Tentative Interim Amendment

NFPA® 652

Standard on the Fundamentals of Combustible Dust

2019 Edition

Reference: 1.3.3(new), A.1.3.3, 2.4, 3.3.6, A.3.3.6, Various new definitions in 3.3, 8.4.2.2, 8.4.2.6.2 item (4), 9.4.6, A.3.3.8, A.9.4.7.4.6 and D.1.2.8
TIA 19-1
(SC 22-4-11 / TIA Log #1619)

Pursuant to Section 5 of the NFPA *Regulations Governing the Development of NFPA Standards*, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 652, *Standard on the Fundamentals of Combustible Dust*, 2019 edition. The TIA was processed by the Technical Committee on Fundamentals of Combustible Dusts, and the Correlating Committee on Combustible Dusts, and was issued by the Standards Council on April 12, 2022, with an effective date of May 2, 2022.

1. Add a new 1.3.3 and associated Annex material to read as follows; and renumber existing paragraphs accordingly:

1.3.3* This standard shall apply to the storage or use of ignitible fibers/flyings, specifically with regard to fire hazards.

A.1.3.3 Ignitible fibers/flyings, as defined in *NFPA 70* and NFPA 499, do not present a flash-fire hazard or explosion hazard and are not included in the definition of *combustible dust* in this standard. Ignitible fibers/flyings present a fire hazard, so locations are classified differently and the electrical installation includes additional restrictions compared to combustible fibers/flyings.

1.3.~~3~~4 This standard shall not apply to the following: …

1.3.4~~5~~ Where an industry …

2. Add a new reference to Section 2.4 as follows:

NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, 2021 edition.

3. Revise 3.3.6 Combustible Dust, and associated Annex material to read as follows:

3.3.6* Combustible Dust. A finely divided combustible particulate solid, including combustible fibers/flyings, that presents a flash-fire hazard or explosion hazard when suspended in air or the process-specific oxidizing medium over a range of concentrations.

A.3.3.6 Combustible Dust. The term *combustible dust* when used in this standard includes powders, fines, fibers, flyings, etc. Combustible fibers/flyings are specifically mentioned because, while the hazard is the same, *NFPA 70* and NFPA 499 treat combustible dust and combustible fibers/flyings separately in regards to establishing hazardous (classified) locations and specifying the electrical installation. Ignitible fibers/flyings, as defined in *NFPA 70* and NFPA 499, do not present a flash-fire or explosion hazard and are not included in the definition of combustible dust in this standard. Ignitible fibers/flyings present a fire hazard, so locations are classified differently and the electrical installation includes additional restrictions compared to combustible fibers/flyings.

This definition also includes consideration of a process-specific oxidizing medium other than air. A larger particle size material might not present a hazard in air, yet could present a hazard in an atmosphere with increased oxygen concentration. Similarly, a combustible metal might still present a hazard in an atmosphere typically considered inert, such as CO_2 or nitrogen.

Dusts traditionally were defined as material 420 µm or smaller (i.e., capable of passing through a U.S. No. 40 standard sieve). For consistency with other standards, 500 µm (i.e., capable of passing through a U.S. No. 35 standard sieve) is now considered an appropriate size criterion. Particle surface area-to-volume ratio is a key factor in determining the rate of combustion. Combustible particulate solids with the smallest ~~a minimum~~ dimension more than 500 µm generally have a surface-to-volume ratio that is too small to pose a deflagration hazard. ~~Flat platelet-shaped particles, flakes, or fibers~~ Fibers/flyings with lengths that are large compared to their diameter or thickness usually do not pass through a 500 µm sieve, yet could still pose a deflagration hazard. Many particulates accumulate electrostatic charge in handling, causing them to attract each other, forming agglomerates. Often, agglomerates behave as if they were larger particles, yet when they are dispersed they present a significant hazard. Therefore, it can be inferred that any particulate that has the smallest ~~a minimum~~ dimension less than or equal to 500 µm could behave as a combustible dust if suspended in air or the process-specific oxidizer. If the smallest ~~minimum~~ dimension of the particulate is greater than 500 µm, it is unlikely that the material would be a combustible dust, as determined by test. The determination of whether a sample of combustible material presents a flash-fire or explosion hazard could be based on a screening test methodology such as provided in the ASTM E1226, *Standard Test Method for Explosibility of Dust Clouds*. Alternatively, ~~and~~ a standardized test method such as ASTM E1515, *Standard Test Method for Minimum Explosible Concentration of Combustible Dusts*, could be used to determine dust explosibility. Chapter 5 has additional information on testing requirements.

…

4. *In 3.3 add new definition for Combustible Fibers/Flyings, and associated Annex material to read as follows:*

3.3.x* Combustible Fibers/Flyings. Fibers/flyings, where any dimension is greater than 500 µm in nominal size, which can form an explosible mixture when suspended in air at standard atmospheric pressure and temperature. [**499,** 2021]

A.3.3.x Combustible Fibers/Flyings. Section 500.5 of *NFPA 70* defines a Class III location. Combustible fibers/flyings can be similar in physical form to ignitible fibers/flyings and protected using the same electrical equipment installation methods. Examples of fibers/flyings include flat platelet-shaped particulate, such as metal flake, and fibrous particulate, such as particle board core material. If the smallest dimension of a combustible material is greater than 500 µm, it is unlikely that the material would be combustible fibers/flyings, as determined by test. Finely divided solids with lengths that are large compared to their diameter or thickness usually do not pass through a 500 µm sieve, yet when tested could potentially be determined to be explosible. [**499,** 2021]

The typical test methods for evaluating an explosible mixture are ASTM E1226, *Standard Test Method for Explosibility of Dust Clouds*, ISO 6184-1, *Explosion protection systems — Part 1: Determination of explosion indices of combustible dusts in air*, or ISO/IEC/UL 80079-20-2, *Explosive atmospheres — Part 20-2: Material characteristics — Combustible dusts test methods*, for procedures for determining the explosibility of dusts. A material that is found to not present an explosible mixture could still be an ignitible fiber/flying, as defined in 3.3.y. Historically, the explosibility condition has been described as presenting a flash fire or explosion hazard. It could be understood that the potential hazard due to the formation of an explosible mixture when suspended in air at standard atmospheric pressure and temperature would include ignition. [**499,** 2021]

While this standard includes larger yet still hazardous materials as a subset of combustible dust, *NFPA 70* addresses them separately for purposes of defining the appropriate electrical classification. Although the hazard is the same when dispersed in a cloud, the electrical installation to prevent ingress of combustible fibers/flyings is different.

5. *In 3.3 add new definition for Ignitible Fibers/Flyings, and associated Annex material to read as follows:*

3.3.y* Ignitible Fibers/Flyings. Fibers/flyings where any dimension is greater than 500 µm in nominal size, which are not likely to be in suspension in quantities to produce an explosible mixture, but could produce an ignitible layer fire hazard. [**499,** 2021]

A.3.3.y Ignitible Fibers/Flyings. Section 500.5 of *NFPA 70* defines a Class III location as one where ignitible fibers/flyings are present, but not likely to be in suspension in the air in quantities sufficient to produce ignitible mixtures. This description addresses fibers/flyings that do not present a flash-fire hazard or explosion hazard by test. This could be because those fibers/flyings are too large or too agglomerated to be suspended in air in sufficient concentration, or at all, under typical test conditions. Alternatively, this could be because they burn so slowly that, when suspended in air, they do not propagate combustion at any concentration. [**499,** 2021]

In this document the zone classification system includes ignitible fibers/flyings as a fire hazard in a layer, which is not addressed in the IEC zone system (see IEC 60079-10-2, *Explosive atmospheres — Part 10-2: Classification of areas — Explosive dust atmospheres*). Where these are present, the user could also consider installation in accordance with Article 503 of *NFPA 70.* [**499,** 2021]

6. *Revise 8.4.2.2, and associated Annex material to read as follows:*

8.4.2.2 Vacuum Cleaning Method.

…
8.4.2.2.1.7* Portable vacuum cleaners that meet the following minimum requirements shall be permitted to be used to collect combustible particulate solids in unclassified ~~(nonhazardous) areas~~ locations:
(1) Materials of construction shall comply with 9.4.7.1.
(2) Hoses shall be conductive or static dissipative.
(3) All conductive components, including wands and attachments, shall be bonded and grounded.
(4) The fan or blower shall be on the clean side of the primary filtration media or wet separation chamber.
(5) Electrical motors shall not be located on the dirty side of the primary filtration media or wet separation chamber unless listed for Class II or Class III, Division 1, as appropriate, or Zone 20 or Zone 21 locations.
(6)*Where liquids or wet materials are picked up by the vacuum cleaner, paper filter elements shall not be used.
(7) Vacuum cleaners used for metal dusts shall meet the requirements of NFPA 484.

A.8.4.2.2.1.7 If a large quantity of material is spilled in an unclassified area, the bulk material should be collected by sweeping or shoveling or with a portable vacuum cleaner listed as suitable for combustible dust hazardous (classified) ~~Class II~~ locations. Vacuum cleaners meeting the requirements in 8.4.2.2.1 can be used to clean up residual material after the bulk of the spill has been collected.

8.4.2.2.2* In combustible dust hazardous (classified) ~~Class II electrically classified (hazardous)~~ locations, electrically powered vacuum cleaners shall be listed for the purpose and location or shall be a fixed-pipe suction system with a remotely located exhauster and an AMS installed in conformance with Section 9.3, and they shall be suitable for the dust being collected.

A.8.4.2.2.2 The Committee is not aware of vendors providing equipment listed for Class III hazardous (classified) ~~electrically classified (hazardous)~~ locations. A common practice is to use equipment listed for combustible dust hazardous (classified) locations ~~Class II~~ in areas classified as Class III.

8.4.2.2.3 Where flammable vapors or gases are present in combustible dust hazardous (classified) locations ~~Class II areas~~, vacuum cleaners shall be listed for both flammable vapors or gases and combustible dust ~~Class I and Class II~~ hazardous (classified) locations.

7. Revise 8.4.2.6.2 item (4) to read as follows:
8.4.2.6.2* Where blowdown using compressed air is used, the following precautions shall be followed:
(1) Prior to using compressed …
(4) All electrical equipment, including lighting, potentially exposed to airborne dust in the area during cleaning is suitable for use in a Class II, Division 2, or Zone 22, hazardous (classified) location in accordance with *NFPA 70*.
…

8. Revise 9.4.6, and associated Annex material to read as follows:
9.4.6 Hazardous (Classified) Locations for Electrical Installations.
9.4.6.1* The identification of the possible presence and extent of hazardous (classified) locations ~~Class II and Class III locations~~ shall be made based on the criteria in ~~500.5(C) and (D)~~ Articles 500 and 506 of *NFPA 70*.

A.9.4.6.1 The best method to eliminate the need for hazardous (classified) locations ~~electrically classified areas~~ is to prevent the release of dust from equipment. The next best method to eliminate the need for hazardous (classified) locations ~~electrically classified areas~~ is to remove the dust by developing proper housekeeping procedures. If the release of dust from equipment cannot be prevented or the dust cannot be cleaned up, then that area might be a hazardous (classified) location ~~an electrically classified area~~. NFPA 499 can be used for guidance to supplement the criteria in ~~Article 500.5 of~~ *NFPA 70*. This guidance depends on a determination of the combustibility of dust in a particular area, the ignitibility properties of the dust, and the nature of possible dust cloud formation and dust layer accumulations within and outside the electrical equipment near the dusts. NFPA 499 is a good source for guidance on identifying hazardous (classified) locations ~~Class III areas~~.
The user of this document should be aware that the dust layer accumulation criteria in Articles 500 and 506 ~~505~~ of *NFPA 70* and NFPA 499 are ~~is~~ intended to address electrical ignition hazards due to overheating or shorting of electrical equipment. ~~The~~ However, the threshold housekeeping dust accumulation criteria in this standard are based on a dust flash-fire or dust deflagration hazard. These differing criteria can lead to different layer depth requirements. It is possible that even where electrically classified equipment is installed the area can still be considered a flash-fire or deflagration hazard.

9.4.6.1.1* The locations and extent of ~~Class II and Class III~~ hazardous (classified) locations ~~areas~~ shall be documented, and such documentation shall be preserved for access at the facility.

A.9.4.6.1.1 Local signage or floor indications should be considered. Having local floor signage provides the everyday operators and anyone else who would be in the facility with the awareness of the ~~electrically classified areas~~ hazardous (classified) locations. Knowledge of ~~electrically classified areas~~ hazardous (classified) locations gives anyone over the lifetime of the facility the awareness of immediate hazards within the facility.

9.4.6.2 Electrical equipment and wiring within ~~Class II~~ hazardous (classified) locations shall comply with ~~Article 502 of~~ *NFPA 70*.

~~**9.4.6.3** Electrical equipment and wiring within Class III locations shall comply with Article 503 of *NFPA 70*.~~

9.4.6.34* Preventive maintenance programs for electrical equipment and wiring in ~~Class II and Class III~~ hazardous (classified) locations shall include provisions to verify that dusttight electrical enclosures are not experiencing visible dust accumulation.

A.9.4.6.34 NFPA 70B contains recommendations on the development of an effective electrical equipment maintenance program. ~~Article~~ Section 502.15 of *NFPA* 70 contains descriptions of seals for electrical enclosures and fittings. The description includes a requirement that sealing fittings be accessible. This requirement is intended to include cabinets and other enclosures such as MCCs, control panels, and main switch gear, but not conduit, raceways, junction boxes, or other similar equipment. Section 506.16 of *NFPA* 70 also addresses seals.

~~**9.4.6.5*** Zone classification for dusts in accordance with Article 506 of *NFPA 70* shall not be permitted.~~

~~**A.9.4.6.5** Article 502 of *NFPA 70* permits the use of Zone 20 equipment installation in a Class II, Division 1, location for the same dust. If the dust is a metal dust and not a combustible metal dust according to the test methods for Group IIIC, based on a conductivity criterion, this would potentially have equipment identified for Group IIIB (suitable for nonconductive dusts) installed in a Class II, Division 1, Group E, location. This would definitely not be appropriate. Contrary to the general statement in 506.6(A) of *NFPA70*, a metal dust could be in Division Group E but not be conductive enough to be in Zone Group IIIC.~~

~~Another discrepancy in the requirements for zone classification versus division classification is that Article 506 of *NFPA 70* provides no limitation on the designation of Zone 22 locations for combustible metal dusts. Under the division system in Article 500.5(C)(1)(3), where there is Group E metal dust in hazardous quantities, the location would be classified as Division 1 and would not be permitted to be classified as Division 2. Under the zone system, the less protective Zone 22 could be chosen.~~

~~Both of these discrepancies are nonconservative in comparison to the division classification system. While the *NEC* has established a framework for the use of zone classification for dusts, these nonconservative discrepancies in the boundaries between dust groups and area classification zones/divisions must be resolved before applying these concepts to industrial situations. The NFPA EECA committee had previously coordinated the boundaries between zone and division for gases but has not yet addressed this significant issue for dusts. Until these discrepancies can be addressed, NFPA 652 should not permit the application of zone classification for combustible dusts in industrial occupancies.~~

9.4.6.4* Electrical equipment exposed to a process-specific oxidizing medium, other than air, shall only use dust exclusion protection methods unless supported by a documented risk assessment.

A.9.4.6.4 Intrinsic safety and nonincendive circuits are defined for use in atmospheric oxygen at concentrations not greater than 21 percent as stated in the ANSI standards used to certify the equipment. Greater than 21 percent oxygen concentration or a more sensitive oxidizing medium would greatly lower the safety factor on these circuits. Dust exclusion types of protection, such as dust ignitionproof, dusttight, purged and pressurized, encapsulation, and hermetically sealed, remain effective regardless of the process-specific oxidizing medium.

9. Add new text to the end of Annex A.3.3.8 to read as follows:

A.3.3.8 Combustible Particulate Solid…

For purposes of determining appropriate electrical installation requirements for combustible particulate solids, NFPA 499 has defined three material subgroups that can warrant establishing hazardous (classified) locations. Combustible dusts, per NFPA 499, are materials with a particle size less than 500 µm that can propagate a deflagration when suspended in a cloud, as determined by test. Combustible fibers/flyings are larger than 500 µm in at least one dimension, yet can still propagate a deflagration in a cloud. Both of these first two subgroups present flash-fire or explosion hazards when suspended in a cloud, as well as fire hazards when in a layer. Ignitible fibers/flyings are larger than 500 µm in at least one dimension, but either are too large or too agglomerated to suspend in the typical test or do not propagate a deflagration in a cloud. Ignitible fibers/flyings do not present a flash-fire or explosion hazard, yet still present a fire hazard when in a layer. All three of these subgroups defined in NFPA 499 are included in the term *combustible particulate solid* as defined and used in NFPA

652. Combustible fibers/flyings as defined in NFPA 499 are included in the term *combustible dust* as used and defined in NFPA 652.

NFPA 70 provides different installation requirements for each of these three material subgroups. Materials smaller than 500 µm require more stringent dust exclusion designs (i.e., Class II or Zone Group IIIB) than materials larger than 500 µm (i.e., Class III or Zone Group IIIA). The exception to this is combustible metals, where both combustible metal dust and combustible metal fibers/flyings require Class II or Zone Group IIIC installations. Ignitible fibers/flyings additionally require lower maximum surface temperatures than combustible fibers/flyings for certain electrical equipment subject to overload conditions. When a hazardous (classified) location is established to address the presence of more than one of the three subgroups, the more stringent electrical installation requirements should be applied.

10. Revise Annex A.9.4.7.4.6 to read as follows:

A.9.4.7.4.6 Table A.9.4.7.4.6 and Figure A.9.4.7.4.6 provide guides for the selection and use of FIBCs based on the MIE of product contained in the FIBC and the nature of the atmosphere surrounding it. While Table A.9.4.7.4.6 indicates division locations, equivalent zone locations are also included. Class I, Division Group C/D is equivalent to Zone Group IIA/IIB. Class II, Division 1 and 2 is equivalent to Zone 20/21/22. Inner liners for FIBCs are separated into three types. Note that the selection of the type of liner is critical to maintaining classification of the FIBC. Appropriate inner liner selection, where applicable, is addressed in IEC 61340-4-4, *Electrostatics — Part 4-4: Standard Test Methods for Specific Applications — Electrostatic Classification of Flexible Intermediate Bulk Containers (FIBC)*.

11. Add a new citation to D.1.2.8 as follows:

D.1.2.8

ISO/IEC 80079-20-2, *Explosive atmospheres — Part 20-2: Material characteristics — Combustible dusts test methods*, 2016.

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