

## Chapter E 111

## GENERAL PROTECTIVE ARRANGEMENTS OF STATIONS AND SUBSTATIONS

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**E 111.01 General requirements for rooms and spaces.** (1) **ENCLOSURE OF ROOMS AND SPACES.** Rooms and spaces shall be so arranged with fences, screens, partitions, or walls as to prevent entrance of unauthorized persons or interference by them with equipment inside, and the entrances not under observation of an authorized attendant shall be kept locked. Signs prohibiting entrance to unauthorized persons shall be displayed at entrances.

(2) **ROOMS AND SPACES.** All rooms or spaces in which electrical equipment is installed shall comply with the following requirements:

(a) *Fire resistant construction.* They shall be as far as practicable, noncombustible.

(b) *Storage and manufacturing processes.* They shall be used neither for the storage of material nor for manufacturing processes causing hazard to electrical operators, except those materials or processes attendant upon the production or distribution of a supply of electrical energy.

(c) *Hazardous conditions.* They shall be free from combustible dust or flyings, flammable gas, or acid fumes in dangerous quantities. (For battery rooms, see chapter E 114. For auxiliary equipment in hazardous locations, see E 112.08.) Also see rules on Dusts, Fumes, Vapors and Gases published by the Industrial Commission.

(d) *Ventilation.* They should be well ventilated. See Industrial Commission codes.

(e) *Moisture and weather.* They should be dry. In outdoor stations or stations in wet tunnels or subways, all live parts of equipment should be enclosed in weatherproof cases, unless the equipment is suitably designed to withstand the prevailing atmospheric conditions.

(3) **ROTATING MACHINERY.** Rotating machinery shall be installed upon suitable supports or foundations and if necessary secured in place.

(4) **FENCES.** Fences used to exclude the public from electrical equipment, shall be so placed that they are not closer to live parts or parts that may become alive than that given in column 3 of table 2, section E 112.05. Such fences shall be of a type that cannot be readily climbed and be not less than 5 feet in height when enclosing equipment operating at 15,000 volts or less and not less than 6 feet in height where the voltage is above 15,000.

**History:** Cr. Register, November, 1961, No. 71, eff. 12-1-61.

**E 111.02 Illumination.** (1) **UNDER NORMAL CONDITIONS.** Rooms and spaces in buildings where electrical apparatus or machinery is located shall have means for artificial illumination in accordance with the

following table. The means of illumination shall be maintained ready for use at all times. (Also see section E 114.09)

*Note:* It is not intended that this rule should require permanent lighting in switch cells and similar small spaces occupied by electrical apparatus where permanent lighting is impracticable.

**TABLE NO. 1**  
**ILLUMINATION INTENSITIES**

	Minimum Foot-Candles	Modern Practice Foot-Candles
(1) Switchboard instruments, gauges, switches, etc.-----	5	10 to 15
(2) Switchboards with no exposed live parts-----	3	5 to 10
(3) Storage battery room-----	3	5 to 10
(4) Generating room, boiler room, pump room (at machinery or exposed live parts)-----	5	10 to 15
(5) Stairways and passageways (Measurements made at floor level) where there is moving machinery, exposed live parts, hot pipes, etc.-----	5	10 to 15
(6) Any transversed space (measured at floor level)-----	2	5 to 10

*Note:* The above illumination values are to be measured at working surfaces, except as stated.

The "minimum foot-candles" specify the lowest illumination for safety, but the "modern practice foot-candles" are recommended.

(2) **EMERGENCY LIGHTING.** A separate emergency source of illumination shall be provided in every station where an attendant is located. This source shall be from an independent generator, storage battery, gas main, portable light, or other suitable source.

*Note:* Flame lamps (gas or oil) should not be used in battery rooms.

(3) **FIXTURES, PENDANTS AND PLUG RECEPTACLES.** (See also chapter E 410). Arrangements of permanent fixtures and plug receptacles shall be such that portable cords need not be brought into dangerous proximity to live or moving apparatus. All lamps shall be arranged to be controlled, replaced, or trimmed from safely accessible places. Pendant conductors shall not be installed where they can be readily moved so as to bring them in contact with live parts of electrical supply equipment.

(4) **ATTACHMENT PLUGS.** Portable conductors shall be attached to fixed wiring only through separable attachment plugs which will disconnect all poles by one operation.

**History:** Cr. Register, November, 1961, No. 71, eff. 12-1-61.

**E 111.03 Buildings, yards and general safety.** (1) **BUILDINGS TO COMPLY WITH BUILDING CODE.** Buildings in which electrical supply equipment is installed shall be constructed in every detail to comply with the building code published by the Industrial Commission.

(2) **GENERAL RULES ON SAFETY TO BE COMPLIED WITH.** Floors, passageways, stairways, floor openings, platforms, runways, moving machinery, etc., shall be constructed and safeguarded as required by the rules on safety published by the Industrial Commission.

(3) **PROTECTION FROM RAIN AND FALLING OBJECTS.** Electrical equipment located outdoors, when necessary, shall be protected against injury from rain, snow, sleet, flying or falling objects.

(4) **EXITS.** Each room or space and each working space about equipment shall have suitable means of exit which shall be kept clear of all obstructions. If the plan of the room or space and the character and arrangement of equipment are such that an accident would be lia-

ble to close or make inaccessible a single exit, as in the case of long narrow rooms, platforms, passageways, spaces behind switchboards, or wire and pipe tunnels, a second exit shall be provided if practicable. In all cases the Building Code should be consulted.

(5) FLOORS. Floors shall have even surfaces and afford secure footing. Projecting nails, loose boards, uneven or greasy floors, and slippery floors should be avoided.

*Note:* Otherwise slippery floors or stairs should be provided with antislip treads.

(6) PASSAGEWAYS. Passageways (including stairways) and working spaces shall be unobstructed, and (except such as are used solely for infrequent inspection, construction and repair) shall, where possible, provide at least 6.5 feet headroom. (See section E 112.06 for working space.) The rules on safety by the Industrial Commission also contain orders applying to passageways.

(7) RUNWAYS AND PLATFORMS, RAILS AND TOE BOARDS. (See rules on safety published by the Industrial Commission.)

(8) STAIRWAYS, HANDRAILS. (See rules on safety published by the Industrial Commission.)

(9) PLATFORMS WITH STAIRWAYS OR STATIONARY LADDERS. (See rules on safety published by the Industrial Commission.)

(10) CONTINUITY. The heads of permanent ladders shall be provided with guards such as gates or sliding pipe sections whenever the heading breaks the continuity of a railing adjacent to working space. For very long ladders occasional landings, turns, or safety loops are recommended.

(11) STAIR TOE BOARDS. Toe boards shall, where practicable, be arranged at back of stairway treads where over exposed live or moving parts or over working spaces, passageways, or other stairways.

(12) WALKS AND PLATFORMS FOR OVERHEAD WORK. (See rules on safety published by the Industrial Commission.)

(13) TRANSFORMER VAULTS ON CUSTOMER'S PREMISES. Transformer vaults on customer's premises shall comply with sections E 450.41 to E 450.48 inclusive.

**History:** Cr. Register, November, 1961, No. 71, eff. 12-1-61.

**E 111.04 Fire fighting appliances.** (1) FIRE EXTINGUISHERS. Adequate approved fire-extinguishing appliances shall be conveniently located and conspicuously marked. Any such appliances which have not been listed by Underwriters' Laboratories, Inc. for use on live parts should be plainly and conspicuously marked with a warning to that effect.

(2) TEMPERATURE CONDITIONS. Fire extinguishers shall not be installed in locations subject to conditions of high and low temperature which will reduce their effectiveness.

*Note:* Carbon-tetrachloride extinguishers are not adversely affected by temperatures between 60° C. (140° F.) and minus 40° C. (-40° F.).

**History:** Cr. Register, November, 1961, No. 71, eff. 12-1-61.

**E 111.05 Oil filled apparatus.** For the purpose of these rules, oil-filled apparatus is divided into 3 classes, each of which requires different treatment: (1) Oil switches and circuit-breakers (See also chapter E 117); (2) transformers, induction regulators, etc. (See also chapter E 115); and (3) lightning arresters (See also chapter E 119). The

necessary safety precautions depend largely on whether the apparatus is located in buildings or outdoors.

(1) **OIL SWITCHES OR CIRCUIT-BREAKERS.** (a) Oil switches or circuit-breakers and their transformers, regulators, reactors, or other associated equipment should be separated from other apparatus by adequate non-flammable barriers, or otherwise adequately isolated. Floors and floor drains should be so arranged that oil will quickly collect in a suitable drainage or storage system provided for the purpose either inside or outside of the building as may be advisable.

(b) Where switches or switch compartments are constructed to prevent an appreciable amount of oil being thrown outside of the compartment, exterior drainage or storage systems are not necessary.

(c) If located outdoors they should be adequately isolated.

(d) If located near building walls the walls should be of fire resistive construction and should have doors or windows so located and arranged that burning oil is not liable to pass through them to flammable material or apparatus.

*Note:* It should be recognized that oil-switch or circuit-breaker failures may depend upon the size and rupturing capacity of the switch or circuit breaker and the short-circuit duty that may be required of it. The short-circuit current depends on the generating capacity supplying the system on which the switch or circuit-breaker is used as modified by the current-limiting characteristics of the system or by special apparatus installed for that purpose. By "generating capacity" is meant all of the apparatus contributing to the short-circuit current.

(2) **TRANSFORMERS, INDUCTION REGULATORS, ETC. CONTAINING A LIQUID THAT WILL BURN.** If transformers, induction regulators, etc. are in buildings, the floors and floor drains should be so arranged that oil will quickly collect in a suitable drainage or storage system provided for the purpose either inside or outside of the building as may be advisable. If the apparatus contains large quantities of oil, each unit or group should preferably be placed in a separate fireproof compartment suitably ventilated. If located outdoors, they should be adequately isolated. Provision should be made for quickly draining away to a safe distance any oil that may be spilled. This may be done by ditches and drains or the oil may be absorbed and danger of spreading removed by paving the yard around the transformers or other devices with cinders or other absorbent material to a depth of several inches. If located in buildings, transformer tanks containing large quantities of oil shall, where practicable, be so arranged that approved fire-quenching material may be introduced above the oil inside the tank or in the surrounding compartment, except where tanks are completely filled with oil or where the space above the oil is filled with an inert gas.

(3) **TRANSFORMERS, INDUCTION REGULATORS, ETC. CONTAINING A LIQUID THAT WILL NOT BURN.** If in buildings, transformers, induction regulators, etc., filled with a liquid that will not burn should comply with section E 115.04.

(4) **LIGHTNING ARRESTERS.** If located in buildings, lightning arresters containing oil should be separated from other equipment by fire walls adequate to completely isolate them in case of fire. When located outdoors they should be adequately isolated. Provision for quickly draining away oil should be made as indicated for transformers in (2) above.

**History:** Cr. Register, November, 1961, No. 71, eff. 12-1-61.