

PLOTTED BY: PAUL R.    PLOTTED DATE: 2016/04/02    PAPER SIZE (AT FULL): ANSI D (22.00" x 34.00 INCHES)  
 FILE: \\FILE-G0C01\DEPT\GO0107 PROGRAM MANAGEMENT & STANDARDS\PMPS DESIGN STANDARDS\7 REFERENCE MATERIAL\24 ELECTRIFICATION\GROUNDING AND BONDING STANDARD DRAWINGS\MXS-000-002.DWG

GENERAL NOTES

1. THESE DRAWINGS ARE PROVIDED FOR INSTRUCTIONAL DESIGN PURPOSES ONLY BASED ON METROLINX GO TRANSIT DESIGN GUIDELINES AND REQUIREMENTS. THE CONSULTANT SHALL VERIFY FOR LOCAL CODE COMPLIANCE, EXISTING SITE CONDITIONS AND INTER DISCIPLINARY DRAWING COORDINATION. ALL DIMENSIONS AND SPECIFICATIONS SHOULD BE VERIFIED BY CONSULTANT AND/OR CONTRACTOR BEFORE ACTUAL CONSTRUCTION BEGINS.
2. THE GROUNDING AND BONDING SYSTEM SHALL COMPLY WITH THE REQUIREMENTS OF THE LATEST REVISION OF THE CANADIAN ELECTRICAL CODE PART 1 AND PART 2, THE ONTARIO ELECTRICAL SAFETY CODE, THE NATIONAL ELECTRICAL CODE, METROLINX GUIDELINES AND THE TECHNICAL AND SAFETY RECOMMENDATIONS OF ANSI, IEEE, EN AND OTHER APPLICABLE LOCAL AND INTERNATIONAL CODES AND STANDARDS.
3. SUGGESTED MANUFACTURERS AND CATALOG NUMBERS FOR STANDARD PRODUCTS ARE PROVIDED HEREIN. ALTERNATIVE MATERIALS MAY BE SUPPLIED, WITH CUT SHEETS SUBMITTED FOR OWNERS APPROVAL PRIOR TO PROCEEDING WITH CONSTRUCTION. ALL MATERIALS SHALL BE CSA APPROVED.
4. PRESCRIBED MATERIALS, CABLES, AND APPURTENANCES SHALL BE COMPLIANT WITH APPLICABLE CSA AND ULC STANDARDS AND SHALL BE CAPABLE OF SUSTAINING SYSTEM SHORT-CIRCUIT CURRENTS FOR UP TO THE TOTAL SWITCH-OFF (TRIP) TIME WITHOUT THERMAL DEGRADATION OR MECHANICAL BREAKDOWN.
5. PER EN50122-1:2011 SECTION 4.1 AND THE LATEST VERSION OF THE METROLINX ELECTRIFICATION PERFORMANCE SPECIFICATIONS (EPS-03000), THE LIMITS OF THE OVERHEAD CONTACT LINE ZONE (OCLZ) ARE CONSIDERED TO BE 4M FROM TRACK CENTRE LINE AT THE TOP OF RAIL (TOR). ANY CONDUCTIVE STRUCTURES OR EQUIPMENT WITHIN THIS ZONE ARE REQUIRED TO BE GROUNDED, WITH THE EXCEPTION OF SMALL CONDUCTIVE PARTS OUTLINED IN EN 50122-1:2011 SECTION 6.3.1.2.
6. ALL DESIGNS PROVIDED HEREIN ARE APPLICABLE ONLY TO MATERIALS AND EQUIPMENT INSTALLED WITH THE OCLZ, AS DEFINED IN NOTE 5.
7. THE GROUNDING AND BONDING EQUIPMENT AND CONNECTIONS ARE SHOWN DIAGRAMMATICALLY ON THE DRAWINGS. THE EXACT LOCATIONS OF CONDUCTORS, GROUND RODS, CONNECTIONS, CONDUITS, ETC. SHALL BE DETERMINED BY THE CONTRACTOR, TAKING INTO ACCOUNT SITE CONDITIONS AND CONSTRAINTS, INCLUDING OTHER EQUIPMENT AND UTILITIES ALREADY LAID.
8. ALL NORMALLY NON-CURRENT CARRYING METALLIC STRUCTURES AND MISCELLANEOUS METALLIC ITEMS WITHIN THE OCLZ (INCLUDING PLATFORM REBAR, STAIRWAYS, HAND RAILS, ELEVATORS, BIKE RACKS, CANOPY COLUMNS, LIGHTING AND CAMERA POLES, ETC.) SHALL BE ISOLATED FROM THE STATIC WIRE AND SHALL BE BONDED DIRECTLY OR INDIRECTLY TO THE GROUND SYSTEM, UNLESS SPECIFIED OTHERWISE. CONNECTIONS AT STRUCTURES AND EQUIPMENT SHALL BE MADE AS INCONSPICUOUS AS PRACTICAL.
9. ALL BURIED CONNECTIONS, INCLUDING CONNECTIONS TO GROUND RODS SHALL BE MADE USING EXOTHERMIC WELD PROCESS (CADWELD "HEAVY DUTY MOLDS" OR APPROVED ALTERNATIVE). ALL ABOVE GROUND CONNECTIONS TO BE COMPRESSION CONNECTED UNLESS OTHERWISE NOTED.
10. ALL GROUNDING WIRES SHALL BE MADE OF BARE STRANDED COPPER, UNLESS OTHERWISE NOTED.
11. BONDS BETWEEN GROUND CONDUCTORS AND EQUIPMENT OR BUILDING STRUCTURE SHALL BE 4/0 AWG BARE COPPER WIRE.
12. ALL EQUIPMENT SUBJECT TO REMOVAL OR RELOCATION FOR THE PURPOSE OF MAINTENANCE OR OPERATION SHALL BE GROUNDED USING BOLT TYPE CONNECTIONS.
13. TWO-HOLE COMPRESSION-TYPE TERMINATION LUGS SHALL BE USED TO CONNECT BONDING CONDUCTORS TO EQUIPMENT ENCLOSURES.
14. CONTACT SURFACES OF EQUIPMENT OR MISCELLANEOUS STEEL SHALL BE SCRAPPED CLEAN TO BRIGHT METAL AND "NO-OX-ID" GREASE OR EQUIVALENT SHALL BE APPLIED BEFORE BOLTING COPPER GROUND LUG OR USING EXOTHERMIC WELD CONNECTION.

15. GROUNDING CONDUCTORS INSTALLED ALONG BEAMS OR COLUMNS SHALL BE RUN ON THE INSIDE OF THE FLANGE, ADJACENT TO THE WEB, WHERE PRACTICAL, AND SHALL BE SUPPORTED WITH CLAMPS. THE CLAMPS SHALL BE BOLT TYPE WITH LOCK TYPE WASHERS.
16. ALL MATERIALS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
17. ALL CONDUIT OPENINGS SHALL BE SEALED WATERTIGHT. CONDUITS MUST BE CAPPED UNTIL GROUNDING CONDUCTORS ARE INSTALLED.
18. REINFORCING STEEL SECTIONS IN CONCRETE STRUCTURES SHALL BE BONDED TO THE GROUNDING SYSTEM WITH MINIMUM 2 (TWO) CONNECTIONS PER SECTION AND SHALL BE CONTINUOUS.
19. ALL GROUNDING AND BONDING CONNECTIONS SHALL BE TESTED BY THE INSTALLER WITH A LOW RESISTANCE OHM-METER AS PER THE LATEST NETA ATS AND IEEE 142. ANY HIGH RESISTANCE CONNECTIONS FOUND SHALL BE CORRECTED BY THE INSTALLER.
20. EXPOSED GROUNDING AND BONDING CONNECTIONS SUCH AS THOSE AT EQUIPMENT, ENCLOSURES, GROUND BUSBARS, AND GROUNDING TESTING WELL STATIONS SHALL BE VISIBLE AND ACCESSIBLE.
21. CONNECTIONS TO REINFORCEMENT STEEL SHALL BE EXOTHERMICALLY WELDED. SPLICES IN GROUNDING CONDUCTORS SHALL NOT BE PERMITTED.
22. EQUIPMENT ENCLOSURE DOORS SHALL BE BONDED WITH FLEXIBLE METAL BONDING STRAPS, INSTEAD OF RELIANCE ON HINGES FOR ELECTRICAL CONTINUITY.
23. NON-BURIED GROUNDING CONDUCTORS SHALL BE PROTECTED AGAINST PHYSICAL DAMAGE AND ACCORDINGLY ROUTED IN CONDUIT, CABLE TRAY SYSTEMS, SYSTEM-WIDE CABLE TROUGHS, OR DUCTBANK SYSTEMS.
24. NON-BURIED CONDUCTORS BETWEEN THE GROUND GRID OR GROUND BUS BAR AND THE GROUNDED EQUIPMENT SHALL BE GREEN INSULATED COPPER WIRE OR CABLE IN NON-METALLIC CONDUIT.
25. WHERE INSULATED CABLES ARE USED, THEY SHALL BE SPECIFIED AND MANUFACTURED IN ACCORDANCE WITH THE APPROPRIATE ELECTRICAL STANDARDS THAT ARE APPLICABLE TO THE WORKING ENVIRONMENT – VOLTAGES, OPERATING AND FAULT CURRENTS – TO WHICH THEY SHALL BE SUBJECTED.
26. AN INSPECTION SHALL BE MADE BY THE DESIGN ENGINEER WITH REGARDS TO ALL THE BURIED CONNECTIONS TO ASSURE CONTINUITY PRIOR TO CONCRETE OR BACKFILL PLACEMENT.
27. WHERE IDENTICAL INSTALLATIONS EXIST, THE FOLLOWING REQUIREMENTS APPLY WHEREVER PRACTICABLE:

a. THE ROUTING OF CONDUIT AND CONDUCTORS BETWEEN STRUCTURES AND ENCLOSURES SHALL NOT DIFFER;

b. CONDUCTOR TERMINATIONS SHALL BE LOCATED IN LIKE MANNER;

c. THE COLOUR OF THE INSULATION JACKET OF INSULATED GROUND CONDUCTORS SHALL BE GREEN;

d. EQUIPMENT BONDING SHALL BE EVALUATED BY EACH SUB-SYSTEM BASED ON THE ELECTRICAL CHARACTERISTICS OF THE PIECE OF EQUIPMENT TO BE GROUNDED.
28. FOR LOCATIONS THAT ARE ACCESSIBLE TO THE PUBLIC, THE FOLLOWING CONSTRAINTS SHALL APPLY TO THE GROUNDING AND BONDING DESIGN:

a. ANCHOR BOLTS AND GROUND LUGS SHALL NOT PROTRUDE IN A MANNER THAT COULD RESULT IN INJURY OR PROPERTY DAMAGE;



b. MATERIALS SHALL BE CONCEALED WHEREVER POSSIBLE;

c. LOCATION OF GROUNDING TESTING WELL STATIONS IN PUBLIC AREAS SHALL BE AVOIDED;

d. TAMPER PROOF HARDWARE SHALL BE USED.

29. UNLESS OTHERWISE NOTED, ALL DRAWINGS ARE NOT TO SCALE.
30. FOR THE PURPOSE OF THIS DRAWING PACKAGE, THE TERM "WIRE" SHALL BE TAKEN TO IDENTIFY A BARE STRANDED COPPER CONDUCTOR.
31. FOR THE PURPOSES OF THIS DRAWING PACKAGE, THE TERM "CABLE" SHALL BE TAKEN TO IDENTIFY A GREEN INSULATED STRANDED COPPER CONDUCTOR.
32. WHERE NOTED THROUGHOUT THE DRAWING PACKAGE, THE CONNECTION BETWEEN EQUIPMENT AND THE GROUND GRID CAN BE MADE DIRECTLY VIA PIGTAIL OR INDIRECTLY THROUGH A HANDHOLE/ENCLOSURE. THE PREFERRED TECHNIQUE SHALL BE BASED ON LOCAL CONDITIONS AS DETERMINED BY DETAIL DESIGN.
33. IN NON-SECURE AREAS THE VISIBILITY OF COPPER WIRE INSTALLED ABOVE GRADE SHOULD BE MINIMIZED TO DISCOURAGE THEFT. AS AN ADDITIONAL DETERRENT, TINNED COPPER WIRES CAN BE UTILIZED IN THESE AREAS.

NOTE:  
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REFERENCE DRAWINGS		ISSUE			REVISIONS			DRAWN BY: RCW 01/22/15	DESIGNED BY: SXF 01/22/15			TRACTION ELECTRIFICATION GROUNDING AND BONDING STANDARD INSTALLATION DESIGN DETAILS GENERAL NOTES					
							CHECKED BY: CTG 01/23/15	APPROVED BY: ZBT 01/23/15									
		2	15/04/06	FINAL DESIGN			SCALE: NTS										
		1	15/03/06	100% DESIGN			FULL SIZE ONLY										
		0	15/02/09	90% DESIGN													
DWG NO.	TITLE	NO.	DATE	ISSUED FOR	REV.	DATE											

CONTRACT NO. RQQ-2011-PP-032	DWG. NO. MXS-000-002	REV. 0	SHEET 2/26
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