

**NEC Requirements for Signs and Labels Used for Traffic Signal
And Roadway Lighting Applications
Part 2 of 2**

Part 1 of this article in the September/October issue of the IMSA Journal reviewed the requirements of signs and labels in the NEC that may apply to Traffic Signal and Roadway Lighting (TS/RL) applications. This article concludes with the requirements from Chapters 4, 6 and 7. There are other sign and labeling requirements in the NEC, but the following are most applicable to Traffic Signal and Roadway Lighting.

A useful reference for signs and labels is ANSI Z535.4-1998, Product Safety Signs and Labels. This standard provides guidelines for the design of safety signs and labels. ANSI Z535.4-1998 is only referenced in NEC Section 110.16 Flash Protection in a fine print note, however use of its guidelines would limit the liability of an agency or user.

Chapter 4 Equipment for General Use

Article: 408 Switchboards and Panelboards

Section: 408.4 Circuit Directory.

Requirement: *All circuits and circuit modifications shall be legibly identified as to purpose or use on a circuit directory located on the face or inside of the panel door in the case of a panelboard, and at each switch on a switchboard.*

Application: All circuits at an electrical service or panelboard for a TS/RL application require identification of their purpose.

Article 426: Fixed Outdoor Electric Deicing and Snow-Melting Equipment

Section: 426.13 Identification.

Requirement: *The presence of outdoor electric deicing and snow-melting equipment shall be evident by the posting of appropriate caution signs or markings where clearly visible.*

Application: To prevent the heat cable from being damaged and to alert personnel to its presence, a caution sign is required. Heat cable manufacturers often will have signs available.

Article: 430 Motors, Motor Circuits, and Controllers

Section: 430.113 Energy from More Than One Source.

Requirement: *Motor and motor-operated equipment receiving electrical energy from more than one source shall be provided with disconnecting means from each source of electrical energy immediately adjacent to the equipment served. Each source shall be permitted to have a separate disconnecting means. Where multiple disconnecting means are provided, a permanent warning sign shall be provided on or adjacent to each disconnecting means.*

Exception No. 1: Where a motor receives electrical energy from more than one source, the disconnecting means for the main power supply to the motor shall not be required to be immediately adjacent to the motor, provided the controller disconnecting means is capable of being locked in the open position.

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Exception No. 2: A separate disconnecting means shall not be required for a Class 2 remote-control circuit conforming with Article 725, rated not more than 30 volts, and that is isolated and ungrounded.

Application: This requirement is more applicable to roadway lighting than traffic signals. Although Article 430 applies to Motors, Motor Circuits and Controllers, many of the same requirements are in the UL 508 Industrial Control Panel standard, a standard that can be used for commercial and industrial lighting control panels. Where there are multiple voltage disconnecting means present, a permanent warning sign is required to warn personnel. Often the control circuit will be a 120V circuit and the lighting circuits will be 480V.

Chapter 6 Special Equipment

Article: 690 Solar Photovoltaic Systems

Section: 690.10 Stand-Alone Systems, (C) Single 120-Volt Supply

Requirement: *The inverter output of a stand-alone solar photovoltaic system shall be permitted to supply 120 volts to single-phase, 3-wire, 120/240-volt service equipment or distribution panels where there are no 240-volt outlets and where there are no multiwire branch circuits. In all installations, the rating of the overcurrent device connected to the output of the inverter shall be less than the rating of the neutral bus in the service equipment. This equipment shall be marked with the following words or equivalent:*

WARNING
SINGLE 120-VOLT SUPPLY. DO NOT CONNECT
MULTIWIRE BRANCH CIRCUITS!

Application: In a two wire stand-alone system, there are no multiwire branch circuits. A multiwire branch circuit is where the neutral carries the unbalanced current between the ungrounded (hot) conductors. If a 120/240 AC service is connected to a two wire stand-alone system, the neutral currents would not cancel and the neutral could overheat.

Section: 690.14 Additional Provisions

(C) Requirements for Disconnecting Means, (2) Marking

Requirement: *Each photovoltaic system disconnecting means shall be permanently marked to identify it as a photovoltaic system disconnect.*

Section: 690.17

Requirement: *Where all terminals of the disconnecting means may be energized in the open position, a warning sign shall be mounted on or adjacent to the disconnecting means. The sign shall be clearly legible and have the following words or equivalent:*

WARNING.
ELECTRIC SHOCK HAZARD.
DO NOT TOUCH TERMINALS. TERMINALS
ON BOTH THE LINE AND
LOAD SIDES MAY BE ENERGIZED
IN THE OPEN POSITION.

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Application: PV systems have voltage on the line side from the solar array and on the load side from the storage battery. Extra care and caution is required for maintenance due to a PV system being dual fed, a condition that does not exist in the typical electrical system.

Section: 690.54 Interactive System Point of Interconnection.

Requirement: *All interactive system(s) points of interconnection with other sources shall be marked at an accessible location at the disconnecting means as a power source with the maximum ac output operating current and the operating ac voltage.*

Application: An interactive system is one that is designed to deliver power to an electrical distribution system. The sing (marking) is to ensure the disconnecting means is identified in the event the PV system needs to be isolated.

Section: 690.55 Photovoltaic Power Systems Employing Energy Storage

Requirement: *Photovoltaic power systems employing energy storage shall also be marked with the maximum operating voltage, including any equalization voltage and the polarity of the grounded circuit conductor.*

Application: For systems with battery storage, the voltage, equalizing voltage and type of ground (positive or negative) must be “marked”.

Section: 690.56 Identification of Power Sources

Requirement:

(A) Facilities with Stand-Alone Systems. Any structure or building with a photovoltaic power system that is not connected to a utility service source and is a stand-alone system shall have a permanent plaque or directory installed on the exterior of the building or structure at a readily visible location acceptable to the authority having jurisdiction. The plaque or directory shall indicate the location of system disconnecting means and that the structure contains a stand-alone electrical power system.

(B) Facilities with Utility Services and PV Systems. Buildings or structures with both utility service and a photovoltaic system shall have a permanent plaque or directory providing the location of the service disconnecting means and the photovoltaic system disconnecting means, if not located at the same location.

Application: The “permanent plaque or directory” is to give the location of the disconnecting means to enable the power to be shut down from all sources in an emergency and to be able to locate the disconnecting means for both the PV and electrical service.

Article: 692 Fuel Cell Systems

Application: Fuel Cell Systems is a new article for the 2002 NEC. Fuels cells may prove to be very practical application for a traffic signal back up power applications. Article 692 is similar to Article 690 and has some of the same requirements for signs and labels. Some of the sections that require signs and labels are:

Section 692.17 Switch or Circuit Breaker 692.4 Installation.

(B) Identification. A permanent plaque or directory, denoting all electrical power sources on or in the premises, shall be installed at each service equipment location.

Section 692.10 Stand-Alone Systems, (C) Single 120-Volt Nominal Supply

Section 692.17 Switch or Circuit Breaker

Section 692.53 Fuel Cell Power Sources

Section 692.54 Fuel Shut-Off

Requirement: *The location of the manual fuel shut-off valve shall be at the location of the primary disconnecting means of the building or circuits supplied.*

Section 692.56 Stored Energy

Section 692.65 Point of Connection

Chapter 7 Special Conditions

Article: 700 Emergency Systems

Section: 700.8 Signs

Requirement: (A) *Emergency Sources. A sign shall be placed at the service entrance equipment indicating type and location of on-site emergency power sources.*

Exception: A sign shall not be required for individual unit equipment as specified in 700.12(E) Grounding.

Where the grounded circuit conductor connected to the emergency source is connected to a grounding electrode conductor at a location remote from the emergency source, there shall be a sign at the grounding location that shall identify all emergency and normal sources connected at that location.

Article: 701 Legally Required Standby Systems

Section: 701.9 Signs

Requirement:

(A) *Mandated Standby. A sign shall be placed at the service entrance indicating type and location of on-site legally required standby power sources.*

Exception: A sign shall not be required for individual unit equipment as specified in 701.1(F).

(B) *Grounding. Where the grounded circuit conductor connected to the legally required standby power source is connected to a grounding electrode conductor at a location remote from the legally required standby power source, there shall be a sign at the grounding location that shall identify all legally required standby power and normal sources connected at that location.*

Article: 702 Optional Standby Systems

Section: 702.8 Signs

Requirement:

(A) *Standby. A sign shall be placed at the service-entrance equipment that indicates the type and location of on-site optional standby power sources. A sign shall not be required for individual unit equipment for standby illumination.*

(B) *Grounding. Where the grounded circuit conductor connected to the optional standby power source is connected to a grounding electrode conductor at a location remote from the optional standby power source, there shall be a sign at the grounding location that shall identify all optional standby power and normal sources connected at that location.*

Application: For Articles 700, 701 and 702

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Part (A): Any location with an emergency, legally required or optionally required generator is required to have a sign at the service disconnecting equipment with the type and location of the power source. This is to ensure all sources of power to the building or structure can be shut off in an emergency.

Note: Individual unit equipment refers to battery powered emergency exit or egress lighting.

Part (B): The sign alerts maintenance personnel that the grounding connection also serves the remote power source, and disconnecting the bonding jumper could open the grounding electrode conductor connection. This is only for generators that are a separately derived system.

Authors Note: If an emergency, legally required or optionally required standby generator is not connected with a transfer switch that transfers the grounded conductor (neutral) then that generator is not a separately derived system and:

1. The generator does not require ground rods (more correctly a grounding electrode system).
2. The generator grounded conductor must not be bonded to the generator frame or in the transfer switch.

A generator that does not have “a solidly connected grounded circuit conductor to the supply conductors”, [Article 100 Definition of Separately Derived System] has to have a grounding electrode system. When the transfer switch is powering loads from the generator, the connection to the building grounded conductor and its connection to the grounding electrode system at the service is opened (the neutral is transferred) so ground rods are required at that generator.

Most transfer switches do not transfer the neutral and the generator is not a separately derived system.



Typical Generator Signs

**Top sign is for compliance with Part A of Articles 700, 701 and 702
Bottom Sign is for compliance of Part B of Articles 700, 701 and 702**

Resources

ANSI Z535.4-1998, Product Safety Signs and Labels is available for \$51.00, from NEMA at www.nema.org, or Global Documents at www.his.com.

A review of safety warning signs can be found at the Lawrence Livermore National Laboratory web site, [http://www.llnl.gov/es and h/hsm/doc_12.01/doc12-01.html#appb](http://www.llnl.gov/es_and_h/hsm/doc_12.01/doc12-01.html#appb)

Future Issues

- January-February 2002: Conductor Color Code Requirements – The green conductor in IMSA cable is used for the green lamp display in a traffic signal head. Find out why this is not a violation of the NEC.
- March-April 2003: Portable Generator Grounding – When does a portable generator have to have ground rods?

About the Author

IMSA Member Tom Baker has been a certified electrician for 23 years and is also an IMSA Level II Traffic Signal Technician. His business, Puget Sound Electrical Training, provides classes on the NEC, Grounding and Bonding, and other electrical subjects. He was recently appointed to the IESNA Roadway Lighting Committee by the IMSA. Contact him via email at tom@psetraining.com, or at 360-377-2492.