Traffic Signal and Roadway Lighting Grounding Quiz

The following quiz is provided courtesy of Mike Holt, of Mike Holt Enterprises. The answers are shown starting on page 29

- **What role does a low resistance ground have in improving power quality?**
- **At a metal lighting pole, are ground rods required to prevent damage to a concrete pole base from lightning?**
- **Is a low resistive earth ground necessary for the proper operation of a transient voltage surge suppressor?**
- **Does a ground rod at a metal traffic signal handhole reduce the dangerous voltage from a ground fault?**

When answering these questions it very important that you base your answers on the following terms as defined by the 2005 *National Electrical Code.*

- ***Bonding (Bonded).*** The permanent joining of metallic parts to form an electrically conductive path that ensures electrical continuity and the capacity to conduct safely any current likely to be imposed [100].
- ***Bonding Jumper, System.*** The connection between the grounded circuit conductor and the *equipment grounding conductor* at a separately derived system [100].
- ***Effective Ground-Fault Current Path.*** An intentionally constructed, permanent, low-impedance electrically conductive path designed and intended to carry current under *ground-fault* conditions from the point of a *ground fault* on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device [250.2].
- ***Ground.*** A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth or to some conducting body that serves in place of the earth [100].
- ***Ground Fault.*** An unintentional, electrically conducting connection between an ungrounded conductor of an electrical circuit and the normally noncurrent-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth [250.2].
- ***Ground-Fault Current Path.*** An electrically conductive path from the point of a *ground fault* on a wiring system through normally noncurrent-carrying conductors, equipment, or the earth to the electrical supply source [250.2].
- ***Grounded.*** Connected to earth or to some conducting body that serves in place of the earth [100].
- ***Grounding Conductor.*** A conductor used to connect equipment or the grounded circuit of a wiring system to a *grounding electrode* [100].
- ***Grounding Conductor, Equipment.*** The conductor used to connect the noncurrent-carrying metal parts of equipment, raceways, and other enclosures to the system grounded conductor, the grounding electrode conductor, or both, at the service equipment or at the source of a separately derived system [100].
- ***Grounding Electrode.*** A device that establishes an electrical connection to the earth [100].

This quiz is not designed to upset you or to cause you conflict, but it might; it's simply designed to demonstrate how easily it is to get confused if you are not careful.

Note: The questions are based on premises wiring systems having a nominal voltage of 120, 120/208, 120/240, 240, 277, 277/480, 480, 347, 347/600, or 600, and assume that all separately derived systems are customer owned inside a building.

Current Flow

1. When electrical current is given multiple conductive paths on which to flow, current will always take the path of least resistance.

Current Flow

2. It is important to *ground* metal parts to a suitable *grounding electrode*, so that in the event of a *ground fault*, dangerous *ground-fault current* will be shunted into the earth, away from persons; thereby protecting them against electric shock.

Current Flow

3. The grounding conductor for a supplementary grounding electrode (for example, a ground rod for a machine tool) must have the capacity to conduct safely any fault current likely to be imposed on it. This is accomplished by sizing the conductor in accordance with Table 250.66 or Table 250.122, depending on the conditions.

Clear a Fault

4. Electrical equipment must be *grounded* so that sufficient fault current will flow through the circuit protection device to quickly open and clear the *ground fault*. For example, a 20A circuit breaker will trip and de-energize a 120V *ground fault* to a metal pole that is *grounded* to a 25 ohm ground rod.

Electrical Equipment

5. Electrical equipment must be *grounded* to ensure that dangerous voltage on metal parts resulting from a *ground fault* can be reduced to a safe value.

Electrical Equipment

6. Metal traffic signal poles and handhole covers must be *grounded* to a suitable *grounding electrode* to ensure that dangerous voltage on metal parts resulting from a *ground fault* can be reduced to a safe value.

Electrical Equipment

7. *Grounding* of metal manhole covers to a suitable *grounding electrode* ensures that dangerous voltage on metal parts resulting from a *ground fault* can be reduced to a safe value.

Service Equipment

8. *Service equipment* must be *grounded* to a *grounding electrode* to ensure that dangerous voltage on metal parts resulting from a *ground fault* can be removed or be reduced to a safe value.

Service Equipment

9. *Grounding* service equipment to a low resistive *grounding electrode* helps in protecting interior wiring and equipment from lightning damage.

Service Equipment

10. Service equipment is *grounded* to a *grounding electrode* to ensure that metal parts, subject to a ground fault, remain at the same potential as the earth.

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Service Equipment
11. *Grounding* of service equipment to a *grounding electrode* is necessary to stabilize the system voltage.

Service Equipment
12. Service equipment is *grounded* to a *grounding electrode* to ensure that the voltage between the metal parts of the electrical installation and the earth remains at the same potential.

Separately Derived System
13. The metal case of a separately derived system is *grounded* to a *grounding electrode* to stabilize the system voltage during normal operation.

Separately Derived System
14. Separately derived systems are *grounded* to a *grounding electrode* to ensure that the voltage between metal parts and the earth remains at the same potential.

Separately Derived Systems
15. *Separately derived systems* must be *grounded* to a *grounding electrode* to ensure that dangerous voltage on metal parts, caused by a *ground fault*, can be removed or be reduced to a safe value.

Separately Derived Systems
16. An ungrounded system gets its name from the fact that both the *separately derived system* and the metal case of the *separately derived system* are isolated from *ground* (earth).

Transformers
17. Failure to *ground* the metal case of a transformer to a *grounding electrode* can result in a dangerous difference of potential between the metal parts of different *separately derived systems*.

Generators
18. The metal case of *generators* are *grounded* to a suitable *grounding electrode* to ensure that dangerous voltage on metal parts, caused by a *ground* fault, can be reduced to a safe value.

Remote Building
19. Building disconnecting means at a remote building supplied by a feeder must be *grounded* to a *grounding electrode* to ensure that dangerous voltage on metal parts, caused by a *ground fault*, can be removed or be reduced to a safe value.

Remote Building
20. The metal disconnecting means at a remote building, supplied by a feeder with an *equipment grounding conductor*, is not required to be *grounded* to a *grounding electrode*.

Remote Building
21. The *grounding* of a building disconnecting means to a suitable *grounding electrode* helps in protecting interior wiring and equipment from a lightning strike.

Outdoor Metal Pole
22. Outdoor metal light poles must be *grounded* to a suitable *grounding electrode* to ensure that dangerous voltage on metal parts, caused by a *ground fault*, can be reduced to a safe value.

Outdoor Metal Pole
23. *Grounding* metal light poles to a *grounding electrode* helps in reducing lightning damage to the luminaires on the metal light pole from a direct lightning strike.

Outdoor Metal Pole
24. *Grounding* metal light poles to a *grounding electrode* helps in preventing damage to building wiring and equipment from lightning striking one of the metal light poles.

Outdoor Metal Pole
25. *Grounding* metal light poles to a *grounding electrode* is necessary to prevent lightning damage to the concrete pole base.

Sensitive Electronic Equipment
26. Studies have shown that a low-resistive *grounding* system improves power quality for sensitive electronic equipment.

Sensitive Electronic Equipment
27. Single-point *grounding* improves equipment performance by preventing ground-loop currents.

Sensitive Electronic Equipment
28. Studies have shown that *grounding* sensitive electronic equipment to an isolated counter-poise ground improves equipment performance because of improved power quality.

Sensitive Electronic Equipment
29. If an electrical system is properly installed, the voltage between the neutral terminal and the ground terminal at a receptacle should be near zero.

Stray Voltage or Neutral-to-Earth Voltage (NEV)
30. *Grounding* premises wiring to a low resistive grounding grid can help reduce stray voltage or neutral-to-earth voltage on metal parts.

Stray Voltage or NEV
31. *Grounding* metal parts of electrical equipment to an equipotential plane can help reduce stray or NEV voltage on the metal parts.

TVSS
32. A low resistive earth *ground* is necessary for the proper operation of transient voltage surge suppressors (TVSSs).

General
33. Because salt water is more conductive than fresh water, a person is more likely to be electrocuted while swimming at a saltwater marina, than a freshwater marina.

Mike Holt is a leading NEC consultant, author and instructor. His web site is the #1 rated electrical web site in the world. His new text on grounding, Grounding Versus Bonding, is an excellent reference for you to understand the above quiz. Find Grounding Versus Bonding and more at www.mikeholt.com

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