

The communication bonding termination shall be permitted to be located in the same area as the primary protector or common communications equipment supplying the relocatable structures.

**545.28 Ground-Fault Circuit-Interrupters (GFCI).** In addition to the requirements of 210.8(B), all receptacle outlets installed in compartments accessible from outside the relocatable structure shall have GFCI protection for personnel.

## ARTICLE

## 547

## Agricultural Buildings

**Part I. General**

**547.1 Scope.** This article applies to the following agricultural buildings or that part of a building or adjacent areas of similar or like nature as specified in 547.1(A) or (B).

Article 547 applies not only to agricultural buildings but also to adjacent areas similar in nature. The requirements address the severe environmental conditions that regularly exist on agricultural premises. Damp and wet conditions, dust from feed and litter, and corrosive agents from livestock excrement are all present in these settings as part of normal operating conditions.

**(A) Excessive Dust and Dust with Water.** Agricultural buildings where excessive dust and dust with water may accumulate, including all areas of poultry, livestock, and fish confinement systems, where litter dust or feed dust, including mineral feed particles, may accumulate.

**(B) Corrosive Atmosphere.** Agricultural buildings where a corrosive atmosphere exists. Such buildings include areas where the following conditions exist:

- (1) Poultry and animal excrement may cause corrosive vapors.
- (2) Corrosive particles may combine with water.
- (3) The area is damp and wet by reason of periodic washing for cleaning and sanitizing with water and cleansing agents.
- (4) Similar conditions exist.

**547.3 Other Articles.** For buildings and structures not having conditions as specified in 547.1, the electrical installations shall be made in accordance with the applicable articles in this Code.

**547.4 Surface Temperatures.** Electrical equipment or devices installed in accordance with this article shall be installed in a manner such that they will function at full rating without developing surface temperatures in excess of the specified normal safe operating range of the equipment or device.

Informational Note: See Part III of Article 502 for use of equipment in Class 2 locations.

**Part II. Installations**

**547.20 Wiring Methods.** Wiring methods shall be limited to the following:

- (1) Type UF
- (2) Type NMC
- (3) Type SE cable-copper
- (4) Jacketed Type MC cable
- (5) Raceways identified for the locations specified in 547.1(A) and (B)

The wiring methods of Article 502, Part II, shall be permitted for areas described in 547.1.

Informational Note: See 300.7, 352.44, and 355.44 for installation of raceway systems exposed to widely different temperatures.

**547.21 Mounting.** All cables shall be secured within 200 mm (8 in.) of each cabinet, box, or fitting. Nonmetallic boxes, fittings, conduit, and cables shall be permitted to be mounted directly to any building surface covered by this article without maintaining the 6 mm (¼ in.) airspace in accordance with 300.6(D).

The 8-inch support distance is less than that required for cables in other types of occupancies. Locating the nonmetallic equipment and wiring methods directly on the interior surface of the building allows a sealant to be placed along the wiring method to facilitate cleaning. Decreasing the support spacing along with eliminating the ¼-inch airspace also reduces the potential for physical damage to cable-type wiring methods in agricultural buildings.

**See also**

**300.6(D),** Exception, regarding installation without airspace on certain surfaces

**547.22 Equipment Enclosures, Boxes, Conduit Bodies, and Fittings.** Equipment enclosures, boxes, conduit bodies, and fittings installed in areas of buildings where excessive dust could be present shall be designed to minimize the entrance of dust and shall have no openings through which dust could enter the enclosure.

**547.23 Damp or Wet Locations.** In damp or wet locations, equipment enclosures, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the enclosure, box, conduit body, or fitting. In wet locations, including normally dry or damp locations where surfaces are periodically washed or sprayed with water, boxes, conduit bodies, and fittings shall be listed for use in wet locations, and equipment enclosures shall be weatherproof.

**547.24 Corrosive Atmosphere.** Where wet dust, excessive moisture, corrosive gases or vapors, or other corrosive conditions could be present, equipment enclosures, boxes, conduit bodies, and fittings shall have corrosion resistance properties suitable for the conditions.



Informational Note No. 1: See Table 110.28 for appropriate enclosure type designations.

Informational Note No. 2: Aluminum and magnetic ferrous materials can corrode in agricultural environments.

**547.25 Flexible Connections.** Where necessary to employ flexible connections, one or more of the following shall be permitted:

- (1) Dusttight flexible connectors
- (2) Liquidtight flexible metal conduit (LFMC) with listed fittings
- (3) Liquidtight flexible nonmetallic conduit (LFNC) with listed fittings
- (4) Flexible cord listed and identified for hard usage and terminated with listed dusttight cord connectors

**547.26 Physical Protection.** All electrical wiring and equipment subject to physical damage shall be protected.

Nonmetallic cables shall not be permitted to be concealed within walls and above ceilings of buildings (i.e., offices, lunchrooms, ancillary areas, etc.) or portions thereof, which are contiguous with or physically adjoined to livestock confinement areas.

Informational Note: Rodents and other pests are common around such installations and will damage nonmetallic cable by chewing the cable jacket and conductor insulation concealed within walls and ceilings of livestock containment areas of agricultural buildings.

**Δ 547.27 Separate Equipment Grounding Conductor.** Where a separate equipment grounding conductor, not part of a listed cable assembly, is installed underground within a location falling under the scope in 547.1, it shall be insulated.

Informational Note: See 250.120(B) for further information on aluminum and copper-clad aluminum conductors.

This requirement improves the longevity of equipment grounding conductors (EGCs) installed underground in the highly corrosive locations that are typical of many farm buildings.

**547.28 Ground-Fault Circuit-Interrupter Protection.** Ground-fault circuit-interrupter (GFCI) protection shall be provided as required in 210.8(B) for areas of agricultural buildings not included in the scope of this article. GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles installed within the following areas:

- (1) Areas requiring an equipotential plane
- (2) Outdoors
- (3) Damp or wet locations
- (4) Dirt confinement areas for livestock

**547.29 Switches, Receptacles, Circuit Breakers, Controllers, and Fuses.** Switches, including pushbuttons, relays, and similar devices, receptacles, circuit breakers, controllers, and fuses, shall be provided with enclosures as specified in 547.22.

**547.30 Motors.** Motors and other rotating electrical machinery shall be totally enclosed or designed so as to minimize the entrance of dust, moisture, or corrosive particles.

**547.31 Luminaires.** Luminaires shall comply with 547.31(A) through (C).

**(A) Minimize the Entrance of Dust.** Luminaires shall be installed to minimize the entrance and accumulation of dust, foreign matter, moisture, and corrosive material.

**(B) Exposed to Physical Damage.** Luminaires exposed to physical damage shall be protected by a suitable guard.

**(C) Exposed to Water.** Luminaires exposed to water from condensation, building cleansing water, or solution shall be listed for use in wet locations.

## **N Part III. Distribution**

**Δ 547.40 Electrical Supply to Building(s) or Structure(s) from a Distribution Point.** Any agricultural building or structure for livestock located on the same premises shall be supplied from a distribution point. More than one distribution point on the same premises shall be permitted.

Any existing agricultural building or structure for other than livestock not under the scope of Article 547 shall be permitted to be supplied in accordance with 250.32(B)(1), Exception No. 1.

The requirements in 547.40 cover the installation of conductors that originate from an electrical distribution point and supply agricultural buildings. A distribution point, sometimes referred to as the center yard pole, or meter pole is often used as a means of centrally locating the origin of the electrical distribution system.

### **See also**

**Article 100** for the definition of the term *distribution point*

Many agricultural sites consist of multiple buildings. A distribution point often supplies multiple buildings via an overhead distribution system. A disconnecting means, referred to as the site-isolating device, disconnects all ungrounded conductors run to the buildings and structures. This device provides a single location for the disconnection of all power to the buildings. It is not considered the service disconnecting means.

The site-isolating device is required to be pole-mounted to the height required for the conductors it supplies, thereby rendering the device inaccessible. The remote operating handle for the device must be readily accessible to personnel. If the supply system includes a grounded conductor, it must be connected to a grounding electrode system at the site-isolating device.

The site-isolating device is not required to provide overcurrent protection. Based on the requirements in 547.41(B) and 547.42, the location of the service disconnecting means and overcurrent protection is on the load side of the site-isolating device. Where the site is supplied by more than one distribution point, a



plaque or directory that provides information about the location of each distribution point and the buildings served by each distribution point is required at each site-isolating device.

In Exhibit 547.1, the pole-mounted site-isolating device is located at the distribution point. A set of overhead service conductors is run to each of the three structures, and a service disconnecting means and overcurrent protection are installed at each building. The supply conductors are considered service conductors because there is no overcurrent protection at the site-isolating device. A grounding electrode system is required at the distribution point, and a grounding electrode conductor (GEC) connection to the supply system grounded conductor must be made at the site-isolating device. A grounding electrode system is also required at each of the buildings.

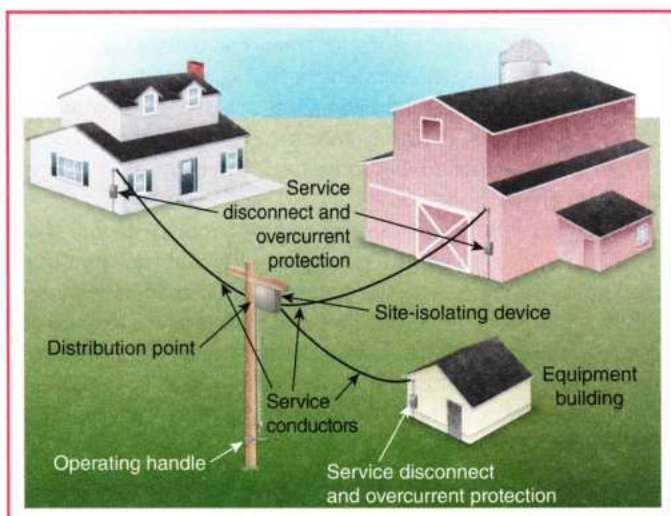
Any portion of an EGC installed underground must be insulated in accordance with 547.27. This is to protect the EGC from the corrosive influences inherent to agricultural premises and to reduce leakage current in those areas where livestock are kept. Prevention of stray voltage at agricultural premises is extremely important.

**N 547.41 Overhead Service.** Overhead service installations shall comply with 547.41(A)(1) through (A)(9), 547.41(B)(1) through (B)(3), or 547.42.

**(A) Site-Isolating Device.** Site-isolating devices shall comply with 547.41(A)(1) through (A)(9).

**(1) Where Required.** A site-isolating device shall be installed at the distribution point where two or more buildings or structures are supplied from the distribution point.

**(2) Location.** The site-isolating device shall be pole-mounted and be not less than the height above grade required by 230.24 for the conductors it supplies.



**EXHIBIT 547.1** Site-isolating device located at the distribution point with service conductors run to each building. A service disconnecting means and overcurrent protection are installed at each building.

**(3) Operation.** The site-isolating device shall simultaneously disconnect all ungrounded service conductors from the premises wiring.

**(4) Grounding and Bonding.** At the site-isolating device, the grounding electrode conductor shall be connected to the system grounded conductor and the enclosure.

**(5) Rating.** The site-isolating device shall be rated for the calculated load as determined by Part V of Article 220.

**(6) Overcurrent Protection.** The site-isolating device shall not be required to provide overcurrent protection.

**(7) Accessibility.** The site-isolating device shall be capable of being remotely operated by an operating handle installed at a readily accessible location. The operating handle of the site-isolating device, when in its highest position, shall not be more than 2.0 m (6 ft 7 in.) above grade or a working platform.

**(8) Series Devices.** An additional site-isolating device for the premises wiring system shall not be required where a site-isolating device meeting all applicable requirements of this section is provided by the serving utility as part of their service requirements.

**(9) Marking.** A site-isolating device shall be permanently marked to identify it as a site-isolating device. This marking shall be located on the operating handle or immediately adjacent thereto.

**(B) Service Disconnecting Means and Overcurrent Protection at the Building(s) or Structure(s).** Where the service disconnecting means and overcurrent protection are located at the building(s) or structure(s), the requirements of 547.41(B)(1) through (B)(3) shall apply.

**(1) Conductor Sizing.** The supply conductors shall be sized in accordance with Part V of Article 220.

**Δ (2) Conductor Installation.** The supply conductors shall be installed in accordance with Part II of Article 225.

**Δ (3) Grounding and Bonding.** For each building or structure, grounding and bonding of the supply conductors shall be in accordance with 250.32, and the following conditions shall be met:

- (1) The equipment grounding conductor is not smaller than the largest supply conductor if of the same material or is adjusted in size in accordance with the equivalent size columns of Table 250.122 if of different materials.
- (2) The equipment grounding conductor is connected to the grounded circuit conductor and the site-isolating device enclosure at the distribution point.

**547.42 Service Disconnecting Means and Overcurrent Protection at the Distribution Point.** The service disconnecting means and overcurrent protection for each set of feeders or



branch circuits shall be located at the distribution point. The service disconnecting means shall be installed in accordance with Part VI of Article 230. The feeders or branch circuits supplied to buildings or structures shall comply with 250.32 and Article 225, Parts I and II.

**Informational Note:** Methods to reduce neutral-to-earth voltages in livestock facilities include supplying buildings or structures with 4-wire single-phase services, sizing 3-wire single-phase service and feeder conductors to limit voltage drop to 2 percent, and connecting loads line-to-line, will provide reasonable efficiency of operation.

**547.43 Identification.** Where a site is supplied by more than one distribution point, a permanent plaque or directory shall be installed at each of these distribution points denoting the location of each of the other distribution points and the buildings or structures served by each.

**547.44 Equipotential Planes and Bonding of Equipotential Planes.** The installation and bonding of equipotential planes shall comply with 547.44(A) and (B). For the purposes of this section, the term *livestock* shall not include poultry.

Grounding and bonding requirements unique to agricultural settings are necessary due to the sensitivity of livestock to slight differences in potential between surfaces with which they are in direct contact. The wet or damp concrete common to animal confinement areas enhances that sensitivity.

Δ **(A) Where Required.** Equipotential planes shall be required in the following areas:

**(1) Indoors.** Equipotential planes shall be installed in confinement areas with concrete floors where metallic equipment is located that may become energized and is accessible to livestock.

**(2) Outdoors.** Equipotential planes shall be installed in concrete slabs where metallic equipment is located that may become energized and is accessible to livestock.

The equipotential plane shall encompass the area where the livestock stands while accessing metallic equipment that may become energized.

**(B) Bonding.** Equipotential planes shall be bonded to the grounding electrode system or an equipment grounding terminal in any panelboard of the electrical grounding system associated with the equipotential plane. The bonding conductor shall be solid copper, insulated, covered or bare, and not smaller than 8 AWG. The means of bonding to wire mesh or conductive elements shall be by pressure connectors or clamps of brass, copper, copper alloy, or other approved means. Slatted floors that are supported by structures that are a part of an equipotential plane shall not require bonding.

**Informational Note No. 1:** See ASEA/ASABE EP473.2-2001 (R2015), *Equipotential Planes in Animal Containment Areas*, for methods to establish equipotential planes.

**Informational Note No. 2:** See ASEA/ASABE EP342.3-2010 (R2015), *Safety for Electrically Heated Livestock Waterers*, for methods for safe installation of livestock waterers.

**Informational Note No. 3:** Low grounding electrode system resistances may reduce voltage differences in livestock facilities.

Electrically heated livestock watering troughs could pose an electric shock hazard for livestock and personnel. The referenced document provides information on the proper installation of such equipment.

## ARTICLE 550

### Mobile Homes, Manufactured Homes, and Mobile Home Parks

#### Part I. General

**550.1 Scope.** This article covers the electrical conductors and equipment installed within or on mobile and manufactured homes, the conductors that connect mobile and manufactured homes to a supply of electricity, and the installation of electrical wiring, luminaires, equipment, and appurtenances related to electrical installations within a mobile home park up to the mobile home service-entrance conductors or, if none, the mobile home service equipment.

**Informational Note:** See NFPA 501-2017, *Standard on Manufactured Housing*, and Part 3280, *Manufactured Home Construction and Safety Standards*, of the Federal Department of Housing and Urban Development for additional information on manufactured housing.

The *Manufactured Home Construction and Safety Standards*, issued by the U.S. Housing and Urban Development Administration (HUD), incorporates many of the requirements of Article 550 of the NEC®. The federal standard contains the requirements for electrical systems, conductors, and equipment installed within or on mobile homes and the conductors that connect mobile homes to a supply of electricity. Mobile homes are defined as manufactured homes in the HUD regulations. For the purposes of the NEC, and unless otherwise indicated, the term *mobile home* includes manufactured homes.

The regulations pertaining to electrical systems are in 24 CFR 3280.801–3280.816. They require that new manufactured homes comply with the federal standard. In some cases, HUD has delegated the enforcement of this standard to state and private inspection agencies and qualified testing laboratories. The service equipment and feeders installed at the mobile or manufactured home site are covered by the requirements in Part III of Article 550.

#### See also

**Article 545** for requirements for mobile homes that are not intended as a dwelling unit

**545.1** commentary for information on the distinction between manufactured homes and manufactured buildings