

110.11 Deteriorating Agents.

Unless identified for use in the operating environment, no conductors or equipment shall be located in damp or wet locations; where exposed to gases, fumes, vapors, liquids, or other agents that have a deteriorating effect on the conductors or equipment; or where exposed to excessive temperatures.

FPN No. 1: See 300.6 for protection against corrosion.

FPN No. 2: Some cleaning and lubricating compounds can cause severe deterioration of many plastic materials used for insulating and structural applications in equipment. Equipment not identified for outdoor use and equipment identified only for indoor use, such as “dry locations,” “indoor use only,” “damp locations,” or enclosure Types 1, 2, 5, 12, 12K, and/or 13, shall be protected against damage from the weather during construction.

FPN No. 3: See Table 110.20 for appropriate enclosure-type designations.

This section was expanded for the 2008 Code to make it clear that several enclosure types must be protected from the weather during construction.

110.12 Mechanical Execution of Work.

Electrical equipment shall be installed in a neat and workmanlike manner.

FPN: Accepted industry practices are described in ANSI/NECA 1-2006, Standard Practices for Good Workmanship in Electrical Contracting, and other ANSI-approved installation standards.

The requirement in 110.12 calling for “neat and workmanlike” installations has appeared in the NEC as currently worded for more than a half-century. It stands as a basis for pride in one's work and has been emphasized by persons involved in the training of apprentice electricians for many years.

Many Code conflicts or violations have been cited by the authority having jurisdiction based on the authority's interpretation of “neat and workmanlike manner.” Many electrical inspection authorities use their own experience or precedents in their local areas as the basis for their judgments.

Application Example

Installations that do not qualify as “neat and workmanlike” include exposed runs of cables or raceways that are improperly supported (e.g., sagging between supports or use of improper support methods); field-bent and kinked, flattened, or poorly measured raceways; or cabinets, cutout boxes, and enclosures that are not plumb or not properly secured.

The FPN directs the user to an industry-accepted ANSI standard that clearly describes and illustrates “neat and workmanlike” electrical installations. See **Exhibit 110.2**.

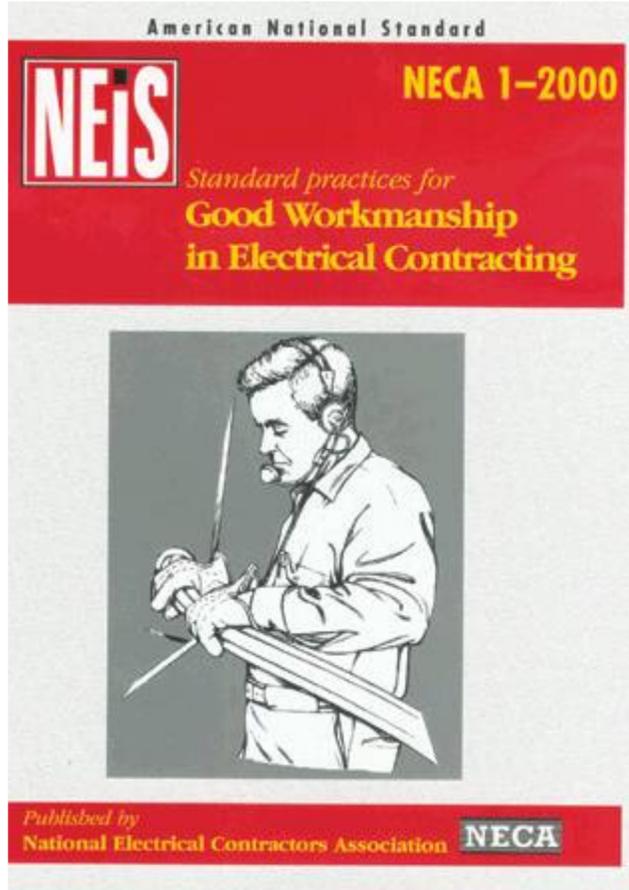


Exhibit 110.2 ANSI/NECA 1-2006, Standard Practice for Good Workmanship in Electrical Contracting, one example of the many ANSI standards that describe “neat and workmanlike” installations.

(A) Unused Openings. Unused openings, other than those intended for the operation of equipment, those intended for mounting purposes, or those permitted as part of the design for listed equipment, shall be closed to afford protection substantially equivalent to the wall of the equipment. Where metallic plugs or plates are used with nonmetallic enclosures, they shall be recessed at least 6 mm (1/4 in.) from the outer surface of the enclosure.

This section was revised for the 2008 Code. It now requires all unused openings other than those openings used for mounting, cooling, or drainage to be closed up. See 408.7 for requirements on unused openings in switchboard and panelboard enclosures.

(B) Integrity of Electrical Equipment and Connections. Internal parts of electrical equipment, including busbars, wiring terminals, insulators, and other surfaces, shall not be damaged or contaminated by foreign materials such as paint, plaster, cleaners, abrasives, or corrosive residues. There shall be no damaged parts that may adversely

affect safe operation or mechanical strength of the equipment such as parts that are broken; bent; cut; or deteriorated by corrosion, chemical action, or overheating.

110.13 Mounting and Cooling of Equipment.

(A) Mounting. Electrical equipment shall be firmly secured to the surface on which it is mounted. Wooden plugs driven into holes in masonry, concrete, plaster, or similar materials shall not be used.

(B) Cooling. Electrical equipment that depends on the natural circulation of air and convection principles for cooling of exposed surfaces shall be installed so that room airflow over such surfaces is not prevented by walls or by adjacent installed equipment. For equipment designed for floor mounting, clearance between top surfaces and adjacent surfaces shall be provided to dissipate rising warm air.

Electrical equipment provided with ventilating openings shall be installed so that walls or other obstructions do not prevent the free circulation of air through the equipment.

Ventilated is defined in Article 100. Panelboards, transformers, and other types of equipment are adversely affected if enclosure surfaces normally exposed to room air are covered or tightly enclosed. Ventilating openings in equipment are provided to allow the circulation of room air around internal components of the equipment; the blocking of such openings can cause dangerous overheating. For example, a ventilated busway must be located where there are no walls or other objects that might interfere with the natural circulation of air and convection principles for cooling. Ventilation for motor locations is covered in 430.14(A and 430.16. Ventilation for transformer locations is covered in 450.9 and 450.45. In addition to 110.13, proper placement of equipment requiring ventilation becomes enforceable using the requirements of 110.3(B).