

Section 924— Miscellaneous Electrical Materials

924.1 General Description

This section includes the requirements for the following miscellaneous electrical materials:

- Ground rods
- Fuses and fuse holders
- Lightning arresters
- Circuit breakers
- Disconnect switches
- Photoelectric controls
- Magnetic contactors

924.1.01 Related References

A. Standard Specifications

General Provisions 101 through 150.

B. Referenced Documents

ASTM A 153/A 153M

EI/NEMA publications

924.2 Materials

Ensure that all electrical materials are approved by the Underwriter's Laboratory or other acceptable testing agency.

924.2.01 Ground Rods

A. Requirements

1. Use ground rods that are 5/8 in, \pm 1/16 in (16 mm, \pm 2 mm) diameter and 8 ft (2.4 m) long, unless otherwise shown on the Plans.
2. Ensure that the rods are galvanized steel with a minimum coating of 2 oz/ft² (610 g/m²) according to ASTM A 153/A 153M.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

924.2.02 Fuses and Fuse Holders

A. Requirements

Use fuses of the amperage indicated on the Plans and with an appropriate voltage rating to operate at the voltage specified on the Plans.

B. Fabrication

1. Use in-the-line, waterproof fuse holders.
 - a. Construct and install the fuse holder so it will retain the fuse on the load side if disconnected or broken apart.
 - b. Install the fuse holder with a breakaway feature, when specified on the Plans.
2. Install a weatherproof boot, furnished by the fuse holder manufacturer, over each end of the fuse holder.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

924.2.03 Lightning Arresters**A. Requirements**

Use lightning arresters of the metal oxide varistor type, rated at 650 volts, and have the number of poles required, unless otherwise specified.

Provide a pole for each ungrounded leg of the service voltage.

B. Fabrication

1. For units not sealed at the factory:
 - a. Apply silicone caulk to the lead entrance.
 - b. Install heat shrinkable tubing, with precoated sealant on the interior surface, over the lead entrance.
2. Place the arrester in a watertight housing. Ensure that the lead entrance to the housing is encapsulated or sealed.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

924.2.04 Circuit Breakers**A. Requirements**

1. Use circuit breakers that have the following characteristics:
 - Are thermal magnetic, molded case, quick-make and quick-break
 - Operate with over-the-center toggles with the handle going to a position between “ON” and “OFF” to indicate automatic tripping
 - Can bolt on with an industrial rating and a minimum interrupting capacity of 10,000 RMS symmetrical amperes
 - Be enclosed in a lockable, weatherproof enclosure
 - Have proper lugs that are sized for the cable used. Do not cut cable strands to attach to circuit breakers.
2. Use multi-pole breakers that are of the single handle and common trip type with a voltage rating of at least 240 volts from line to ground.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

924.2.05 Disconnect Switches**A. Requirements**

1. Use disconnect switches with the voltage and ampere rating specified on the Plans.
2. Fuse the switches as designated on the Plans.
3. Use switches that are 2-pole, 3-wire, solid neutral with heavy duty rating, unless otherwise specified. You may install the switch separately or with a magnetic contactor.
4. Enclose the switch in a lockable, stainless steel, weatherproof enclosure.
5. Use the proper lug sized for the cable used. Do not cut cable strands to attach to disconnect switches.

924.2.06

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

924.2.06 Photoelectric Controls

A. Requirements

1. Use photoelectric controls that have the following characteristics:
 - Have a factory setting for turn-on at 1.5 footcandles (16 lux) ambient light level
 - Have a suitable differential between turn-on and turn-off levels to prevent cycling at critical levels
 - Operate on a supply voltage of 105-130 volts, 50/60 Hz AC, with an inrush rating of 120 amperes at 120 volts
 - Operate with a lamp load rating of 1,000 watts for incandescent and 1,800 volt-amperes for mercury vapor and fluorescent lamps
 - Contain built-in surge and lightning protection
 - Have a rated life at full load of at least 5,000 on-off operations
 - Have relay contacts that are single-pole, single-throw (SPST), normally closed (NC)
 - Have dielectric strength of at least 5,000 volts between any current carrying part and metal mounting surface
 - Withstand an ambient temperature range of -65° to 158° F (-54° to 70° C)
 - Have a moistureproof housing about 2-1/4 in (60 mm) high with a base diameter of less than 3-1/4 in (85 mm)
 - Have a chassis of molded phenolic with three locking-type blades and a neoprene gasket that meet EEI/NEMA publications
2. Provide an approved receptacle for mounting the photoelectric control.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

924.2.07 Magnetic Contactors

A. Requirements

1. Use magnetic contactors that have the following characteristics:
 - Have the voltage and ampere rating as specified on the Plans
 - Have the number of poles required to open each ungrounded conductor
 - Have a coil voltage of 120 volts, 60 Hz AC, unless otherwise specified
 - Are in lockable, stainless steel, weatherproof enclosures, unless otherwise specified
 - Have proper lugs sized for the cable used
2. Do not cut cable strands to attach to contactors.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.

Section 925—Traffic Signal Equipment

925.1 General Description

This section provides specifications for a variety of traffic signal equipment.

925.1.01 Related References**A. Standard Specifications**

Section 500—Concrete Structures
 Section 647—Traffic Signal Installation
 Section 682—Electrical Wire, Cable and Conduit
 Section 833—Joint Fillers and Sealers
 Section 870—Paints (Field Painting)
 Section 923—Electrical Conduit
 Section 935—Fiber Optic System

B. Referenced Documents

NEMA TS-1 ITE Traffic Signal Lamps
 IMSA #20-1-1984
 IMSA #20-4-1984
 IMSA #20-6-1984
 IMSA #50-2-1984
 IMSA #51-5-1984
 UL #493 Carol #C6047 or Belden #9773
 Traffic Signal Control Equipment Specifications, current edition and addenda, State of California Business, Transportation & Housing Agency
 CALTRANS Qualified Products List, QPL, “Polyurethane Sealant for Inductive Loops” and QPL-XX, “Model 2070 traffic Controllers”, Transportation Electrical Equipment Specifications (TEES).
 QPL 75

925.2 Materials**A. Requirements**

Ensure that the traffic signal equipment and materials meet the Plans and Specifications.

All equipment furnished shall be new and meet the requirements of the following:

- Underwriter’s Laboratory Incorporated (UL)
- Electronic Industries Association (EIA)
- National Electric Code (NEC)
- American Society of Testing and Materials (ASTM)
- American National Standards Institute (ANSI)
- International Municipal Signal Association (IMSA)