

## Chapter E 113

## ROTATING EQUIPMENT (THIS INCLUDES GENERATORS, MOTORS, MOTOR GENERATORS, AND CONVERTERS)

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**E 113.01 Speed-control and stopping devices.** (1) **SPEED LIMITS FOR PRIME MOVERS.** Prime movers driving generating equipment shall be provided with automatic speed-limiting devices, where harmful over-speed can otherwise occur, in addition to their governors, if necessary as with some types of steam turbines.

(2) **STOPS FOR ROTATING EQUIPMENT.** Stopping devices, such as switches or valves which can be operated from locations convenient to machine operators, shall be provided for prime movers or motors driving generating equipment. Devices which operate in such a way that the development of defects or their becoming inoperative will stop the units protected should be used where practicable. Controls to be used in emergency for machinery and electrical equipment should be so located as to permit operation with a minimum of danger during such emergency (See E 117.06 for fuses and circuit-breakers).

(3) **SPEED LIMIT FOR MOTORS.** Machines of the following types shall be provided with speed-limiting devices unless their inherent characteristics or the load and the mechanical connection thereto are such as to safely limit the speed, or unless the machine is always under the manual control of a qualified operator:

- (a) Separately excited direct-current motors.
- (b) Series motors.
- (c) Motor generators and converters which can be driven at excessive speed from the direct-current end, as by a reversal of current or decrease in load.

*Note:* The required limitation of speed may be obtained by the use of a relay, centrifugal switch or other similar device which will cut off the supply of energy when excessive speed is attained.

(4) **LOW-VOLTAGE OR UNDER-VOLTAGE PROTECTION.** All motors so employed or arranged that an unexpected starting of the motor is a hazard, shall be equipped with low-voltage protection which will automatically cause and maintain the interruption of the motor circuit when the voltage falls below an operating value.

(a) Exception: Those motors with an emergency or essential use or where the opening of the circuit will cause a special hazard to life or service are exempted.

(5) **ADJUSTABLE SPEED MOTORS.** Adjustable speed motors, if controlled by means of field regulation, shall be so equipped and connected that the field cannot be weakened sufficiently to permit dangerous speed.

(6) **PROTECTION OF CONTROL CIRCUITS.** Where speed-limiting or stopping devices are electrically operated, the control circuits by which such devices are actuated shall be in conduit or otherwise suitably protected from mechanical injury, in accordance with section E 116.02.

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

**E 113.02 Guards for live parts.** (1) **GUARDS ON ROTATING EQUIPMENT.** Guards complying with section E 112.05 shall be provided.

(2) **ACCESS TO LIVE PARTS.** Where necessary, steps and handrails shall be installed on or about large machines to afford ready access to live parts which must be examined or adjusted during operation.

(3) **FRAME SWITCHES.** Where switches are installed on the frames of generating equipment for the purpose of reducing inductive voltage in generator and converter field coils they shall be suitably constructed or guarded to prevent passersby from inadvertently coming in contact with the live parts, to protect persons handling them, and to prevent their being accidentally opened or closed.

(4) **ARCING SHIELDS.** Suitable shields or barriers other than rails shall be provided where practicable to prevent arcing on large commutators or any other parts of moving apparatus from injuring persons in the vicinity, as in the case of narrow working spaces located immediately above or beside such equipment.

(a) **Exception:** Twenty-five cycle apparatus of less than 150 volts is exempted.

(b) It is recommended that where suitable shields have not been installed goggles should be available.

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

**E 113.03 Grounding machine frames.** (1) **GROUNDING MACHINE FRAMES.** All frames of rotating electrical equipment shall be effectively grounded except as permitted below and in section E 112.08.

(2) **COUPLED MACHINES.** Where 2 or more machines, either of which operates at more than 150 volts, are mechanically coupled together and the operator can touch the frames of more than one at a time, the frames of all such shall be effectively grounded, or bonded together electrically.

(a) **Exception:** This rule may be waived with high-voltage series generator sets in existing installations where for operating reasons the generators must have their frames insulated from the ground and the motor frame is grounded, and where it is impracticable to place insulating barriers between the grounded and ungrounded frames.

(3) **AUXILIARIES.** Exciters and auxiliary circuits electrically connected to generators or other machines of more than 750 volts (with frames ungrounded) shall be installed, protected, and identified as machines and circuits of the same voltage as that of the machine for which they are auxiliaries.

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

**E 113.04 Terminal bases and bushings.** (1) **TERMINAL BASES.** Terminal bases, if used on motors or generators, should preferably be of suitable fire-resistant and moisture resistant insulating material such as slate, marble, or porcelain. It is recommended that unguarded termi-

nals be protected by a cover of insulating material or grounded metal.

(2) **BUSHINGS.** Bushings where used for wires coming through frames of motors or generators should preferably be of porcelain, suitable composition material, or of hardwood properly filled, except that soft rubber may be used if not exposed to oils, grease or other deleterious substances in such quantities as to cause their rapid destruction.

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

**E 113.05 Deteriorating agencies.** (1) **PROTECTION REQUIRED.** Suitable shields or enclosures shall be provided to protect exposed current-carrying parts, insulation of leads, balance coils, or other electrical devices belonging to motors and generating equipment where installed directly under equipment or in other locations where dripping oil, excessive moisture, steam vapors, or similar injurious agents exist.

(2) **GROUNDING.** The metal frames and other exposed noncurrent-carrying metal parts of equipment in these locations shall be effectively grounded.

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

**E 113.06 Motors.** (1) **CONTROL.** If the starting is caused automatically (not manually) as, for example, by a float switch, or if the starting device or control switch is not located close to the motor and all parts of the machinery operated, the starting arrangement shall be designed so that it can positively be kept open by means of locks or equivalent devices.

(2) **MOTORS IN HAZARDOUS LOCATIONS.** Motors with their auxiliary equipment, at which sparking or arcing or high temperature is liable to occur, when in rooms normally containing explosives, flammable gas, or flammable flyings shall be so installed, as to reduce the hazard by enclosure in an adequately ventilated separate compartment, by solidly enclosed equipment designed for use in explosive atmospheres, or, when protected against flyings only, by partitioning off a space or by a suitable boxing.

(3) **MOTORS EXPOSED TO DUST.** Motors should be protected from dust. Enclosed-type motors are recommended in dusty places, being preferable to boxing.

(4) **MOTORS ON WOODEN FLOORS.** Where practicable, motors permanently located on wooden floors should be provided with suitable drip pans.

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