment of garments outside the drycleaning equipment. Blending is not applicable for wetcleaning.

A.3.3.5 Control Equipment. Control equipment is designed to eliminate or reduce flammable and combustible hazards and atmospheres and can include the following:

- (1) *Blanketing (or padding).* The technique of maintaining an atmosphere that is either inert or fuel-enriched in the vapor space of a container or vessel.
- (2) *Intrinsically safe equipment.* The use of equipment and wiring that are incapable of releasing sufficient electrical energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture.
- (3) *Inert atmospheres.* The creation of an atmosphere where combustion cannot occur.

A.3.3.13.2 Version II Equipment. Version II equipment is equipment or machines that incorporate safety controls and release fugitive emissions of combustible or hazardous liquids or vapor from a drycleaning process during normal operation. It is also known as a transfer system.

A.3.3.13.3 Version III Equipment. Version III equipment is equipment or machines that incorporate safety controls and does not release fugitive emission of combustible or hazardous liquids or vapor in a drycleaning process during normal operation. It is also known as a dry-to-dry system.

A.3.3.15.1 Type I Facility. The facility type is defined based on the lowest numerical class of solvent in use. Facilities employing multiple drycleaning solvents in different solvent classes, blended or unadulterated, are defined by the solvent in the numerically lowest class of solvent. A facility might use Class III and Class IV solvents but because the type of facility is based on the lowest numerical class, it would be considered a Type III facility.

A.3.3.15.2 Type II Facility. The facility type is defined based on the lowest numerical class of solvent in use. Facilities employing multiple drycleaning solvents in different solvent classes, blended or unadulterated, are defined by the solvent in the numerically lowest class of solvent. A facility might use Class III and Class IV solvents but because the type of facility is based on the lowest numerical class, it would be considered a Type III facility.

A.3.3.15.3 Type III Facility. The facility type is defined based on the lowest numerical class of solvent in use. Facilities employing multiple drycleaning solvents in different solvent classes, blended or unadulterated, are defined by the solvent in the numerically lowest class of solvent. A facility might use Class III and Class IV solvents but because the type of facility is based on the lowest numerical class, it would be considered a Type III facility.

A.3.3.15.4 Type IV Facility. The facility type is defined based on the lowest numerical class of solvent in use. Facilities employing multiple drycleaning solvents in different solvent classes, blended or unadulterated, are defined by the solvent in the numerically lowest class of solvent. A facility might use Class III and Class IV solvents but because the type of facility is based on the lowest numerical class, it would be considered a Type III facility.

• **A.3.3.18 Flash Point (FP).** Certain mixtures of flammable or combustible liquids and other substances, such as halogenated hydrocarbons, either do not exhibit a flash point using the standard closed-cup test methods or will exhibit elevated flash points. However, if the other substance is the more volatile component, preferential evaporation of this component can result in a liquid that does have a flash point or has a flash point that is lower than the original mixture. To evaluate the fire hazard of such mixtures, flash point tests should be conducted after fractional evaporation of 10, 20, 40, 60, or even 90 percent of the original sample or other fractions representative of the conditions of use. If the flammable or combustible liquid is a blend of substances having differing flash points and there is a potential for the components to separate during normal operation, the flash point of each component of the blend needs to be reported.

The appropriate test procedure and apparatus are as follows:

- (1) The flash point of liquids having a viscosity less than 45 Saybolt Universal Seconds (SUS) at 37.8°C (100°F) and a flash point below 93.4°C (200°F) is determined in accordance with ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*.
- (2) The flash point of liquids having a viscosity of 45 SUS or more at 37.8°C (100°F) or a flash point of 93.4°C (200°F) or higher is determined in accordance with ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*.

N A.3.3.22 Ignitable Liquid. Unless otherwise specified, the term *liquid* means an ignitable liquid.

The term *ignitable liquid* refers to any liquid that will burn. Class I liquids [FP < 37.8°C (100°F)], Class II and Class III liquids [FP ≥ 37.8°C (100°F)], and inflammable liquids are all ignitable liquids. [30, 2021]

• **A.3.3.27 Solvents.** See A.3.3.18.

A.3.3.27.6 Class IV Solvent. Class IV solvents include, but are not limited to, perchloroethylene, trichloroethylene, liquid CO₂, and water.

A.3.3.30 Storage Tank. A tank containing solvent that is an integral part of a drycleaning machine or an integral part of drycleaning equipment is not considered a storage tank.

N A.3.3.33 Upper Flammable Limit (UFL). This term is also known as the upper explosive limit (UEL). Mixtures above this limit are said to be "too rich." [36, 2021]

A.4.2.2 For example, equipment designed for Class IV solvents cannot be used for Class III or Class II solvents. The committee is unaware of any acceptable conversions in which a machine using a higher class of solvent has been converted to a lower class solvent which is why this has been prohibited by this standard.

A.5.4.1 The content, frequency, and documentation of employee right-to-know training should conform to the applicable requirements of 29 CFR 1910.1200. Fire prevention and fire safety training conforming to 29 CFR 1910.38 and 29 CFR 1910.156 should also be required. Where employees are required to wear PPE, they should be thoroughly trained in the use and maintenance of that equipment.

All employees should be trained in their primary language in order for training to be effective.

A.6.4.3(2) There are currently no known listing requirements for drycleaning solvents. However, some of the criteria that could be included in future testing includes flashpoint stability, solvent degradation, the need for additives and stabilizers, and the integrity of the product in its application.

A.6.4.3(3) Qualified testing laboratories may include third-party independent laboratories or Nationally Recognized Testing Laboratories. Testing may include flashpoint, UFL, LFL, stability, and corrosivity of the solvent.

A.6.4.4.1 There are currently no known listing requirements for drycleaning solvents. However, some of the criteria that could be included in future testing includes flashpoint stability, solvent degradation, the need for additives and stabilizers, and the integrity of the product in its application. [See also A.6.4.3(2).]

The "anticipated conditions" are the normal temperatures and pressures anticipated in the drycleaning process. It is not the committee's intent to require the solvent supplier to anticipate how all the possible additives that are added during the drycleaning process might change the solvent properties. Requirements for the safe storage and use of the great variety of flammable and combustible liquids commonly available depend primarily on their fire characteristics, particularly the flash point, which is the basis for the classification system. It should be noted that a liquid's classification can be changed by contamination. For example, placing a Class II liquid into a tank that last contained a Class I liquid can change the flash point of the Class II liquid so that it falls into the range of a Class I liquid. The same situation can exist where a Class II liquid is exposed to the vapors of a Class I liquid via an interconnecting vapor line. Care should be exercised in such cases to apply the requirements appropriate to the actual classification. Refer to the NFPA *Fire Protection Guide to Hazardous Materials* for flash point and other fire hazard data.

The volatility of a liquid is increased by heating. Where Class II or Class III liquids are exposed to storage conditions, use conditions, or process operations in which they are naturally or artificially heated to or above their flash points, additional fire safety features, such as ventilation, separation from ignition sources, diking, or electrical area classification, might be necessary.

N A.6.5.2(1) It should be noted that the original equipment manufacturer might only have a solvent class indication on its nameplate. In this case, the conditions of 6.5.2(2) or 6.5.2(3) apply.

A.7.1 Version I equipment for Type II facilities is prohibited per 4.2.3.

A.7.2.1 Horizontal separation would be required if there was another occupancy above or below the facility. Vertical separa-

tion would be required where another occupancy was adjacent to the facility.

A.7.2.4.2(3) The instrumentation required would monitor the control of the concentration of combustible components. Above 60 percent of the combustible mixture LEL, an interlock would automatically cause a reduction in combustible vapor concentration by stopping a liquid feed flow, turning off heat sources, and/or purging with additional air. Instrumentation is calibrated as recommended by the manufacturer. Consideration is given where the enclosure being protected presents a personnel hazard for an alarm to indicate abnormal operation of the system. Such alarms are set at a lower percentage of LEL, typically 50 percent.

A.7.2.5.2(3) The instrumentation required would monitor the control of the concentration of combustible components. Above 60 percent of the combustible mixture LEL, an interlock would automatically cause a reduction in combustible vapor concentration by stopping a liquid feed flow, turning off heat sources, and/or purging with additional air. Instrumentation is calibrated as recommended by the manufacturer. Consideration is given where the enclosure being protected presents a personnel hazard for an alarm to indicate abnormal operation of the system. Such alarms are set at a lower percentage of LEL, typically 50 percent. [See also 7.2.4.2(3).]

A.7.4.1.1(3) The instrumentation required would monitor the control of the concentration of combustible components. Above 60 percent of the combustible mixture LEL, an interlock would automatically cause a reduction in combustible vapor concentration by stopping a liquid feed flow, turning off heat sources, and/or purging with additional air. Instrumentation is calibrated as recommended by the manufacturer. Consideration is given where the enclosure being protected presents a personnel hazard for an alarm to indicate abnormal operation of the system. Such alarms are set at a lower percentage of LEL, typically 50 percent. [See also A.7.2.4.2(3).]

A.7.8 For further information, see NFPA 77.

A.7.8.3 Special consideration should be given to the generation and accumulation of static electricity where fabrics are loaded into or removed from equipment.

A.8.2.1 It is not the intent to require separation of offices or other areas that are ancillary to the drycleaning operation, such as clothing receiving, repair, or mercantile areas. Horizontal separation would be required if there was another occupancy above or below the facility. Vertical separation would be required where another occupancy is adjacent to the facility.

A.8.5.2.1.1(3) See A.7.2.4.2(3).

A.8.5.2.3.1 Each solvent has a temperature at which vapor concentrations are produced that reach 25 percent of the LEL for that solvent. Either the solvent manufacturer should provide the equipment manufacturer with the temperatures that causes that solvent to reach 25 percent of the LEL or the equipment manufacturer should test the solvent to determine this temperature. The equipment that is approved for the solvent would have the ability to control the heating of the solvent to a level below 25 percent of the LEL based on the solvent that is approved for use in the machine. Equipment does not necessarily require an LEL measuring device.

A.9.3.4 Consideration should be given if a flammable or combustible solvent is blended with a nonflammable liquefied gas.

A.9.3.4.1.1 Typical pressures in operation for carbon dioxide drycleaning machines can be greater than 4826 kPa (700 psi).

A.9.3.4.2.1.1 Consideration shall be given to the possibility of carbon dioxide drifting and settling into adjacent places outside of where the carbon dioxide is used. A detection system should also be installed in that location.

A.9.3.4.2.1.7 See NFPA 704 for guidance on labeling for emergency response. See NFPA 12 for additional information on signage for carbon dioxide systems.

Annex B Document Requirements Flowchart

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

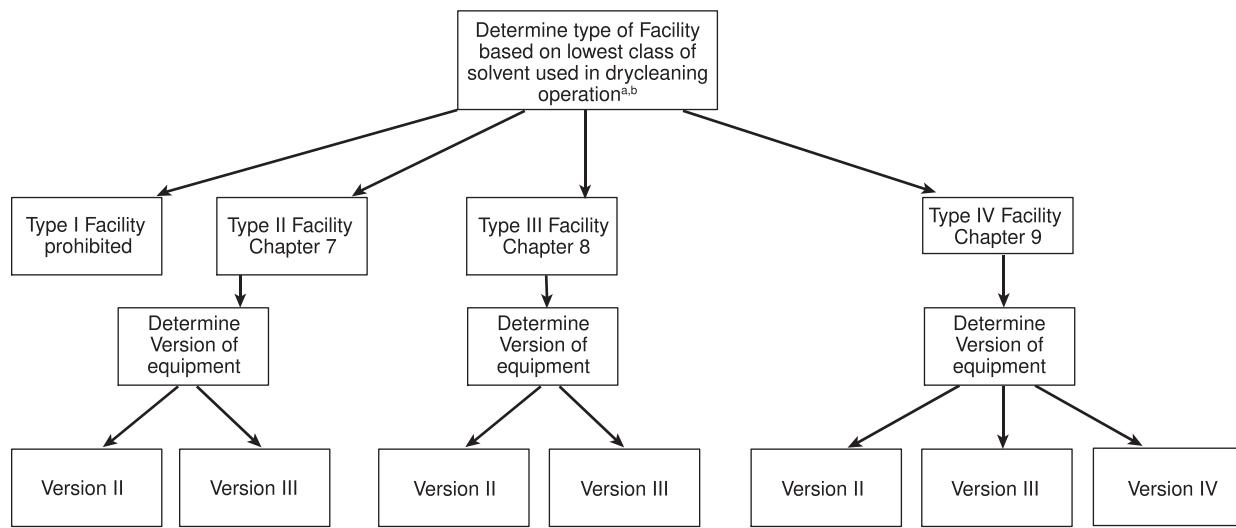
B.1 Figure B.1 shows a flowchart for determining the requirements in NFPA 32 based on the type of facility and the version of equipment in use.

Annex C Solvent Characteristics

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 Typical Drycleaning Solvent Characteristics Figure C.1 is not comprehensive. It is provided only as a reference for AHJs to assist in the application of requirements in NFPA 32.

SDSs should be consulted prior to such application of the requirements of this standard.



^aDrycleaning operations that have laundry or wetcleaning operations should also refer to Chapter 10.

^bThe requirements of Chapters 4 through 6 apply to all Facilities.

Facility Types

Facility type is defined based on the lowest numerical class of solvent used in the equipment.

Type I: Facilities employing Class I solvents.

Type II: Facilities employing Class II solvents.

Type III: Facilities employing Class IIIA and Class IIIB solvents.

Type IV: Facilities employing Class IV solvents.

Equipment Versions

Version I: An open system employing either combustible or noncombustible liquid that is continuously open to the atmosphere

Version II: An open-circuit system employing combustible or noncombustible liquid, that releases fugitive emissions, suppresses and controls combustion, and that has safety controls

Version III: A closed-looped system employing combustible or noncombustible liquid that does not release emissions, prevents combustion, and that has safety controls

Version IV: A closed-loop system for noncombustible liquids that has safety controls and that does not release emissions

△ FIGURE B.1 NFPA 32 Document Requirements Flowchart.

	CAS numbers and chemicals composition										Physical properties									
	CLASS II / SOLVENT Petroleum (Stoddard)		CLASS IIIA HYDROCARBON ALKANES, ISOALKANES, CYCLIC AROMATICS, 3-BUTYL HYDROXYPROPIONATE, ISOPARAFFINS 2-PROPANOL		ISOPARAFFINS, ALIPHATIC HYDROCARBON, ISOALKANES NAPHTHA		ISOPARAFFINIC HYDROCARBON ACETALS		DIBUTOXYMETHANE, BUTYL HYDROCARBON / ALIPHATIC PROPYLENE GLYCOL ETHER		SYSTEM UTILIZING CO ₂ AND ETHER		DECAMETHYLCYCLOPENTASILOXANE		DIPROPYLENE GLYCOL t-BUTYL ETHER		CLASS IV / SOLVENT N-PROPYL BROMIDE*		Physical properties	
	102.5°F																			
Physical properties																				
Class II solvent	FP= 100°F to 139°F																			
Class IIIA solvent	FP=140°F to 200°F		141°F	142°F	142°F	144°F	154°F	154°F	170°F	183°F										
Class IIIB solvent	FP= ≥ 200°F																			
Class IV solvent	No flash point																			
CAS number	8052-41-3	687-47-8, 64742-48-9, 5131-66-8, 8028-48-8	64742-48-9	68551-17-7	2568-90-3	64742-48-9 10 to 60%	Proprietary 20 to 70%	75-52-5	541-02-6	(EC) 1272/2008 (CLP)	132739-31-2 25265-71-8	106-94-5	127-18-4							
Requires stabilizer						Yes											Yes	Yes		
Blended		Yes					Yes	Yes			Yes						Yes	Yes		
100% pure	Yes		Yes	Yes	Yes						Yes									
Vapor pressure	0.1 kPa	<0.6 kPa	0.064 kPa	0.199 kPa	1.3 kPa	NA	NA	0.027 kPa	NA	0.0053 kPa		18.53 kPa								
Specific gravity	0.79	0.81	0.767	0.762	0.83	0.83	0.83	0.96		0.96		1.3	1.62							
UEL level	% of air	8.0%	7.0%	5.3%	5.4%	23.6%	>4.0 %	>4.0%	NA	NA	6.7%	9.5%*								
LEL level	% of air	0.6%	0.6%	0.7%	0.68%	0.63%	0.7%	0.7%	NA	NA	1.70%	3.8%*								
VOC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Exempt	Yes	Yes	Yes	HAP / TAC				No			

*Nonflammable per OSHA & DOT, vapors will form a flammable mixture at a concentration of 3.8% to 9.5%.

Note: 1 kPa = 0.145 psi = 7.5 mm Hg; 100°F = 37.78°C

△ FIGURE C.1 Typical Drycleaning Solvent Characteristics.

Annex D Informational References

D.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

▲ **D.1.1 NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2018 edition.

NFPA 77, *Recommended Practice on Static Electricity*, 2019 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 edition.

Fire Protection Guide to Hazardous Materials, 14th edition, 2010.

D.1.2 Other Publications.

D.1.2.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*, 2016a.

ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*, 2019.

D.1.2.2 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 29, Code of Federal Regulations, Part 1910.38, "Emergency Action Plans."

Title 29, Code of Federal Regulations, Part 1910.156, "Fire Brigades."

Title 29, Code of Federal Regulations, Part 1910.1200, "Hazard Communication."

D.2 Informational References. (Reserved)

D.3 References for Extracts in Informational Sections.

NFPA 30, *Flammable and Combustible Liquids Code*, 2021 edition.

NFPA 36, *Standard for Solvent Extraction Plants*, 2021 edition.

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