

SPECIAL OCCUPANCIES

Chapter E 500

HAZARDOUS LOCATIONS

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E 500.01 Scope. (1) The provisions of chapters E 500—E 503 apply to locations in which the administrative authority judges the apparatus and wiring to be subject to the conditions indicated by the following classifications. It is intended that each room, section or area (including motor and generator rooms, and rooms for the enclosure of control equipment) shall be considered individually in determining its classification. Except as modified in chapters E 500—E 503, all other applicable rules contained in this code shall apply to electrical apparatus and wiring installed in hazardous locations. For definitions of "approved" and "explosion-proof" as used in these chapters, refer to chapter E 100. "dust-ignition-proof" is defined in section E 502.01.

(2) Equipment and associated wiring approved as intrinsically safe may be installed in any hazardous location for which it is approved, and the provisions of chapters E 500—E 517 need not apply to such installation. Intrinsically safe equipment and wiring is incapable of releasing sufficient electrical energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture. Abnormal conditions will include accidental damage to any part of the equipment or wiring, insulation or other failure of electrical components, application of over-voltage, adjustment and maintenance operations, and other similar conditions.

Note 1. Through the exercise of ingenuity in the layout of electrical installations for hazardous locations, it is frequently possible to locate much of the equipment in less hazardous or in non-hazardous areas and thus to reduce the amount of special equipment required. In some cases, hazards may be reduced or hazardous areas limited or eliminated by adequate positive-pressure ventilation from a source of clean air in conjunction with effective safeguards against ventilation failure. It is recommended that the administrative authority be consulted before such layouts are prepared. It is recommended also that the administrative authority be familiar with such recorded industrial experience as well as with such standards of the National Fire Protection Association as may be of use in the classification of various areas with respect to hazard.

Note 2. For recommendations for protection against static electricity hazards, refer to the standards of the National Fire Protection Association on this subject.

Note 3. Where rigid conduit is used in hazardous locations, it is necessary to have all threaded joints made up wrench tight to minimize sparking when fault current flows through the conduit system. Where it is impractical to make a threaded joint tight, a bonding jumper should be utilized.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 500.02 Special precaution. (1) The intent of chapters E 500—E 503 is to require a form of construction of equipment, and of installation that will insure safe performance under conditions of proper use and maintenance. It, therefore, is assumed that inspection authorities and users will exercise more than ordinary care with regard to installation and maintenance.

(2) The characteristics of various atmospheric mixtures of hazardous gases, vapors and dusts depend on the specific hazardous material involved. It is necessary therefore that equipment be approved not only for the class of location but also for the specific gas, vapor or dust that will be present.

Note: For purposes of testing and approval, various atmospheric mixtures have been grouped on the basis of their hazardous characteristics and facilities have been made available for testing and approval of equipment for use in the following atmospheric groups:

Group A, Atmospheres containing acetylene;
Group B, Atmospheres containing hydrogen, or gases or vapors of equivalent hazard such as manufactured gas;

Group C, Atmospheres containing ethyl-ether vapors, ethylene, or cyclo-propane;

Group D, Atmospheres containing gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, lacquer solvent vapors or natural gas;

Group E, Atmospheres containing metal dust, including aluminum, magnesium, and their commercial alloys, and other metals of similarly hazardous characteristics;

Group F, Atmospheres containing carbon black, coal or coke dust;

Group G, Atmospheres containing flour, starch, or grain dusts.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 500.03 Specific occupancies. See chapters E 510 to E 517 inclusive for rules applying to garages, aircraft hangars, gasoline dispensing and service stations, bulk storage plants, finishing processes, and flammable anesthetics.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 500.04 Class I locations. Class I locations are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Class I locations shall include the following:

(1) **CLASS I, DIVISION 1.** Locations (a) in which hazardous concentrations of flammable gases or vapors exist continuously, intermittently, or periodically under normal operating conditions, (b) in which hazardous concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage, or (c) in which breakdown or faulty operation of equipment or processes which might release hazardous concentrations of flammable gases or vapors, might also cause simultaneous failure of electrical equipment.

Note: This classification usually includes locations where flammable volatile liquids or liquefied flammable gases are transferred from one container to another; interiors of spray booths and areas in the vicinity of spraying and painting operations where volatile flammable solvents are used; locations containing open tanks or vats of volatile flammable liquids; drying rooms or compartments for the evaporation of flammable solvents; locations containing fat and oil extraction apparatus using volatile flammable solvents; portions of cleaning and dyeing plants where hazardous liquids are used; gas generator rooms and other portions of gas manufacturing plants where flammable gas may escape; inadequately ventilated pump rooms for flammable gas or for volatile flammable liquids; and all other locations where hazardous concentrations of flammable vapors or gases are likely to occur in the course of normal operations.

(2) **CLASS I, DIVISION 2.** Locations (a) in which flammable volatile liquids or flammable gases are handled, processed or used, but in which the hazardous liquids, vapors or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in case of abnormal operation of equipment,

(b) in which hazardous concentrations of gases or vapors are normally prevented by positive mechanical ventilation, but which might become hazardous through failure or abnormal operation of the ventilating equipment, or (c) which are adjacent to class I, division 1 locations, and to which hazardous concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clear air, and effective safeguards against ventilation failure are provided.

Note 1. This classification usually includes locations where flammable volatile liquids or flammable gases or vapors are used, but which, in the judgment of the code administrative authority, would become hazardous only in case of an accident or of some unusual operating condition. The quantity of hazardous material that might escape in case of accident, the adequacy of ventilating equipment, the total area involved, and the record of the industry or business with respect to explosions or fires are all factors that should receive consideration in determining the classification and extent of each hazardous area.

Note 2. Piping without valves, checks, meters and similar devices would not ordinarily be deemed to introduce a hazardous condition even though used for hazardous liquids or gases. Locations used for the storage of hazardous liquids or of liquefied or compressed gases in sealed containers would not normally be considered hazardous unless subject to other hazardous conditions also.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 500.05 Class II locations. Class II locations are those which are hazardous because of the presence of combustible dust. Class II locations shall include the following:

(1) **CLASS II, DIVISION 1.** Locations (a) in which combustible dust is or may be in suspension in the air continuously, intermittently or periodically under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures, (b) where mechanical failure or abnormal operation of machinery or equipment might cause such mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electrical equipment, operation of protection devices, or from other causes, or (c) in which dusts of an electrically conducting nature may be present.

Note 1. This classification usually includes the working areas of grain handling and storage plants; rooms containing grinders or pulverizers, cleaners, graders, scalpers, open conveyors or spouts, open bins or hoppers, mixers or blenders, automatic or hopper scales, packing machinery, elevator heads and boots, stock distributors, dust and stock collectors (except all-metal collectors vented to the outside), and all similar dust producing machinery and equipment in grain processing plants, starch plants, sugar pulverizing plants; malting plants, hay grinding plants, and other occupancies of similar nature; coal pulverizing plants (except where the pulverizing equipment is essentially dust-tight); all working areas where metal dusts and powders are produced, processed, handled, packed or stored (except in tight containers); and all other similar locations where combustible dust may, under normal operating conditions, be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

Note 2. Combustible dusts which are electrically non-conducting include dusts produced in the handling and processing of grain and grain products, pulverized sugar and cocoa, dried egg and milk powders, pulverized spices, starch and pastes, potato and woodflour, oil meal from beans and seed, dried hay, and other organic materials which may produce combustible dusts when processed or handled. Electrically conducting non-metallic dusts include dusts from pulverized coal, coke and charcoal. Metallic dusts from magnesium, aluminum and aluminum bronze are particularly hazardous and every precaution must be taken to avoid ignition and explosion.

(2) **CLASS II, DIVISION 2.** Locations in which combustible dust will not normally be in suspension in the air, or will not be likely to be thrown into suspension by the normal operation of equipment or apparatus, in quantities sufficient to produce explosive or ignitable mix-

tures, but (a) where deposits or accumulations of such dust may be sufficient to interfere with the safe dissipation of heat from electrical equipment or apparatus, or (b) where such deposits or accumulations of dust on, in, or in the vicinity of electrical equipment might be ignited by arcs, sparks or burning material from such equipment.

Note: Locations where dangerous concentrations of suspended dust would not be likely, but where dust accumulations might form on, or in the vicinity of electrical equipment, would include rooms and areas containing only closed spouting and conveyors, closed bins or hoppers, or machines and equipment from which appreciable quantities of dust would escape only under abnormal operating conditions; rooms or areas adjacent to locations described in subsection E 500.05 (1), and into which explosive or ignitable concentrations of suspended dust might be communicated only under abnormal operating conditions; rooms or areas where the formation of explosive or ignitable concentrations of suspended dust is prevented by the operation of effective dust control equipment; warehouses and shipping rooms where dust producing materials are stored or handled only in bags or containers; and other similar locations.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 500.06. Class III locations. Class III locations are those which are hazardous because of the presence of easily ignitable fibers or flyings, but in which such fibers or flyings are not likely to be in suspension in air in quantities sufficient to produce ignitable mixtures. Class III locations shall include the following:

(1) **CLASS III, DIVISION 1.** Locations in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured or used.

Note 1. Such locations usually include some parts of rayon, cotton and other textile mills; combustible fiber manufacturing and processing plants; cotton gins and cotton-seed mills; flax processing plants; clothing manufacturing plants; woodworking plants; and establishments and industries involving similar hazardous processes or conditions.

Note 2. Easily ignitable fibers and flyings include rayon, cotton (including cotton linters and cotton waste), sisal or henequen, istle, jute, hemp, tow, cocoa fiber, oakum, baled waste kapok, Spanish moss, excelsior and other materials of similar nature.

(2) **CLASS III, DIVISION 2.** Locations in which easily ignitable fibers are stored or handled (except in process of manufacture).

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.