

City of Colorado Springs Traffic Signal Grounding Methods



October 30, 2014
Revision 1

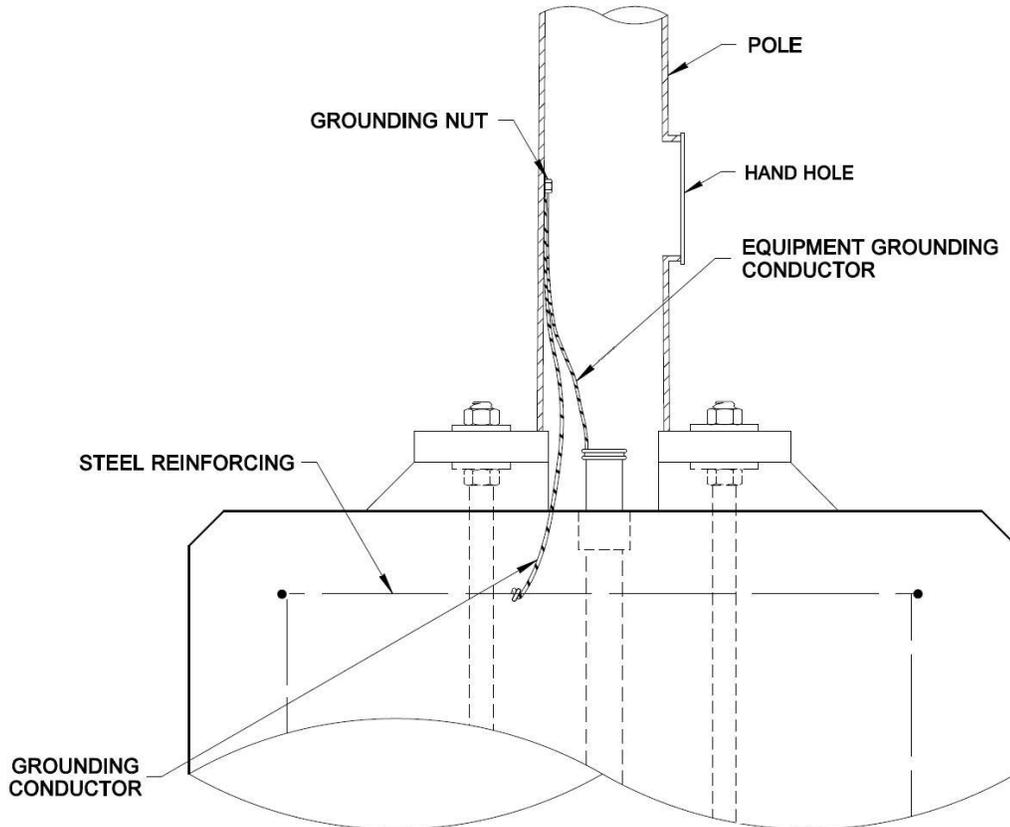
1.0 New Construction and Reconstruction Grounding Methods

1.1 Metered Service

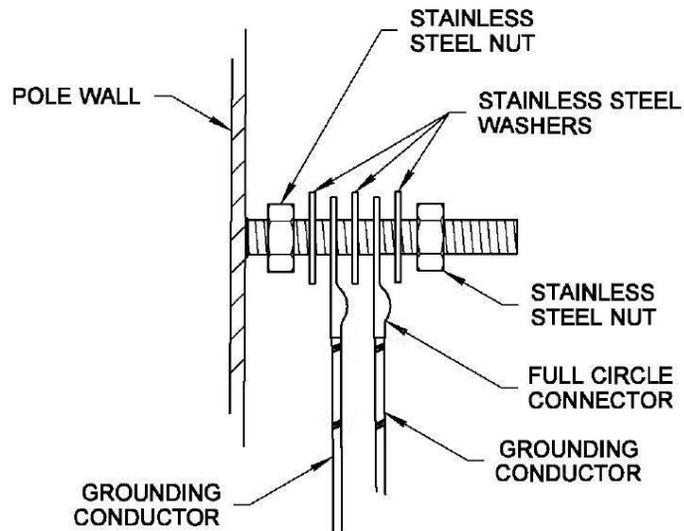
- Conflicting grounding methods in the “Colorado Springs Utilities Electric Line Extensions & Service Standards” document from CSU supercede this section (section 1.1)
- Install at least two grounding electrodes (ground rods), at least six feet apart
 - Drive 5/8in. x 8ft. copper grounding electrodes to a minimum depth of 6 inches below final grade (top of rod 6 inches below grade)
 - Measure grounding effectiveness of interconnected grounding electrodes using an earth ground meter
 - If greater than 25Ω then install up to two additional grounding electrodes (maximum of four) at least six feet apart
- The Grounding Electrode Conductor (GEC) from the grounding electrodes to the service must be at least 6 gauge, solid copper
- All pole and cabinet Equipment Grounding Conductors (EGCs) must be brought to the service
- The ground bus bar at the service must be large enough for all EGCs, service neutral and the GEC

1.2 Metal Poles with Nominal Voltage (50-120VAC) Apparatuses

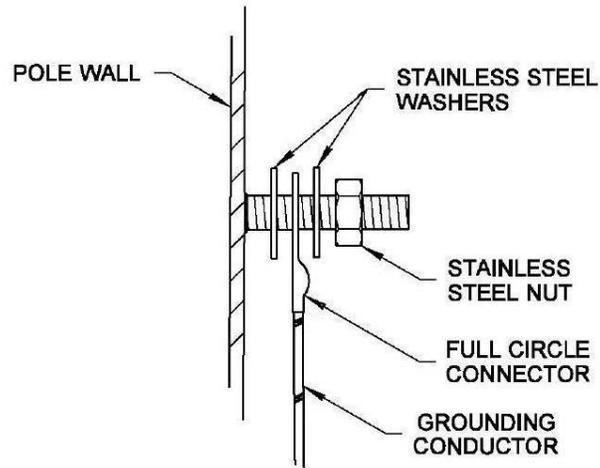
- Ground pole using Ufer ground
 - Grounding Electrode Conductor (GEC) – at least 6 gauge, bare, stranded copper
 - Connect to rebar cage (must have a combined rebar length of 20 feet) of concrete foundation using clamp suitable for submersion in concrete



- Connect to pole's grounding point using properly crimped ring terminal*
 - Remove all paint/coating to bare metal
 - Sandwich ring terminal between washers



- Connect Equipment Grounding Conductor (EGC) between pole and metered service
 - Use at least 10 gauge, insulated, green, stranded copper
 - Connect to pole's grounding point using properly crimped ring terminal (see above)
 - Rout to metered service and connect to its ground bus bar
- If used, the messenger wire, of a span & tether configuration, must be bonded to each pole
 - Use at least 6 gauge, stranded copper
 - Connect to messenger (span) wire using a clamp
 - Connect to ground point (i.e. anchored/bonded stud) of pole using properly crimped ring terminal*
 - Remove all paint/coating to bare metal
 - Sandwich ring terminal between washers



1.3 Metal Poles with Low Voltage (less than 50V AC/DC) Apparatuses

- If pole's foundation has rebar cage, ground pole using Ufer ground (see section 1.2)
- Otherwise, if pole has solar panel(s) or is greater than 8 feet tall, ground pole using a grounding electrode (ground rod)
 - Drive a 5/8in. x 8ft. copper grounding electrode to a minimum depth of 7.5 feet within a handhole enclosure (pull box)
 - Grounding Electrode Conductor (GEC) – at least 6 gauge, bare, stranded copper
 - Connect to grounding electrode using suitable clamp
 - Connect to pole's grounding point using properly crimped ring terminal (see section 1.2)*
 - Remove all paint/coating to bare metal
 - Sandwich ring terminal between washers

1.4 Controller Cabinets

1.4.1 Base Mount

- DO NOT use grounding electrode (ground rod) or Ufer ground
- Connect Equipment Grounding Conductor (EGC) between cabinet and metered service
 - Use at least 6 gauge, insulated, green, stranded copper
 - Connect to cabinet's ground bus bar
 - Rout to metered service and connect to its ground bus bar

1.4.2 Pole Mount

- DO NOT intentionally bond cabinet to pole (this will cause a ground loop [noise])
- Connect Equipment Grounding Conductor (EGC) between cabinet and metered service
 - Use at least 6 gauge, insulated, green, stranded copper
 - Connect to cabinet's ground bus bar
 - Rout to metered service and connect to its ground bus bar

1.5 Pole Mount Apparatuses

1.5.1 Auxiliary Equipment, Metal Cabinets

- Connect Equipment Grounding Conductor (EGC) between cabinet and pole, these cabinets are getting power from the traffic signal cabinet (sub-panel) need to equalize potential between the cabinet and pole.
 - Use at least 10 gauge, insulated, green, stranded copper
 - Connect to cabinet's internal panel/rack that is bonded to the cabinet's shell

- Connect to ground point (i.e. anchored/bonded stud) of pole using properly crimped ring terminal (see section 1.2)*
 - Remove all paint/coating to bare metal
 - Sandwich ring terminal between washers
- If cabinet has nominal AC supplied as a sub-service (i.e. from controller cabinet)
 - Make sure sub-service's equipment ground is ISOLATED from the cabinet's shell and panel/rack (i.e. use plastic outlet box)
 - Connect EGC between isolated outlet(s) and sub-service source using at least 10 gauge, insulated, green, stranded copper
 - Sub-service's EGC (i.e. EGC from controller cabinet) and pole's EGC must go to the same metered service
- If cabinet has nominal AC supplied from metered service
 - Connect EGC between cabinet and metered service
 - Use at least 10 gauge, insulated, green, stranded copper
 - Connect to cabinet's panel/rack
 - Rout to metered service and connect to its ground bus bar
 - Cabinet's EGC and pole's EGC must go to the same metered service

1.5.2 Solar Powered Equipment, Metal Cabinets

- Connect Equipment Grounding Conductor (EGC) between cabinet and pole
 - Use at least 10 gauge, insulated, green, stranded copper
 - Connect to cabinet's internal panel/rack that is bonded to the cabinet's shell
 - Connect to ground point (i.e. anchored/bonded stud) of pole using properly crimped ring terminal*
 - Remove all paint/coating to bare metal
 - Sandwich ring terminal between washers
- Pole must be grounded (see section 1.3)

1.5.3 Cameras, Radios/Antennas, Street Lighting and Lighted Signs

- Connect Equipment Grounding Conductor (EGC) between apparatus (camera, radio/antenna, light, sign, etc.) and ground point (i.e. anchored/bonded stud)
 - Use at least 14 gauge, stranded copper
 - Connect to apparatus's grounding point
 - Connect to ground point (i.e. anchored/bonded stud) of pole using properly crimped ring terminal (see section 1.2)*
 - Remove all paint/coating to bare metal
 - Sandwich ring terminal between washers
- If apparatus is AC powered then power source must originate from same metered service where pole's EGC is terminated

1.5.4 Variable Message Sign

- If Variable Message Sign (VMS) has nominal AC supplied as a sub-service (i.e. from controller cabinet)
 - DO NOT intentionally bond sign to pole
 - Connect Equipment Grounding Conductor (EGC) between sign's power panel and sub-service source using at least 10 gauge, insulated, green, stranded copper
 - Sub-service's EGC (i.e. EGC from controller cabinet) and pole's EGC must go to the same metered service
- If sign has nominal AC supplied from metered service
 - Connect EGC between sign and pole
 - Use at least 10 gauge, insulated, green, stranded copper
 - Connect to ground point of sign's power panel
 - Connect to ground point (i.e. anchored/bonded stud) of pole using properly crimped ring terminal (see section 1.2)*
 - Remove all paint/coating to bare metal
 - Sandwich ring terminal between washers
 - Connect EGC between sign and metered service
 - Use at least 10 gauge, insulated, green, stranded copper
 - Connect to ground point of sign's power panel
 - Rout to metered service and connect to its ground bus bar
 - Sign's EGC and pole's EGC must go to the same metered service

2.0 Previously Constructed Grounding Methods

2.1 Metered Service

- Conflicting grounding methods in the "Colorado Springs Utilities Electric Line Extensions & Service Standards" document from CSU supercede this section (section 2.1)
- Mandatory – for all poles and cabinets with Equipment Grounding Conductors (EGCs) that connect to the service, DISCONNECT all grounding electrodes (ground rods) NOT connected directly to the service to eliminate parallel ground paths (ground loops)
- Mandatory – install at least one grounding electrode with Grounding Electrode Conductor (GEC) connected to service
- Suggested – install two grounding electrodes, at least six feet apart
 - GEC from the grounding electrodes to the service should be at least 6 gauge, stranded copper
 - Measure grounding effectiveness of interconnected grounding electrodes using an earth ground meter
 - If greater than 25Ω then install up to two additional grounding electrodes (maximum of four) at least six feet apart

2.2 Metal Poles with Nominal Voltage (50-120VAC) Apparatuses

- Mandatory if possible – if not grounded via Ufer ground of the foundation, then install at least one grounding electrode (ground rod) and bond it to the pole
- Suggestion – install Equipment Grounding Conductor (EGC) between pole and metered service (see section 1.2)

2.3 Metal Poles with Low Voltage (less than 50V AC/DC) Apparatuses

- Mandatory if possible – if pole has solar panel(s) or is greater than 8 feet tall, then install at least one grounding electrode (ground rod) and bond it to the pole (see section 1.3)

2.4 Controller Cabinets

2.4.1 Base Mount

- Mandatory – DO NOT use grounding electrode (ground rod) or Ufer ground
- Mandatory – connect Equipment Grounding Conductor (EGC) between cabinet and metered service
 - Use insulated, green, stranded copper
 - Connect to cabinet's ground bus bar
 - Rout to metered service and connected to its ground bus bar

2.4.2 Pole Mount

- Mandatory – DO NOT use grounding electrode (ground rod) or Ufer ground
- Mandatory – DO NOT intentionally bond cabinet to pole
- Mandatory – connect Equipment Grounding Conductor (EGC) between cabinet and metered service
 - Use insulated, green, stranded copper
 - Connect to cabinet's ground bus bar
 - Rout to metered service and connected to its ground bus bar

2.5 Pole Mount Apparatuses

2.5.1 Auxiliary Equipment, Metal Cabinets

- Mandatory – If cabinet has nominal AC supplied as a sub-service (i.e. from controller cabinet)
 - DO NOT use grounding electrode (ground rod) or Ufer ground
 - DO NOT intentionally bond cabinet to pole
 - Make sure sub-service's equipment ground is connected to cabinet's outlet (outlet in the auxiliary cabinet) using insulated, green, stranded copper
- Suggestion – ground as per section 1.5.1

2.5.2 Solar Powered Equipment, Metal Cabinets

- Suggestion – ground as per section 1.5.2

2.5.3 Cameras, Radios/Antennas, Street Lighting and Lighted Signs

- Suggestion – ground as per section 1.5.3

2.5.4 Variable Message Sign

- Suggestion – ground as per section 1.5.4

Multiple conductors may be crimped in a ring terminal if manufactures crimping recommendations are followed