150. ELECTRICAL SAFETY

01. Scope

a. Electrical installations and utilization shall conform to all other applicable requirements of this standard, the National Electric Code, as well as the following provisions. Nothing in this standard shall be construed to prohibit better or otherwise safer conditions than specified herein. (7-1-97)

02. Definitions: For definitions of other terms used in this section, see sub-section 010 of this standard. (7-1-97)

a. Energized means connected to an energy source or containing residual or stored energy. (7-1-97)

b. Energy Isolating Device is a mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated electrical circuit breaker, a disconnect switch, manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Punch buttons, selector switches, and other control circuit type devices are not energy isolating devices. (7-1-97)
c. Energy Source is any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy. (7-1-97)

d. Extension Cord or Cord Set is a portable flexible electric cord of any length which has one male connector on one end and one or more female connectors on the other end and has no built in over-current protection. (7-1-97)

e. Flexible Cord is multi-conductor flexible sheathed cable which is used for extension cords, as the connection means for appliances, and for permanent use by connecting pieces of equipment or devices to each other or to the premises wiring system where flexibility or portability is required. (7-1-97)

f. Ground is an electrical conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or some conducting body that serves in place of the earth. (7-1-97)

g. Ground Fault Circuit Interrupter is a device intended for the protection of personnel whose function is to de-energize within a n established period of time the electric circuit to the load when a fault current to ground exceeds a predetermined value that is less than that required to operate the over-current protective device of the supply circuit. (7-1-97)

h. Lockout is the placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed. (7-1-97)

i. Lockout Device is a device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds. (7-1-97)

j. Power Tap is a device with a flexible cord that has a male connector on one (1) end of the cord and a housing containing built-in over-current protection and one or more receptacles on the other end of the cord. (7-1-97)

k. Protective Materials and Hardware are locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware provided by the employer for isolating, securing, or blocking of machines or equipment from energy sources. (7-1-97)

l. Qualified Person is a person familiar with the construction, operation, and safety requirements of the equipment and the hazards involved. (7-1-97)

m. Receptacle is an electrical contact device installed at an outlet for the attachment of a single attachment plug. A multiple outlet is a device containing two or more receptacles. (7-1-97)

n. Servicing and/or Maintenance is workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or un-jamming of machines or equipment, and
making adjustments or tool changes where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy. (7-1-97)

o. Setting Up is any work performed to prepare a machine or equipment to perform its normal production operation. (7-1-97)

p. Spill” is any unintentional release of electrolyte. (10-1-06)

q. Tagout is the placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed. (7-1-97)

r. Tagout Device is a prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed. (7-1-97)

s. Watertight is an electrical enclosure that is so constructed that moisture will not enter the enclosure. (7-1-97)

t. Weatherproof is an electrical enclosure that is so constructed or protected that exposure to the weather will not interfere with successful operation. Rainproof, rain-tight, or watertight equipment can fulfill the requirements for weatherproof where varying weather factors other than wetness, such as snow, ice, dust, or temperature extremes are not a factor. (7-1-97)

03. General Requirements: (7-1-97)

a. Insulated floors, mats, or platforms shall be provided for personnel handling exposed energized switches or fuses for voltages over one-hundred-fifty (150)-volts. (7-1-97)

b. The employer shall establish a program consisting of energy control procedures, employee training, and periodic inspections to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, startup, or release of electricity could occur and cause injury, the machine or equipment shall be isolated from the energy source and rendered inoperative. (7-1-97)

c. Doors to high voltage vaults shall be kept locked. (7-1-97)

d. Doors into electrical control panel rooms shall be marked with a plainly visible and legible sign stating "ELECTRICAL ROOM" or similar approved wording. (7-1-97)

e. External feeder service conductors that are uncovered or un-insulated shall be a minimum of: (7-1-97)

i. Ten (10) feet above finished grade, sidewalks, or from any platform or projection from which they might be reached; (7-1-97)

ii. Twelve (12) feet over areas subject to vehicular traffic other than trucks; (7-1-97)
iii. Fifteen (15) feet over areas subject to truck traffic; (7-1-97)

iv. Eighteen (18) feet over public streets, alleys, roads, and driveways. (7-1-97)

f. Danger signs shall be posted to warn of high voltage electrical danger. (7-1-97)

g. Personnel shall not enter spaces containing exposed energized parts unless adequate illumination is provided that enables the person to perform the work safely. Where lack of illumination or an obstruction precludes observation of the work to be performed, personnel shall not perform tasks near exposed energized parts. Personnel shall not reach blindly into areas which may contain energized parts. (7-1-97)

h. Conductive materials and equipment that are in contact with any part of a persons body shall be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts. If a person must handle long dimensional conductive objects (such as ducts and pipes) in areas with exposed live parts, the employer shall institute work practices (such as the use of insulation, guarding, and material handling techniques) which will minimize the hazard. (7-1-97)

i. Portable ladders shall have nonconductive side rails if they are used where personnel or the ladder could contact energized parts. (7-1-97)

j. Conductive articles of jewelry and clothing shall not be worn if they might contact exposed energized parts. However, such articles may be worn if they are rendered nonconductive by covering, wrapping, or other insulating means. (7-1-97)

k. Where live parts present an electrical contact hazard, personnel may not perform housekeeping duties at such close distances to the energized parts that there is a possibility of contact, unless adequate safeguards (such as insulating equipment or barriers) are provided. Electrically conductive cleaning materials (including conductive solids such as steel wool, metallized cloth, and silicon carbide, as well as conductive liquid solutions) shall not be used in proximity to energized parts unless procedures are followed which will prevent electrical contact. (7-1-97)

l. Only a qualified person following the provisions of sub-sections 150.11.c and d of this standard may defeat an electrical safety interlock, and then only temporarily while they are working on the equipment. The interlock system shall be returned to its operable condition when this work is completed. (7-1-97)

m. Personnel working in areas where there are potential electrical hazards shall be provided with and shall use electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed. Note: Personal protective equipment requirements are contained in sub-section 050.13 of this standard. (7-1-97)

n. Hands shall not be wet when plugging and unplugging flexible electric cords to an energized circuit. (7-1-97)
o. Equipment connected by cord and plug with exposed noncurrent carrying metal parts likely to become energized, such as the following, shall be grounded. (7-1-00)

i. Refrigerators, freezers, and air conditioners. (7-1-00)

ii. Clothes-washing, clothes-drying, and dish-washing machines, and sump pumps. (7-1-00)

iii. Hand-held motor-operated tools, stationary and fixed motor-operated tools, and light industrial motor-operated tools. (7-1-00)

iv. Motor-operated appliances of the following types: hedge clippers, lawn mowers, snow blowers, and wet scrubbers. (7-1-00)

v. Cord and plug appliances used in damp or wet locations or by persons standing on the ground or on metal floors or working inside metal tanks or boilers. (7-1-00)

vi. Tools likely to be used in wet and conductive locations. (7-1-00)

vii. Portable hand lamps. (7-1-00)

EXCEPTION: Tools and portable hand lamps likely to be used in wet or conductive locations shall not be required to be grounded where supplied through an isolating transformer with an ungrounded secondary of not over fifty (50) volts. (7-1-00)

EXCEPTION: Listed portable tools and appliances protected by an approved system of double insulation, or its equivalent, shall not be required to be grounded. Where such a system is employed, the equipment shall be distinctively marked to indicate that the tool or appliance utilizes an approved system of double insulation. (7-1-00)

04. Power Cords: (7-1-97)

a. Flexible cords for equipment or appliances requiring grounding shall have a grounding lug installed on the plug. (7-1-97)

b. Flexible cords shall be protected against damage. (7-1-97)

c. Flexible cords shall not be permitted to run through holes in walls, ceilings, floors, or to be attached to the facility, building, or structure surfaces. (7-1-97)

d. Flexible cords shall not be permitted to run through doorways, windows, etc. (7-1-97)

e. Flexible cords shall not be permitted to have worn, frayed, or damaged areas. (7-1-97)

f. Flexible cords shall be inspected for serviceability prior to each use. (7-1-97)

g. Flexible cord plug terminals shall be integral to the plug. (7-1-97)
h. Flexible cords shall not be spliced. (7-1-97)

i. Flexible cords shall have proper polarity. (7-1-97)

j. When an attachment plug is to be attached to a receptacle or flexible cord, the plug and receptacle shall first be checked to ensure that they are of the proper mating configurations. (7-1-97)

k. Adapters which interrupt the continuity of the equipment grounding connection shall not be used. (7-1-97)

l. Hands shall not be wet when plugging and unplugging flexible electric power cords to an energized circuit. (7-1-97)

05. Extension Cords: (7-1-97)

a. Only approved listed flexible electric extension cords shall be permitted for use. (7-1-97)

b. Flexible cords used to power equipment or appliances requiring grounding shall have a grounding lug installed on the plug. (7-1-97)

c. Flexible cords shall be protected against environmental or physical damage. (7-1-97)

d. Flexible cords shall not be permitted as a substitute for fixed permanent electric wiring. (7-1-97)

e. Flexible cords shall not be permitted to run through walls, ceilings, floors, or to be attached to the facility, building, or structure surfaces. (7-1-97)

f. Flexible cords shall not be permitted to run through doorways, windows, etc. (7-1-97)

g. Flexible cords shall not be permitted to be concealed behind walls, ceilings, floors, or floor coverings. (7-1-97)

h. Flexible cords shall not be permitted to have worn, frayed, or damaged areas. (7-1-97)

i. Flexible cords shall have strain relief at the attachment ends. (7-1-97)

j. Flexible cords shall be inspected for serviceability prior to each use. (7-1-97)

k. Flexible cords shall be plugged directly to an approved electric receptacle. (7-1-97)

l. Defective flexible cords shall not be used. (7-1-97)

m. Flexible cord plug terminals shall be integral to the plug. (7-1-97)
n. When an attachment plug is to be attached to a receptacle, the plug and receptacle shall first be checked to ensure that they are of the proper mating configurations. (7-1-97)

o. Flexible cords shall not be spliced. (7-1-97)

p. Flexible cords shall have proper polarity. (7-1-97)

q. Flexible cords shall not be stapled or otherwise attached to walls, ceiling, or other facility, building, or structure surfaces. (7-1-97)

r. Hands shall not be wet when plugging and unplugging flexible cords to an energized circuit. (7-1-97)

06. Power Taps: (7-1-97)

a. Electric power taps shall be plugged directly to an approved electric receptacle. They shall not be "daisy chained", "piggy backed" or otherwise connected to one another. (7-1-97)

b. Electric power taps shall be listed. (7-1-97)

c. Electric power tap cords shall not extend through walls, ceilings, floors, under doors or floor coverings, or be subject to environmental or physical damage. (7-1-97)

d. Electric power taps shall be of the polarized or grounded type. (7-1-97)

e. Electric power tap power cords shall not be permitted to have worn, frayed, or damaged areas. (7-1-97)

f. Electric power tap power cords shall have strain relief at the attachment ends. (7-1-97)

g. Defective electric power taps shall not be used. (7-1-97)

h. Electric power tap power cord plug terminals shall be integral to the plug. (7-1-97)

i. Electric power tap power cords shall not be spliced. (7-1-97)

j. Electric power tap power cords shall not be stapled or otherwise attached to walls, ceiling, or other facility, building, or structure surfaces. (7-1-97)

07. Fixtures, Enclosures, Boxes, and Panels: (7-1-97)

a. A thirty-six (36) inch clear work area shall be maintained in front of electric control panels, service equipment, switchboards, or motor control centers. The clear work space shall have a minimum headroom of seventy-eight (78) inches. (7-1-97)
b. Illumination shall be provided for all working spaces about electric control panels, service equipment, switchboards, or motor control centers. (7-1-97)

c. Electric fixtures and receptacles shall not have any exposed electric conductors. (7-1-97)

d. Cover plates shall be used to cover all exposed conductors in junction boxes, panels, electric enclosures, etc. (7-1-97)

e. Doors and cover plates on electric panels and panel boxes doors shall be kept closed and latched. (7-1-97)

f. Electric enclosures in wet/damp locations shall be approved for such locations and shall be protected from damage. (7-1-97)

g. Electric receptacles shall be protected from dampness (7-1-97)

h. Electric junction boxes shall be large enough to accommodate the number of wires enclosed. (7-1-97)

i. Electric panels, boxes, enclosures, and conduits shall be securely fastened. (7-1-97)

j. Conduit connections, joints, and fittings shall be tight and conduit shall not be allowed to become kinked. (7-1-97)

k. Nothing shall be hung from or stored on electric conduits, wiring trays, or fixtures. (10-1-06)

l. Electric panels and panel boxes shall have up-to-date directories/labels to identify individual circuits. (7-1-97)

m. Electric fixtures and receptacles shall have proper polarity. (7-1-97)

n. Electric installations and enclosures shall be protected against damage. (7-1-97)

o. Electric installations, enclosures, and conductors shall be protected against corrosion. (7-1-97)

08. Equipment: (7-1-97)

a. Parts of electrical equipment which in ordinary operation produce arcs, sparks, flames, or molten metal shall be enclosed or separated and isolated from all combustible material. (7-1-97)

b. Electrical equipment shall be legibly marked with the manufacturer's name/trademark, voltage, current, wattage, or other ratings as necessary. The markings shall be of sufficient durability to withstand the environment involved. (7-1-97)
c. Live parts of electric equipment operating at fifty (50) volts or more shall be guarded against accidental contact by approved cabinets, other forms of approved enclosures, or location in a room, vault, or similar enclosure accessible only to qualified persons. (7-1-97)

d. Permanent ladders or stairways shall be provided to give safe access to the working space around electric equipment installed on platforms, balconies, mezzanine floors, or in attic or roof rooms or spaces. (7-1-97)

e. Receptacles, cord connectors, and attachment plugs shall be constructed so that no receptacle or cord connector will accept an attachment plug with a different voltage or current rating than that for which the device is intended. However, a twenty (20)ampere T-slot receptacle or cord connector may accept a fifteen (15) ampere attachment plug of the same voltage rating. (7-1-97)

f. Portable electric equipment shall be handled in a manner which will not cause damage. (7-1-97)

g. Flexible electric power or extension cords shall not be used to raise or lower equipment. (7-1-97)

h. Electric appliances and equipment are to be maintained so as not to be a hazard. (7-1-00)

09. Ground Fault Circuit Interrupters (GFCI): (7-1-97)

a. Electrical equipment operating around pools, spas, therapeutic pools, and fountains shall be GFCI protected. (7-1-97)

b. Electric receptacles in automotive repair facilities shall be GFCI protected. (7-1-97)

c. De-icing/snow melting impedance heating installations shall be GFCI protected. (7-1-97)

d. Electrical service on construction/remodeling sites shall be GFCI protected. (7-1-97)

e. Electric receptacles in bathrooms shall be GFCI protected. (7-1-97)

f. Electric receptacles in kitchens where the receptacles are installed to serve the counter top surfaces shall be GFCI protected. (7-1-97)

g. Electric receptacles installed to serve the counter top surfaces within 6-feet of a sink shall be GFCI protected. (7-1-97)

h. Electric receptacles located on rooftops shall be GFCI protected. (7-1-97)

i. Electric equipment operating in wet locations shall be GFCI protected. (10-1-06)

j. Electric receptacles located in wet locations or six (6) feet of a water source shall be GFCI protected. (10-1-06)
10. Fixed Electric Wiring: (7-1-97)

a. Fixed electric wiring shall be installed and maintained to meet the requirements of the National Electric Code NFPA-70. (7-1-00)

b. Fixed electric wiring shall have strain relief at the points where it enters and leaves fixtures, enclosures, boxes, and panels. (7-1-97)

c. Electric wiring shall be so installed that, when completed, the system shall be free from short circuits and from grounds other than as required or permitted by the National Electric Code NFPA-70. (7-1-00)

11. Work Practices: (7-1-97)

a. Safety related work practices shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits which are or may be energized. The specific safety related work practices shall be consistent with the nature and extent of the associated electrical hazards. (7-1-97)

b. Live parts to which personnel may be exposed shall be de-energized before personnel works on or near them, unless it can be demonstrated that de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations. (7-1-97)

c. If the exposed live parts are not de-energized (i.e., for reasons of increased or additional hazards or in feasibility), other safety related work practices shall be used to protect personnel who may be exposed to the electrical hazards involved. Such work practices shall protect personnel against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object. The work practices that are used shall be suitable for the conditions under which the work is to be performed and for the voltage level of the exposed electric conductors or circuit parts. (7-1-97)

d. Only qualified persons may work on electric parts or equipment that have not been de-energized under the procedures of sub-section 150.12 of this standard. Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personnel protective equipment, insulating and shielding materials, and insulated tools. (7-1-97)

e. When work is to be performed near overhead lines, the lines shall be de-energized and grounded, or other protective measures shall be provided before work is started. If the lines are to be de-energized, arrangements shall be made with the person or organization that operates or controls the electric circuits involved to de-energize and ground them. If protective measures, such as guarding, isolating, or insulating, are provided, these precautions shall prevent personnel from contacting such lines directly with any part of their body or indirectly through conducting materials, tools, or equipment. Only properly qualified personnel shall install insulating devices on overhead power transmission or distribution lines. When an unqualified person is working on the ground or in an elevated position near overhead lines, the location shall be such that the
person and the longest conductive object they may have cannot come closer to any unguarded, energized line than the following distances: (7-1-97)

i. For voltages to ground fifty (50) kV or below - ten (10) feet; (7-1-97)

ii. For voltages to ground over (50) kV - ten (10) feet plus four (4) inches for every ten (10) kV over fifty (50) kV. (7-1-97)

f. When a qualified person is working in the vicinity of overhead lines, whether in an elevated position or on the ground, the person may not approach or take any conductive object without an approved insulating handle closer to exposed energized parts than shown in Table 150.11-A unless: (7-1-97)

i. The person is insulated from the energized part (gloves, with insulating sleeves if necessary, rated for the voltage involved are considered to be insulation of the person from the energized part on which work is performed), (7-1-97)

ii. The energized part is insulated both from all other conductive objects at a different potential and from the person, (7-1-97)

iii. The person is insulated from all conductive objects at a potential different from that of the energized part. (7-1-97)

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**g.** When personnel work in a confined or enclosed space (such as a vault) that contains exposed energized parts, the employer shall provide, and personnel shall use, protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and the like shall be secured to prevent their swinging into personnel and causing them to contact exposed energized parts. (7-1-97)

**12. Lockout/Tagout Procedures:** (7-1-97)

**a.** The employer shall establish a written program consisting of energy control procedures, personnel training, and periodic inspections to ensure that, before any personnel perform any servicing or maintenance on a machine, equipment, or circuits where the unexpected energizing, start up, or release of stored energy could occur and cause injury, the machine, equipment, or circuit is isolated from the energy source and rendered inoperative. (7-1-97)

**b.** While any person is exposed to contact with parts of fixed electric equipment or circuits which have been de-energized, the circuits energizing the parts shall be locked-out or tagged or both in accordance with the following requirements in the order presented: (7-1-97)

**i.** A safe procedure for de-energizing circuits and equipment shall be determined before circuits or equipment are de-energized; (7-1-97)
ii. The circuits and equipment to be worked on shall be disconnected from all electric energy sources (Control circuit devices, such as push buttons, selector switches, and interlock, shall not be used as the sole means of de-energizing circuits or equipment.); (7-1-97)

iii. Stored electric energy which might endanger personnel shall be released. (Capacitors shall be discharged and high capacitance elements shall be shorted-circuited and grounded, if the stored electric energy might endanger personnel.); (7-1-97)

iv. Stored non-electrical energy in devices that could re-energize electric circuit parts shall be blocked or relieved to the extent that the circuit parts could not be accidentally energized by the device. (7-1-97)

c. A lock and a tag or a multiple lockout or multiple tagout device shall be placed on each disconnecting means used to de-energize circuits and equipment on which work is to be performed. The lock shall be attached so as to prevent persons from operating the disconnect means unless they resort to undue force or the use of tools. Each tag shall contain a statement prohibiting unauthorized operation of the disconnecting means and removal of the tag. If a lock cannot be applied, or if the employer can demonstrate that tagging procedures will provide a level of safety equivalent to that obtained by the use of a lock, a tag may be used without a lock. A tag used without a lock shall be supplemented by at least one additional safety measure that provides a level of safety equivalent to that provided by use of a lock such as removal of an isolating circuit element, blocking of a controlling switch, or opening of an extra disconnecting device. A lock may be placed without a tag only when all of the following conditions have been met: Only one circuit or piece of equipment is de-energized, the lockout period does not extend beyond the work shift, and personnel exposed to the hazards associated with re-energizing the circuit or equipment are familiar with this procedure. (7-1-97)

d. Verification of the de-energization of circuits or equipment shall be by a qualified person who shall do one of the following; (7-1-97)

i. Operate the equipment controls or otherwise verify that the equipment cannot be restarted or;

(7-1-97)

ii. Use test equipment to test the circuit elements to which personnel will be exposed and shall verify that the circuit elements and equipment parts are de-energized. The test shall also determine if any energized condition or re-accumulation of energy exists as a result of inadvertently induced voltage or unrelated voltage back feed even though specific parts of the circuit have been de-energized and presumed to be safe. (7-1-97)

e. Re-energizing of circuits or equipment, even temporarily, shall be in accordance with the following requirements in the order presented: (7-1-97)

i. A qualified person shall conduct tests and visual inspections, as necessary, to verify that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed, so that the circuits and equipment can be safely energized; (7-1-97)
ii. Personnel exposed to the hazards associated with re-energizing the circuit or equipment shall be warned to stay clear of the circuits and equipment; (7-1-97)

iii. Each lock and tag shall be removed by the person who applied it or under their direct supervision. However if the person who applied the lock and/or tag is absent from the workplace then the lock and/or tag may be removed by a qualified person designated to perform this task provided that the employer ensures that the person who applied the lock and/or tag is not available at the workplace and the employer ensures that the person is made aware that the lock and/or tag has been removed before they resume work at the workplace. (7-1-97)

13. Stationary Storage Battery Systems (10-1-06)

a. Stationary storage battery systems having an electrolyte capacity of more than fifty (50) gallons for flooded lead acid, nickel cadmium, valve regulated lead acid, or one-thousand (1,000) pounds of lithium-ion, used for facility standby power, emergency power, or uninterrupted power supplies, shall comply with this sub section and Table 150-13. (10-1-06)

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TABLE 150.13

BATTERY REQUIREMENTS

- Flooded Lead Acid Batteries
- Flooded Nickel-Cadmium Batteries
- Valve Regulated Lead Acid Batteries
- Lithium-Ion Batteries
b. Vented lead acid, nickel-cadmium or other types of non-recombinant batteries shall be provided with safety venting caps. (10-1-06)

c. Valve regulated batteries shall be equipped with self-resealing flame-arresting safety vents. (10-1-06)

d. Valve regulated batteries shall be provided with a listed device or other approved method to preclude, detect, and control thermal runaway. (10-1-06)

e. Enclosure of stationary battery systems shall comply with the International Building Code. Battery shall be allowed to be in the same room with the equipment they support. (10-1-06)

f. When stationary batteries are installed in a separate equipment room accessible only to authorized personnel, they shall be permitted to be installed on an open rack for ease of maintenance. (10-1-06)

g. When a system of valve regulated lead acid, lithium, or other type of sealed, non-venting batteries is situated in an occupied work area, it shall be allowed to be housed in a non-combustible cabinet or other enclosure to prevent access by unauthorized personnel. (10-1-06)

h. When stationary batteries are contained in cabinets on occupied work areas, the cabinet enclosures shall be located within ten (10) feet of the equipment that they support. (10-1-06)

i. An approved method and materials for the control and neutralization of a spill of electrolyte shall be provided in areas containing lead-acid, nickel-cadmium, or other types of batteries with free-flowing liquid electrolyte. (10-1-06)

**EXCEPTION:** Valve regulated lead-acid, lithium-ion, or other types of sealed batteries with immobilized electrolyte shall not require spill controls. (10-1-06)

j. For battery systems containing lead-acid, nickel-cadmium, or other types of batteries with free flowing electrolyte, the method and materials shall be capable of neutralizing a spill from the largest battery to a pH between seven point zero (7.0) and nine point zero (9.0). (10-1-06)

k. For valve regulated lead acid or other types of sealed batteries with immobilized electrolyte, the method and material shall be capable of neutralizing a spill of three (3%) percent of the capacity of the largest cell or block in the room to a pH between seven point zero (7.0) and nine point zero (9.0). (10-1-06)

**EXCEPTION:** Lithium-ion batteries shall not require neutralization. (10-1-06)

l. Ventilation of stationary storage battery systems shall comply with subsections 150.13a through 150.13c and table 150.13. (10-1-06)

m. Room ventilation shall be provided in accordance with subsection 080.23 of this standard and the following: (10-1-06)
i. For flooded lead-acid, flooded nickel-cadmium, and valve regulated lead-acid batteries, the ventilation system shall be designed to limit the maximum concentration of hydrogen to one (1%) percent of the total volume of the room; or (10-1-06)

ii. For flooded lead-acid, flooded nickel-cadmium, and valve regulated lead-acid batteries, the ventilation system shall be designed to limit the maximum concentration of hydrogen to one (1%) percent of the total volume of the room; or (10-1-06)

EXCEPTION: Lithium-ion batteries shall not require ventilation. (10-1-06)

n. When valve regulated lead-acid batteries are installed inside a cabinet, the cabinet shall be approved for use in occupied spaces and shall be mechanically or naturally vented by one of the following methods: (10-1-06)

i. The cabinet ventilation shall limit the maximum concentration of hydrogen to one (1%) percent of the total volume of the cabinet during the worst-case event of simultaneous “boost” charging of all the batteries in the cabinet; or (10-1-06)

ii. Continuous ventilation shall be provided at a rate of not less than one (1) cubic foot per minute per square foot of floor area covered by the cabinet. The room in which the cabinet is installed shall also be vented as required in sub-section 150.13m. (10-1-06)

o. Doors into electrical equipment rooms or buildings containing stationary battery systems shall be provided with approved signs. The signs shall state that:

i. The room contains energized battery systems. (10-1-06)

ii. The room contains energized electrical circuits. (10-1-06)

iii. The battery electrolyte solutions, where present, are corrosive liquids. (10-1-06)

p. Cabinets shall have exterior labels that identify the manufacture, model number, and the system and electrical rating (voltage and current) of the contained battery system. There shall be signs within the cabinet that indicate the relevant electrical, chemical, and fire hazards. (10-1-06)

q. The battery system shall be seismically braced in accordance with section 030.07 of this standard. (10-1-06)

r. An approved automatic smoke detector system shall be installed in rooms containing stationary battery systems. (10-1-06)