

Chapter E 660

X-RAY EQUIPMENT

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A. SCOPE AND INSTALLATION

E 660.01 Scope. The provisions of this chapter shall apply to all X-ray equipment operating at any frequency or voltage for medical or industrial use, or for any other purpose.

Note 1. Nothing in this chapter shall be construed as specifying safeguards against the useful beam or stray X-ray radiation.

Note 2. Recommendations for radiation protection by the National Committee on Radiation Protection and Measurement are published as National Bureau of Standards Handbooks obtainable from Superintendent of Documents, Washington 25, D. C.

Note 3. Recommendations for radiation protection of industrial X-ray installations by the American Standard Association Z 54 Sectional Committee are obtainable from the American Standards Association, New York 17, New York.

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

E 660.02 Hazardous locations or 600 volt supply. Unless approved for the location, X-ray and related equipment shall not be installed or operated in hazardous locations or operated on a supply potential of more than 600 volts.

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

E 660.03 Connection to supply circuit. (1) **STATIONARY EQUIPMENT.** X-ray equipment permanently installed shall be connected to the power supply by means of a wiring method meeting the general requirements of this code, except that equipment properly supplied by branch circuits not larger than a 30-ampere branch circuit may be supplied through suitable plug and hard service cable or cord.

(2) **PORTABLE AND TRANSPORTABLE.** Portable type X-ray equipment of any capacity shall be supplied through a suitable plug and hard service cable or cord. Transportable X-ray equipment of any capacity may be connected to its power supply by suitable temporary connections and hard service cable or cord.

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

E 660.04 Disconnecting means. (1) A fused disconnecting means or manually operable circuit-breaker of adequate capacity for at least 50% of the input required for the momentary rating of the X-ray equipment shall be provided in the supply circuit at a location readily

accessible from the X-ray control. For equipment requiring 125-volt line fuses of 30 ampere or less a plug and receptacle of proper size and of an approved make may serve as a disconnecting means. Individual branch circuit disconnecting means shall not be required for portable X-ray equipment of any capacity which complies with section E 660.10.

(a) *Definitions:* 1. Continuous rating. Continuous rating is a constant load which can be carried for an indefinite period of time.

2. Long time rating. A long time rating is the rating based on an operating interval of 5 minutes or longer.

3. Momentary rating. A momentary rating is the rating based on an operating interval that does not exceed 5 seconds.

(2) The capacity of the branch circuit conductors and the ratings of disconnecting means and overcurrent protection for X-ray equipment is usually recommended by the manufacturer for the specific installation.

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

E 660.05 Wiring terminals. Unless provided with a permanently attached cord or a cord set, X-ray equipment shall be provided with suitable wiring terminals or leads for the connection of conductors of at least the size required by the input load corresponding to the long time rating of the equipment.

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

E 660.06 Number of conductors in raceway. The number of control circuit conductors installed in a raceway may be in accordance with table 1 of chapter E 900.

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

E 660.07 X-ray installations. (1) **SHOCKPROOF INSTALLATIONS.** All new equipment used on new installations of X-ray equipment, or used or reconditioned equipment moved to and re-installed at a new location shall be of the approved shockproof type, except as provided for in subsection E 660.07 (2). All controls, tables, X-ray tube stands, transformer tanks, shockproof cables, and X-ray tube heads, etc., shall be suitably grounded to prevent accidental shock to patient or operator.

(2) **NON-SHOCKPROOF RE-INSTALLATIONS.** No non-shockproof X-ray equipment shall be re-installed in a new location without special permission from the administrative authority. Any such equipment shall be re-installed in an approved manner.

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

E 660.08 On fluoroscopic tables. Where permitted in accordance with subsection E 660.07 (2), leads on fluoroscopic tables shall be adequately insulated or be provided with barriers which will guard against inadvertent contact.

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

B. CONTROL

E 660.09 Stationary equipment. A manually controlled device shall be incorporated in the X-ray control supply or in the primary circuit to the high voltage transformer, and shall be adequate to control the

load resulting from failures in the high voltage circuit. This device shall be a part of the X-ray equipment, but may be located in a separate enclosure immediately adjacent to the X-ray control unit.

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

E 660.10 Portable equipment. Portable equipment shall comply with section E 660.09, but the manually controlled device shall be located in or on the equipment.

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

E 660.11 General. (1) **RADIOGRAPHIC TYPE.** There shall be provided a timer or automatic exposure terminating device and also a switch of a type which opens automatically except when held closed by the operator.

(2) **FLUOROSCOPIC TYPE.** A switch shall be provided which shall be designed to open automatically except when held closed by the operator.

(3) **THERAPY.** A timer or automatic exposure terminating device shall be provided which is not of the repeating type.

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

C. INDUSTRIAL APPARATUS

E 660.12 Industrial X-ray apparatus. (1) **RADIOGRAPHIC AND FLUOROSCOPIC TYPES.** A switch which shall be designed to open automatically except when held closed by the operator, or a timer, shall be provided except on equipment or installations effectively enclosed or provided with interlocks to prevent ready access to live current-carrying parts during operation.

(2) **INDUSTRIAL OR LABORATORY APPARATUS; DIFFRACTION OR IRRADIATION TYPES.** Positive indication of energization by pilot lights, readable meter deflections or equivalent means shall be provided except on equipment or installations effectively enclosed or provided with interlocks to prevent ready access to live current-carrying parts during operation.

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

E 660.13 Foot switch. Switches operated by foot pressure to control the X-ray exposure shall return automatically to the X-ray off position when foot pressure is removed.

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

E 660.14 Independent control. Where more than one piece of apparatus is operated from the same high-voltage circuit, each piece or each group of apparatus as a unit shall be provided with a high-voltage switch or equivalent disconnecting means. This disconnecting means shall be constructed, enclosed, or located so as to avoid contact by persons with its live parts.

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

D. TRANSFORMERS AND CAPACITORS

E 660.15 General. Transformers and capacitors which are part of an X-ray apparatus shall not be required to conform to the requirements of chapters E 450 and E 460 of this code.

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

E 660.16 Draining capacitor charge. Capacitors shall be provided with an automatic means for discharge and grounding the plates whenever the transformer primary is disconnected from the source of supply.

(1) **EXCEPTION No. 1.** Where all current-carrying parts of capacitors, and of the conductors connected therewith, are at least 8 feet from the floor and are inaccessible to unauthorized persons.

(2) **EXCEPTION No. 2.** Where within 8 feet from the floor, are within enclosures of grounded metal or insulating material.

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

E. GUARDING AND GROUNDING

E 660.17 General. (1) **HIGH VOLTAGE PARTS.** All high voltage parts, including X-ray tubes, shall be mounted within grounded enclosures. Either air, oil, gas or other suitable insulating media may be used to insulate the high voltage from the grounded enclosure. The connections from the high voltage equipment to X-ray tubes and other high voltage components shall be made with high voltage cables of the shockproof type.

(2) **LOW VOLTAGE CABLES.** Low voltage connecting cables to oil filled units such as transformers, condensers, oil coolers, and high voltage switches which are not completely sealed shall be of the oil resistant type.

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

E 660.18 Grounding. Non-current-carrying metal parts of tube stands, fluoroscopic and other equipment shall be grounded in the manner prescribed in chapter E 250.

(1) **PORTABLES.** Portable equipment shall be provided with an approved grounding type plug.

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