

TYPICAL GROUNDING DIAGRAM  
INTERSECTION WITH ADVANCE WARNING SIGNALS

DIAGRAM 'A'

TYPICAL AAWD INTERSECTION WIRING DIAGRAM

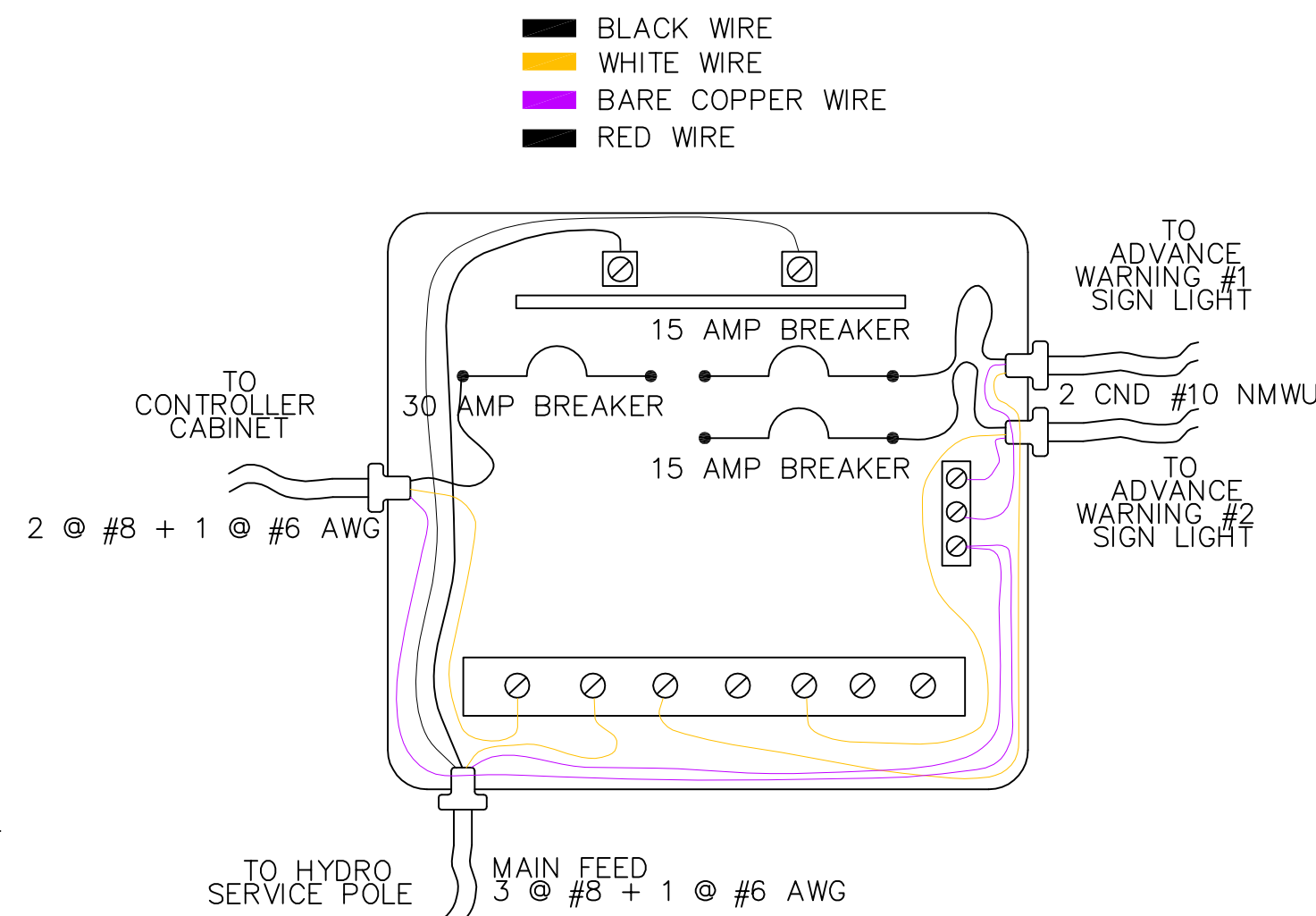
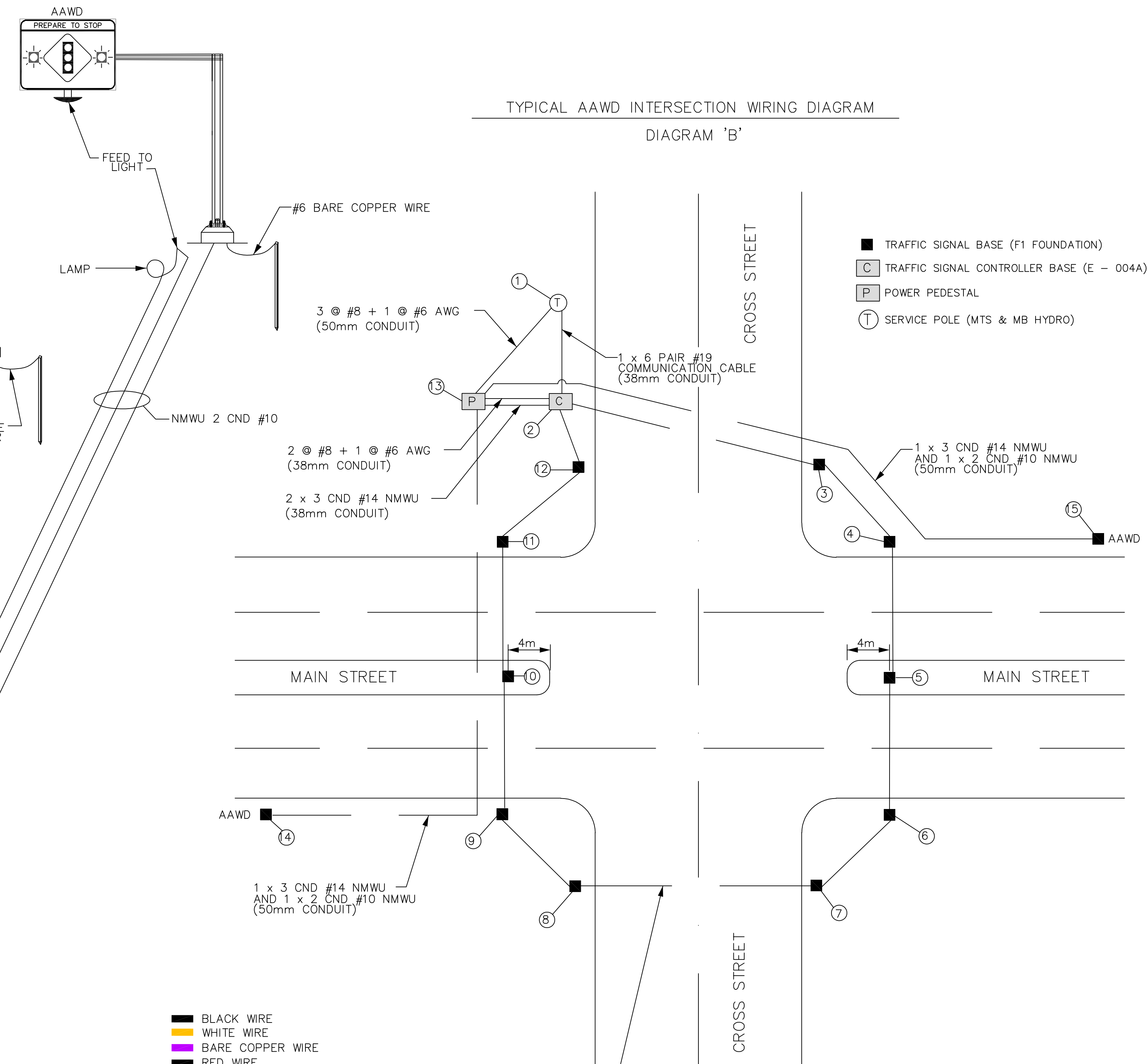
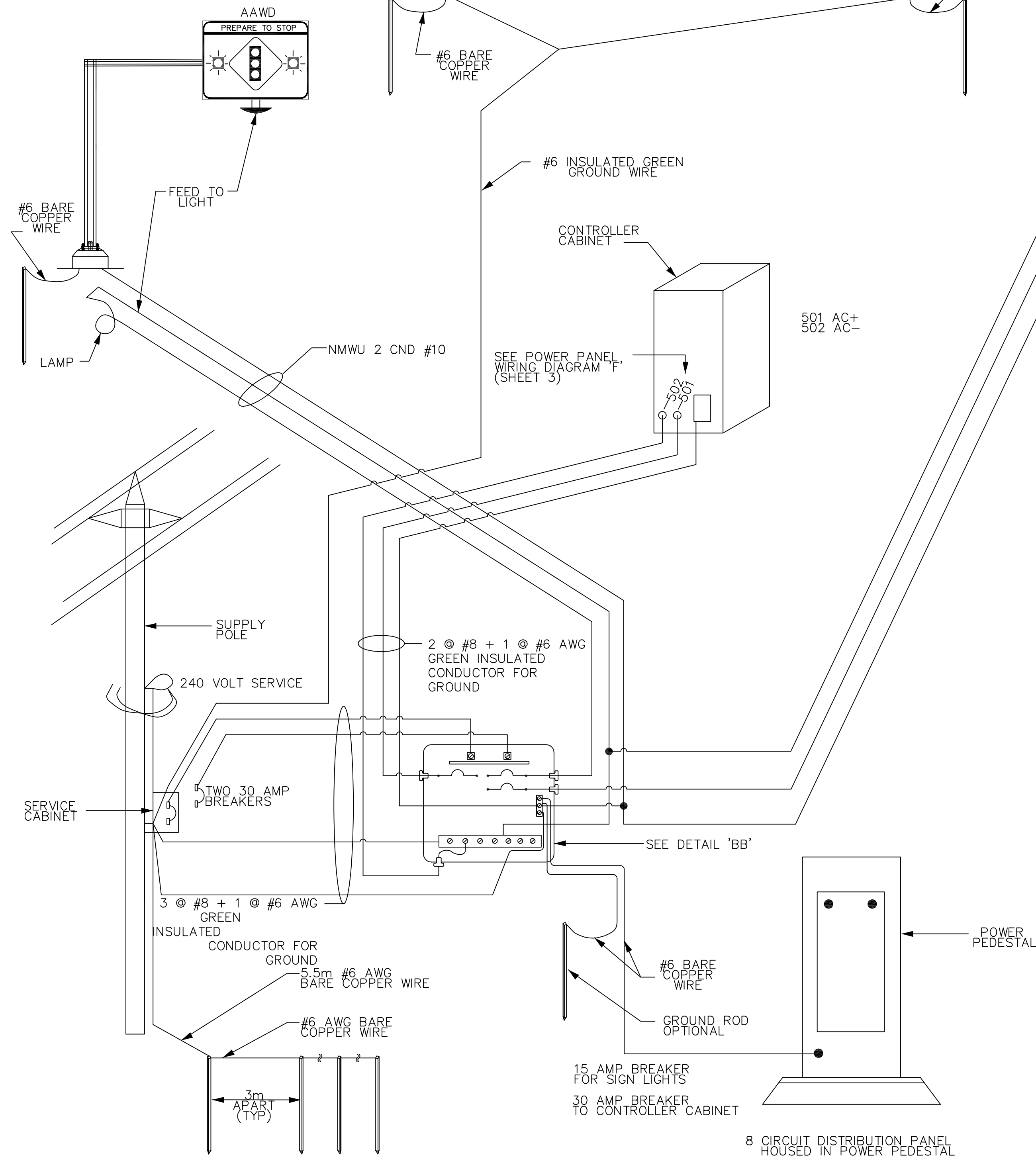
DIAGRAM 'B'

GROUND ROD  
19mm x 3m COPPER COATED

DETAIL 'AA'  
TYPICAL

NOTES:

- Four ground rods to be installed at the service switch.
- Bond conductors installed in raceways shall be insulated, if the raceway exceeds two quarter beneath or fifteen meters in length.
- Manitoba Hydro must inspect, approve and stamp power pedestals prior to installation.



DETAIL 'BB'  
8 CIRCUIT DISTRIBUTION PANEL WIRING



| REVISIONS | DATE         | BY      | DESCRIPTION                |
|-----------|--------------|---------|----------------------------|
|           | APR.12, 2010 | WDD/SDB | ISSUED FOR CONSTRUCTION    |
|           | APR.19, 2010 | WDD/SDB | RE-ISSUED FOR CONSTRUCTION |

**Manitoba**

TRAFFIC ENGINEERING

TYPICAL TRAFFIC SIGNAL SPECIFICATIONS WITH ADVANCE WARNING FLASHERS

|                 |         |
|-----------------|---------|
| SCALE:          | N.T.S.  |
| DATE:           | 08 2009 |
| PREPARED BY:    | D.G.C.  |
| REGION:         | N/A     |
| TRAFFIC SIGNALS |         |
| SHEET 1 OF 4    |         |
| T0-057a         |         |

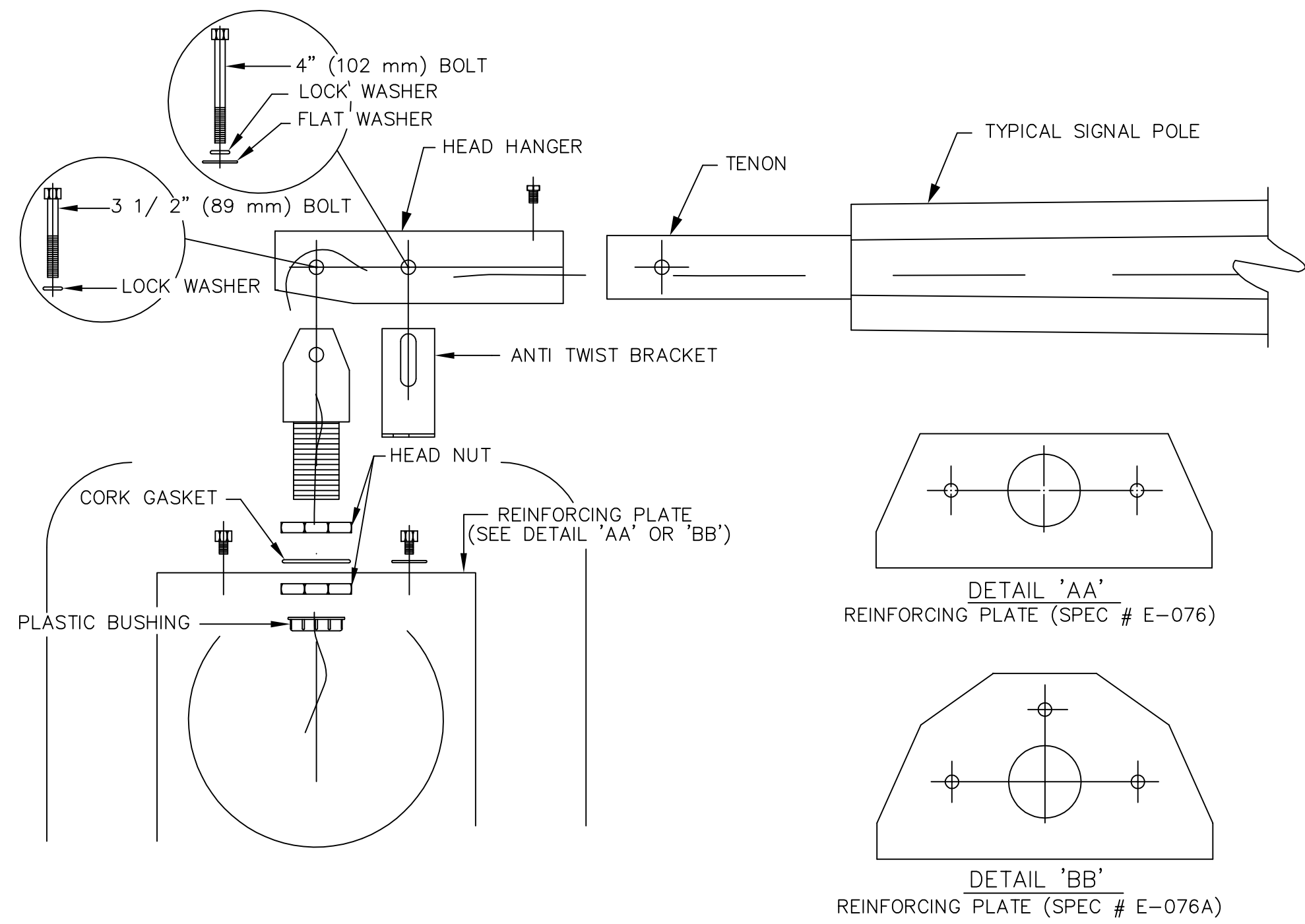


DIAGRAM DEPICTING 7 CONDUCTOR RISER CABLE EXITING POLE & ENTERING SIGNAL DISPLAYS

DIAGRAM 'C'

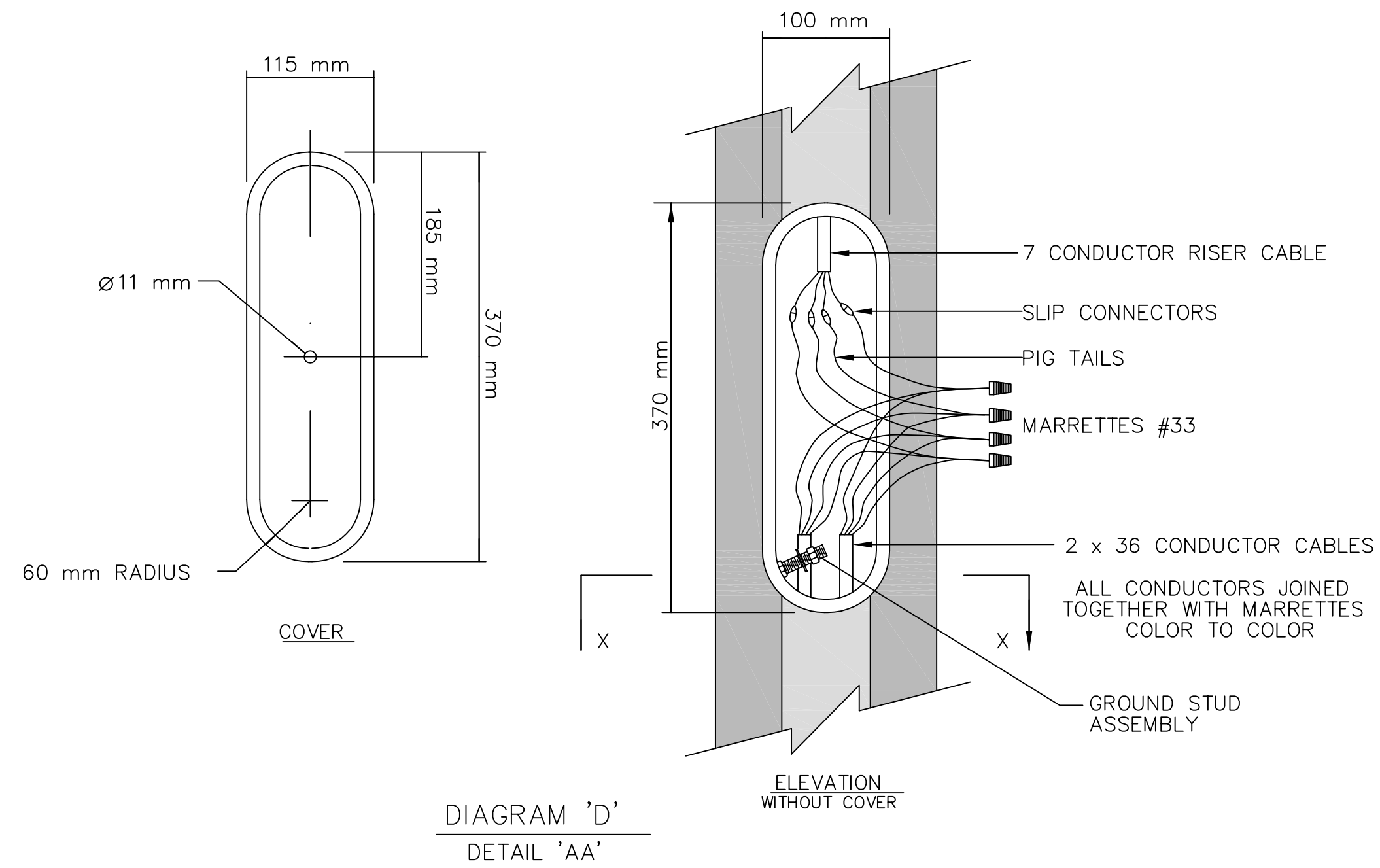
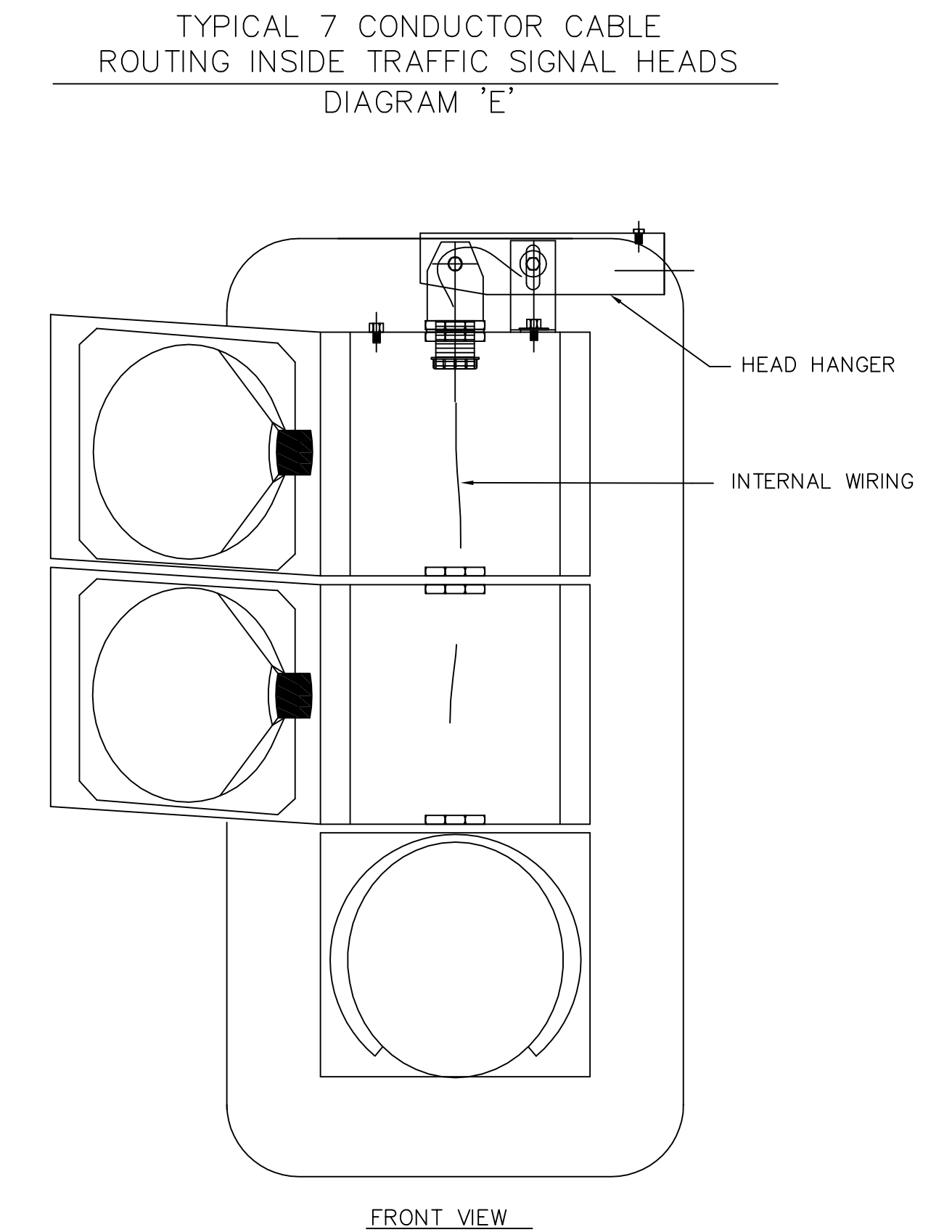


DIAGRAM 'D' DETAIL 'AA'



FRONT VIEW

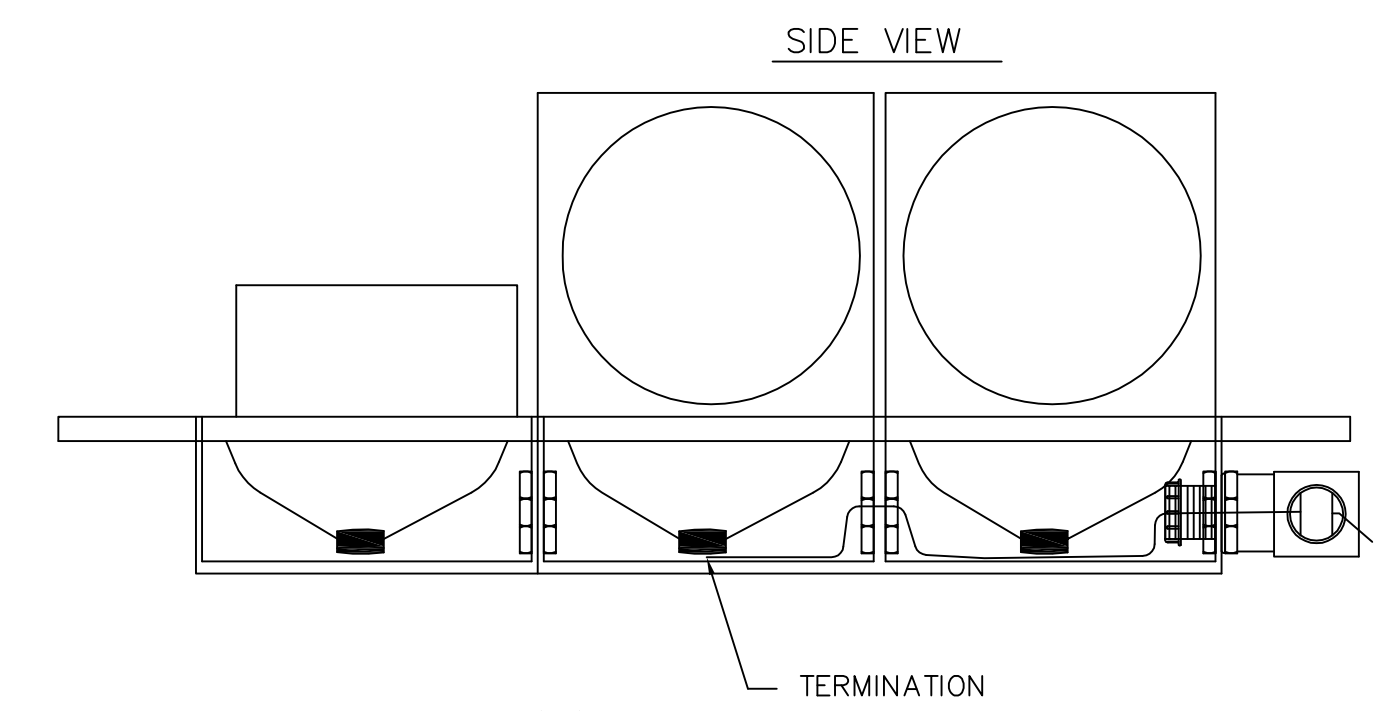


DIAGRAM 'E' DETAIL 'AA'

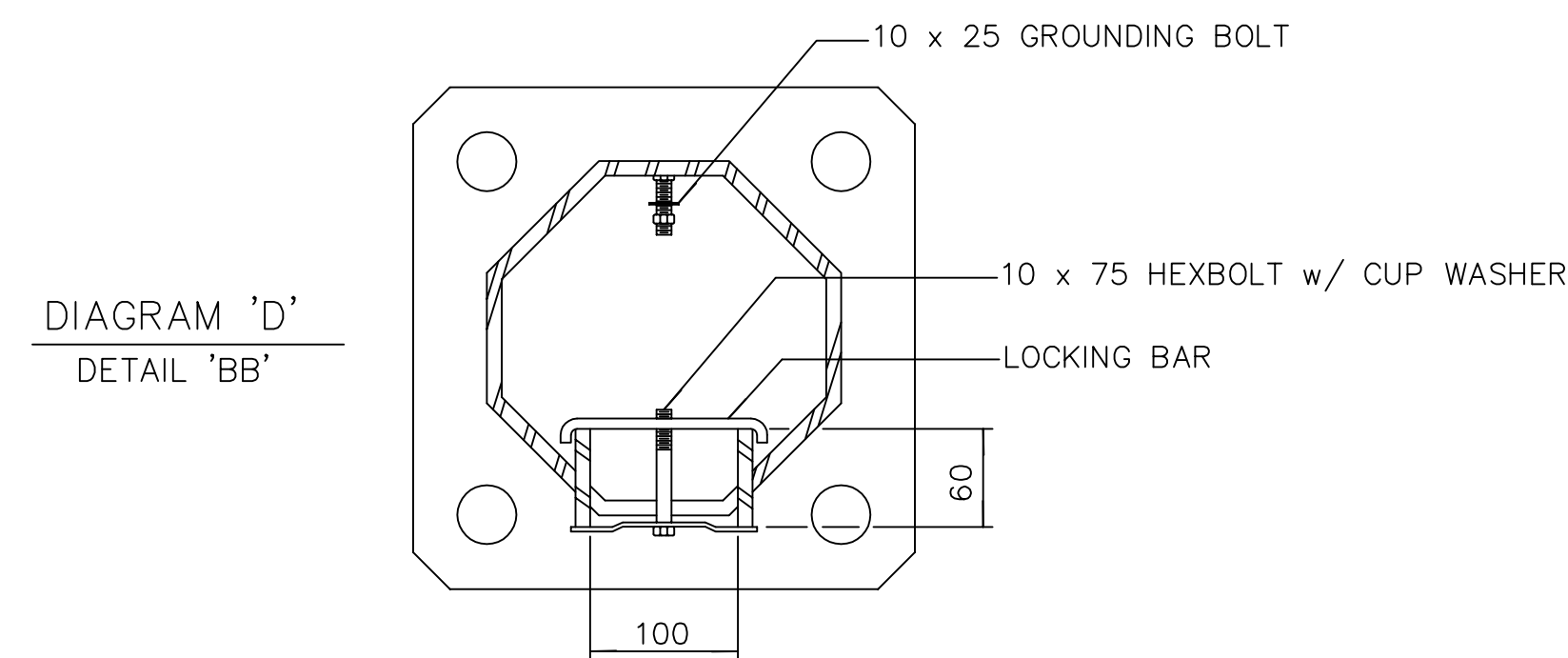


DIAGRAM 'D' DETAIL 'BB'

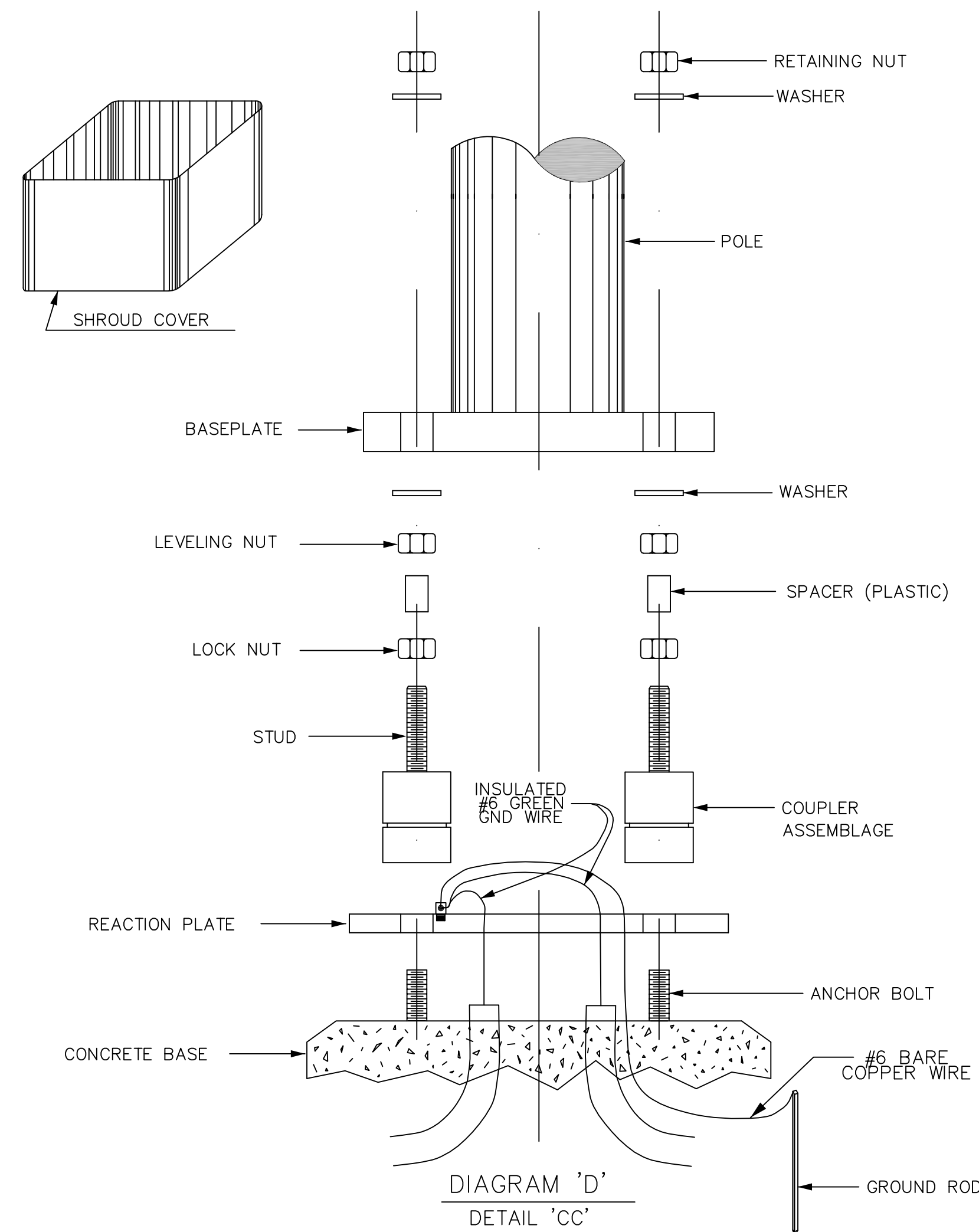
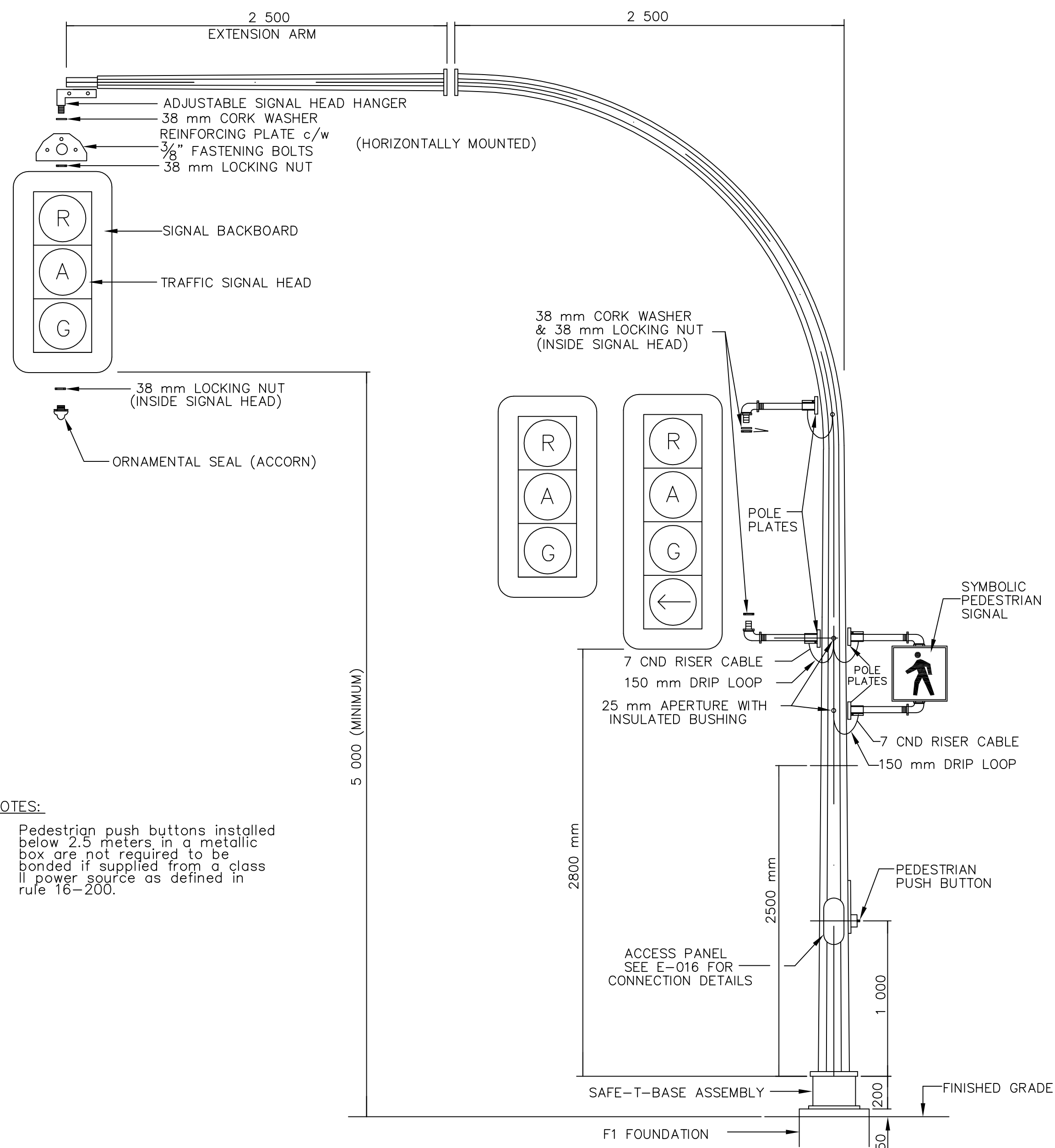


DIAGRAM 'D' DETAIL 'CC'



NOTES:  
1. Pedestrian push buttons installed below 2.5 meters in a metallic box are not required to be bonded if supplied from a class II power source as defined in rule 16-200.

Cable, control, traffic signal, 14 AWG solid copper, 7 conductors, 0.045 PVC jacket with 0.025 P.E. insulation, color coded RED / ORANGE / BLACK / BLUE / WHITE / VIOLET / WHITE-BLACK with the first color being the base and the second color the tracer, latest I.M.S.A. spec 19-1, 7 conductor cable used to control displays of traffic signal heads.



| REVISIONS | DATE         | BY     | DESCRIPTION                |
|-----------|--------------|--------|----------------------------|
|           | APR.12, 2010 | WCD/SB | ISSUED FOR CONSTRUCTION    |
|           | APR.19, 2010 | WCD/SB | RE-ISSUED FOR CONSTRUCTION |

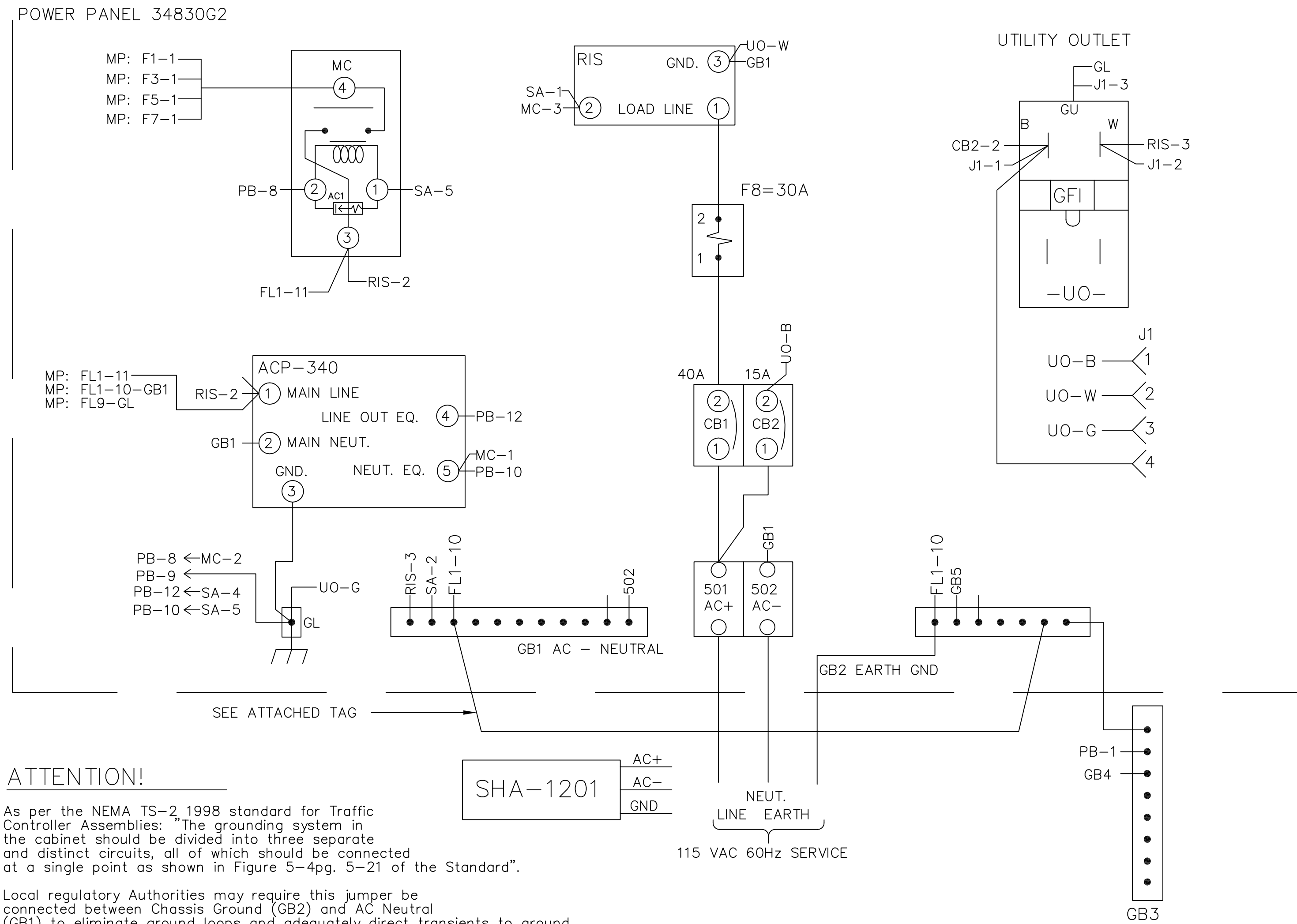
**Manitoba**

TRAFFIC ENGINEERING

**TYPICAL TRAFFIC SIGNAL SPECIFICATIONS WITH ADVANCE WARNING FLASHERS**

|                 |         |
|-----------------|---------|
| SCALE:          | N.T.S.  |
| DATE:           | 08 2009 |
| PREPARED BY:    | D.G.C.  |
| REGION:         | N/A     |
| TRAFFIC SIGNALS |         |
| SHEET 2 OF 4    |         |
| T0-057a         |         |

CONTROLLER CABINET POWER PANEL WIRING  
DIAGRAM 'F'



ATTENTION!

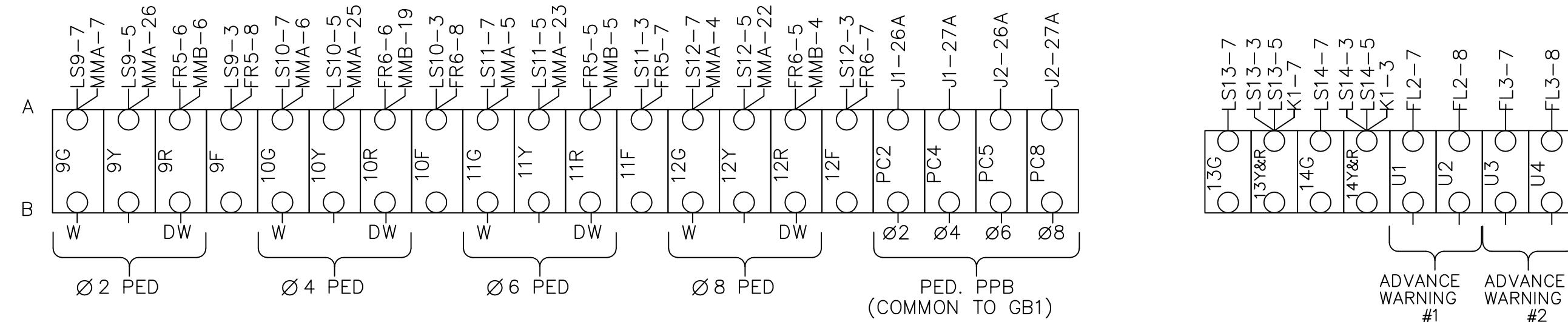
As per the NEMA TS-2, 1998 standard for Traffic Controller Assemblies: "The grounding system in the cabinet should be divided into three separate and distinct circuits, all of which should be connected at a single point as shown in Figure 5-4pg. 5-21 of the Standard".

Local regulatory Authorities may require this jumper be connected between Chassis Ground (GB2) and AC Neutral (GB1) to eliminate ground loops and adequately direct transients to ground.

Typical Wiring Setup for 36 Conductor Cable

|                            |  |  |
|----------------------------|--|--|
| Phase 1:                   | Left Turn Green Arrow<br>Left Turn Amber Arrow<br>Red Ball | White - Black Conductor<br>Black Conductor<br>Red - White Conductor          |
| Phase 2:                   | Green Ball<br>Amber Ball<br>Red Ball                       | White - Green Conductor<br>White - Orange Conductor<br>White - Red Conductor |
| Phase 3:                   | Left Turn Green Arrow<br>Left Turn Amber Arrow<br>Red Ball | Green - White Conductor<br>Black - White Conductor<br>Blue - White Conductor |
| Phase 4:                   | Green Ball<br>Amber Ball<br>Red Ball                       | Green - Blue Conductor<br>Green - Orange Conductor<br>Green - Red Conductor  |
| Phase 5:                   | Left Turn Green Arrow<br>Left Turn Amber Arrow<br>Red Ball | Blue - Green Conductor<br>Blue - Orange Conductor<br>Blue - Red Conductor    |
| Phase 6:                   | Green Ball<br>Amber Ball<br>Red Ball                       | Red - Green Conductor<br>Red - Orange Conductor<br>Red Conductor             |
| Phase 7:                   | Left Turn Green Arrow<br>Left Turn Amber Arrow<br>Red Ball | Black - Green Conductor<br>Black - Orange Conductor<br>Black - Red Conductor |
| Phase 8:                   | Green Ball<br>Amber Ball<br>Red Ball                       | Orange - Green Conductor<br>Orange Conductor<br>Orange - Red Conductor       |
| Phase 2 Pedestrian Signal: | Walk<br>Don't Walk   | Blue - Black Conductor<br>Blue Conductor                                     |
| Phase 4 Pedestrian Signal: | Walk<br>Don't Walk   | Orange - Blue Conductor<br>Orange - White Conductor                          |
| Phase 6 Pedestrian Signal: | Walk<br>Don't Walk   | Black - Blue Conductor<br>Red - Blue Conductor                               |
| Phase 8 Pedestrian Signal: | Walk<br>Don't Walk   | Orange - Black Conductor<br>Red - Black Conductor                            |
| Neutral:                   |  | White 10 AWG Conductor   |
| Equipment Ground:          |  | Green - Black Conductor  |
| Spare Unused Conductors:   |  | Green Conductor<br>White - Blue Conductor                                    |

CONTROLLER CABINET FIELD OUTPUT TERMINALS  
DIAGRAM 'G'



FIELD TERMINALS  
(COMMONS TO GB1)

Cable, control, traffic signal, 36 conductor.  
Note: All conductors shall be #14AWG, except the white. The white conductor (neutral) shall be #10 AWG stranded copper. The first color in the base color, the second color in the tracer color.

0.045 PVC jacket with 0.025 P.E. insulation, 1" M<sup>3</sup> S<sup>3</sup> A Spec 19-1, color coded as follows:

WHITE / GREEN-BLACK / RED / ORANGE / GREEN /  
RED-WHITE / BLACK / WHITE-BLACK / BLUE-WHITE /  
BLACK-WHITE / GREEN-WHITE / BLACK-RED / BLUE-RED /  
RED-GREEN / BLUE / BLUE-BLACK / RED-BLACK /  
ORANGE-BLACK / ORANGE-GREEN / WHITE-RED /  
ORANGE-RED / BLACK-GREEN / WHITE-GREEN /  
GREEN-ORANGE / RED-BLUE / BLACK-ORANGE /  
BLACK-BLUE / WHITE-ORANGE / WHITE-BLUE /  
RED-ORANGE / ORANGE-WHITE / ORANGE-BLUE /  
RED-GREEN / GREEN-BLUE / BLUE-ORANGE / BLUE-GREEN

Example: Base color-tracer color black-white



| REVISIONS | DATE         | BY     | DESCRIPTION                |
|-----------|--------------|--------|----------------------------|
|           | APR.12, 2010 | WCD/SB | ISSUED FOR CONSTRUCTION    |
|           | APR.19, 2010 | WCD/SB | RE-ISSUED FOR CONSTRUCTION |

**Manitoba**

TRAFFIC ENGINEERING

**TYPICAL TRAFFIC SIGNAL SPECIFICATIONS WITH ADVANCE WARNING FLASHERS**

|                 |         |
|-----------------|---------|
| SCALE:          | N.T.S.  |
| DATE:           | 08 2009 |
| PREPARED BY:    | D.G.C.  |
| REGION:         | N/A     |
| TRAFFIC SIGNALS |         |
| SHEET 3 OF 4    |         |
| T0-057a         |         |



## Typical Grounding and Wiring for a Highway Intersection with Advance Warning Signals

### NOTES:

- Four (4) ground rods shall be installed at the supply cabinet. Spacing shall be as follows – first ground rod shall be 5.5m from the supply cabinet, remaining three (3) rods shall be located 3m from each other either in a line pattern or in a square pattern with no rod being closer than the 5.5m from the supply pole and bonded to the ground lug in the service box by a #6 bare copper stranded wire (Diagram A).
- A ground rod at the distribution pedestal is not required if the pedestal is located within 3m of the power supply cabinet. If a ground rod is required it will be as Diagram A.
- The supply cabinet shall be located at a minimum distance of 10m from the traffic controller cabinet and 5.5m from the supply ground rods.
- Each pole in the traffic intersection is to be grounded using one (1) ground rod (Diagram A).
- All ground wires in the system are to be #6 AWG, insulated inside the conduits and bare copper direct buried.
- A #6 green insulated ground wire bonds all poles, power pedestal and power supply together (Diagram A).
- On poles not containing breakaway bases (Diagram D– Details 'AA' & 'BB'), the #6 green insulated and the #6 bare copper wires are attached to the ground stud either at the edge of the hand access hole (Detail 'AA') or at the back of the pole (Detail 'BB') depending on type of pole.
- On poles containing a breakaway base (Diagram D – Detail 'CC'), the #6 bare copper and #6 green insulated wires are attached to the reaction plate by means of a ground lug which is drilled and tapped into the plate.
- The breakaway base assembly then forms a mechanical grounding bond between the reaction plate and the pole (this is done to prevent cable shearing when pole is hit by vehicle).
- Breakaway bases only to be used when deemed safe to do so.
- A 36 conductor (Diagram B) is installed originating at the controller and going through poles 3 to 12 and then back to controller.
- A continuous loop of 36 conductor cable is installed for accident purposes. If an accident occurs during winter months causing damage to one stretch of 36 conductor cable, the damaged stretch may be disconnected while still maintaining a power source to each pole.
- Typical wiring configuration for the 36 conductor cable (Sheet 3). The green – black conductor is the equipment ground and is hooked up continuous around the intersection but not bonded to the reaction plates or ground studs in the poles.
- The green – black wire is grounded only at the controller (GB3 – Diagram F).
- The 36 conductor cables are joined together at each pole – color to color by means of marrettes at the hand access hole (Diagram D – Detail 'AA'). All conductors are terminated.
- The 36 conductor cable originates at the controller output terminals (Diagram G) and is wired according to the 36 conductor wiring setup and forms a complete loop around the intersection.
- At each pole's hand access hole where the two 36 conductor cables are terminated, appropriate pigtails with female slip connectors are added to the proper phase or vehicle movement wire colors.
- A 7 conductor riser cable (Diagram E– Detail 'AA') is then attached to the pigtails on the 36 conductors (Diagram D – Detail 'AA') by means of male slip connectors and routed through the pole (Diagram C) to control the traffic signal displays.
- All traffic signal equipment shall be grounded to the equipment ground to ensure safety of maintenance staff.
- Grounding is done by bonding the white – black conductor of the 7 conductor cable to the signal display head, and connecting it to the green – black conductor in the 36 conductor cable (equipment ground), but not to the system ground (#6 insulated green wire).
- The violet conductor in the 7 conductor cable is used to control the green light or walk, the orange conductor the amber light, the red conductor the red light or don't walk and the white conductor is the neutral. The black and blue conductors are for directional arrows.
- A 6 twisted pair 19 gauge communication cable is also installed around the intersection (Diagram B), and is used to control low voltage audible devices or ground contact closure push buttons.
- The drain wire and cable shield on the communication cable are bonded together at each pole and made continuous around intersection, but are only grounded at the controller GB3 (Diagram F).
- A grounding electrode or rod is installed at each Advance Warning (AAWD) Signal pole, and is bonded to the pole ground stud by a #6 bare copper stranded wire.
- There is no #6 green insulated ground wire installed between the AAWD and the controller.
- A 2 conductor #10 NMWU cable is installed from the distribution panel (Diagram A – Detail 'BB') to feed the sign illumination lamp at the AAWD. The bare copper conductor in the 2 conductor is attached to the ground lug in the distribution panel and to the AAWD pole ground stud.
- A 3 conductor #14 NMWU cable is also installed from the controller, through the power pedestal (Diagram B), and terminated in the AAWD pole to control the sign flashing signals. The bare copper conductor is attached to GB2 (Diagram F) and the AAWD pole ground stud.
- 2 @ #8 with 1 @ #6 insulated ground cable are installed between the power pedestal and the controller cabinet to supply power to the controller from the distribution panel. The #6 insulated ground conductor is attached to the ground lug in the distribution panel and to GB2 (Diagram F) in the controller cabinet.
- 3 @ #8 with 1 @ #6 insulated ground cable are installed between the service box on the supply pole (Diagram A) and the distribution panel in the power pedestal.
- The neutral bar in the service box is bonded to the ground lug.
- The #6 insulated ground conductor is attached to the ground lug at the service point and to the ground lug in the distribution panel.
- The neutral bars in the distribution panel and in the controller cabinet are not bonded to ground. This is only done at the service point.
- The jumper wire between GB1 and GB2 (Diagram F) is removed.
- The #6 bare copper stranded wire can be attached to the ground rods or electrodes by bolted clamp or copper welding by thermit process.



| REVISIONS<br><table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">DATE</th> <th style="width: 10%;">BY</th> <th style="width: 80%;">DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td>APR-12, 2010</td> <td>WCD/SB</td> <td>ISSUED FOR CONSTRUCTION</td> </tr> <tr> <td>APR-19, 2010</td> <td>WCD/SB</td> <td>RE-ISSUED FOR CONSTRUCTION</td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> | DATE         | BY              | DESCRIPTION                | APR-12, 2010 | WCD/SB | ISSUED FOR CONSTRUCTION | APR-19, 2010 | WCD/SB | RE-ISSUED FOR CONSTRUCTION |  |  |  | <p><b>Manitoba</b></p> <p>TRAFFIC ENGINEERING</p> | SCALE: N.T.S.<br>DATE: 08 2009<br>PREPARED BY: D.G.C.<br>REGION: N/A |
|---|--------------|-----------------|----------------------------|--------------|--------|-------------------------|--------------|--------|----------------------------|--|--|--|---|--|
|   | DATE         | BY              | DESCRIPTION                |              |        |                         |              |        |                            |  |  |  |   |  |
|   | APR-12, 2010 | WCD/SB          | ISSUED FOR CONSTRUCTION    |              |        |                         |              |        |                            |  |  |  |   |  |
|   | APR-19, 2010 | WCD/SB          | RE-ISSUED FOR CONSTRUCTION |              |        |                         |              |        |                            |  |  |  |   |  |
|   |              |                 |                            |              |        |                         |              |        |                            |  |  |  |   |  |
| <p><b>TYPICAL TRAFFIC SIGNAL SPECIFICATIONS WITH ADVANCE WARNING FLASHERS</b></p>   |              | TRAFFIC SIGNALS |                            |              |        |                         |              |        |                            |  |  |  |   |  |
|   |              | SHEET 4 OF 4    |                            |              |        |                         |              |        |                            |  |  |  |   |  |
|   |              | T0-057a         |                            |              |        |                         |              |        |                            |  |  |  |   |  |