

## Chapter E 520

## THEATERS AND ASSEMBLY HALLS

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## A. GENERAL

**E 520.01 Scope.** The requirements of this chapter shall apply to all buildings, or part of a building, designed, intended, or used for dramatic, operatic, motion-picture or other shows, and night clubs, dance halls, armories, sporting arenas, bowling alleys, public auditoriums, television studios and like buildings used for public assembly.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.02 Motion-picture projectors.** Motion-picture equipment and its installation and use shall comply with chapter E 540.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.03 Sound reproduction.** Sound-reproducing equipment and its installation shall comply with Wis. Adm. Code chapter E 640.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.04 Wiring method.** The wiring method shall be metal raceways, type ALS cable or type MI cable except as follows:

(1) EXCEPTION No. 1. As provided in Wis. Adm. Code chapter E 640, Sound Reproduction, in chapter E 800, Communication Circuits, and in chapter E 725 for Class 2 Remote Control and Signal Circuits.

(2) EXCEPTION No. 2. Where the area intended for public assembly has a capacity of less than 200 persons, type AC metal-clad cable as provided in chapter E 334 may be used, or for concealed work, concealed knob-and-tube work or non-metallic sheathed cable as provided in chapters E 324 and E 336 may also be used.

**Note:** For recommendations for determination of population capacity, refer to the table in the note under Wis. Adm. Code section E 700.06.

(3) **EXCEPTION No. 3.** The wiring for stage set lighting and stage effects and other wiring which is not fixed as to location shall be done with approved portable cables and approved flexible cords.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.05 Number of conductors in raceway.** The number of conductors permitted in any metal conduit or electrical metallic tubing for border or stage pocket circuits or for remote control conductors shall not exceed that shown in table 1 of chapter E 900. In the case of auxiliary gutters or wireways, the sum of the cross-sectional areas of all contained conductors at any cross-section shall not exceed 20% of the interior cross-sectional area of the gutter or wireway.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.06 Enclosing and guarding live parts.** Live parts shall be enclosed or guarded to prevent accidental contact by persons and objects. All switches shall be of the externally operable type. Rheostats shall be placed in approved cases or cabinets which enclose all live parts, having only the operating handles exposed.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

## B. FIXED STAGE SWITCHBOARD

**E 520.21 Dead front.** Stage switchboards shall be of the dead-front type.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.22 Guarding back of switchboard.** Stage switchboards having exposed live parts on the back of such boards shall be enclosed by the building walls, wire mesh grills, or by other approved methods. The entrance to this enclosure shall be by means of a self-closing door.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.23 Control and overcurrent protection of receptacle circuits.** Means shall be provided at the stage switchboard for the control and individual overcurrent protection of branch circuits to stage and gallery receptacles used for portable stage equipment.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.24 Metal hood.** A stage switchboard that is not completely enclosed dead-front and dead-rear or recessed into a wall shall be provided with a metal hood extending the full length of the board to protect all equipment on the board from falling objects.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.25 Dimmers.** Dimmers shall conform to the following:

(1) **DISCONNECTION AND OVERCURRENT PROTECTION.** Where dimmers are installed in ungrounded conductors, each dimmer shall have overcurrent protection not greater than 125% of the dimmer rating, and shall be disconnected from all ungrounded conductors when the master or individual switch or circuit-breaker supplying such dimmer is in the open position.

(2) **RESISTANCE OR REACTOR TYPE DIMMERS.** Resistance or series reactor type dimmers may be placed in either the grounded or the ungrounded conductor of the circuit. Where designed to open either the supply circuit to the dimmer or the circuit controlled by it, the dimmer shall then comply with section E 380.01.

*Note:* It is recommended that resistance or reactor type dimmers be placed in the grounded neutral conductor of the circuit provided they do not open the circuit.

(3) **AUTO-TRANSFORMER TYPE DIMMERS.** The circuit supplying an auto-transformer type dimmer shall not exceed 150 volts between conductors. The grounded conductor shall be common to the input and output circuits. See Wis. Adm. Code section E 200.04.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

### C. STAGE EQUIPMENT—FIXED

**E 520.41 Circuit loads.** Footlights, border lights, and proscenium side lights shall be so arranged that no branch circuit supplying such equipment will carry a load exceeding 20 amperes; provided that where heavy-duty lampholders only are used, such circuits may conform to the provisions of chapter E 210 for circuits supplying heavy-duty lampholders.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.42 Conductor insulation.** Foot, border, proscenium, or portable strip light fixtures shall be wired with conductors having insulation suitable for the temperatures at which the conductors will be operated and not less than 125°C. (257°F.). See table E 310.02 (1).

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.43 Footlights.** (1) Where metal trough construction is employed for footlights, the trough containing the circuit conductors shall be made of sheet metal not lighter than No. 20 MS (USS Revised) gauge treated to prevent oxidation. Lampholder terminals shall be kept at least  $\frac{1}{2}$  inch from the metal of the trough. The circuit conductors shall be soldered to the lampholder terminals.

(2) Where the metal trough construction specified in subsection (1) is not used, footlights shall consist of individual outlets with lampholders, wired with rigid or flexible metal conduit, type ALS cable or type MI cable. The circuit conductors shall be soldered to the lampholder terminals. Disappearing footlights shall be so arranged that the current supply shall be automatically disconnected when the footlights are replaced in the recess designed therefor.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.44 Borders and proscenium sidelights.** (1) **CONSTRUCTION AND DESIGN.** Borders and proscenium sidelights shall be constructed as prescribed in section E 520.43, shall be suitably stayed and supported, and shall be so designed that the flanges of the reflectors or other adequate guards will protect the lamps from mechanical injury and from accidental contact with scenery or other combustible material.

(2) **CABLES FOR BORDER LIGHTS.** Cables for supply to border lights shall be types S, SO, or ST flexible cord. See table E 400.11. The

cables shall be suitably supported. Such cables shall be employed only where flexible conductors are necessary.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.45 Receptacles.** Receptacles intended for the supply of arc lamps shall have not less than 50 amperes capacity and shall be supplied by conductors not smaller than No. 6. Receptacles intended for the supply of incandescent lamps shall have not less than 20 amperes capacity and shall be supplied by conductors not smaller than No. 12. Plugs for arc and incandescent receptacles shall not be interchangeable.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.46 Stage pockets.** Receptacles intended for the connection of portable stage lighting equipment shall be mounted in suitable pockets or enclosures, and shall comply with the requirements of section E 520.45.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.47 Lamps in scene docks.** Lamps installed in scene docks shall be so located and guarded as to be free from mechanical injury and provide an air space of not less than 2 inches between such lamps and any combustible material.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.48 Curtain motors.** Curtain motors having brushes or sliding contacts shall comply with one of the following conditions:

(1) Be of the totally-enclosed, enclosed-fan-cooled, or enclosed-pipe-ventilated types.

(2) Be enclosed in separate rooms or housings built of non-combustible materials so constructed as to exclude flyings or lint, and properly ventilated from a source of clean air.

(3) Have brush or sliding-contact end of motor enclosed by solid metal covers.

(4) Have brushes or sliding contacts enclosed in substantial, tight, metal housings.

(5) Have the upper half of brush or sliding-contact end of the motor enclosed by a wire screen or perforated metal and the lower half enclosed by solid metal covers.

(6) Have wire screens or perforated metal placed at the commutator or brush ends. No dimension of any opening in the wire screen or perforated metal shall exceed .05 inch, regardless of the shape of the opening and of the material used.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.49 Flue-damper control.** Where stage flue dampers are released by an electrical device, the circuit operating the latter shall be normally closed and shall be controlled by at least 2 externally-operable switches, one switch being placed at the electrician's station and the other where designated by the administrative authority. The device shall be designed for the full voltage of the circuit to which it is connected, no resistance being inserted. The device shall be located in the loft above the scenery and shall be enclosed in a suitable iron box having a tight, self-closing door.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**D. PORTABLE SWITCHBOARDS ON STAGE**

**E 520.51 Supply.** Portable switchboards shall be supplied only from outlets especially provided for this purpose. Such outlets shall include externally operable, enclosed fused switches or circuit-breakers mounted on the stage wall or at the switchboard in locations readily accessible from the stage floor.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.52 Overcurrent protection.** Circuits from portable switchboards directly supplying equipment containing incandescent lamps of not over 300 watts shall be protected by overcurrent devices having a rating or setting of not more than 20 amperes. Circuits for lamp-holders over 300 watts may be used where overcurrent protection conforms to the provisions of chapter E 210. Other circuits shall be provided with overcurrent devices with a rating or setting not higher than the current required for the connected load.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.53 Construction.** Portable switchboards for use on stages shall comply with the following:

(1) **ENCLOSURE.** Portable switchboards shall be placed within an enclosure of substantial construction which may be so arranged that the enclosure is open during operation. Enclosures of wood shall be completely lined with sheet metal of not less than No. 24 MS (USS Revised) gauge, and shall be well galvanized, enameled, or otherwise properly coated to prevent corrosion or be of a corrosion-resistant material.

(2) **LIVE PARTS.** Except as provided for dimmer face plates in subsection (5), there shall be no exposed live parts within the enclosure.

(3) **SWITCHES AND CIRCUIT-BREAKERS.** All switches and circuit-breakers shall be of the externally-operable, enclosed type.

(4) **CIRCUIT PROTECTION.** Overcurrent devices shall be provided in each ungrounded conductor of every circuit supplied through the switchboard. Enclosures shall be provided for all overcurrent devices in addition to the switchboard enclosure.

(5) **DIMMERS.** The terminals of dimmers shall be provided with enclosures, and dimmer face plates shall be so arranged that accidental contact cannot be readily made with the face-plate contacts.

(6) **INTERIOR CONDUCTORS.** All conductors within the switchboard enclosure shall be stranded and, except for cables feeding to or from the switchboard, shall be asbestos-colored type AA or other types approved for a maximum operating temperature of 200°C. (392°F.). Each conductor shall have an ampacity at least equal to the rating of the circuit-breaker, switch or fuse which it supplies, except for conductors for incandescent lamp circuits having overcurrent protection not exceeding 20 amperes. Conductors shall be enclosed in metal troughs or securely fastened in position and shall be bushed where they pass through metal.

(7) **PILOT LIGHT.** A pilot light shall be provided within the enclosure and shall be so connected to the circuit supplying the board that

the opening of the master switch will not cut off the supply to the lamp. This lamp shall be on an independent circuit having overcurrent protection of a rating or setting of not more than 15 amperes.

(8) **SUPPLY CONNECTIONS.** The supply to a portable switchboard shall be by means of flexible cord (types S, SO, or ST) terminating within the switchboard enclosure or in an externally-operable fused master switch or circuit-breaker. The supply cable shall have sufficient ampacity to carry the total load on the switchboard and shall be protected by overcurrent devices.

(9) **CABLE ARRANGEMENT.** Cables shall be protected by bushings where they pass through enclosures and shall be so arranged that tension on the cable will not be transmitted to the connections.

(10) **TERMINALS.** Terminals to which stage cables are connected shall be so located as to permit convenient access to the terminals. At terminals not provided with approved pressure connectors the following construction shall be employed:

(a) For conductors of No. 10 or larger, solder lugs shall be used.

(b) For conductors smaller than No. 10, the strands shall be soldered together where connected to clamps or binding screws not specifically approved as pressure connectors.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

### E. STAGE EQUIPMENT—PORTABLE

**E 520.61 Arc lamps.** The construction of arc lamps shall be approved by the authorities having jurisdiction.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.62 Portable plugging boxes.** Portable plugging boxes shall conform to the following:

(1) **ENCLOSURE.** The construction shall be such that no current-carrying part will be exposed.

(2) **RECEPTACLES AND OVERCURRENT PROTECTION.** Each receptacle shall have a rating of not less than 30 amperes, and shall have overcurrent protection which shall be installed in an enclosure equipped with self-closing doors.

(3) **BUSBARS AND TERMINALS.** Busbars shall have an ampacity equal to the sum of the ampere ratings of all the receptacles. Lugs shall be provided for the connection of the master cable.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.63 Lights on scenery.** (1) Brackets on scenery shall be wired internally and the fixture stem shall be carried through to the back of the scenery where a bushing shall be placed on the end of the stem, except that externally wired brackets or other fixtures may be used when wired with cords designed for hard usage which shall extend through scenery and without joint or splice in canopy of fixture back and terminate in an approved type stage connector located within 18 inches of the fixture, unless such location is impractical.

(2) Fixtures shall be securely fastened in place.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.64 Portable strips.** Portable strips shall be constructed in accordance with the requirements for border lights and proscenium side lights in section E 520.44 (1). The supply cable shall be protected by bushings where it passes through metal and shall be so arranged that tension on the cable will not be transmitted to the connections. See section E 520.42 for wiring of portable strips.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.65 Festoons.** Joints in festoon wiring shall be staggered where practicable. Lamps enclosed in lanterns or similar devices of combustible material shall be equipped with approved guards.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.66 Special effects.** Electrical devices used for simulating lightning, waterfalls, and the like, shall be so constructed and located that flames, sparks, or hot particles cannot come in contact with combustible material.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.67 Cable connectors.** Cable connectors for flexible conductors shall be so constructed that tension on the cord or cable will not be transmitted to the connections. See section E 400.10. The female half of the connector shall be attached to the line end of the cord or cable.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.68 Conductors for portables.** Flexible conductors used to supply portable stage equipment shall be types S, SO or ST, except that reinforced cord may be used to supply stand lamps where the cord is not liable to severe physical damage and has overcurrent protection rated at not over 20 amperes.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

## F. DRESSING ROOMS

**E 520.71 Pendent lampholders.** Pendent lampholders shall not be installed in dressing rooms.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.72 Lamp guards.** All incandescent lamps in dressing rooms, where less than 8 feet from the floor, shall be equipped with open-end guards riveted to the outlet box cover or otherwise sealed or locked in place.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

**E 520.73 Switches required.** All lights and receptacles in dressing rooms shall be controlled by wall switches installed in the dressing rooms. Each switch controlling receptacles shall be provided with a pilot light to indicate when the receptacle or receptacles are energized.

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68.

G. GROUNDING

E 520.81 Grounding. All metal raceways shall be grounded. The metal frames and enclosures of equipment including border lights shall be grounded, except the frames and enclosures of portable equipment on grounded circuits operating at not over 150 volts to ground and not within reach of grounded surfaces. Grounding, when employed, shall be done in the manner specified in chapter E 250.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.