(9) The floor covering within the children's playground structure shall exhibit a Class I interior floor finish classification, as described in Chapter 10 of NFPA *101* when tested in accordance with NFPA 253.

10.20.1.2* Light-transmitting plastics used for children's playgrounds shall meet all of the following criteria:

(1) They shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929.

(2) They shall have a smoke developed index not greater than 450 when tested in the manner intended for use in accordance with ASTM E 84, *Standard Test Method of Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, or not greater than 75 when tested in the thickness intended for use in accordance with ASTM D 2843, *Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics*.

(3) They shall meet the criteria of one of the following classifications:

(a) CC1 — Plastic materials that have a burn length of 1 in. (25 mm) or less and flame extinguishment when tested at a nominal thickness of 0.060 in. (1.5 mm), or in the thickness intended for use, in accordance with ASTM D 635, *Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position*

(b) CC2 — Plastic materials that have a burning rate of 2½ in./min (64 mm/min) or less when tested at a nominal thickness of 0.060 in. (1.5 mm), or at a thickness intended for use, in accordance with ASTM D 635

10.20.1.3 Indoor children's playground structures shall have a minimum horizontal separation from other structures of 20 ft (6.1 m).

10.20.1.4 Indoor children's playground structures shall not exceed 300 ft^2 (28 m^2) in area, unless approved by the AHJ.

Chapter 11 Building Services

11.1 Electrical Fire Safety.

11.1.1 Section 11.1 shall apply to new, existing, permanent, or temporary electrical appliances, equipment, fixtures, or wiring.

11.1.1.1 Existing installations shall be permitted to be continued in use provided the lack of conformity does not present an imminent hazard danger.

11.1.2 All electrical appliances, fixtures, equipment, or wiring shall be installed and maintained in accordance with NFPA 70, *National Electrical Code*.

11.1.3 Permanent wiring shall be installed and maintained in accordance with NFPA 70.

11.1.4 Permanent wiring abandoned in place shall be tagged or otherwise identified at its termination and junction points as "Abandoned in Place" or removed from all accessible areas and insulated from contact with other live electrical wiring or devices.

11.1.5 Multiplug Adapters.

11.1.5.1 Multiplug adapters, such as multiplug extension cords, cube adapters, strip plugs, and other devices, shall be listed and used in accordance with their listing.

11.1.5.2 Multiplug adapters shall not be used as a substitute for permanent wiring or receptacles.

11.1.6 Relocatable Power Taps.

11.1.6.1 Relocatable power taps shall be of the polarized or grounded type with overcurrent protection and shall be listed.

11.1.6.2 The relocatable power taps shall be directly connected to a permanently installed receptacle.

11.1.6.3 Relocatable power tap cords shall not extend through walls, ceilings, or floors; under doors or floor coverings; or be subject to environmental or physical damage.

11.1.7 Extension Cords.

11.1.7.1 Extension cords shall be plugged directly into an approved receptacle, power tap, or multiplug adapter and shall, except for approved multiplug extension cords, serve only one portable appliance.

11.1.7.2* The ampacity of the extension cords shall not be less than the rated capacity of the portable appliance supplied by the cord.

11.1.7.3 The extension cords shall be maintained in good condition without splices, deterioration, or damage.

11.1.7.4 Extension cords shall be grounded when servicing grounded portable appliances.

11.1.7.5 Extension cords and flexible cords shall not be affixed to structures; extend through walls, ceilings, or floors, or under doors or floor coverings; or be subject to environmental or physical damage.

11.1.7.6 Extension cords shall not be used as a substitute for permanent wiring.

11.1.8 Temporary Installations.

11.1.8.1 Other Articles. Except as specifically modified in Article 590 of NFPA 70, all other requirements of NFPA 70 for permanent wiring shall apply to temporary wiring installations. [**70**:590.2(A)]

11.1.8.2 Approval. Temporary wiring methods shall be acceptable only if approved based on the conditions of use and any special requirements of the temporary installation. [**70**:590.2(B)]

11.1.8.3 During the Period of Construction. Temporary electrical power and lighting installations shall be permitted during the period of construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities. [**70**:590.3(A)]

11.1.8.4 90 Days. Temporary electrical power and lighting installations shall be permitted for a period not to exceed 90 days for holiday decorative lighting and similar purposes. [**70**:590.3(B)]

11.1.8.5 Emergencies and Tests. Temporary electrical power and lighting installations shall be permitted during emergencies and for tests, experiments, and developmental work. [**70**:590.3(C)]

11.1.8.6 Removal. Temporary wiring shall be removed immediately upon completion of construction or purpose for which the wiring was installed. [**70**:590.3(D)]

11.1.9 Building Disconnect.

11.1.9.1* Means shall be provided for the fire department to disconnect the electrical service to a building, structure, or facility when the electrical installation is covered under the scope of NFPA 70.

11.1.9.2 The disconnecting means shall be maintained accessible to the fire department.

11.1.9.3 Identification of Disconnecting Means.

11.1.9.3.1 Each disconnecting means shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident. The marking shall be of sufficient durability to withstand the environment involved. [**70**:110.22(A)]

11.1.10 Covers. All panelboard and switchboards, pull boxes, junction boxes, switches, receptacles, and conduit bodies shall be provided with covers compatible with the box or conduit body construction and suitable for the conditions of use.

11.2 Heating, Ventilation, and Air-Conditioning.

11.2.1 Air-Conditioning, Heating, Ventilating Ductwork, and Related Equipment. Air-conditioning, heating, ventilating ductwork, and related equipment shall be in accordance with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, or NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, as applicable, unless such installations are approved existing installations, which shall be permitted to be continued in service. [***101***:9.2.1]

11.2.2 Ventilating or Heat-Producing Equipment. Ventilating or heat-producing equipment shall be in accordance with NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids*; NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances*; NFPA 31, *Standard for the Installation of Oil-Burning Equipment*; NFPA 54, *National Fuel Gas Code*; or NFPA 70, as applicable, unless such installations are approved existing installations, which shall be permitted to be continued in service. [***101***:9.2.2]

11.3 Elevators, Escalators, and Conveyors.

11.3.1 Fire Fighters' Emergency Operations.

11.3.1.1 All new elevators shall conform to the Fire Fighters' Emergency Operations requirements of ASME A17.1/CSA B44, *Safety Code for Elevators and Escalators*. [***101***:9.4.3.1]

11.3.1.2 All existing elevators having a travel distance of 25 ft (7620 mm) or more above or below the level that best serves the needs of emergency personnel for fire-fighting or rescue purposes shall conform to the Fire Fighters' Emergency Operations requirements of ASME A17.3, *Safety Code for Existing Elevators and Escalators*. [***101***:9.4.3.2]

11.3.2 Number of Cars. The number of elevator cars permitted in a hoistway shall be in accordance with 8.6.8.3 of NFPA *101*. [***101***:9.4.4]

11.3.3* Elevator Machine Rooms. Elevator machine rooms that contain solid-state equipment for elevators, other than existing elevators, having a travel distance exceeding 50 ft (15 m) above the level of exit discharge or exceeding 30 ft (9150 mm) below the level of exit discharge shall be provided with independent ventilation or air-conditioning systems to maintain temperature during fire fighters' emergency operations for elevator operation *(see 11.3.1)*. The operating temperature shall be established by the elevator equipment manufacturer's specifications. When standby power is connected to the elevator, the machine room ventilation or air-conditioning shall be connected to standby power. [***101***:9.4.5]

11.3.4 Elevator Testing.

11.3.4.1 Elevators shall be subject to periodic inspections and tests as specified in ASME A17.1/CSA B44, *Safety Code for Elevators and Escalators*. [***101***:9.4.6.1]

11.3.4.2 All elevators equipped with fire fighters' emergency operations in accordance with 11.3.1 shall be subject to a monthly operation with a written record of the findings made and kept on the premises as required by ASME A17.1/CSA B44, *Safety Code for Elevators and Escalators*. [***101***:9.4.6.2]

11.3.4.3 The elevator inspections and tests required by 11.3.4.1 shall be performed at frequencies complying with one of the following:

(1) Inspection and test frequencies specified in Appendix N of ASME A17.1/CSA B44, *Safety Code for Elevators and Escalators*
(2) Inspection and test frequencies specified by the AHJ [***101***:9.4.6.3]

11.3.5 Openings to Exit Enclosures. Conveyors, elevators, dumbwaiters, and pneumatic conveyors serving various stories of a building shall not open to an exit enclosure. [***101***:9.4.7]

11.3.6 Standardized Fire Service Elevator Keys. Elevators equipped with Phase I Emergency Recall, and Phase II emergency in-car operation, and First Responder Use/Fire Service Access Elevators, shall be equipped to operate with a standardized fire service key approved by the AHJ. Existing buildings shall comply with 11.3.6.5.

11.3.6.1 Requirements for Standardized Fire Service Keys.

11.3.6.1.1 All fire service elevator keys within the jurisdiction shall be uniform and specific for the jurisdiction. Keys shall be cut to a uniform key code.

11.3.6.1.2 Fire service elevator keys shall be a patent protected design to prevent unauthorized duplication.

11.3.6.1.3 Fire service elevator keys shall be factory restricted by the manufacturer to prevent the unauthorized distribution of key blanks. No uncut key blanks shall be permitted to leave the factory.

11.3.6.1.4 Fire service elevator keys subject to these rules shall be engraved with "DO NOT DUPLICATE."

11.3.6.2 Access to Standardized Fire Service Keys. Access to standardized fire service elevator keys shall be restricted to the following:

(1) Elevator owners or their authorized agents
(2) Elevator contractors
(3) Elevator inspectors of the jurisdiction
(4) Fire code officials of the jurisdiction
(5) The fire department and other emergency response agencies designated by the AHJ

11.3.6.3 Duplication or Distribution of Keys. No person shall duplicate a standardized fire service elevator key or issue, give, or sell a duplicated key unless in accordance with this *Code*.

11.3.6.4 Responsibility to Provide Keys. The building owner shall provide up to three (3) standardized fire service keys if required by the AHJ, upon installation of a standardized fire service key switch or switches in the building.

11.3.6.5 Existing Buildings. Existing buildings shall be in compliance with this requirement 1 year after adoption by the AHJ.

11.3.6.5.1 Where a standardized key cylinder cannot be installed in an existing elevator key switch assembly, the building's nonstandardized fire service elevator keys shall be provided in an access box in accordance with 11.3.6.5.1.1 through 11.3.6.5.1.6.

11.3.6.5.1.1 The access box shall be compatible with an existing rapid entry access box system in use in the jurisdiction and approved by the AHJ.

11.3.6.5.1.2 The front cover shall be permanently labeled with the words "Fire Department Use Only – Elevator Keys."

11.3.6.5.1.3 The access box shall be mounted at each elevator bank at the lobby nearest to the lowest level of fire department access.

11.3.6.5.1.4 The access box shall be mounted at a location approved by the AHJ.

11.3.6.5.1.5 Contents of the access box shall be limited to the fire service elevator key. Additional elevator access tools, keys, and information pertinent to emergency planning or elevator access shall be permitted when authorized by the AHJ.

11.3.6.5.1.6 In buildings with two or more elevator banks, a single access box shall be permitted to be used where such elevator banks are separated by not more than 30 ft (9140 mm). Additional access boxes shall be provided for each individual elevator or elevator bank separated by more than 30 ft (9140 mm).

11.3.6.5.1.7 A single access box shall be permitted to be located adjacent to a fire command center, or the nonstandard fire service elevator key shall be secured in an access box used for other purposes and located in accordance with 18.2.2.1 when approved by the AHJ.

11.4 Utilities. Equipment using fuel gas and related gas piping shall be installed in accordance with NFPA 54, *National Fuel Gas Code*, or NFPA 58, *Liquefied Petroleum Gas Code. (See Chapter 69 for LP-Gas fuel supply and storage installations.)*

11.4.1 Existing installations shall be permitted to be continued in service, subject to approval by the AHJ.

11.4.2 Aboveground gas meters, regulators, and piping exposed to vehicular damage shall be protected in accordance with 60.5.1.9.

11.5 Heating Appliances.

11.5.1 General.

11.5.1.1 The installation of stationary liquid fuel–burning appliances, including but not limited to industrial-, commercial-, and residential-type steam, hot water, or warm air heating appliances; domestic-type range burners; space heaters; and portable liquid fuel–burning equipment shall comply with Section 11.5 and NFPA 31, *Standard for the Installation of Oil-Burning Equipment.*

11.5.1.2 Section 11.5 shall also apply to all accessories and control systems, whether electric, thermostatic, or mechanical, and all electrical wiring connected to liquid fuel–burning appliances, and shall comply with Section 11.5 and NFPA 31, *Standard for the Installation of Oil-Burning Equipment.* [**31:**1.1.2]

11.5.1.3 Section 11.5 shall also apply to the installation of liquid fuel storage and supply systems connected to liquid fuel–burning appliances, and shall comply with Section 11.5 and NFPA 31, *Standard for the Installation of Oil-Burning Equipment.* [**31:**1.1.3]

11.5.1.4 Section 11.5 shall also apply to those multifueled appliances in which a liquid fuel is one of the standard or optional fuels. [**31:**1.1.4]

11.5.1.5* Section 11.5 shall not apply to internal combustion engines, oil lamps, or portable devices not specifically covered in NFPA 31. *(See Chapter 11 of NFPA 31 for portable devices that are covered in NFPA 31.)* [**31:**1.1.5]

11.5.1.6 The installation of gas-fired heating appliances shall comply with Section 11.5 and NFPA 54. *(See Chapter 69 for LP-Gas fuel supply and storage installations.)*

11.5.1.7 All heating appliances shall be approved or listed.

11.5.1.8 Permits. Permits, where required, shall comply with Section 1.12.

11.5.1.9 Electrical wiring and utilization equipment used in connection with oil-burning appliances or equipment shall be installed in accordance with Section 11.1. [**31:**4.4.1]

11.5.1.10 Acceptable Liquid Fuels.

11.5.1.10.1* The type and grade of liquid fuel used in a liquid fuel–burning appliance shall be that liquid fuel for which the appliance is listed and approved or is stipulated by the manufacturer. Liquid fuels shall meet one of the following specifications and shall not contain gasoline or any other flammable liquid:

(1) ASTM D 396, *Standard Specification for Fuel Oils*
(2) ASTM D 3699, *Standard Specification for Kerosene*
(3) ASTM D 6448, *Industrial Burner Fuels from Used Lube Oils*
(4) ASTM D 6751, *Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuel*
(5) ASTM D 6823, *Commercial Burner Fuels from Used Lube Oils* [**31:**4.5.1]

11.5.1.10.2 Crankcase oil or used oil shall not be used as fuel unless all of the following conditions are met:

(1) The installation is in a commercial or industrial occupancy.
(2) The oil-burning appliance is designed to burn crankcase oil or used oil and is listed for such use.
(3) The appliance is installed in accordance with the manufacturer's instructions and with the terms of its listing.
(4) The installation meets the applicable requirements of Section 4.6 and Chapter 12 of NFPA 31. [**31:**4.5.2]

11.5.1.10.3* Where heavy oils are used, the following shall be required:

(1) The oil-burning appliance shall be designed to burn such fuels.
(2) Means shall be provided to maintain the oil at its proper atomizing temperature.
(3) Automatically operated burners that require preheating of oil shall be arranged so that no oil can be delivered for combustion until the oil is at the proper atomizing temperature.
(4)* Use of an oil-fired appliance that is listed in accordance with ANSI/UL 296A, *Standard for Waste Oil-Burning Air-Heating Appliances*, shall be deemed as meeting the intent of 11.5.1.10.3(1) through 11.5.1.10.3(3). [**31:**4.5.3]

11.5.1.10.4 A properly sized and rated oil filter or strainer shall be installed in the oil supply line to an oil burner. [**31**:4.5.4]

11.5.1.11 Clothes Dryers.

11.5.1.11.1 Clothes dryers shall be cleaned to maintain the lint trap and keep the mechanical and heating components free from excessive accumulations of lint.

11.5.1.11.2 The requirements of 11.5.1.11.1 shall not apply to clothes dryers in individual dwelling units of residential occupancies.

11.5.2 Kerosene Burners and Oil Stoves.

11.5.2.1 Kerosene burners and oil stoves shall be equipped with a primary safety control furnished as an integral part of the appliance by the manufacturer to stop the flow of oil in the event of flame failure. Barometric oil feed shall not be considered a primary safety control.

11.5.2.2 A conversion range oil burner shall be equipped with a thermal (heat-actuated) valve in the oil supply line, located in the burner compartment of the stove.

11.5.2.3 Only listed kerosene heaters shall be used. The following safeguards shall apply:

(1) Provide adequate ventilation
(2) Do not place on carpeting
(3) Keep 3 ft (0.9 m) away from combustible furnishings or drapes
(4) Use only approved Type 1-K water clear kerosene
(5) Allow to cool before refueling

11.5.3 Portable Electric Heater.

11.5.3.1 The AHJ shall be permitted to prohibit use of portable electric heaters in occupancies or situations where such use or operation would present an undue danger to life or property.

11.5.3.2 Portable electric heaters shall be designed and located so that they cannot be easily overturned.

11.5.3.3 All portable electric heaters shall be listed.

11.5.4 Vents. All chimneys, smokestacks, or similar devices for conveying smoke or hot gases to the outer air and the stoves, furnaces, incinerators, boilers, or any other heat-producing devices or appliances shall be installed and maintained in accordance with NFPA 54 and NFPA 211.

11.6 Rubbish Chutes, Incinerators, and Laundry Chutes.

11.6.1 Enclosure.

11.6.1.1 Rubbish chutes and laundry chutes shall be separately enclosed by walls or partitions in accordance with the provisions of Section 12.7. [***101***:9.5.1.1]

11.6.1.2 Inlet openings serving chutes shall be protected in accordance with Section 12.7. [***101***:9.5.1.2]

11.6.1.3 The doors of chutes specified in 11.6.1.2 shall open only to a room that is designed and used exclusively for accessing the chute opening. [***101***:9.5.1.3]

11.6.1.4 The room used for accessing the chute opening shall be separated from other spaces in accordance with Section 8.7 of NFPA *101*. [***101***:9.5.1.4]

11.6.1.5 The requirements of 11.6.1.1 through 11.6.1.4 shall not apply where otherwise permitted by the following:

(1) Existing installations having properly enclosed service chutes and properly installed and maintained service openings shall be permitted to have inlets open to a corridor or normally occupied space.
(2) Rubbish chutes and laundry chutes shall be permitted to open into rooms not exceeding 400 ft^2 (37 m^2) that are used for storage, provided that the room is protected by automatic sprinklers. [***101***:9.5.1.5]

11.6.2 Installation and Maintenance. Rubbish chutes, laundry chutes, and incinerators shall be installed and maintained in accordance with NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment*, unless such installations are approved existing installations, which shall be permitted to be continued in service. [***101***:9.5.2]

F L F L F L **11.6.2.1** Chapter 51 of NFPA 1 and NFPA 86, *Standard for Ovens and Furnaces,* shall apply to crematory furnaces for humans and animals.

11.6.2.2 NFPA 82 shall not apply to crematory furnaces for humans and animals.

11.7 Stationary Generators and Standby Power Systems.

11.7.1 Stationary Combustion Engines and Gas Turbines Installation. Stationary generator sets shall be installed in accordance with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, and NFPA 70.

11.7.2 Portable Generators.

11.7.2.1* Portable generators shall not be operated or refueled within buildings, on balconies, or on roofs.

11.7.2.1.1 Portable generators shall be permitted to be operated or refueled in a building or room that has been constructed for such use in accordance with the building code.

11.7.2.1.2 Fueling from a container shall be permitted when the engine is shut down and engine surface temperature is below the autoignition temperature of the fuel.

11.7.2.2 Portable generators shall be positioned so that the exhaust is directed as follows:

(1) At least 5 ft (1.5 m) in any direction away from any openings or air intakes
(2) Away from the building

11.7.3 Emergency and Legally Required Standby Power Systems.

11.7.3.1 General. New stationary generators for emergency use or for legally required standby power required by this *Code*, the building code, or other codes and standards shall be installed in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems.*

11.7.3.2 Acceptance. Newly installed stationary generators for emergency use or for legally required standby power for fire protection systems and features shall demonstrate the capacity of the energy converter, with its controls and accessories, to survive without damage from common and abnormal disturbances in actual load circuits by any of the following means:

(1) By tests on separate prototype models
(2) By acceptance tests on the system components as performed by the component suppliers
(3) By listing for emergency service as a completely factory-assembled and factory-tested apparatus

11.7.4 Stored Electrical Energy Emergency and Legally Required Standby Power System Installation. Stored electrical energy systems required by this *Code*, the building code, or other NFPA codes and standards shall be installed in accordance with NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, and NFPA 70.

11.7.5 Maintenance and Testing.

11.7.5.1 Stationary generators used for emergency or legally required standby power shall be tested and maintained in accordance with NFPA 110 and NFPA 37.

11.7.5.2 Stationary generators required by this *Code*, the building code, or other NFPA codes and standards shall be maintained in accordance with NFPA 110.

11.7.5.3 Stored electrical energy systems required by this *Code*, the building code, or other NFPA codes and standards shall be maintained in accordance with NFPA 111.

11.8* Smoke Control.

11.8.1 Newly installed smoke-control systems shall be inspected by the AHJ and tested in accordance with the criteria established in the approved design documents, NFPA 204 and NFPA 92.

11.8.2 Smoke-control systems shall have an approved maintenance and testing program to ensure operational integrity in accordance with this section. Components of such systems shall be operated, maintained, and tested in accordance with their operation and maintenance manuals.

11.8.2.1 Testing. Operational testing of the smoke-control system shall be in accordance with NFPA 92, and shall include all equipment related to the system including, but not limited to, initiating devices, fans, dampers, controls, doors, and windows.

11.8.2.1.1 An approved written schedule for such operational tests shall be established.

11.8.2.2 Test records shall be maintained on the premises and must indicate the date of such testing, the qualified service personnel, and any corrective measures needed or taken.

11.8.3 All smoke-control systems and devices shall be maintained in a reliable operating condition and shall be replaced or repaired where defective.

11.8.4 The AHJ shall be notified when any smoke-control system is out of service for more than 4 hours in a 24-hour period and again upon restoration of service of such systems.

11.8.5 The AHJ shall be permitted to require the building to be evacuated or an approved fire watch to be provided for all portions left unprotected by the fire protection system shutdown until the fire protection system has been returned to service.

11.9 Emergency Command Center. Where required, emergency command centers shall comply with Section 11.9.

11.9.1 The location, design, content, and fire department access of the emergency command center shall be approved by the fire department.

11.9.2 The emergency command center shall be separated from the remainder of the building by a fire barrier having a fire resistance rating of not less than 1 hour.

11.9.3 The emergency command center room shall be a minimum of 96 ft^2 (8.9 m^2) with a minimum dimension of 8 ft (2.4 m).

11.9.4 The following shall be provided in the emergency command center:

(1) The fire department communication unit
(2) A telephone for fire department use with controlled access to the public telephone system
(3) Schematic building plans indicating the typical floor plan and detailing the building core means of egress, fire protection systems, fire-fighting equipment, and fire department access
(4) Work table
(5) If applicable, hazardous material management plans for the building

11.9.5 Where otherwise required, the following devices or functions shall be provided within the emergency command center:

(1) The emergency voice/alarm communication system unit
(2) Fire detection and alarm system annunciator unit
(3) Annunciator visually indicating the location of the elevators and whether they are operational
(4) Status indicators and controls for air-handling systems
(5) Controls for unlocking stairway doors simultaneously
(6) Sprinkler valve and waterflow detector display panels
(7) Emergency and standby power status indicators
(8) Fire pump status indicators
(9) Generator supervision devices and manual start and transfer features
(10) Public address system, where specifically required by other sections of this *Code*
(11) Controls required for smoke control

11.9.6 Emergency Command Center Acceptance Testing. Devices, equipment, components, and sequences shall be individually tested in accordance with appropriate standards and manufacturers' documented instructions.

11.10* Two-Way Radio Communication Enhancement Systems.

11.10.1 In all new and existing buildings, minimum radio signal strength for fire department communications shall be maintained at a level determined by the AHJ.

11.10.2 Where required by the AHJ, two-way radio communication enhancement systems shall comply with *NFPA 72*.

11.10.3 Where a two-way radio communication enhancement system is required and such system, components, or equipment has a negative impact on the normal operations of the facility at which it is installed, the AHJ shall have the authority to accept an automatically activated responder system.

11.11 Medical Gas and Vacuum Systems. Medical gas and vacuum systems shall comply with NFPA 99, *Health Care Facilities Code*.

11.12 Photovoltaic Systems.

11.12.1 New photovoltaic systems shall be installed in accordance with Section 11.10, Section 11.12 and NFPA 70.

11.12.2 Building-Mounted Photovoltaic Installations.

11.12.2.1* Marking. Photovoltaic systems shall be permanently marked as specified in this subsection.

11.12.2.1.1 Main Service Disconnect Marking. A label shall be permanently affixed to the main service disconnect panel serving alternating current (ac) and direct current (dc) photovoltaic systems. The label shall be red with white capital letters at least ¾ in. (19 mm) in height and in a nonserif font, to read: "WARNING: PHOTOVOLTAIC POWER SOURCE." The materials used for the label shall be reflective, weather resistant, and suitable for the environment.

11.12.2.1.2 Circuit Disconnecting Means Marking. A permanent label shall be affixed adjacent to the circuit breaker controlling the inverter or other photovoltaic system electrical controller serving ac

and dc photovoltaic systems. The label shall have contrasting color with capital letters at least $^3/_8$ in. (10 mm) in height and in a nonserif font, to read: "PHOTOVOLTAIC DISCONNECT." The label shall be constructed of durable adhesive material or other approved material.

11.12.2.1.3* Conduit, Raceway, Enclosure, Cable Assembly, and Junction Box Markings. Marking shall be required on all interior and exterior dc conduits, raceways, enclosures, cable assemblies, and junction boxes.

11.12.2.1.3.1 Marking Locations. Marking shall be placed on all dc conduits, raceways, enclosures, and cable assemblies every 10 ft (3048 mm), at turns, and above and below penetrations. Marking shall be placed on all dc combiner and junction boxes.

11.12.2.1.3.2* Marking Content and Format. Marking for dc conduits, raceways, enclosures, cable assemblies, and junction boxes shall be red with white lettering with minimum $^3/_8$ in. (10 mm) capital letters in a nonserif font, to read: "WARNING: PHOTOVOLTAIC POWER SOURCE." Marking shall be reflective, weather resistant, and suitable for the environment.

11.12.2.1.4 Secondary Power Source Markings. Where photovoltaic systems are interconnected to battery systems, generator backup systems, or other secondary power systems, additional signage acceptable to the AHJ shall be required indicating the location of the secondary power source shutoff switch.

11.12.2.1.5 Installer Information. Signage, acceptable to the AHJ, shall be installed adjacent to the main disconnect indicating the name and emergency telephone number of the installing contractor.

11.12.2.1.6* Inverter Marking. Markings shall not be required for inverters.

11.12.2.2 Access, Pathways, and Smoke Ventilation.

11.12.2.2.1 General. Access and spacing requirements shall be required to provide emergency access to the roof, provide pathways to specific areas of the roof, provide for smoke ventilation opportunity areas, and to provide emergency egress from the roof.

11.12.2.2.1.1 Exceptions. The AHJ shall be permitted to grant exceptions where access, pathway, or ventilation requirements are reduced due to any of the following circumstances:

(1) Proximity and type of adjacent exposures
(2) Alternative access opportunities, as from adjoining roofs
(3) Ground level access to the roof
(4) Adequate ventilation opportunities beneath photovoltaic module arrays
(5) Adequate ventilation opportunities afforded by module set back from other rooftop equipment
(6) Automatic ventilation devices
(7) New technologies, methods, or other innovations that ensure adequate fire department access, pathways, and ventilation opportunities

11.12.2.2.1.2 Pitch. Designation of ridge, hip, and valley shall not apply to roofs with 2-in-12 or less pitch.

11.12.2.2.1.3 Roof Access Points. Roof access points shall be defined as areas where fire department ladders are not placed over openings (windows or doors), are located at strong points of building construction, and are in locations where they will not conflict with overhead obstructions (tree limbs, wires, or signs).

11.12.2.2.2 One- and Two-Family Dwellings and Townhouses. Photovoltaic systems installed in one- and two-family dwellings and townhouses shall be in accordance with this section.

11.12.2.2.2.1 Access and Pathways.

11.12.2.2.2.1.1 Hip Roof Layouts. Photovoltaic modules shall be located in a manner that provides a 3 ft (914 mm) wide clear access pathway from the eave to the ridge of each roof slope where the photovoltaic modules are located. The access pathway shall be located at a structurally strong location of the building, such as a bearing wall.

Exception: The requirement of 11.12.2.2.2.1.1 shall not apply where adjoining roof planes provide a 3 ft (914 mm) wide clear access pathway.

11.12.2.2.2.1.2 Single Ridge Layouts. Photovoltaic modules shall be located in a manner that provides two 3 ft (914 mm) wide access pathways from the eave to the ridge on each roof slope where the modules are located.

11.12.2.2.2.1.3 Hip and Valley Layouts. Photovoltaic modules shall be located no closer than 1½ ft (457 mm) to a hip or valley if modules are to be placed on both sides of the hip or valley. Where modules are located on only one side of a hip or valley of equal length, the photovoltaic modules shall be allowed to be placed directly adjacent to the hip or valley.

11.12.2.2.2.2 Ridge Setback. Photovoltaic modules shall be located not less than 3 ft (914 mm) below the ridge.

11.12.2.2.3 Buildings Other Than One- and Two-Family Dwellings and Townhouses. Photovoltaic energy systems installed in any building other than one- and two-family dwellings and townhouses shall be in accordance with this section. Where the AHJ determines that the roof configuration is similar to a one- and two-family dwelling or townhouse, the AHJ shall allow the requirements of 11.12.2.2.2.

11.12.2.2.3.1 Access. A minimum 4 ft (1219 mm) wide clear perimeter shall be provided around the edges of the roof for buildings with a length or width of 250 ft (76.2 m) or less along either axis. A minimum 6 ft (1829 mm) wide clear perimeter shall be provided around the edges of the roof for buildings having length or width greater than 250 ft (76.2 m) along either axis.

11.12.2.2.3.2 Pathways. Pathways shall be established as follows:

(1) Pathways shall be over areas capable of supporting the live load of fire fighters accessing the roof.
(2) Centerline axis pathways shall be provided in both axes of the roof.
(3) Centerline axis pathways shall run where the roof structure is capable of supporting the live load of fire fighters accessing the roof.
(4) Pathways shall be in a straight line not less than 4 ft (1219 mm) clear to skylights, ventilation hatches, and roof standpipes.
(5) Pathways shall provide not less than 4 ft (1219 mm) clear around roof access hatches with at least one not less than 4 ft (1219 mm) clear pathway to the parapet or roof edge.

11.12.2.2.3.3 Smoke Ventilation. Ability for fire department smoke ventilation shall be provided in accordance with this section.

11.12.2.2.3.3.1 Maximum Array. Arrays of photovoltaic modules shall be no greater than 150 ft (45.7 m) × 150 ft (45.7 m) in distance in either axis.

11.12.2.2.3.3.2 Ventilation Options. Ventilation options between array sections shall be one of the following:

(1) A pathway 8 ft (2438 mm) or greater in width
(2) A pathway 4 ft (1219 mm) or greater in width and bordering on existing roof skylights or ventilation hatches
(3) A pathway 4 ft (1219 mm) or greater in width and bordering 4 ft (1219 mm) × 8 ft (2438 mm) venting cutouts options every 20 ft (6096 mm) on alternating sides of the pathway

11.12.2.2.4 Location of Direct Current (DC) Conductors.

11.12.2.2.4.1 Exterior-mounted dc conduits, wiring systems, and raceways for photovoltaic circuits shall be located as close as possible to the ridge, hip, or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities.

11.12.2.2.4.2 Conduit runs between subarrays and to dc combiner boxes shall be designed to take the shortest path from the array to the dc combiner box.

11.12.2.2.4.3 DC combiner boxes shall be located so that conduit runs are minimized in the pathways between arrays.

11.12.2.2.4.4 DC wiring shall be run in metallic conduit or raceways where located within enclosed spaces in a building.

11.12.2.2.4.4.1 Where dc wiring is run perpendicular or parallel to load-bearing members, a minimum 10 in. (254 mm) space below roof decking or sheathing shall be maintained.

11.12.3 Ground-Mounted Photovoltaic System Installations. Ground-mounted photovoltaic systems shall be installed in accordance with 11.12.3.1 through 11.12.3.3.

11.12.3.1* Clearances. A clear area of 10 ft (3048 mm) around ground-mounted photovoltaic installations shall be provided.

11.12.3.2* Noncombustible Base. A gravel base or other noncombustible base acceptable to the AHJ shall be installed and maintained under and around the installation.

11.12.3.3* Security Barriers. Fencing, skirting, or other suitable security barriers shall be installed when required by the AHJ.

Chapter 12 Features of Fire Protection

12.1 General. This chapter shall apply to new, existing, permanent, or temporary buildings.

12.2* Construction.

12.2.1* Where required by this *Code*, a type of building construction shall comply with NFPA 220, *Standard on Types of Building Construction*.

12.2.2 Fire safety construction features for new and existing occupancies shall comply with this *Code* and the referenced edition of NFPA *101*.

12.3 Fire-Resistive Materials and Construction.

12.3.1 The design and construction of fire walls and fire barrier walls that are required to separate buildings or subdivide a building to prevent the spread of fire shall comply with Section 12.3 and NFPA 221, *Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls*.

12.3.2* Quality Assurance for Penetrations and Joints. In new buildings three stories or greater in height, a quality assurance program for the installation of devices and systems installed to protect penetration and joints shall be prepared and monitored by the RDP responsible for design. Inspections of firestop systems and fire-resistive joint systems shall be in accordance with 12.3.2.1 and 12.3.2.2.

12.3.2.1 Inspection of firestop systems of the types tested in accordance with ASTM E 814, *Standard Test Method for Fire Tests of Through-Penetration Fire Stops*, or ANSI/UL 1479, *Standard for Fire Tests of Through-Penetration Firestops*, shall be conducted in accordance with ASTM E 2174, *Standard Practice for On-Site Inspection of Installed Fire Stops*. [**5000:**40.9.1]

12.3.2.2 Inspection of fire-resistive joint systems of the types tested in accordance with ASTM E 1966, *Standard Test Method for Fire-Resistive Joint Systems*, or ANSI/UL 2079, *Standard for Tests for Fire Resistance of Buildings Joint Systems*, shall be conducted in accordance with ASTM E 2393, *Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers*. [**5000:**40.9.2]

12.3.3* Maintenance of Fire-Resistive Construction.

12.3.3.1 Required fire-resistive construction, including fire barriers, fire walls, exterior walls due to location on property, fire-resistive requirements based on type of construction, draft-stop partitions, and roof coverings, shall be maintained and shall be properly repaired, restored, or replaced where damaged, altered, breached, penetrated, removed, or improperly installed.

12.3.3.2 Where required, fire-rated gypsum wallboard walls or ceilings that are damaged to the extent that through openings exist, the damaged gypsum wallboard shall be replaced or returned to the required level of fire resistance using a listed repair system or using materials and methods equivalent to the original construction.

12.3.3.3 Where readily accessible, required fire-resistance-rated assemblies in high-rise buildings shall be visually inspected for integrity at least once every 5 years.

12.3.3.3.1 The person responsible for conducting the visual inspection shall demonstrate appropriate technical knowledge and experience in fire-resistance-rated design and construction acceptable to the AHJ.

12.3.3.3.2 A written report prepared by the person responsible for conducting the visual inspection shall be submitted to the AHJ documenting the results of the visual inspection.

12.4 Fire Doors and Other Operating Protectives.

12.4.1* The installation and maintenance of assemblies and devices used to protect openings in walls, floors, and ceilings against the spread of fire and smoke within, into, or out of buildings shall comply with Section 12.4 and NFPA 80, *Standard for Fire Doors and Other Opening Protectives*. [**80:**1.1]

12.4.2* With the exception of fabric fire safety curtain assemblies, Section 12.4 addresses assemblies that have been subjected to standardized fire tests. *(See Chapter 20 of* NFPA 80, *Standard for Fire Doors and Other Opening Protectives.)* [**80:**1.1.1]

12.4.3* Incinerator doors, record room doors, and vault doors are not covered in Section 12.4. [**80:**1.1.2]

12.4.4* Requirements for horizontally sliding, vertically sliding, and swinging doors as used in this *Code* do not apply to hoistway doors for elevators and dumbwaiters. [**80:**1.1.3]