



# **STANDARDS**

**for 66kV and Below**



**IMPORTANT**

THESE STANDARDS ARE THE EXCLUSIVE PROPERTY OF  
MANITOBA HYDRO AND ALL RIGHTS ARE RESERVED.  
ANY RELEASE, REPRODUCTION OR OTHER USE THEREOF  
WITHOUT THE EXPRESS WRITTEN CONSENT OF THE  
MANITOBA HYDRO DISTRIBUTION STANDARDS ENGINEER  
IS STRICTLY PROHIBITED.

## GROUNDING

1. USE OF COPPERWELD GROUND RODS

COPPERWELD GROUND RODS SHALL BE USED IN ALL AREAS OF THE PROVINCE ON THE DISTRIBUTION GROUNDING SYSTEM.

CONNECTION TO GROUND RODS

ALL CONNECTIONS TO GROUND RODS SHALL BE MADE USING AN APPROVED CONNECTION. ALL CONNECTIONS SHALL BE INSPECTED TO ASSURE A PROPER CONNECTION HAS BEEN MADE.

2. SEASONAL VARIATIONS OF GROUND RESISTANCE

THE DEPTH OF ALL GROUND RODS SHALL BE SUFFICIENT TO ENSURE ADEQUATE GROUNDING RESISTANCE DURING ALL SEASONS. GROUND RESISTANCE CAN INCREASE DUE TO VARIATIONS IN THE WATER TABLE AND THE DEPTH OF THE FROST. A GROUND ROD LENGTH OF 3 METERS IS MINIMUM.

3. EQUIPMENT, CASES AND CUBICLES

ALL CASES OF DISTRIBUTION APPARATUS INSTALLATIONS, SUCH AS TRANSFORMERS, VOLTAGE REGULATORS, CIRCUIT RECLOSERS, CAPACITORS, CONCENTRIC NEUTRAL/CORRUGATED TAPE SHIELD DIPS AND RISERS, DISTRIBUTION CENTER CUBICLES, JUNCTION POINT CUBICLES, ETC., CONNECTED TO PRIMARY LINES SHALL BE GROUNDED.

4. OVERHEAD NEUTRAL, CONCENTRIC NEUTRAL/CONCENTRIC TAPE SHIELD OF CABLE AND GROUND INTERCONNECTION

THE PRINCIPLE OF RUNNING THE GROUNDING CONDUCTORS IN OPEN VIEW WHERE CONNECTIONS ARE MADE SHALL BE OBSERVED WHENEVER POSSIBLE. THIS APPLIES TO GROUND INTERCONNECTIONS BETWEEN SURGE ARRESTERS, ACRs, CONCENTRIC NEUTRAL/CONCENTRIC TAPE SHIELD OF CABLE, TRANSFORMER BANKS, ETC. THESE GROUNDING CONDUCTOR INTERCONNECTIONS SHALL BE PLAINLY SEEN BY PERSONS WORKING ON THE POLE IN ORDER THAT APPROPRIATE SAFETY MEASURES RELATING TO SECOND POINTS OF CONTACT MAY BE TAKEN. IT ALSO APPLIES WHERE GROUNDING CONDUCTORS ARE RUN TO THE NEUTRAL ON A Z OR XY TYPE LINE AND DIP AND RISER POLES OF THE RUD SYSTEM TAP OFF. REASONABLE SLACKNESS SHOULD BE MAINTAINED IN THESE CONDUCTORS TO PREVENT VIBRATION FAILURE.

5. GROUNDING IN ROCK AREAS

WHERE GROUND CONDITIONS ARE SUCH THAT GROUND RODS CANNOT BE DRIVEN AT TRANSFORMER INSTALLATIONS OR OTHER POINTS WHERE THEY ARE NORMALLY REQUIRED, GROUNDING POINTS SHALL BE ESTABLISHED IN THE NEAR VICINITY.

*SUPERCEDES ORIGINAL SEALED BY E. WIEBE ON 94-07-11*

APPROVED	REVISIONS			MANITOBA HYDRO DISTRIBUTION STANDARDS		
ORIGINAL DRAWING SEALED BY D.R. ORR 15-10-22	15-09	3	REVISED NOTES, RESEALED	<b>GROUNDING</b>		
	00-07	2	NOTE 1 REVISED TO INCLUDE CADWELD			
	98-11	1	ADDED COPPERWELD GROUNDS RODS			
DRAWN C.A.	CHECKED G.D.	DATE 15-09		<b>CD 50-5</b>		SHT 0001 OF 3
						REV 03

6. OVERHEAD MULTIPLE GROUNDED NEUTRAL DISTRIBUTION SYSTEM

AT THE TIME OF CONSTRUCTION USE GN1 ASSEMBLY. THE PREFERRED METHOD OF REDUCING THE GROUND RESISTANCE, IS TO USE DEEP GROUNDING WITH SECTIONAL RODS IN SERIES.

IF AFTER INSTALLATION AND TESTING THE GN1 ASSEMBLY USING DEEP GROUNDING, IT IS OBVIOUS THAT THE REQUIRED 25 OHM RESISTANCE CANNOT BE OBTAINED, USE GN2 OR GN3 ASSEMBLY USING DEEP GROUNDING TO REDUCE RESISTANCE.

IF THE RESISTANCE OF THE SYSTEM GROUND, INCLUDING THE CUSTOMER GROUND WHERE APPLICABLE, EXCEEDS 5 OHMS IN THE SUMMER, WITH ONE GROUND DISCONNECTED, REDUCE THE SYSTEM GROUND RESISTANCE.

7. OVERHEAD EARTH RETURN DISTRIBUTION SYSTEM (Q-LINE)

AT THE TIME OF CONSTRUCTION, USE GN1 AT THE TAP-OFF POLE AND GN1 AT THE TRANSFORMER POLE. IF THE TRANSFORMER IS LOCATED ON A LINE POLE USE GO1. THE GROUNDING INSTALLATIONS SHALL BE THOROUGHLY INSPECTED TO ENSURE QUALITY OF WORKMANSHIP. THE PREFERRED METHOD OF REDUCING THE GROUND RESISTANCE IS TO USE DEEP GROUNDING WITH SECTIONAL RODS IN SERIES.

IF AFTER INSTALLATION AND TESTING OF THE ABOVE GROUND ROD INSTALLATIONS USING DEEP GROUNDING, IT IS OBVIOUS THAT THE REQUIRED 5 OHM RESISTANCE OF THE ASSEMBLIES CANNOT BE OBTAINED, INSTALL A THIRD GN1 ASSEMBLY ONE SPAN AWAY. (REFER TO CD50-15 AND CD50-20 FOR FURTHER DETAILS).

IF THE RESISTANCE OF THE SYSTEM GROUND, INCLUDING THE CUSTOMER GROUND WHERE APPLICABLE, EXCEEDS 5 OHMS IN THE SUMMER WITH ONE GROUND ROD DISCONNECTED, REDUCE THE SYSTEM GROUND RESISTANCE.

8. UNDERGROUND DISTRIBUTION SYSTEM AT TIME OF CONSTRUCTION

AT TIME OF CONSTRUCTION USE GU1 ASSEMBLY AT ALL UNDERGROUND CABLE POLES.

USE Q-LINE GROUNDING STANDARDS AT ALL OVERHEAD TRANSFORMER POLES SUPPLIED FROM THE RUD SYSTEM.

USE GROUND ROD LAYOUT SHOWN IN SECTION 220 OF THIS STANDARD FOR PADMOUNTED EQUIPMENT. THE RESISTANCE OF THE INSTALLATION SHALL BE 5 OHMS OR LESS. THE PREFERRED METHOD OF REDUCING THE GROUND RESISTANCE IS TO USE DEEP GROUNDING WITH SECTIONAL RODS IN SERIES.

THE GROUNDING INSTALLATIONS SHALL BE THOROUGHLY INSPECTED TO ENSURE QUALITY OF WORKMANSHIP.

IF THE RESISTANCE OF THE SYSTEM GROUND, INCLUDING THE CUSTOMER GROUND WHERE APPLICABLE, EXCEEDS 5 OHMS IN THE SUMMER WITH ONE GROUND ROD DISCONNECTED, REDUCE THE SYSTEM GROUND RESISTANCE.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS					
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-11				<b>GROUNDING</b>					
DRAWN R.L.B./CAD	CHECKED	DATE 93-11	<b>CD 50-5</b>		<table border="1"> <tr> <td>SHT</td> <td>REV</td> </tr> <tr> <td>0002 OF 3</td> <td>02</td> </tr> </table>	SHT	REV	0002 OF 3	02
SHT	REV								
0002 OF 3	02								

IF AFTER INSTALLATION AND TESTING OF THE ABOVE GROUND ROD INSTALLATIONS USING DEEP GROUNDING, IT IS OBVIOUS THAT THE REQUIRED 5 OHM RESISTANCE OF THE ASSEMBLIES CANNOT BE OBTAINED, INSTALL MULTI RODS IN PARALLEL USING USING GU2 OR GU3 ASSEMBLIES.

HOWEVER, IF THE SUMMER COMBINED GROUND RESISTANCE OF THE RODS ONLY EXCEED 5 OHMs, GROUNDING SHALL BE IMPROVED TO MEET THE REQUIRED STANDARDS. (REFER TO CD50-15 AND CD50-20 FOR FURTHER DETAILS).

9. REGULATOR NEUTRAL ON Q-LINES

ON 2 AND 3 PHASE LINES, INSTALL A NEUTRAL BETWEEN ALL REGULATORS AND GN1 ASSEMBLY AT EACH REGULATOR. ON SINGLE PHASE LINES, Q-LINES ONLY, INSTALL 1 SPAN OF NEUTRAL ON EACH SIDE OF REGULATOR AND USE GN1 AT EACH GROUNDING POLE AS PER DRAWING CD100-10.

10. INTERCHANGE TRANSFORMERS

AT TIME OF CONSTRUCTION, USE GN1 AT EACH END POLE. THE RESISTANCE OF THE GROUNDING ASSEMBLY AT EACH POLE MUST NOT EXCEED 5 OHMs.

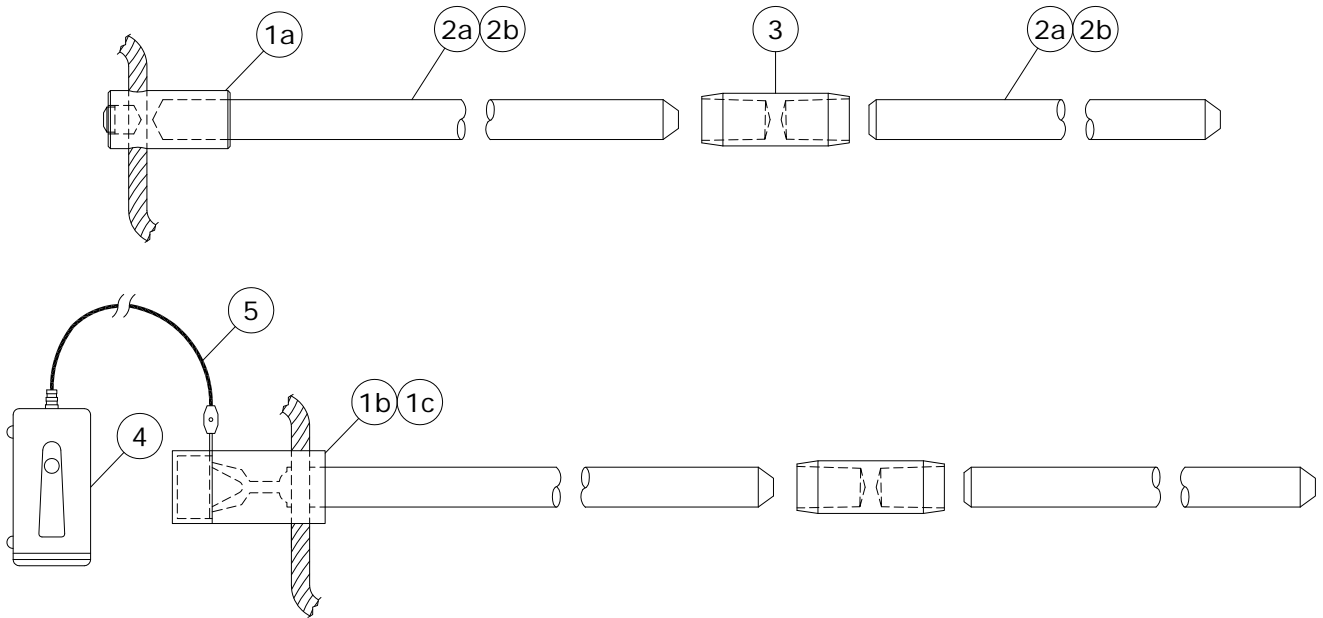
THE PREFERRED METHOD OF REDUCING THE GROUND RESISTANCE IS TO USE DEEP GROUNDING WITH SECTIONAL RODS IN SERIES.

IF AFTER INSTALLATION AND TESTING OF THE GN1 ASSEMBLIES USING DEEP GROUNDING AT EACH POLE, WITH THE OTHER DISCONNECTED, IT IS OBVIOUS THAT THE REQUIRED 5 OHM RESISTANCE OF THE ASSEMBLY CANNOT BE OBTAINED, USE A GN2 OR GN3 ASSEMBLY USING DEEP GROUNDING TO REDUCE RESISTANCE.

11. GROUND TESTING OF NEW AND UPGRADED INSTALLATIONS

ALL GROUND RODS SHALL BE TESTED AND MADE TO COMPLY WITH THIS STANDARD UPON INSTALLATION. TEST RESULTS SHALL BE RECORDED ON TLMS, (TRANSFORMER LOAD MANAGEMENT SYSTEM).

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS		
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-11				<b>GROUNDING</b>		
		00-07	2			NOTES REVISED SHEET 4 DELETED
		98-11	1			NOTES REVISED
DRAWN R.L.B./CAD	CHECKED	DATE 93-11	<b>CD 50-5</b>		SHT 0003 OF 3	REV 02



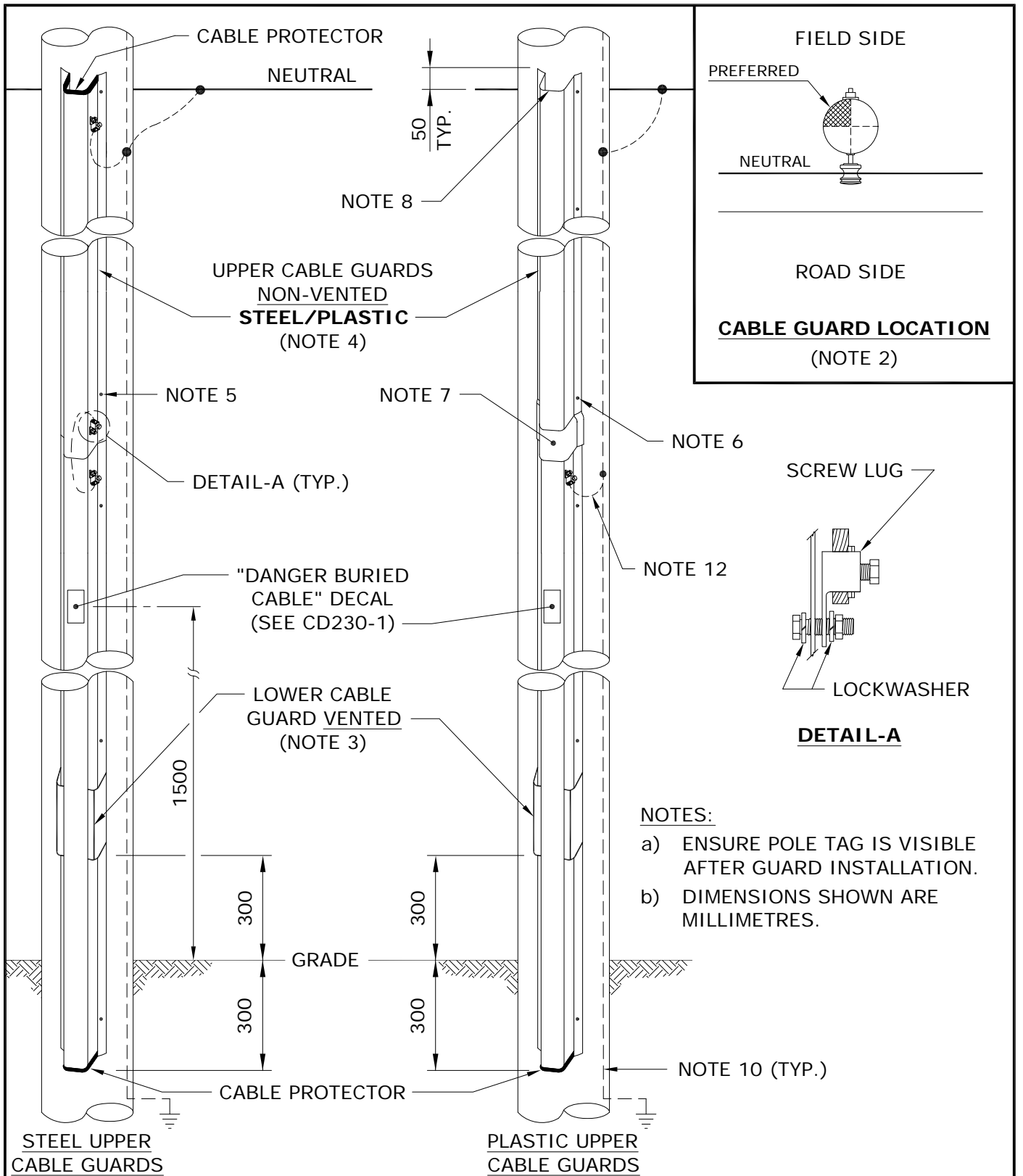
**COPPERWELD - SECTIONAL**

ITEM No.	DESCRIPTION	MH CIIC
1a	HAMMERLOCK FOR #2 & #4 CU	04 60 24
1b	ONE SHOT PLUS FOR 2/0	03 59 15
1c	ONE SHOT PLUS FOR 4/0	03 77 06
2a	10' CU-WELD ROD SECTIONAL (SEE NOTE 2)	71 70 10
2b	6' CU-WELD ROD SECTIONAL	00 68 26
3	COUPLING CU-WELD	00 52 27
4	ELECTRONIC IGNITER FOR ONE SHOT PLUS WITH 15' CORD	03 59 10
5	15' REPLACEMENT CORD	03 67 43

**NOTES:**

- FOR 3/4" GROUND RODS. IF A 5/8" GROUND ROD IS ENCOUNTERED, IT IS TO BE REPLACED WITH A 3/4" ROD.
- FIRST GROUND ROD SHALL BE A 10' ROD.

APPROVED  ORIGINAL DRAWING SEALED BY E.H. WIEBE 99-01-04	REVISIONS			MANITOBA HYDRO DISTRIBUTION STANDARDS	
	13-01	3	ADDED HAMMERLOCK CONNECTOR	<b>GROUND ROD MATERIAL DETAIL</b>	
	08-07	2	ADDED ELECTRONIC IGNITER & REVISED TABLE		
00-08	1	REMOVED STEEL AND GALVANIZED RODS, ONE SHOT ADDED			
DRAWN R.L.B./CAD	CHECKED D.F./D.O.	DATE 98-08	<b>CD 50-7</b>		SHT 0001 OF 1
					REV 03



SUPERCEDES ORIGINAL SEALED BY E. WIEBE ON 94-07-03

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY J.J.D. RINGASH 15-10-29	16-04	4	REVISED NOTE	<b>CABLE GUARD DETAILS ON DIP/RISER POLES</b>	
	15-10	3	ADDED NOTE a), RESEALED		
	99-10	2	PLASTIC CABLE GUARD AND SHEET 2 ADDED		
DRAWN C.A.	CHECKED J.R.	DATE 15-10		<b>CD 200-63</b>	
				SHT	REV
				0001 OF 2	04

NOTES:

1. FOR CABLE GUARD SELECTION GUIDE, REFER TO DRAWING CD200-66.
2. TO PROVIDE A SAFER CLIMBING SURFACE AND TO PREVENT VEHICULAR DAMAGE TO THE CABLE GUARD, THE PREFERRED ATTACHMENT OF THE CABLE GUARD TO THE POLE SHOULD BE IN THE QUADRANT AS SHOWN.
3. THE LOWER CABLE GUARD SHALL BE GALVANIZED STEEL AND VENTED.
4. UPPER CABLE GUARD SHALL BE PLASTIC FOR THE 50mm & 90mm GUARDS AND GALVANIZED STEEL FOR THE 130mm GUARD.
5. ATTACH GALVANIZED STEEL CABLE GUARD TO POLE WITH 3/8" LAG SCREWS (72-60-03).
6. ATTACH THE PLASTIC CABLE GUARD TO THE POLE WITH #16 x 2" WOOD SCREWS (72-95-10), C/W FLAT WASHERS (86-10-04).
7. POSITION THE LAP-JOINT OF THE PLASTIC CABLE GUARD DOWN & OVER LAPPED A MINIMUM OF 25mm ONTO THE VENTED CABLE GUARD.
8. ENSURE THAT THE INNER EDGE IS BEVELLED.
9. CABLE GUARD TO EXTEND 50mm ABOVE THE NEUTRAL CONDUCTOR.
10. GROUNDING AND BONDING CONDUCTORS SHALL BE #4 BARE COPPER.
11. FOR GROUNDING CONNECTIONS, REFER TO DRAWING CD200-60.
12. BOND VENTED CABLE GUARD AT THIS POINT.

*SUPERCEDES ORIGINAL SEALED BY E. WIEBE ON 99-11-03*

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS		
ORIGINAL DRAWING SEALED BY J.J.D. RINGASH 15-10-29				<b>CABLE GUARD DETAILS ON DIP/RISER POLES</b>		
		16-04	2			ADDED FLAT WASHERS TO NOTE 6
		15-10	1			RESEALED
DRAWN C.A.	CHECKED J.R.	DATE 15-10	<b>CD 200-63</b>		SHT 0002 OF 2	
					REV 02	

SECONDARY CABLE	TYPICAL USAGE
#4 AL. CONCENTRIC NEUTRAL	STREET LIGHT CIRCUITS
1/0 AL. TRIPLEX	SECONDARY RESIDENTIAL SERVICES AND HEAVILY LOADED STREET LIGHT CIRCUITS WHERE VOLTAGE DROP MAY BE A PROBLEM
4/0 AL. TRIPLEX	SECONDARY RESIDENTIAL SERVICES
350 TRIPLEX	SECONDARY RESIDENTIAL SERVICES
4/0 AL. TRIPLEX	THREE PHASE SECONDARY SERVICES ADD #2 Cu BARE NEUTRAL UP TO 200 AMP
350 AL. QUADRAPLEX	THREE PHASE SECONDARY SERVICES 400 AMP OR 200A OVER 75m
750 AL. OR 1000 CU.	THREE PHASE SECONDARY SERVICES OVER 400 AMPS

NOTE:

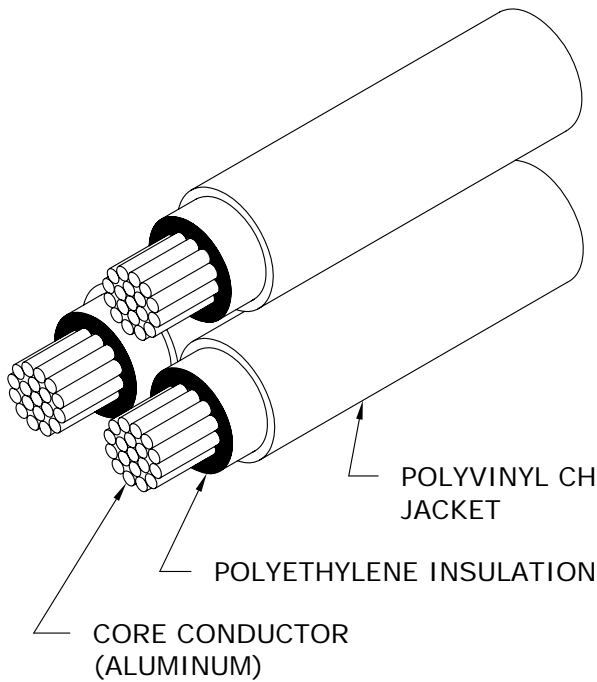
SEE CD225-4 FOR SIZING AND SPACING OF SINGLE AND THREE PHASE CONDUCTORS.

*SUPERCEDES ORIGINAL SEALED BY E. WIEBE ON 88-03-29*

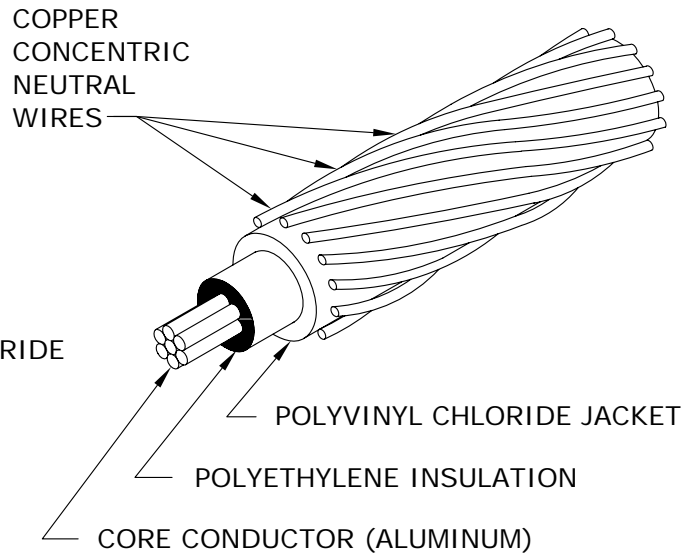
APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY J.J.D. RINGASH 17-01-25	17-01	11	ADDED 4/0 AL TRIPLEX TO TABLE, RESEALED	<b>UNDERGROUND SECONDARY CABLE</b>	
	06-03	10	ADDED NOTE AND 350 TRIPLEX		
	99-04	9	4/0 AL. TRIPLEX, NOTE CHANGED		
DRAWN C.A.	CHECKED K.S.	DATE 17-01	<b>CD 210-12</b>		SHT 0001 OF 2
					REV 11



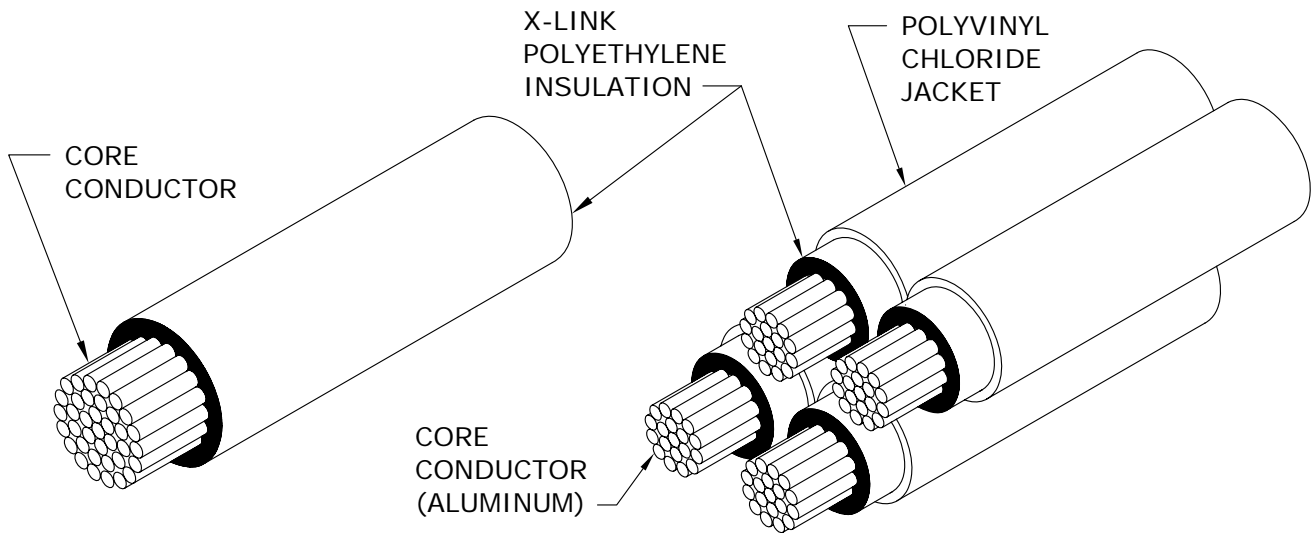
# BASIC CONSTRUCTION OF UNDERGROUND SECONDARY CABLES



**1/0 & 4/0 AND 350 TRIPLEX**



**# 4 CONCENTRIC NEUTRAL CABLE**



**750 kcmil (AL) & 1000 kcmil (CU) RWU**

**350 kcmil QUADRAPLEX**

APPROVED	REVISIONS			MANITOBA HYDRO DISTRIBUTION STANDARDS			
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-03	06-03	2	REPLACED 4/0 TRIPLEX WITH 4/0 & 350 TRIPLEX	<b>UNDERGROUND SECONDARY CABLE</b>			
	95-01	1	C/N WIRES NO LONGER TINNED				
	93-07	0	500 MCM DELETED 350 750 kcmil ADDED FORMERLY CD210-3				
DRAWN W.B./CAD	CHECKED B.H.	DATE 93-07	<b>CD 210-12</b>			SHT 0002 OF 2	REV 02

## UNDERGROUND SECONDARY CABLE

VOLTAGE RATING	600V	600V	600V	600V	1000V	1000V	1000V
CORE CONDUCTOR SIZE	#4	1/0	4/0	350 kcmil	750 kcmil	1000 kcmil	1000 kcmil
CORE CONDUCTOR MATERIAL	ALUM.	ALUM.	ALUM.	ALUM.	ALUM.	ALUM.	COPPER
TYPE OF CABLE	C/N	TRIPLEX	TRIPLEX	TRIPLEX OR QUADPLEX	1-COND.	1-COND.	1-COND.
NEUTRAL SIZE AND TYPE	#6 CU. Concentric Neutral	1/0 ALUM.	4/0 ALUM.	350 kcmil ALUM.	NONE	NONE	NONE
MIN. BENDING RADIUS (mm)	125	115	150	180	250	300	300
DC RESISTANCE @ 20°C (OHMS/km)	1.360	0.538	0.269	0.163	0.076	0.057	0.035
** DIRECT BURIED AMPACITY (@ 20°C ambient)	125	215	300	420	* 725	* 840	* 1080
VENTED CABLE GUARD AMPACITY (@ 20°C ambient)	100	175	250	330	575	680	855
*** BURIED DUCT AMPACITY (@ 20°C ambient)	70	130	195	265	425	495	630
CONDUCTOR DIAMETER (mm)	5.4	8.9	12.7	15.8	25	26.9	26.9
NOMINAL DIA. OVER INSUL. (mm)	8.6	12.5	16.5	21.6	31.4	33.5	33.5
NOMINAL DIA. OVER JACKET (mm)	12.74	14.7	17.8	22.8	N/A	N/A	N/A
LINEAL MASS (kg/km)	N/A	760	1320	2200/2900	1330	1369	4983
COLD SHRINK END CAPS (MH CIIC)	N/A	15 31 40	15 31 40	15 31 60	15 31 75	15 31 75	15 31 75
HEAT SHRINK END CAPS (MH CIIC)	03 67 31	03 67 31	03 67 31	03 67 30	01 79 82	03 48 63	03 48 63

\* PROVIDED MULTIPLE CONDUCTORS PER PHASE ARE SPACED AS SHOWN IN DRAWING CD225-4.

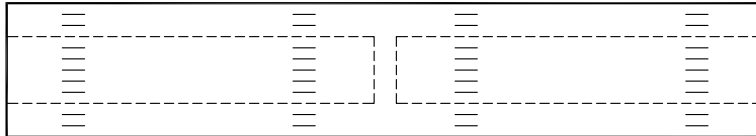
\*\* CABLES DIRECTLY BURIED OUT OF PADMOUNT TRANSFORMERS OR PEDESTALS.

\*\*\* CABLES IN NON-VENTED CABLE GUARDS OR IN CONDUITS LONGER THAN 2 METRES.

*SUPERCEDES ORIGINAL SEALED BY E. WIEBE ON 94-07-03*

APPROVED  ORIGINAL DRAWING SEALED BY J.J.D. RINGASH 16-03-30	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS					
	17-01	5	REVISED TABLE		<b>STANDARD UNDERGROUND SECONDARY CABLE DATA</b>			
	16-03	4	ADDED 1000 kcmil ALUM. COND., REVISED DATE, RESEALED					
08-12	3	ADDED COLD & HEAT SHRINK CAPS AND LINEAL MASS TO TABLE						
DRAWN C.A.	CHECKED J.R.	DATE 16-03		<b>CD 210-15</b>			SHT 0001 OF 1	REV 05

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- FOR SPLICING SECONDARY ALUMINUM/COPPER CONDUCTORS.
- NOT SUITABLE FOR USE ON PRIMARY CONDUCTORS.
- COMPLETE WITH BARRIER TO PREVENT MOISTURE MIGRATION.
- FILLED WITH SYNTHETIC INHIBITOR.
- STAMPED WITH CONDUCTOR AND DIE SIZE.
- **COMPRESSION TOOL DIE MUST MATCH DIE NUMBER STAMPED ON CONNECTOR.**
- WIRE BRUSH ALL CONDUCTORS PRIOR TO INSTALLING CONNECTOR.

**\* UNDERGROUND SECONDARY CABLE COMPRESSION CONNECTORS**

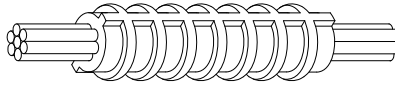
CONDUCTOR SIZE		STORES CODE	TOOL (DIES)	
FROM	TO		PREFERRED	ALTERNATE
#4	#4	74 27 64	Y35 (UCSA 22)	** MD6 (WCSA 22, BG)
1/0	#2	74 27 30		
1/0	1/0	74 27 65		
4/0	1/0	74 27 67	Y35 (UCSA 24)	** MD6 (WCSA 24, 249)
4/0	4/0	74 27 68		
350	4/0	74 27 78	Y35 (UCSA 28)	---
350	350	74 27 72		
750	500	74 27 27	Y46/ADPT (UCSA 30)	---

\* FOR CONNECTING INSULATED ALUMINUM TO BARE COPPER, REFER TO DRAWING CD215-13.

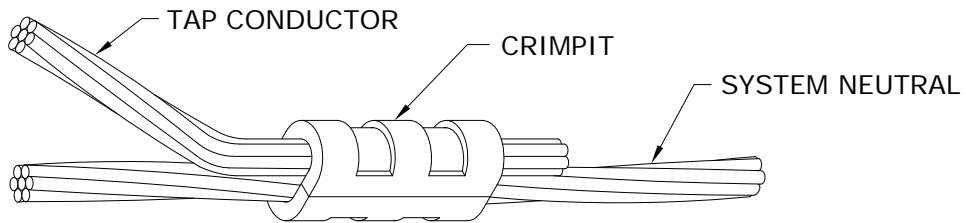
\*\* ROTATE MD6 TOOL 180° AFTER EVERY CRIMP.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS					
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-03				<b>UNDERGROUND SECONDARY CABLE COMPRESSION CONNECTORS</b>					
		95-09	2					350-4/0 CONNECTOR ADDED	
		95-01	1					NOTE ON MD6 TOOL ADDED	
DRAWN W.B./CAD	CHECKED G.W.	DATE 93-07		<b>CD 210-21</b>		SHT 0001 OF 1	REV 02		

- COMPRESSION TOOL DIE MUST MATCH DIE NUMBER STAMPED ON CONNECTOR.
- WIRE BRUSH CONDUCTORS PRIOR TO INSTALLING COMPRESSION CONNECTORS.



<b>UNDERGROUND NEUTRAL COMPRESSION CONNECTORS</b>			
CONDUCTOR SIZE		STORES CODE	TOOL (DIES)
FROM	TO		
#4	#4	74 32 04	MD6 (162)
#2	#2	74 32 02	MD6 (163)
2/0	2/0	74 31 26	MD6 (166)
4/0	4/0	74 31 28	Y35 (168)
350	350	74 32 31	Y35 (267)



<b>UNDERGROUND NEUTRAL "C" TYPE (CRIMPIT) COMPRESSION CONNECTORS</b>			
<b>* (FOR USE ON COPPER CONDUCTORS ONLY)</b>			
CONDUCTOR SIZE		STORES CODE	TOOL (DIES)
RUN	TAP		
#6 - #4	#6	74 41 10	MD6 (BG)
#4	#4	74 40 90	MD6 (BG)
#2	#4	74 40 80	MD6 (WC)
#2	#2	74 40 70	MD6 (WC)
1/0 - 2/0	1/0 - 2/0	74 41 12	Y35 (UO)
3/0 - 250	#6 - 2/0	74 41 15	Y35 (U997)
3/0 - 250	3/0 - 250	74 41 16	Y35 (U997)
300 - 500	#6 - 2/0	54 23 60	Y46 (P1011)
300 - 500	3/0 - 250	18 30 74	Y46 (P1011)

\* FOR CONNECTING BARE COPPER TO INSULATED ALUMINUM, REFER TO DRAWING CD215-13.

APPROVED  ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-03	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS							
	10-12	2	ADDED CONNECTOR							
	95-01	1	NOTES REARRANGED							
	93-07	0	CONNECTORS ADDED, FORMERLY CD210-8							
DRAWN W.B./CAD			CHECKED K.C.H.		DATE 93-07		<b>CD 210-24</b>		SHT	REV
									0001 OF 1	02

THERE ARE FOUR METHODS FOR SPLICING 600 VOLT UNDERGROUND SECONDARY CABLES:

- 1) HEAT SHRINK INSULATING TUBING SPLICE
- 2) PRE-STRETCHED INSULATING TUBING SPLICE
- 3) RAYCHEM RAYVOLVE
- 4) TAPED SPLICE

750 kcmil AND 1000 kcmil CABLES, USED IN CONJUNCTION WITH 3-PHASE COMMERCIAL SERVICES, SHALL NOT BE SPLICED, EXCEPT FOR EMERGENCY REPAIRS.

**GENERAL INSTRUCTIONS:**

1. a) FOR 1/0 AND 4/0 TRIPLEX CABLES:
  - REMOVE ANY DAMAGED OR CONTAMINATED PORTIONS OF CABLE.
  - TRAIN CABLES INTO FINAL POSITION (DO NOT SNAKE IN TRENCH).
  - CUT CABLES SQUARE AND BUTT ENDS.
  - STAGGER SPLICES.
  - PROCEED TO STEP 2.
- b) FOR #4 CONCENTRIC NEUTRAL CABLE:
  - REMOVE ANY DAMAGED OR CONTAMINATED PORTIONS OF CABLE.
  - TRAIN CABLES INTO FINAL POSITION WITH ENDS OVERLAPPING C/L BY 150mm.
  - TIGHTLY TWIST CONCENTRIC NEUTRAL WIRES INTO A BUNDLED CONDUCTOR FOR APPROXIMATELY 250mm AND TEMPORARILY FOLD BACK.
  - CUT OFF APPROXIMATELY 100mm OF CABLE FROM EACH END.
  - PROCEED TO STEP 2.
2. SELECT APPROPRIATE SLEEVE AND DIE ACCORDING TO DRAWING CD210-21.
3. SELECT SPLICING METHOD (FOR CORRECT MANUFACTURED SPLICES, REFER TO TABLE ON SHEET 2 of 3).  
NOTE: FOR SPLICING BARE COPPER NEUTRAL WIRE TO INSULATED ALUMINUM CABLE, REFER TO DRAWING CD215-13.
4. REMOVE JACKET AND INSULATION FROM CABLES AS PER FIGURE 1 OR FOLLOW MANUFACTURERS INSTRUCTIONS; BE CAREFUL NOT TO NICK INSULATION OR CONDUCTOR.
5. CLEAN CONDUCTOR WITH WIRE BRUSH. INSTALL CONNECTOR.  
NOTE: EXCEPT FOR TAPED SPLICE, SLIDE TUBING OVER ONE CONDUCTOR BEFORE INSTALLING CONNECTOR.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS					
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-03				<b>SPLICES FOR UNDERGROUND SECONDARY CABLES</b>					
		96-05	2					NOTES REVISED, SHEET 3 ADDED	
		95-01	1					NOTES 3, 7 & TABLE ADDED	
DRAWN W.B./CAD	CHECKED G.W.	DATE 93-07		<b>CD 215-12</b>		SHT 0001 OF 3	REV 02		

6. CLEAN JACKET (50mm), INSULATION, AND CONNECTOR WITH AN APPROVED CLEANING SOLVENT (S.C.# 43 11 95).
7. COMPLETE SELECTED SPLICE (AS CHOSEN IN STEP 3).  
NOTE: TO COMPLETE #4 CONCENTRIC NEUTRAL SPLICE, PROCEED TO STEP 8.
8. FOR #4 CONCENTRIC NEUTRAL CABLE: (CONT'D)
- a) APPLY 1 LAYER OF 1/4 STRETCHED 50mm WIDE RUBBER MASTIC TAPE (S.C.# 78 55 28) OVER CENTRE OF COMPLETED SPLICE.
  - b) TRAIN TWISTED CONCENTRIC NEUTRAL WIRE (STEP 1b) INTO FINAL POSITION ALLOWING ADEQUATE CLEARANCE FOR MD6 PRESS.
  - c) PLACE "C" TYPE COMPRESSION CONNECTOR OVER TWISTED WIRES AND CRIMP. REFER TO DRAWING CD210-24.
  - d) TRIM OFF PROTRUDING WIRES AND COMPRESS WITH PLIERS ELIMINATING ANY SHARP ENDS.
  - e) APPLY A 100mm STRIP OF 50mm WIDE RUBBER MASTIC TAPE OVER CONNECTOR AND PROTRUDING WIRES.  
NOTE: SHINY SIDE AGAINST CONNECTOR AND THE 100mm LENGTH PARALLEL TO CONNECTOR AND WIRE.
  - f) FORM TAPED CONCENTRIC NEUTRAL CONNECTION AND WIRES AROUND SPLICE AND CABLE.
  - g) APPLY 2 LAYERS 3/4 STRETCHED COLD WEATHER VINYL TAPE (S.C.# 78 55 98) OVER TAPED CONCENTRIC NEUTRAL CONNECTION AND SPLICE, APPROXIMATELY 50mm WIDE.

MANUFACTURED SPLICES FOR SECONDARY CABLES		
CONDUCTOR SIZE	TYPE OF SPLICE	STORES CODE
#4 TO 1/0	PRESTRETCHED	85 13 10
4/0	PRESTRETCHED	85 13 40
4/0 TO 350	HEAT SHRINK	85 13 50
350	PRESTRETCHED	03 31 80

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS					
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-03	15-02	3	REMOVED RAYVOLVE SPLICE FROM TABLE	<b>SPLICES FOR UNDERGROUND SECONDARY CABLES</b>					
	08-03	2	REVISED TABLE AND NOTE 6						
	96-05	1	FIGURES MOVED TO NEW SHEET 3						
DRAWN W.B./CAD	CHECKED J.R.	DATE 93-07	<b>CD 215-12</b>		<table border="1" style="float: right;"> <tr> <td>SHT</td> <td>REV</td> </tr> <tr> <td>0002 OF 3</td> <td>03</td> </tr> </table>	SHT	REV	0002 OF 3	03
SHT	REV								
0002 OF 3	03								

**FOR TAPED SPLICE**

TAPES SHALL ONLY BE APPLIED DIRECTLY FROM ROLL ONTO SPLICE, HALF LAPPED AND STRETCHED TO 3/4 OF THEIR ORIGINAL WIDTH.

1. APPLY 3 LAYERS OF SELF-AMALGAMATING ETHYLENE PROPYLENE RUBBER (E.P.R.) TAPE (S.C. 78 55 23) AS PER FIGURE 2.

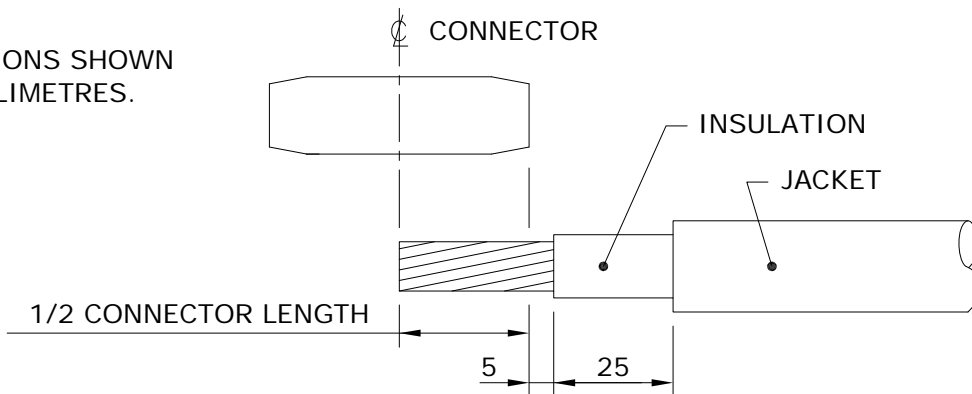
2. APPLY 2 LAYERS OF COLD WEATHER VINYL TAPE (S.C. 78 55 98) AS PER FIGURE 2.

OR

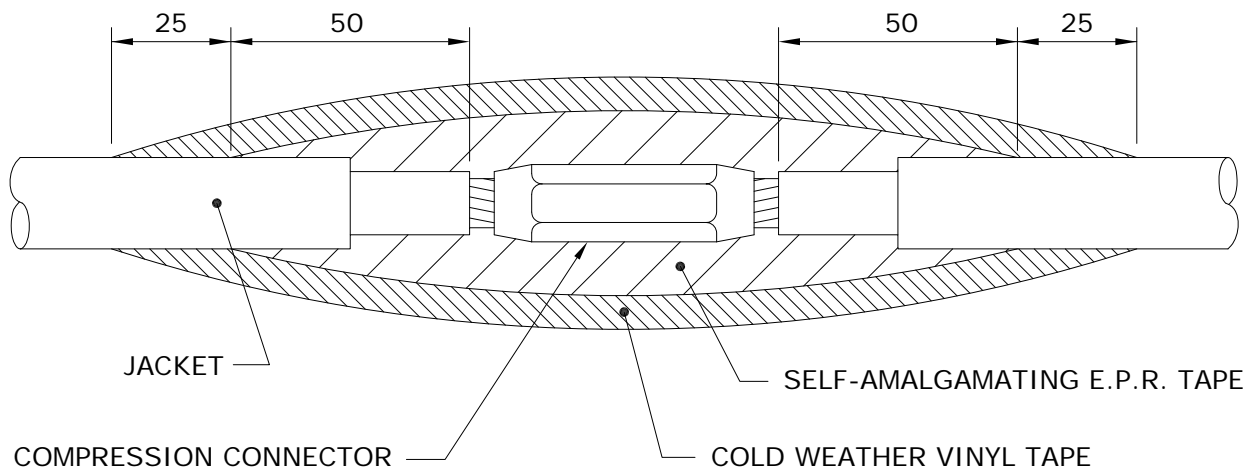
APPLY 3 LAYERS OF SELF-AMALGAMATING HIGH TEMPERATURE SILICONE TAPE (S.C. 03 74 67). VINYL TAPE IS NOT REQUIRED.

**NOTE:**

DIMENSIONS SHOWN ARE MILLIMETRES.



**FIGURE 1**



**FIGURE 2**

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 97-01-08		10-12 1 REVISED COMPRESSION CONNECTOR AND NOTE 2		<b>SPLICES FOR UNDERGROUND SECONDARY CABLES</b>	
DRAWN W.B./CAD	CHECKED K.C.H.	DATE 96-05		<b>CD 215-12</b>	
				SHT 0003 OF 3	REV 01

**CABLE PREPARATION:**

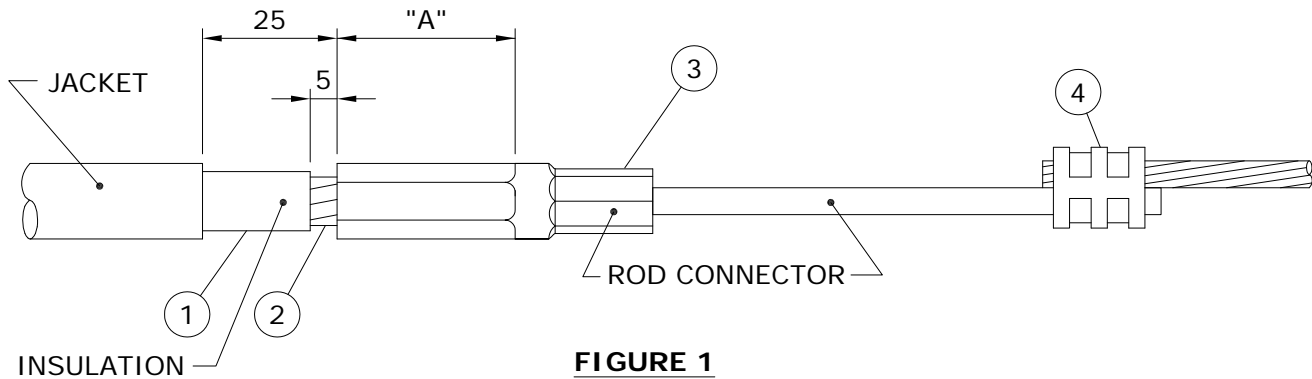
- ① REMOVE PVC (POLYVINYL CHLORIDE) JACKET TO DIMENSION "A" PLUS 25mm.
- ② REMOVE POLYETHYLENE INSULATION TO DIMENSION "A" PLUS 5mm.  
USE ABRASIVE TAPE (SC. 78 50 04) ON ALL CONNECTON SURFACES.
- ③ INSTALL ROD CONNECTOR AS PER TABLE BELOW AND FIGURE 1.

CONDUCTOR SIZE	* ROD CONNECTOR STORES CODE No.	PRESS	DIE
1/0 ALUMINUM	74 27 62	Y35/MD6	CSA 22
4/0 ALUMINUM	74 27 69	Y35/MD6	CSA 24

\* ROD IS FACTORY CRIMPED INTO CONNECTOR

- ④ CONNECT BARE COPPER STRANDED WIRE TO ROD CONNECTOR AS PER TABLE BELOW. USE ABRASIVE TAPE ON ALL CONNECTON SURFACES.

CONDUCTOR SIZE	CONNECTOR STORES CODE No.	PRESS	DIE
COPPER ROD TO #4 COPPER STRANDED	74 40 90	Y35/MD6	WBG
COPPER ROD TO #2 COPPER STRANDED	74 40 70	MD6	WC



**FIGURE 1**

**NOTE:** DIMENSIONS SHOWN ARE MILLIMETRES.

APPROVED	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS		
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-03			<b>SPLICING SECONDARY NEUTRAL (BARE COPPER TO INSULATED ALUMINUM)</b>		
	08-11	2			REVISED TABLE AND COMPRESSION CONNECTOR
	94-10	1			ROD CONNECTOR ADDED
DRAWN W.B./CAD	CHECKED B.H./K.C.H.	DATE 94-06	<b>CD 215-13</b>		
			SHT 0001 OF 2	REV 02	

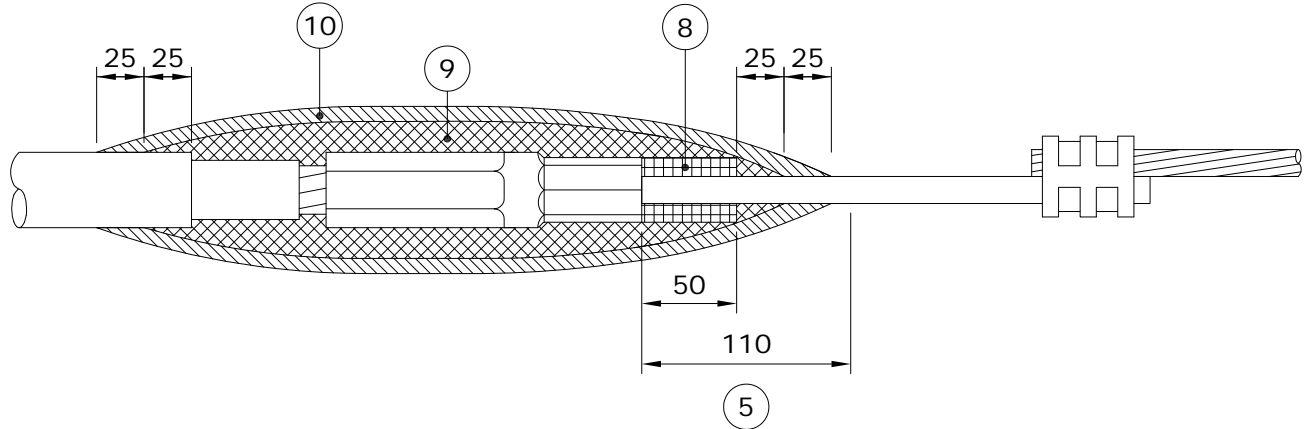


**TAPING:**

- 5 ABRASE ROD PORTION OF ROD CONNECTOR WITH ABRASIVE TAPE AS SHOWN IN FIGURE 2.
- 6 CLEAN JACKET, INSULATION & ROD CONNECTOR WITH AN APPROVED CLEANING SOLVENT (S.C.# 43 11 95).
- 7 CUT ONE PIECE OF RUBBER MASTIC TAPE (S.C. 78 55 28) INTO EITHER A 50mm WIDE x 75mm LONG STRIP FOR 1/0 CONNECTOR OR A 50mm WIDE x 125mm LONG STRIP FOR 4/0 CONNECTOR.
- 8 APPLY THE PRECUT STRIP OF RUBBER MASTIC TAPE 1/4 STRETCHED, SHINING SIDE DOWN ONTO THE ROD AS SHOWN IN FIGURE 2.
- 9 APPLY 2 LAYERS OF HALF LAPPED 3/4 STRETCHED SELF AMALGAMATING ETHYLENE PROPYLENE RUBBER TAPE (S.C.# 78 55 23) AS SHOWN IN FIGURE 2.
- 10 APPLY 2 LAYERS OF HALF LAPPED 3/4 STRETCHED COLD WEATHER VINYL TAPE (S.C.# 78 55 98) AS SHOWN IN FIGURE 2.

**NOTE:**

WHEN INSTALLING A MANUFACTURED SPLICE INCLUDE STEPS 5 THRU 8 WITH THE MANUFACTURERS INSTRUCTIONS. THIS WILL PROVIDE THE PROPER INSULATION AND MOISTURE SEAL.

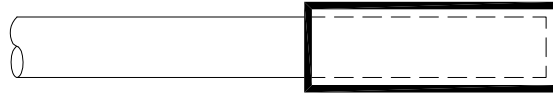


**FIGURE 2**

**NOTE:** DIMENSIONS SHOWN ARE MILLIMETRES.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS		
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-03				<b>SPLICING SECONDARY NEUTRAL (BARE COPPER TO INSULATED ALUMINUM)</b>		
		08-11	2			REVISED NOTE 6 & COMPRESSION CONNECTOR
		94-10	1			TAPING PROCEDURE REVISED
DRAWN W.B./CAD	CHECKED K.C.H.	DATE 94-06	<b>CD 215-13</b>		SHT 0002 OF 2	
					REV 02	

ALL UNENERGIZED UNDERGROUND CABLE ENDS SHALL BE CAPPED WITH AN END CAP TO SEAL AGAINST MOISTURE INGRESS INTO CABLE CONDUCTOR. IF AN END CAP IS NOT AVAILABLE, A TAPED END IS ACCEPTABLE.

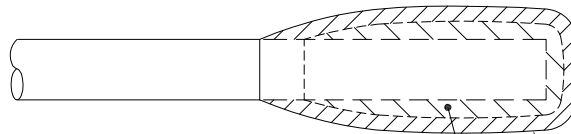


**END CAP**  
(PREFERRED)

COLD SHRINK		HEAT SHRINK	
MH CIIC CODE	DIAMETER OF CABLE OVER JACKET	MH CIIC CODE	DIAMETER OF CABLE OVER JACKET
15 31 40	12mm - 21mm	03 67 31	10mm - 18mm
15 31 60	16mm - 30mm	03 67 30	17mm - 30mm
15 31 75	26mm - 50mm	01 79 82	25mm - 50mm
03 33 54	45mm - 84mm	03 48 63	47mm - 94mm

**NOTES:**

1. REFER TO DWGS. CD210-6, CD210-9 AND CD210-15 FOR CABLE DIAMETERS.
2. DO NOT INSTALL CONCENTRIC NEUTRALS ON UNJACKETED CABLES INSIDE THE END CAPS.



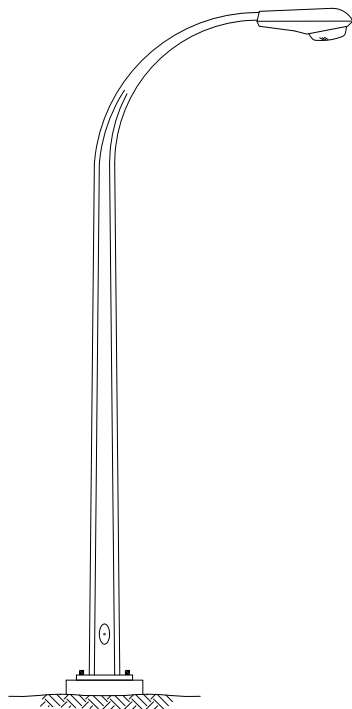
RUBBER MASTIC TAPE (2 - LAYERS)  
COLD WEATHER VINYL TAPE (2 - LAYERS)

**TAPED END**  
(ALTERNATE)

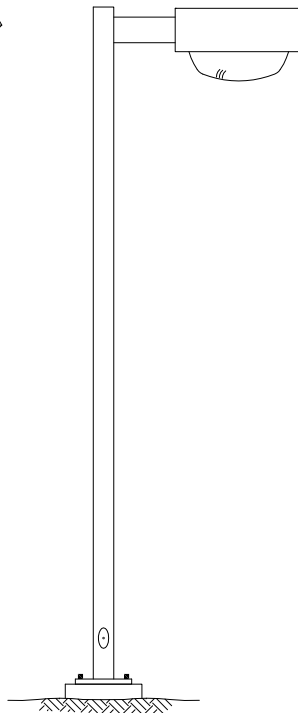
**TAPED END INSTALLATION:**

APPLY TWO LAYERS HALF LAPPED RUBBER MASTIC TAPE COVERED WITH TWO LAYERS HALF LAPPED COLD WEATHER VINYL TAPE.

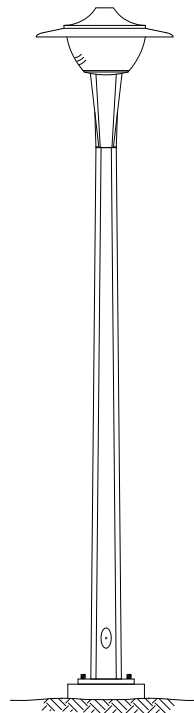
APPROVED  ORIGINAL DRAWING SEALED BY E.H. WIEBE 88-03-29	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS							
	08-12	4	REVISED TABLE							
	95-01	3	NOTE FOR HEAT SHRINK ADDED							
	93-07	2	SHT. 2 DELETED, FORMERLY CD215-10							
DRAWN W.B./CAD			CHECKED K.C.H.		DATE 87-10		<b>CD 215-21</b>		SHT	REV
									0001 OF 1	04



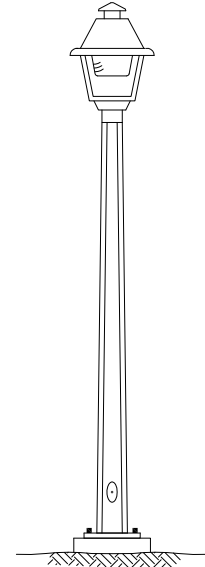
**DAVIT BM**  
(BASE MOUNTED)



**SQUARE BM**  
(BASE MOUNTED)



**POST-TOP  
CONTEMPORARY BM**  
(BASE MOUNTED)



**POST-TOP  
COLONIAL BM**  
(BASE MOUNTED)

POLE TYPE	COLOUR	MOUNTING HEIGHT m (ft)	ARM REACH m	BOLT SQUARE mm	BOLT CIRCLE mm	STORES CODE NO.	CABLE LENGTH m **
DAVIT BM	GALVANIZED	7.7 (25)	1.8	179	254	75 42 26	11
DAVIT BM *	GALVANIZED	9.1 (30)	2.4	197	279	75 43 30	13
DAVIT BM	GALVANIZED	10.7 (35)	3.0	206	292	75 44 36	15
DAVIT BM	GALVANIZED	13.7 (45)	3.0	243	343	75 46 45	18
SQUARE BM	DARK BRONZE	6.1 (20)	0.5	179	254	75 42 20	8
SQUARE BM	DARK BRONZE	10.7 (35)	0.5	206	292	75 45 30	14
POST-TOP BM CONTEMPORARY	GALVANIZED	6.1 (20)	N/A	179	254	75 41 22	7
POST-TOP BM COLONIAL	GALVANIZED	4.7 (15)	N/A	179	254	75 41 15	6

**NOTES:**

\* FOR REPLACEMENT PURPOSES; NOT TO BE USED FOR NEW INSTALLATIONS.

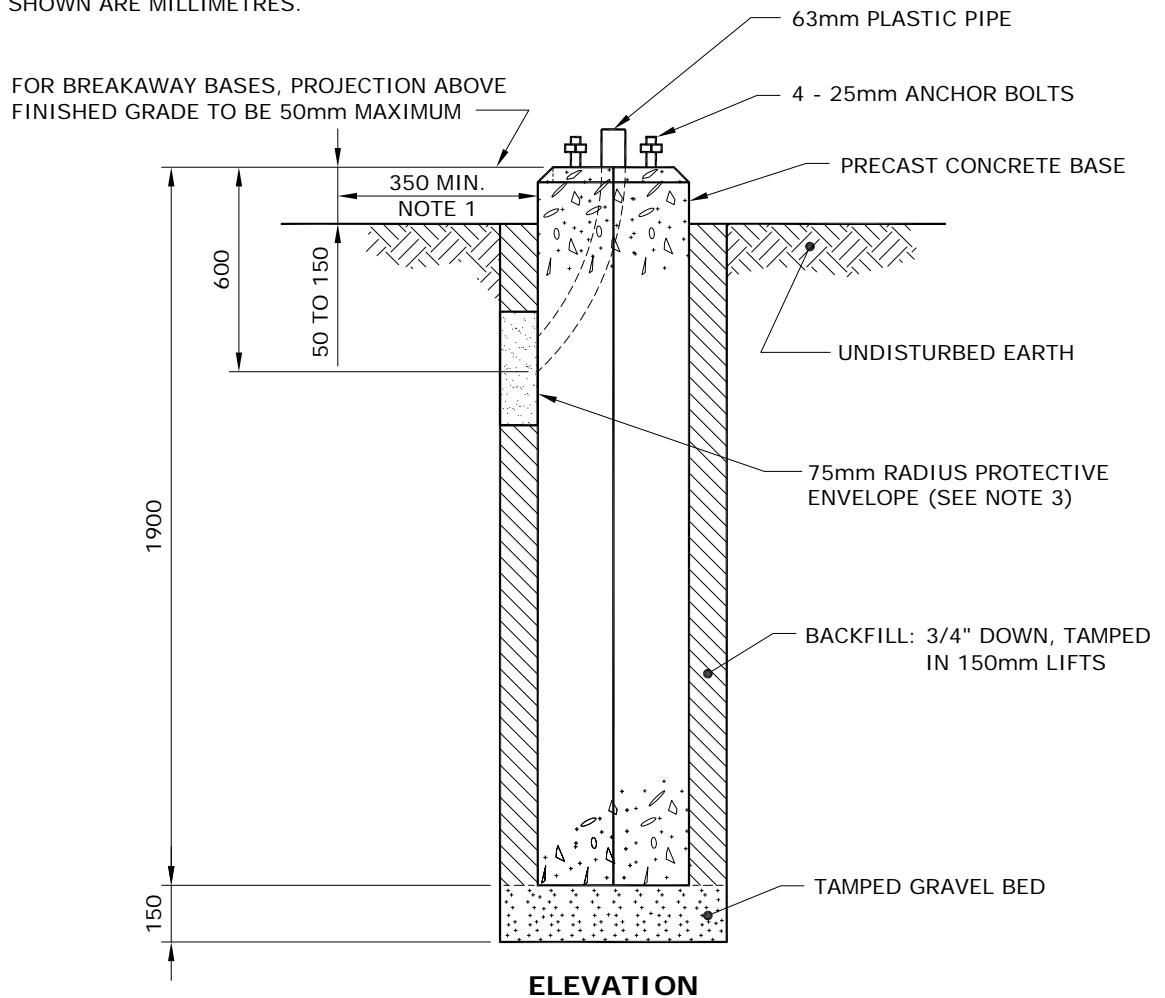
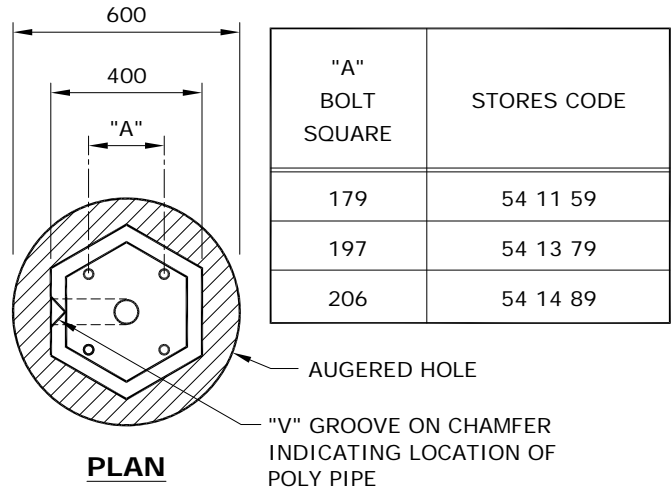
\*\* LENGTH OF 2 CONDUCTORS #12 CABLE REQUIRED PER POLE.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS			
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28	13-01	3	ADDED CONTEMPORARY AND COLONIAL POLES	<b>STANDARD STEEL STREET LIGHT POLES</b>			
	12-05	2	REVISED DRAWING & CANCELLED SHEETS 2 AND 3				
	94-09	1	DELETED ORNAMENTAL				
DRAWN W.B./CAD	CHECKED L.D./D.O.	DATE 88-06	<b>CD 300-1</b>		SHT 0001 OF 1	REV 03	

## 7.7 - 10.7 STREET LIGHT POLES

**NOTES:**

1. FOR FUTURE ACCESS TO LOWER PORTION OF PLASTIC PIPE, LOCATE "V" GROOVE SIDE OF BASE TO ROADWAY PROVIDED THAT:
  - a) A MIN. HORIZONTAL SEPARATION OF 350mm IS MAINTAINED TO ANY PAVED SURFACE OR STRUCTURE; OR
  - b) IF LESS THAN 350mm, ROTATE BASE 90°
2. ROUTE UNDERGROUND CABLES DIRECTLY INTO PLASTIC PIPE.
3. IN BACKFILL AREA, ENCASE UNDERGROUND CABLES IN A 75mm RADIUS ENVELOPE OF EXCAVATED MATERIAL OR SAND TO PROTECT CABLES. DO NOT BACKFILL WITH EXCAVATED MATERIAL OR SAND MORE THAN 1/6 OF THE WAY AROUND BASE.
4. SEE CD300-9 FOR ANCHOR ROD TIGHTENING METHOD.
5. DIMENSIONS SHOWN ARE MILLIMETRES.

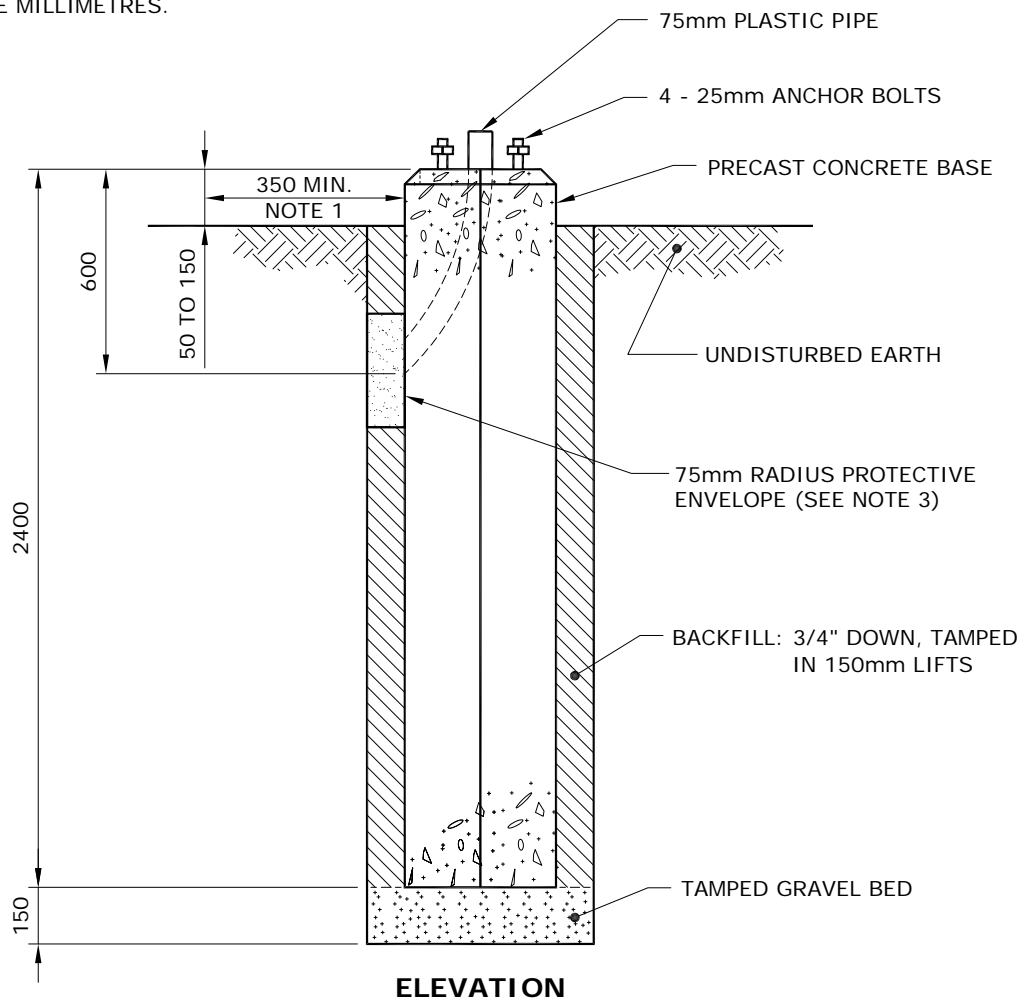
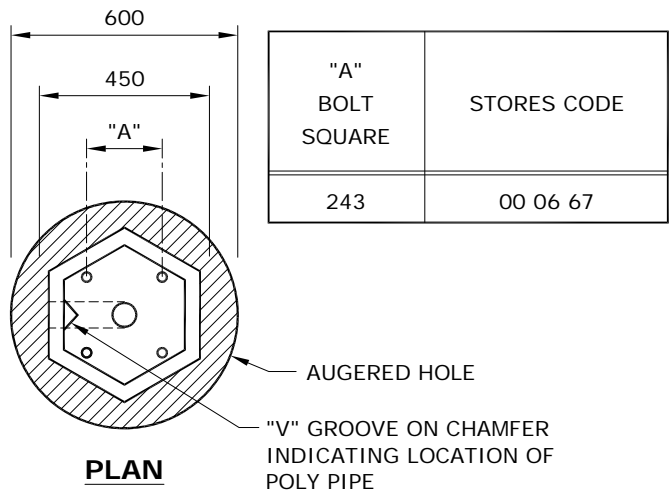


APPROVED	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-29	10-08	3	CHANGED BACKFILL NOTES, AND ADDED SHEET 3	
	99-05	2	SHEET 2 of 2 ADDED, 7.7 - 10.7 STREET LIGHT ADDED	
	96-10	1	V-GROOVE LOCATION, POLY PIPE SIZE NOTES CHANGED	
<b>INSTALLATION OF PRECAST CONCRETE BASE</b>			<b>CD 300-6</b>	
DRAWN W.B./CAD	CHECKED L.D./K.C.H.	DATE 88-06	SHT 0001 OF 3	REV 03

### 13.7 STREET LIGHT POLE

**NOTES:**

1. FOR FUTURE ACCESS TO LOWER PORTION OF PLASTIC PIPE, LOCATE "V" GROOVE SIDE OF BASE TO ROADWAY PROVIDED THAT:
  - a) A MIN. HORIZONTAL SEPARATION OF 350mm IS MAINTAINED TO ANY PAVED SURFACE OR STRUCTURE; OR
  - b) IF LESS THAN 350mm, ROTATE BASE 90°
2. ROUTE UNDERGROUND CABLES DIRECTLY INTO PLASTIC PIPE.
3. IN BACKFILL AREA, ENCASE UNDERGROUND CABLES IN A 75mm RADIUS ENVELOPE OF EXCAVATED MATERIAL OR SAND TO PROTECT CABLES. DO NOT BACKFILL WITH EXCAVATED MATERIAL OR SAND MORE THAN 1/6 OF THE WAY AROUND BASE.
4. SEE CD300-9 FOR ANCHOR ROD TIGHTENING METHOD.
5. DIMENSIONS SHOWN ARE MILLIMETRES.

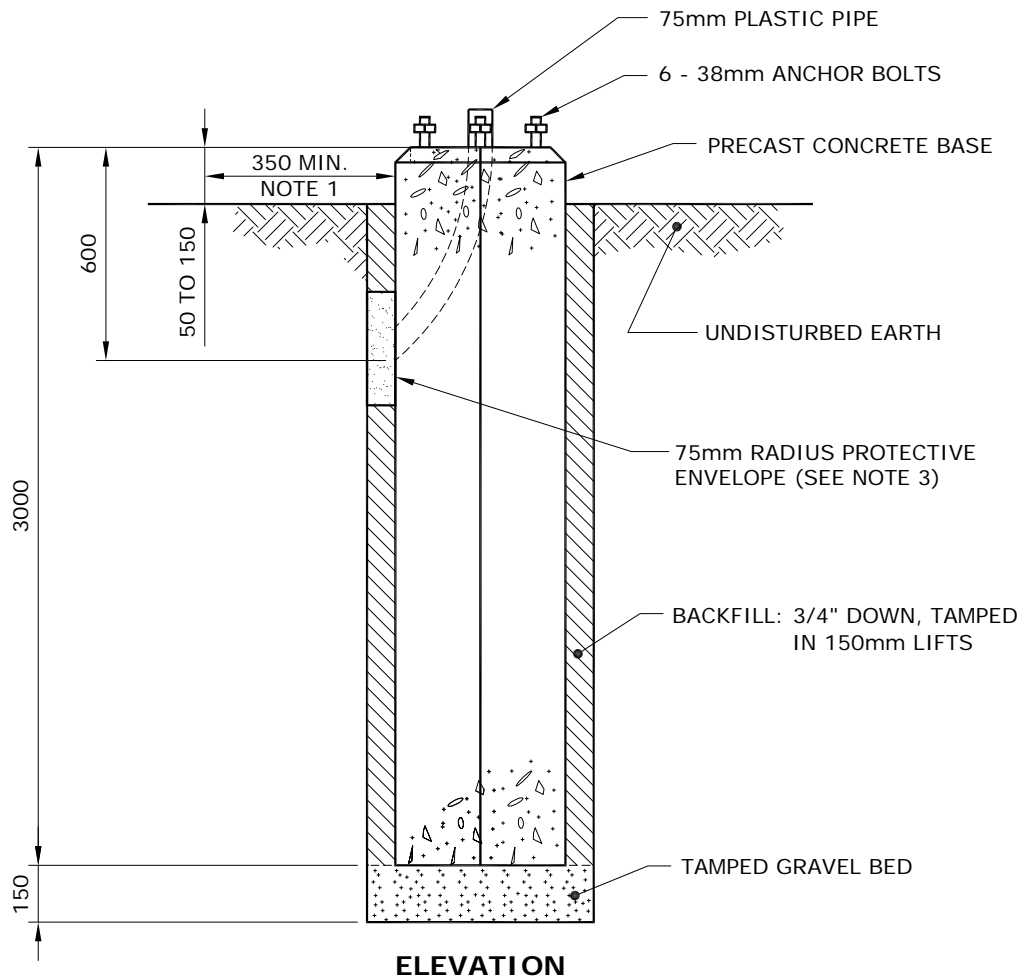
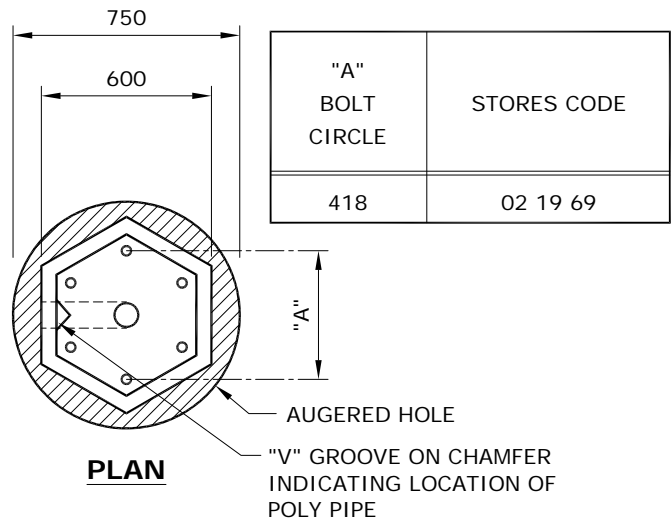


APPROVED	REVISIONS	MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-29		<b>INSTALLATION OF PRECAST CONCRETE BASE</b>	
	10-08	1	CHANGED BACKFILL NOTES, AND ADDED SHEET 3
DRAWN R.L.B./CAD	CHECKED L.D./K.C.H.	DATE 99-05	<b>CD 300-6</b>
			SHT 0002 OF 3
			REV 01

## 16.8m & 19.8m STREET LIGHT POLE

**NOTES:**

1. FOR FUTURE ACCESS TO LOWER PORTION OF PLASTIC PIPE, LOCATE "V" GROOVE SIDE OF BASE TO ROADWAY PROVIDED THAT:
  - a) A MIN. HORIZONTAL SEPARATION OF 350mm IS MAINTAINED TO ANY PAVED SURFACE OR STRUCTURE; OR
  - b) IF LESS THAN 350mm, ROTATE BASE 90°
2. ROUTE UNDERGROUND CABLES DIRECTLY INTO PLASTIC PIPE.
3. IN BACKFILL AREA, ENCASE UNDERGROUND CABLES IN A 75mm RADIUS ENVELOPE OF EXCAVATED MATERIAL OR SAND TO PROTECT CABLES. DO NOT BACKFILL WITH EXCAVATED MATERIAL OR SAND MORE THAN 1/6 OF THE WAY AROUND BASE.
4. SEE CD300-9 FOR ANCHOR ROD TIGHTENING METHOD.
5. DIMENSIONS SHOWN ARE MILLIMETRES.



APPROVED	REVISIONS	MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY K.C. HAMILTON 10-08-13		<b>INSTALLATION OF PRECAST CONCRETE BASE</b>	
DRAWN C.A.	CHECKED L.D./K.C.H.	DATE 10-08	<b>CD 300-6</b>
		SHT 0003 OF 3	REV 00

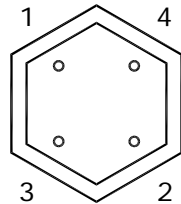
TO DEVELOP THE REQUIRED TENSION ON ANCHOR RODS, THE TURN-OF-NUT METHOD IS USED.

### TURN-OF-NUT

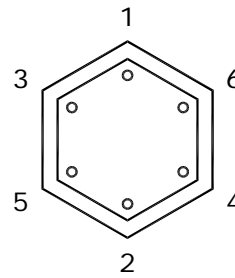
1. ENSURE ALL ANCHOR RODS AND NUTS ARE FREE OF DEBRIS AND THAT THE ANCHOR RODS ARE LUBRICATED.
2. PLACE POLE ONTO CONCRETE PILE, INSTALL WASHERS AND NUTS AND TIGHTEN UNTIL DEVELOPING A SNUG-TIGHTENED CONNECTION.

**SNUG-TIGHTENED:** THE TIGHTNESS THAT IS ATTAINED AFTER A FEW IMPACTS OF AN IMPACT WRENCH OR THE FULL FORCE OF A WORKER USING AN ORDINARY ONE FOOT LONG WRENCH.

3. TIGHTENING OF THE BOLTS MUST BE PERFORMED IN A MANNER THAT BRINGS THE FAYING SURFACES UP "EVENLY" AS PER THE STAR PATTERN TIGHTENING SEQUENCE.



FOUR ANCHOR BOLT PATTERN  
(13.7m AND BELOW)



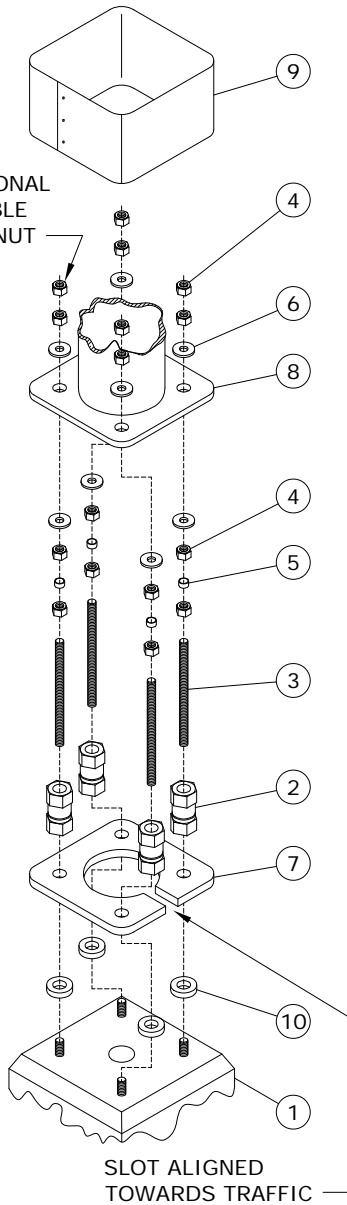
SIX ANCHOR BOLT PATTERN  
(16.8m AND 19.8m)

4. ENSURE THE POLE IS PLUMB AND ADD LEVELING SHIMS IF REQUIRED. SNUG-TIGHTEN THE ANCHOR BOLTS AGAIN.
5. BEVELED WASHERS ARE REQUIRED IF THE NUT CANNOT BE BROUGHT INTO FIRM CONTACT WITH THE BASE PLATE.
6. MARK THE REFERENCE LOCATION OF THE NUT AFTER SNUG-TIGHTENING THE PLUMB POLE.
7. FINAL TIGHTENING OF NUTS IS PERFORMED IN INCREMENTS AS PER THE STAR PATTERN, WITH A MINIMUM OF TWO FULL TIGHTENING CYCLES. PROPER TENSIONING IS ACHIEVED WHEN THE NUT IS ROTATED 1/3 OF A TURN BEYOND SNUG-TIGHT. THE TOLERANCE FOR THIS IS PLUS 20°.

APPROVED	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY K.C. HAMILTON 10-08-13			<b>METHOD FOR ANCHOR ROD TIGHTENING</b>	
DRAWN C.A.	CHECKED L.D.	DATE 10-08	<b>CD 300-9</b>	
			SHT 0001 OF 1	REV 00

THE FOLLOWING INSTALLATION INSTRUCTIONS ARE APPLICABLE TO NEW OR EXISTING BREAKAWAY BASE INSTALLATIONS ON CONCRETE BASES.

**PROCEDURE:**

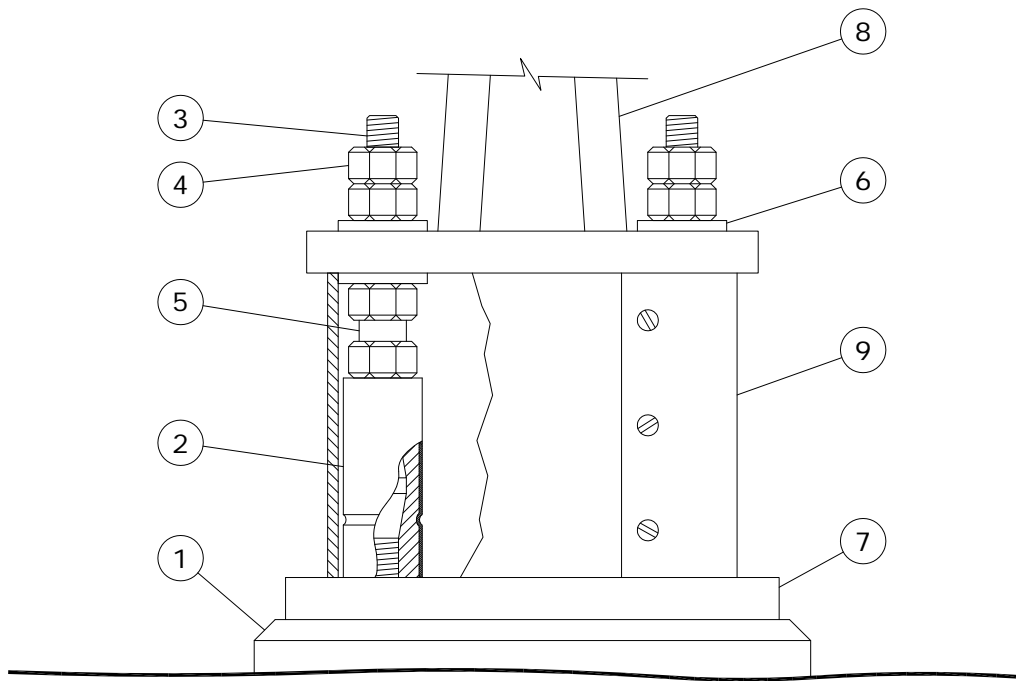


1. CLEAN THE TOP SURFACE OF THE CONCRETE BASE AND ENSURE SURFACE IS FLAT AND LEVEL WITH NO SPALLING OR OTHER SURFACE CONDITIONS THAT MAY AFFECT THE PERFORMANCE OF THE COUPLERS.
  2. THE PREFERRED MAXIMUM HEIGHT ABOVE LEVEL GRADE TO THE BASE OF THE COUPLER IS 50mm OR LESS. THIS PROVIDES THE RECOMMENDED CLEARANCE IN THE EVENT OF A COLLISION WITH THE STRUCTURE.
  3. MEASURE THE HEIGHT OF THE THREADED ANCHOR BOLTS ABOVE THE REACTION PLATE AND VERIFY THIS MEASUREMENT IS BETWEEN 1 1/4" AND 1 5/8".
  4. IF THE EXPOSED LENGTH OF THE ANCHOR BOLT IS GREATER THAN THE RECOMMENDED LENGTH, OPTIONAL SPACERS MAY BE USED (ITEM 10).
  5. IT IS RECOMMENDED THAT THE THREADED ANCHOR BOLT-COUPLER CONNECTION BE COATED WITH RUST-INHIBITING GREASE. THIS WILL FACILITATE REMOVAL OF THE COUPLER WHEN IT IS NECESSARY. A SUITABLE PRODUCT FOR THIS APPLICATION IS ARCAN 1, A WHITE, WATER RESISTANT GREASE MARKETED BY IMPERIAL OIL LTD.
  6. THREAD THE COUPLER ASSEMBLY ON EACH ANCHOR BOLT (IF THE COUPLER ASSEMBLY UPPER STUD BECOMES LOOSE AS A RESULT OF HANDLING, ENSURE THAT THE STUD IS ENGAGED AT LEAST 38mm, BUT NOT MORE THAN 44mm IN THE COUPLER BEFORE LOCKING WITH THE LOCK NUT.)
  7. SNUG UP EACH COUPLER AGAINST THE CONCRETE BASE. TIGHTEN EACH COUPLER ALTERNATELY AND INCREMENTALLY, BY MEANS OF A WRENCH OR A PIPE WRENCH ON THE BOTTOM HEX OF THE COUPLER. USE THE TURN-OF-NUT METHOD AS PER CD300-9.
- NOTE: TIGHTENING THE COUPLER ON THE TOP HEX MAY WEAKEN THE COUPLER AT THE MACHINED GROOVE AND MAKE THE COUPLER UNUSEABLE.**
8. BRING THE LEVELING NUTS (AND HENCE, THE LOWER WASHERS) INTO A LEVEL PLANE AS DESIRED MAKING CERTAIN THAT AT LEAST ONE PLASTIC SPACER REMAINS IN CONTACT WITH ITS LEVELING NUT AND ITS LOCK NUT.
  9. PLACE THE POLE BASE OVER THE PROTRUDING STUDS, AND SECURE THE POLE WITH THE UPPER WASHERS AND RETAINING NUTS.
  10. WITH THE POLE IN THE REQUIRED VERTICAL ORIENTATION, AND BEFORE FINAL TIGHTENING, ENSURE THAT ALL LEVELING NUTS, RETAINING NUTS AND UPPER AND LOWER WASHERS ARE MADE SNUG AGAINST THE POLE BASE PLATE.
  11. TIGHTEN THE RETAINING NUTS WITH THE TURN-OF-NUT METHOD AS PER CD300-9.
  12. MAKE THE NECESSARY WIRING CONNECTIONS, AND INSTALL THE PROTECTIVE SHROUD.

SUPERCEDES ORIGINAL SEALED BY E. WIEBE ON 89-04-28

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY D.R. ORR 16-06-27	16-06	4	CORRECTED TYPO, RESEALED	<b>BREAKAWAY BASE INSTALLATION</b>	
	10-08	3	UPDATED STANDARD, REVISED TITLE, AND ADDED SHEET 2		
	07-06	2	REVISED NOTE 4 AND ADDED NOTE 5		
DRAWN C.A.	CHECKED L.D.	DATE 16-06		<b>CD 300-10</b>	
				SHT 0001 OF 2	REV 04

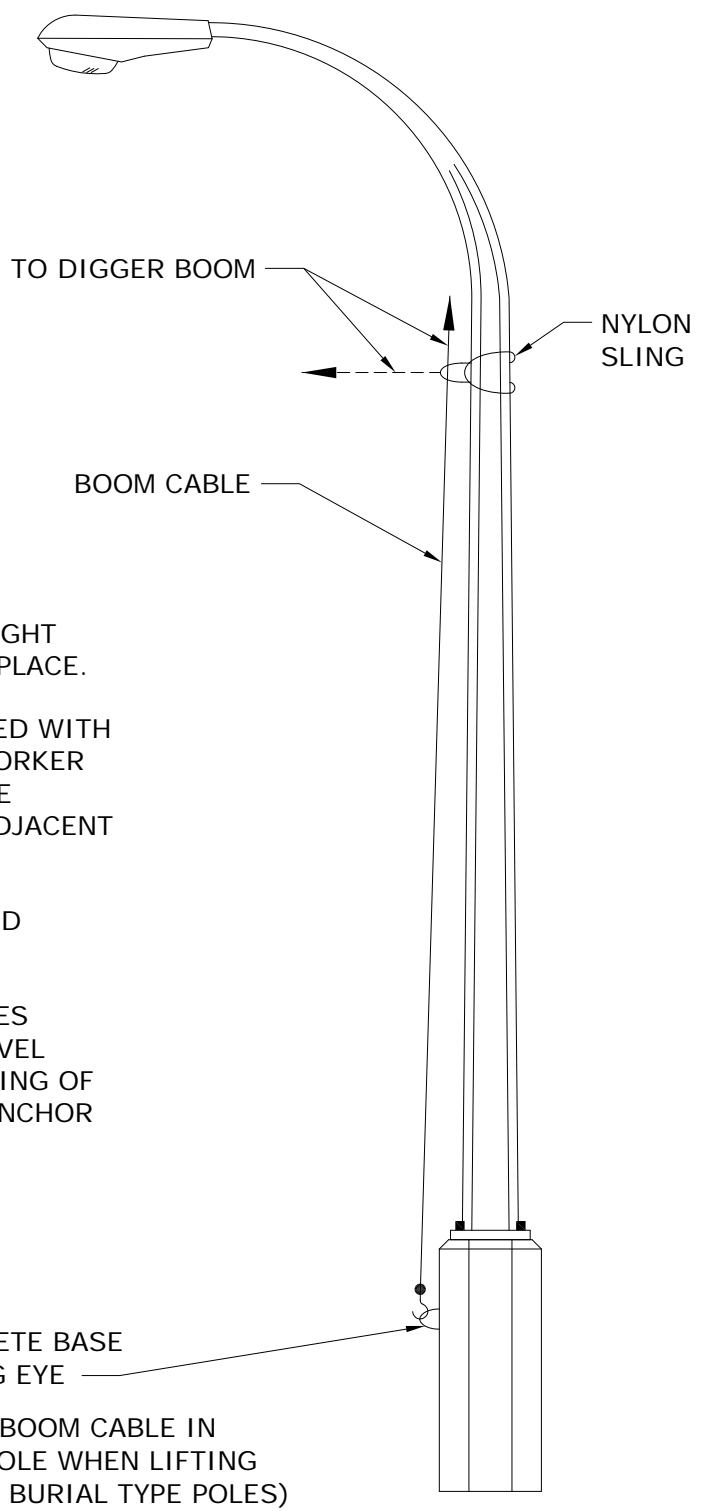




**BILL OF MATERIAL**

ITEM NO.	DESCRIPTION	QUANTITY
1	CONCRETE BASE	1
2	COUPLING	4
3	1" - 8 UNC GALV. STUD	4
4	1" - 8 UNC GALV. HEAVY HEX NUT	16
5	SPACER	4
6	1" GALV. FLAT WASHER	8
7	REACTION PLATE	1
8	POLE	1
9	SHROUD ASSEMBLY	1
10	GALV. SHIM	4

APPROVED  ORIGINAL DRAWING SEALED BY K.C. HAMILTON 10-08-13	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS		
			<b>BREAKAWAY BASE INSTALLATION</b>		
DRAWN C.A.	CHECKED L.D.	DATE 10-08	<b>CD 300-10</b>	SHT 0002 OF 2	REV 00



NOTES:

1. DO NOT LIFT ASSEMBLED STREET LIGHT POLE WITH BREAKAWAY DEVICE IN PLACE.
2. STREET LIGHT POLE TO BE INSTALLED WITH HANDHOLE ORIENTED TO ALLOW WORKER WORKING IN THE HANDHOLE TO SEE ONCOMING TRAFFIC IN THE LANE ADJACENT TO THE POLE.
3. CD300-16 APPLIES TO PILE MOUNTED STANDARDS UP TO 10.7m.
4. FOR 13.7m, 16.8m, AND 19.8m POLES INSTALL PILE FIRST, THEN POLE. LEVEL POLE AND PERFORM FINAL TIGHTENING OF ANCHOR NUTS. SEE CD300-9 FOR ANCHOR ROD TIGHTENING METHOD.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28		13-01 1 REVISED NOTES & TITLE		<b>RECOMMENDED METHOD OF LIFTING ASSEMBLED STREET LIGHT POLE AND BASE</b>	
DRAWN W.B./CAD	CHECKED L.D./D.O.	DATE 88-07	SHT 0001 OF 1		REV 01

### DAVITS

POLE TYPE	MOUNTING HEIGHT m (ft)	MATERIAL	WEIGHT *, ** kg (±10%)
DAVIT (BM)	7.7 (25)	STEEL	97
DAVIT (BM)	9.1 (30)	STEEL	125
DAVIT (BM)	10.7 (35)	STEEL	157
DAVIT (BM)	13.7 (45)	STEEL	219
DAVIT (BM)	16.8 (55)	STEEL	330
DAVIT (BM)	19.8 (65)	STEEL	428
STRAIGHT SHAFT	16.8 (55)	STEEL	388
STRAIGHT SHAFT	19.8 (65)	STEEL	557
POST-TOP DB	4.7 (15)	CONCRETE	544
DAVIT DB	11.3 (37)	CONCRETE	998
DAVIT DB	13.7 (45)	CONCRETE	1087

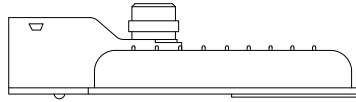
\* WEIGHTS DO NOT INCLUDE ARMS OR LUMINAIRES.

\*\* WEIGHTS GATHERED FROM MANUFACTURER'S DRAWING.

### BASES

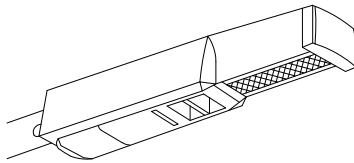
TYPE	WEIGHT kg (±10%)
179	605
197	605
206	605
243	970
418	2151

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS					
ORIGINAL DRAWING SEALED BY D.R. ORR 16-01-14				<b>RIGGING WEIGHTS OF STREET LIGHT COMPONENTS</b>					
DRAWN C.A.	CHECKED G.D.	DATE 16-01	<b>CD 300-18</b>		<table border="1"> <tr> <td>SHT</td> <td>REV</td> </tr> <tr> <td>0001 OF 1</td> <td>00</td> </tr> </table>	SHT	REV	0001 OF 1	00
SHT	REV								
0001 OF 1	00								



**LED ROADWAY LUMINAIRE**

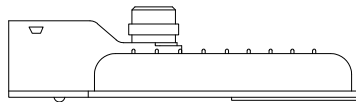
LED ROADWAY LUMINAIRES			
LUMINAIRE WATTAGE (NOMINAL)	REPLACES (HPS)	CIIC	
		GREY	BLACK
40 W LED	70 W HPS	05 15 44	05 15 71
60 W LED	100 W HPS	05 15 45	05 15 73
90 W LED	150 W HPS	05 15 47	05 15 74
150 W LED	250 W HPS	05 15 48	05 15 75
240 W LED	400 W HPS	05 15 49	05 15 76



**LED LANE LUMINAIRE**

LED LANE LUMINAIRES		
LUMINAIRE WATTAGE (NOMINAL)	REPLACES (HPS)	CIIC
50 W LED	70 W HPS	05 15 50

LED LANE LUMINAIRES ARE AVAILABLE WITH GREY COATING ONLY.



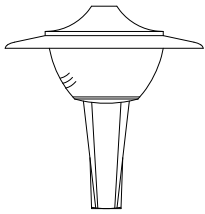
**LED DUSK-TO-DAWN LUMINAIRE**

LED DUSK-TO-DAWN (AREA) LUMINAIRES		
LUMINAIRE WATTAGE (NOMINAL)	REPLACES (HPS)	CIIC
60 W LED	100 W HPS	05 15 51
90 W LED	150 W HPS	05 15 52

LED DUSK-TO-DAWN LUMINAIRES ARE AVAILABLE WITH GREY COATING ONLY.

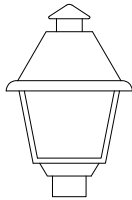
- ALL LED LUMINAIRES AUTOMATICALLY ADJUST FOR EITHER A 120V OR 240V SUPPLY.
- ALL LED LUMINAIRES COME WITH A PHOTOCCELL RECEPTACLE.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY D.R. ORR 15-02-11		16-12 1 REVISED NOTES		<b>STANDARD LED LUMINAIRES</b>	
		DATE 15-02		<b>CD 300-24</b>	
				SHT 0001 OF 2	
				REV 01	



**LED POST TOP LUMINAIRE  
- CONTEMPORARY**

LED POST TOP LUMINAIRES - CONTEMPORARY		
LUMINAIRE WATTAGE (NOMINAL)	CIIC	PHOTOMETRIC DISTRIBUTION
60 W LED	05 17 30	ASYMMETRICAL



**LED POST TOP LUMINAIRE  
- COLONIAL**

LED POST TOP LUMINAIRES - COLONIAL		
LUMINAIRE WATTAGE (NOMINAL)	CIIC	PHOTOMETRIC DISTRIBUTION
60 W LED	05 17 28	ASYMMETRICAL
60 W LED	05 17 29	SYMMETRICAL



**LED POST TOP LUMINAIRE  
- ACORN**

LED POST TOP LUMINAIRES - ACORN		
LUMINAIRE WATTAGE (NOMINAL)	CIIC	PHOTOMETRIC DISTRIBUTION
60 W LED	05 17 26	ASYMMETRICAL
60 W LED	05 17 27	SYMMETRICAL

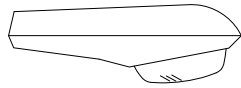


**LED POST TOP LUMINAIRE  
- OCTAGONAL LANTERN**

LED POST TOP LUMINAIRES - ACORN		
LUMINAIRE WATTAGE (NOMINAL)	CIIC	PHOTOMETRIC DISTRIBUTION
60 W LED	05 17 32	ASYMMETRICAL
60 W LED	05 17 33	SYMMETRICAL

- LED CONTEMPORARY LUMINAIRES ARE AVAILABLE WITH GREY COATING ONLY. ALL OTHER DECORATIVE LUMINAIRES ARE BLACK.
- ALL LED LUMINAIRES AUTOMATICALLY ADJUST FOR EITHER A 120V OR 240V SUPPLY.
- ALL LED LUMINAIRES COME WITH A PHOTOCCELL RECEPTACLE.

APPROVED	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY D.R. ORR 15-02-11			<b>STANDARD LED LUMINAIRES</b>	
	16-12	1 REVISED NOTES		
DRAWN C.A.	CHECKED L.D./D.O.	DATE 15-02	<b>CD 300-24</b>	

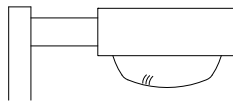


**ROADWAY LUMINAIRE**

ROADWAY LUMINAIRES - UNPAINTED				
WATTAGE	LAMP TYPE	P.E. CELL RECEPTACLE	RATED VOLTAGE	CIIC #
70	H.P.S.	YES	120/240	46 72 17
100	H.P.S.	YES	120/240	46 72 18
150	H.P.S.	YES	120/240	46 72 19
250	H.P.S.	YES	120/240	46 72 21
400	H.P.S.	NO	* 120/240	46 72 22
1000	H.P.S.	NO	* 120/240	46 72 30

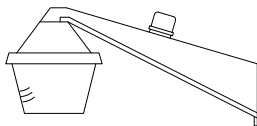
ROADWAY LUMINAIRES - PAINTED BLACK				
WATTAGE	LAMP TYPE	P.E. CELL RECEPTACLE	RATED VOLTAGE	CIIC #
100	H.P.S.	YES	120/240	03 76 75
150	H.P.S.	YES	120/240	03 46 76
250	H.P.S.	YES	120/240	03 46 77
400	H.P.S.	NO	* 120/240	03 47 03

\* 400 WATT AND 1000 WATT H.P.S. ROADWAY LUMINAIRE IS FACTORY CONNECTED FOR 240 VOLT OPERATION; HOWEVER, RECYCLED LUMINAIRES MAY HAVE BEEN RECONNECTED FOR 120 VOLT OPERATION.  
**WHEN INSTALLING ANY LUMINAIRE ON A 240 VOLT CIRCUIT, CHECK CONNECTIONS TO ENSURE THAT LUMINAIRE BALLAST IS PROPERLY WIRED FOR 240 VOLT OPERATION.**



**SQUARE PACK LUMINAIRE**

SQUARE PACK LUMINAIRES				
WATTAGE	LAMP TYPE	P.E. CELL RECEPTACLE	RATED VOLTAGE	CIIC #
100	H.P.S.	YES	120/240	46 73 10
150	H.P.S.	YES	120/240	46 73 15
250	H.P.S.	YES	120/240	46 73 25

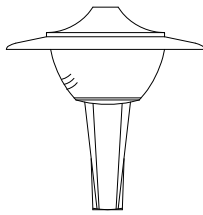


**DUSK TO DAWN LUMINAIRE**

DUSK TO DAWN (SENTINAL) LUMINAIRES				
WATTAGE	LAMP TYPE	P.E. CELL RECEPTACLE	RATED VOLTAGE	CIIC #
100	H.P.S.	YES	120	46 70 10
150	H.P.S.	YES	120	46 70 25

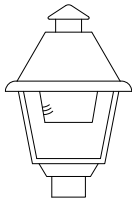
NOTE: ALL HPS LUMINAIRES ARE TO BE SUPERCEDED BY LED. SEE CD300-24 FOR DETAILS.

APPROVED  ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28	REVISIONS			MANITOBA HYDRO DISTRIBUTION STANDARDS	
	15-02	6	REVISED TITLE & ADDED LED NOTE	<b>STANDARD HPS LUMINAIRES</b>	
	13-01	5	ADDED LUMINAIRES AND SHEET 2		
99-01	4	COLONIAL POST TOP ADDED			
DRAWN W.B./CAD	CHECKED D.O.	DATE 88-07	<b>CD 300-25</b>		SHT 0001 OF 2
					REV 06



**POST TOP LUMINAIRE  
- CONTEMPORARY**

POST TOP LUMINAIRES - CONTEMPORARY				
WATTAGE	LAMP TYPE	P.E. CELL RECEPTACLE	RATED VOLTAGE	CIIC #
100	H.P.S.	YES	120	46 72 14



**POST TOP LUMINAIRE  
- COLONIAL**

POST TOP LUMINAIRES - COLONIAL				
WATTAGE	LAMP TYPE	P.E. CELL RECEPTACLE	RATED VOLTAGE	CIIC #
100	H.P.S.	YES	120	46 72 15



**POST TOP LUMINAIRE  
- ACORN**

POST TOP LUMINAIRES - ACORN				
WATTAGE	LAMP TYPE	P.E. CELL RECEPTACLE	RATED VOLTAGE	CIIC #
100	H.P.S.	YES	120/240	03 72 63



**POST TOP LUMINAIRE  
- OCTAGONAL**

POST TOP LUMINAIRES - OCTAGONAL				
WATTAGE	LAMP TYPE	P.E. CELL RECEPTACLE	RATED VOLTAGE	CIIC #
100	H.P.S.	YES	120/240	03 67 33

NOTE: ALL HPS LUMINAIRES ARE TO BE SUPERCEDED BY LED. SEE CD300-24 FOR DETAILS.

APPROVED  ORIGINAL DRAWING SEALED BY D.R. ORR 13-02-12	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS						
	15-02	1	REVISED TITLE & ADDED LED NOTE						
DRAWN C.A.			CHECKED D.O.	DATE 13-01	<b>CD 300-25</b> <table border="1"> <tr> <td>SHT</td> <td>REV</td> </tr> <tr> <td>0002 OF 2</td> <td>01</td> </tr> </table>	SHT	REV	0002 OF 2	01
SHT	REV								
0002 OF 2	01								

**TRENCH AND PLOW-IN LOCATION**

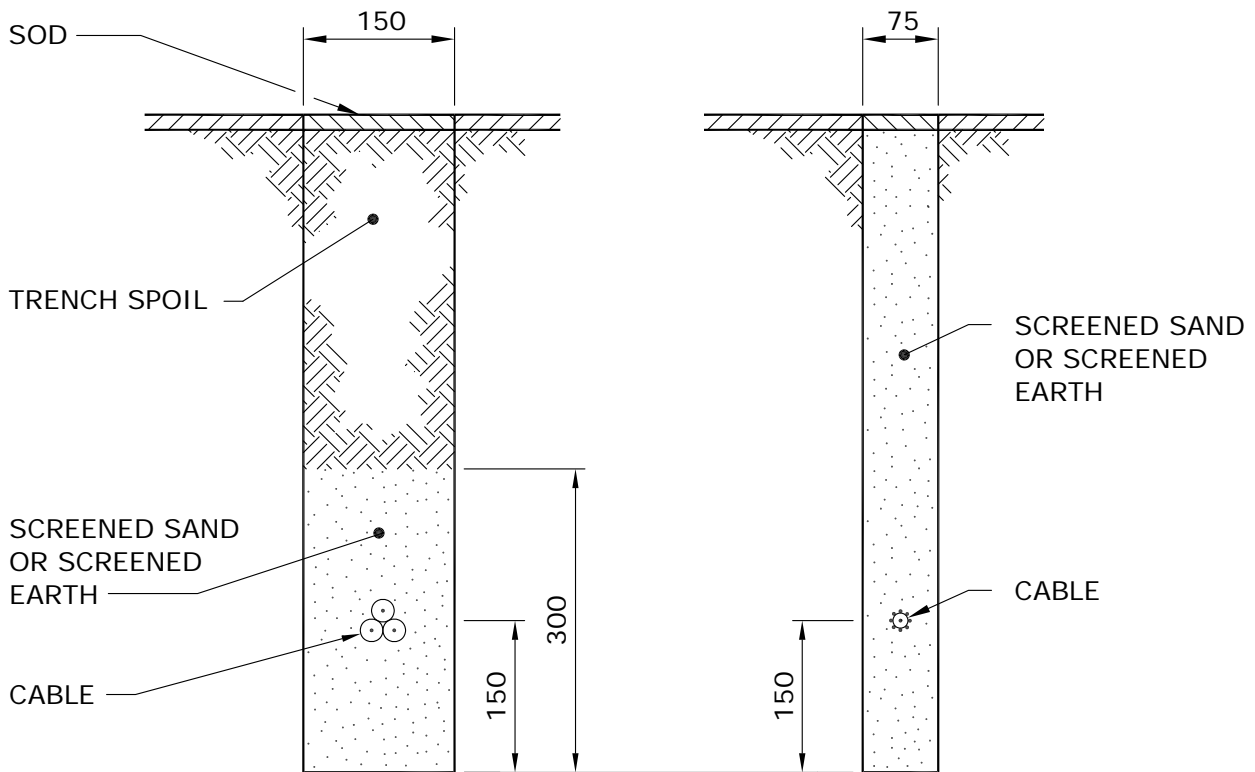
GENERALLY, THE TRENCH LOCATION WILL DICTATE THE LOCATION OF THE LIGHT STANDARDS. CONTACT SHALL BE MADE WITH THE GOVERNING MUNICIPAL AUTHORITY TO DETERMINE THEIR SET BACK REQUIREMENTS. CONTACT SHALL ALSO BE MADE WITH THE CITY OF WINNIPEG UNDERGROUND STRUCTURES OR THE INDIVIDUAL UTILITIES OUTSIDE WINNIPEG TO DETERMINE THE EXISTENCE AND EXACT LOCATION OF OTHER UTILITIES PLANT. THIS INFORMATION WILL BE INCLUDED ON THE WORK ORDER PLANS.

**DEPTH OF BURIAL**

THE CABLE SHALL BE BURIED BELOW THE SURFACE OF THE EARTH A MINIMUM OF 600mm IN SODDED AREAS AND 1000mm IN ROADWAYS.

**TRENCH DETAILS**

TYPICAL TRENCH DETAILS FOR SODDED AREAS ARE SHOWN BELOW, FOR TRENCH DETAILS UNDER ROADWAYS REFER TO DRAWING CD205-14. SEE NOTES ON SHEET 2 of 2.



**NOTE:** DIMENSIONS SHOWN ARE MILLIMETRES.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28	96-01	3	ROADWAY DEPTH ADDED	<b>PLOWING AND TRENCHING DETAILS FOR UNDERGROUND STREET LIGHT CIRCUITS</b>	
	95-09	2	BURIAL DEPTH NOTE ADDED		
	94-04	1	COMBINED WITH DWG. CD305-2		
DRAWN W.B./CAD	CHECKED	DATE 88-07	<b>CD 305-1</b>		SHT 0001 OF 2
					REV 03



NOTES:

1. FOR TYPICAL TRENCH DETAIL INSTALLATION UNDER ROADWAYS, REFER TO DRAWING CD205-14.
2. THESE ARE ALTERNATIVE TRENCH WIDTHS. A 75mm TRENCH IS PREFERABLE WHERE THE GROUND IS FIRM AND A CLEAN CUT CAN BE MADE. A 150mm TRENCH IS PREFERABLE WHERE THE GROUND IS TOO LOOSE TO MAINTAIN A FIRM TRENCH WALL.
3. THE CABLES INDICATED IN THE VIEWS CAN BE USED IN EITHER TRENCH.
4. THE 75mm TRENCH SHALL BE BACKFILLED WITH SCREENED SAND OR SCREENED EARTH.
5. THE 150mm TRENCH SHALL BE BACKFILLED WITH THE TRENCH SPOIL IF IT IS FREE FROM ROCKS OR DEBRIS. IF THE TRENCH SPOIL CONTAINS ROCKS OR DEBRIS, SCREENED SAND OR SCREENED EARTH SHALL BE INSTALLED AS SHOWN.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS		
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28				<b>PLOWING AND TRENCHING DETAILS FOR UNDERGROUND STREET LIGHT CIRCUITS</b>		
		96-01	2			NOTES REVISED
		94-04	1			COMBINED WITH DWG. CD305-2
DRAWN W.B./CAD	CHECKED	DATE 88-07	<b>CD 305-1</b>		SHT 0002 OF 2	
					REV 02	

1. **GENERAL**

PLOWED-IN CABLES SHALL BE PULLED TO 1m ABOVE GRADE AT EACH STREET LIGHT STANDARD LOCATION. THE CABLE DEPTH SHALL BE MAINTAINED AT THE 600mm PLOW DEPTH AS CLOSE AS POSSIBLE TO THE STREET LIGHT STANDARD LOCATION BEFORE RAISING THE PLOW. THE PLOW SHALL BE RETURNED TO THE 600mm PLOW DEPTH AS CLOSE AS POSSIBLE TO THE CENTRE LINE OF THE STREET LIGHT STANDARD LOCATION.

CABLES LAID IN TRENCHES SHALL HAVE SUFFICIENT SLACK TO ALLOW FOR FUTURE MOVEMENT OR SETTLING OF THE TRENCH FLOOR. CABLES SHALL PROJECT 1m ABOVE GRADE AT EACH LOCATION.

2. **USE OF POLYETHYLENE PIPE**

2.1 WHERE CABLES ARE INSTALLED UNDER EXISTING PAVEMENT, POLYETHYLENE PIPE SHALL BE INSTALLED TO PROTECT THE CABLES IF THE HOLE IS AUGERED OR PUSHED THROUGH MATERIAL CONTAINING ROCKS, STONES, OR DEBRIS.

2.2 AT THE JUNCTION OF THE MAIN TRENCH AND THE STREET OR DRIVEWAY CROSSING, THE BOTTOM OF THE TRENCH SHALL BE BACKFILLED AND TAMPED TO THE LEVEL OF THE POLYETHYLENE PIPES TO PREVENT SHARP BENDS IN THE CABLE AND TRAPPING OF WATER IN THE PIPE.

3. **SPLICES - UNDERGROUND CABLES**

UNDERGROUND STREET LIGHT CABLES (i.e. #4 ALUMINUM CONCENTRIC NEUTRAL CABLE AND 1/0 TRIPLEXED CABLE) ARE TO BE SPLICED USING AN APPROPRIATE COMPRESSION SLEEVE (SEE DRAWING CD210-21) AND THE SPLICE IS TO BE INSULATED USING ONE OF THE FOLLOWING METHODS:

- 1) RAYCHEM RAYVOLVE SPLICE
- 2) PRE-STRETCHED INSULATING TUBING SPLICE
- 3) HEAT SHRINK INSULATING TUBING SPLICE
- 4) TAPED SPLICE

FOR COMPLETE INSTRUCTIONS REGARDING THE ABOVE SPLICES, REFER TO DRAWING CD215-12.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS			
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28		94-04 1		DWG. REFERENCE CHANGED			
DRAWN W.B./CAD	CHECKED W.C.	DATE 88-07	<b>CD 310-1</b>			SHT 0001 OF 2	REV 01

4. **CABLE END CAPS**

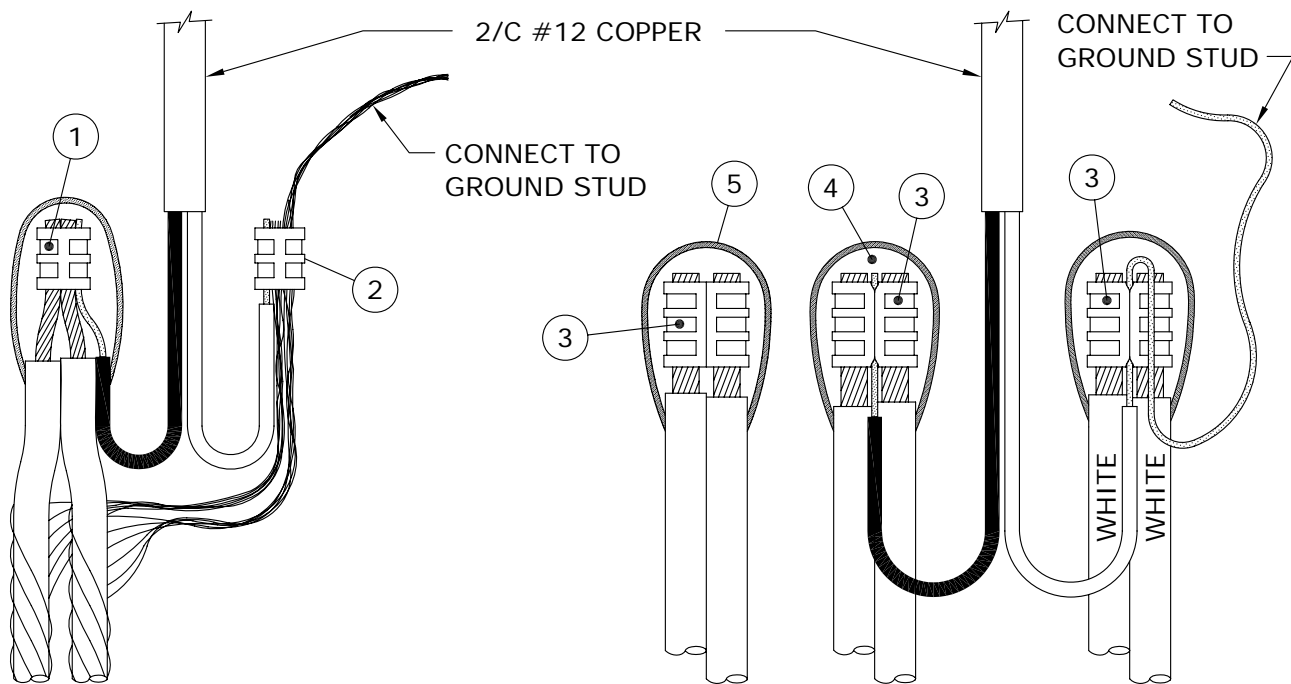
STREET LIGHT CABLES WHICH ARE NOT GOING TO BE SPLICED OR TERMINATED IMMEDIATELY FOLLOWING INSTALLATION SHALL BE CUT SQUARE AND SEALED WITH AN END CAP. REFER TO DRAWING CD215-21 FOR DETAILS.

5. **GROUNDING OF STREET LIGHT STANDARDS**

5.1 ALL STREET LIGHT STANDARDS SHALL BE GROUNDED BY CONNECTING THE NEUTRAL TO THE GROUND STUD INSIDE THE STANDARD. REFER TO DRAWING CD310-4 FOR DETAILS.

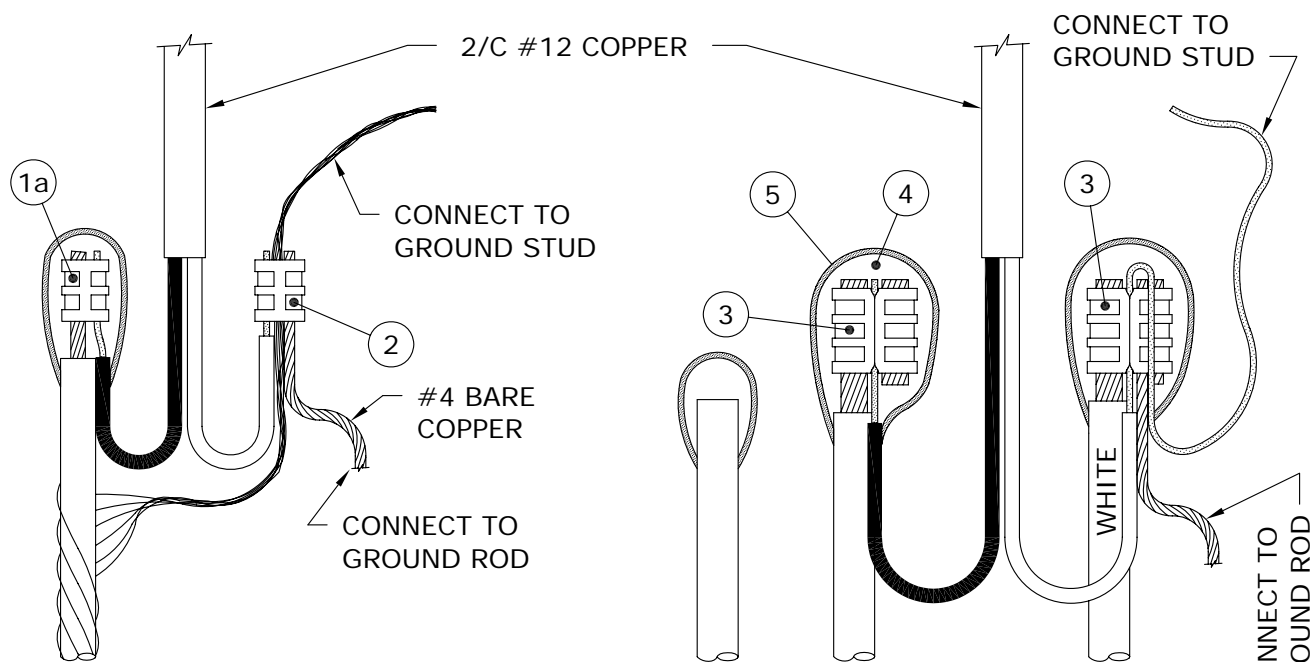
5.2 A GROUND ROD SHALL BE INSTALLED AND CONNECTED TO THE GROUND STUD AT THE LAST STANDARD ON THE STREET LIGHT CIRCUIT.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28		94-04 1 DWG. REFERENCE CHANGED		<b>INSTALLATION OF STREET LIGHT CABLES</b>	
W.B./CAD		W.C.		DATE	
				88-07	
<b>CD 310-1</b>				SHT	
				0002 OF 2	
				01	



**No. 4 ALUMINUM C/N CABLE  
(TYPICAL FEED THROUGH)**

**1/0 ALUMINUM TRIPLEX CABLE  
(TYPICAL FEED THROUGH)**



**No. 4 ALUMINUM C/N CABLE  
(TYPICAL END OF CIRCUIT)**

**1/0 ALUMINUM TRIPLEX CABLE  
(TYPICAL END OF CIRCUIT)**

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28		94-04 1		CONN. REVISED DUE TO INSUL. NEUTRAL	
DRAWN W.B./CAD	CHECKED W.C.	DATE 88-07	<b>CD 310-4</b>		SHT 0001 OF 2
					REV 01

BILL OF MATERIAL

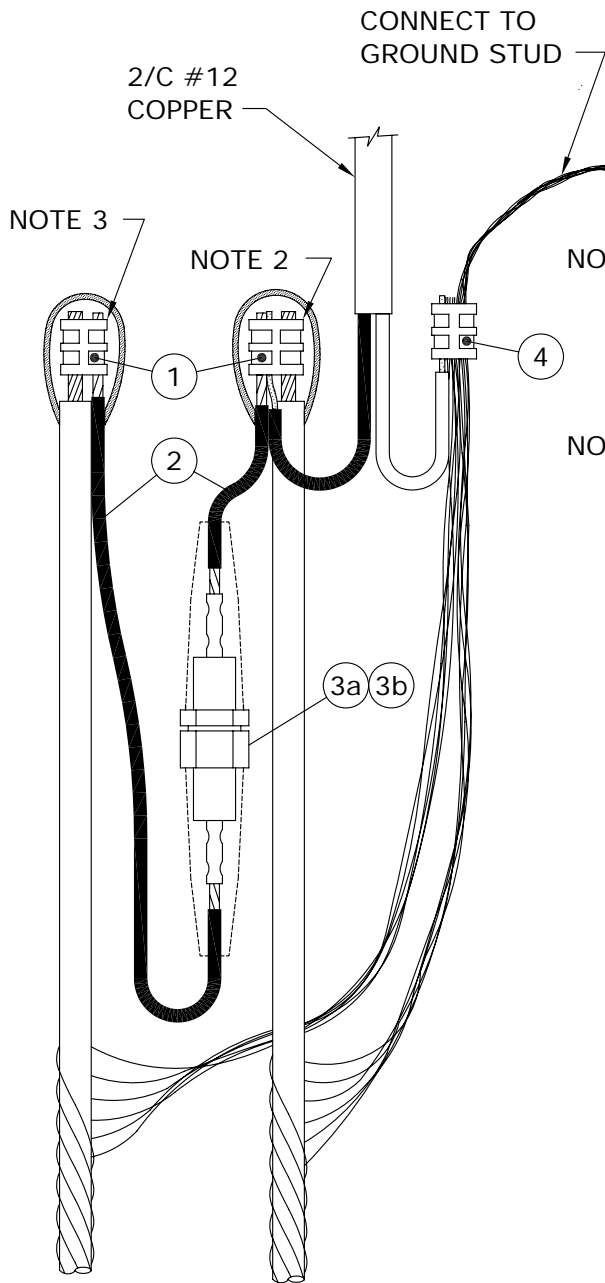
ITEM No.	DESCRIPTION	STORES CODE No.		QUANTITY
		FOR USE WITH # 4 AL. C/N	FOR USE WITH 1/0 AL. TRIPLEX	
1	'C' TYPE AL. COMPRESSION TAP	74 41 30	---	1
1a	'H' TYPE AL. COMPRESSION TAP	74 40 10	---	1 *
2	'C' TYPE CU. COMPRESSION TAP	74 40 90	---	1
3	'H' TYPE AL. COMPRESSION TAP	---	74 40 60	3 **
4	TAPE, SELF-AMALGAMATING EPR	78 55 23	78 55 23	1/4 ROLL
5	TAPE, COLD WEATHER VINYL	78 55 98	78 55 98	1/4 ROLL

- \* FOR END OF CIRCUIT WHEN USING ONLY ONE CABLE.
- \*\* AT END OF CIRCUIT, QUANTITY MAY BE LESS THAN SHOWN.

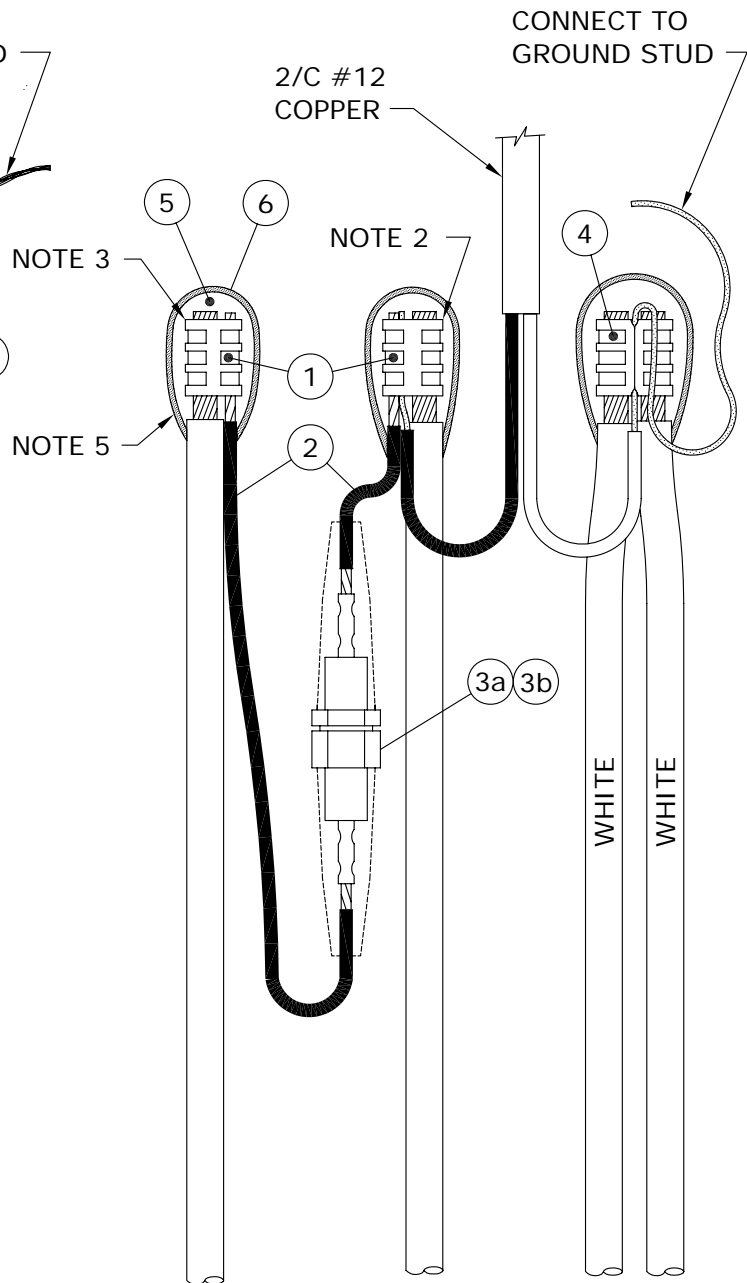
NOTES:

1. **LEAVE SUFFICIENT SLACK ON CONDUCTORS TO ALLOW REMOVAL FROM HANDHOLE FOR MAINTENANCE.**
2. FOR PROPER TAPING PROCEDURE, REFER TO DRAWING CD215-12.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS					
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-03				<b>CONNECTION DETAIL IN STEEL STREET LIGHT STANDARD</b>					
DRAWN W.B./CAD	CHECKED W.C.	DATE 94-05	<b>CD 310-4</b>		<table border="1"> <tr> <td>SHT</td> <td>REV</td> </tr> <tr> <td>0002 OF 2</td> <td>00</td> </tr> </table>	SHT	REV	0002 OF 2	00
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**No. 4 ALUMINUM C/N CABLE**



**1/0 ALUMINUM TRIPLEX CABLE**

APPROVED	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28			<b>STREET LIGHT CIRCUIT PROTECTED BY 30A FUSE IN STREET LIGHT STANDARD</b>	
	94-04	1		
DRAWN W.B./CAD	CHECKED W.C.	DATE 88-07	<b>CD 310-9</b>	

BILL OF MATERIAL

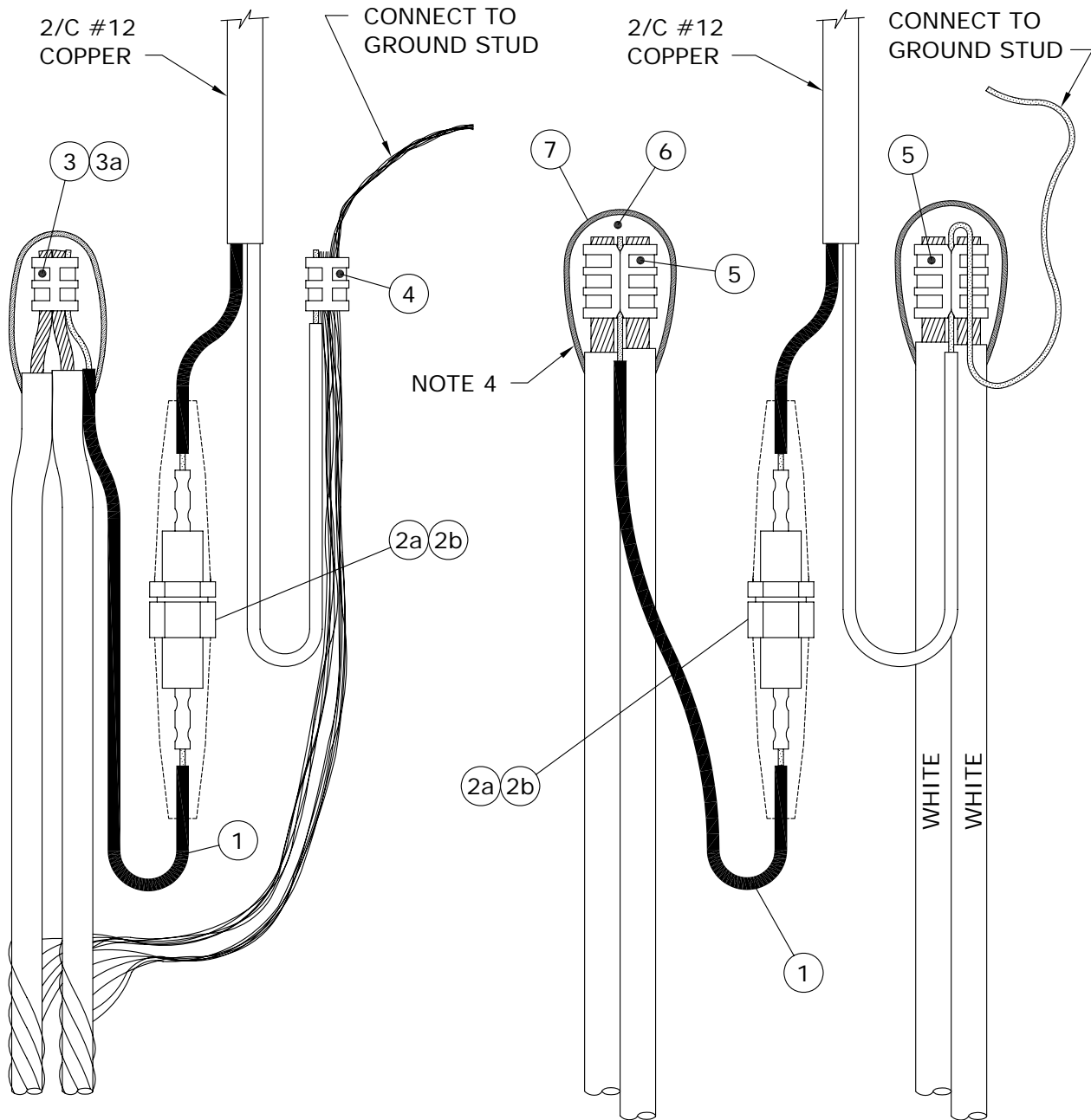
ITEM No.	DESCRIPTION	STORES CODE No.		QUANTITY
		FOR USE WITH # 4 AL. C/N	FOR USE WITH 1/0 AL. TRIPLEX	
1	'H' TYPE COMPRESSION TAP	74 40 10	74 40 30	2
2	WIRE, # 8 CU., 600V, PVC	93 10 08	93 10 08	1m
3a	FUSEHOLDER, 15/30A C/W BOOTS	31 91 30	31 91 30	1
3b	FUSE, 30A	31 14 30	31 14 30	1
4	'C' TYPE COMPRESSION TAP	74 40 90	---	1
	'H' TYPE COMPRESSION TAP	---	74 40 60	1 *
5	TAPE, SELF-AMALGAMATING EPR	78 55 23	78 55 23	1/4 ROLL
6	TAPE, COLD WEATHER VINYL	78 55 98	78 55 98	1/4 ROLL

\* WHEN USING 1/0 ALUMINUM TRIPLEX 1 ADDITIONAL 'H' TYPE COMPRESSION TAP (S.C.# 74 40 60) IS REQUIRED TO CONNECT SECOND (FEED THROUGH) HOT LEG.

NOTES:

- LEAVE SUFFICIENT SLACK ON CONDUCTORS AND FUSE HOLDER TO ALLOW REMOVAL FROM HANDHOLE FOR FUSE REPLACEMENT AND MAINTENANCE.**
- INSERT #12 COPPER AND #8 COPPER IN SMALL GROOVE.
- INSERT DOUBLE THICKNESS OF #8 COPPER IN SMALL GROOVE.
- FOR SPLICING FEED THROUGH HOT LEG, REFER TO DRAWING CD310-4.
- FOR PROPER TAPING PROCEDURE, REFER TO DRAWING CD215-12.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-03				<b>STREET LIGHT CIRCUIT PROTECTED BY 30A FUSE IN STREET LIGHT STANDARD</b>	
DRAWN W.B./CAD	CHECKED W.C.	DATE 94-05	<b>CD 310-9</b>		SHT 0002 OF 2
					REV 00



**No. 4 ALUMINUM C/N CABLE**

**1/0 ALUMINUM TRIPLEX CABLE**

**NOTE:**

RECOMMENDED FOR PROTECTING LUMINAIRE WHICH ARE TO BE MOUNTED ON STREET LIGHT POLES 16.8m AND HIGHER.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS		
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28				<b>INDIVIDUAL LUMINAIRE PROTECTED BY 15A FUSE IN STREET LIGHT STANDARD</b>		
		95-01	2			NOTE ADDED
		94-04	1			CONN. REVISED DUE TO INSUL. NEUTRAL
DRAWN W.B./CAD	CHECKED G.W.	DATE 88-07	<b>CD 310-10</b>		SHT 0001 OF 2	
					REV 02	



BILL OF MATERIAL

ITEM No.	DESCRIPTION	STORES CODE No.		QUANTITY
		FOR USE WITH # 4 AL. C/N	FOR USE WITH 1/0 AL. TRIPLEX	
1	2/C # 12 COPPER	93 52 12	93 52 12	1m
2a	FUSEHOLDER, 15/30A C/W BOOTS	31 91 30	31 91 30	1
2b	FUSE, STREET LIGHT, 15A	31 14 15	31 14 15	1
3	'C' TYPE AL. COMPRESSION TAP	74 41 30	---	1
3a	'H' TYPE AL. COMPRESSION TAP	74 40 10	---	1 *
4	'C' TYPE CU. COMPRESSION TAP	74 40 90	---	1
5	'H' TYPE AL. COMPRESSION TAP	---	74 40 60	3 **
6	TAPE, SELF-AMALGAMATING EPR	78 55 23	78 55 23	1/4 ROLL
7	TAPE, COLD WEATHER VINYL	78 55 98	78 55 98	1/4 ROLL

- \* FOR END OF CIRCUIT WHEN USING ONLY ONE CABLE.
- \*\* AT END OF CIRCUIT, QUANTITY MAY BE LESS THAN SHOWN.

NOTES:

1. **LEAVE SUFFICIENT SLACK ON CONDUCTORS AND FUSE HOLDER TO ALLOW REMOVAL FROM HANDHOLE FOR FUSE REPLACEMENT AND MAINTENANCE.**
2. FOR SPLICING FEED THROUGH HOT LEG, REFER TO DRAWING CD310-4.
3. FOR END OF CIRCUIT, REFER TO DRAWING CD310-4.
4. FOR PROPER TAPING PROCEDURE, REFER TO DRAWING CD215-12.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 94-07-03				<b>INDIVIDUAL LUMINAIRE PROTECTED BY 15A FUSE IN STREET LIGHT STANDARD</b>	
DRAWN W.B./CAD	CHECKED W.C.	DATE 94-05	<b>CD 310-10</b>		SHT 0002 OF 2
					REV 00

SUPPLY VOLTAGES

THE SUPPLY VOLTAGE FOR STREET LIGHT CIRCUITS MAY BE PROVIDED BY POLE-MOUNTED DISTRIBUTION TRANSFORMERS OR BY PAD-MOUNTED DISTRIBUTION TRANSFORMERS.

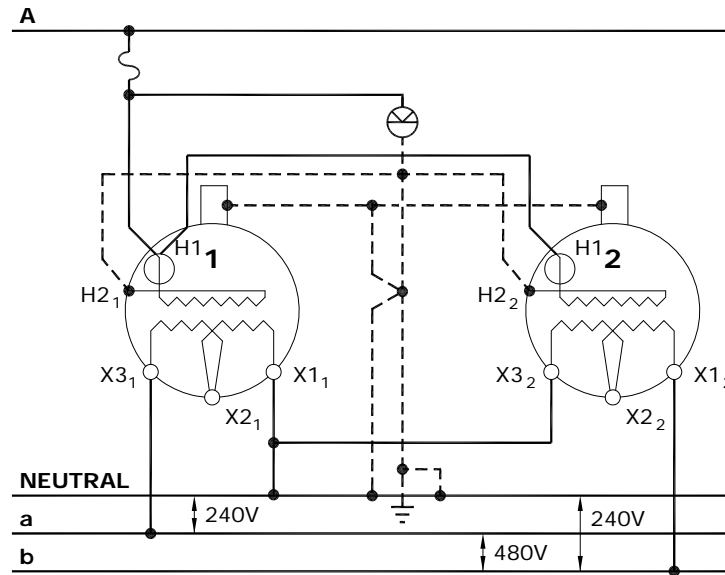
THE MAJORITY OF ROADWAY LUMINAIRES ARE RATED FOR OPERATION ON EITHER 120 VOLT OR 240 VOLT CIRCUITS AND ARE FACTORY WIRED FOR 120 VOLT OPERATION EXCEPT FOR 400 WATT H.P.S. LUMINAIRES WHICH ARE RATED FOR 120/240 VOLT OPERATION BUT ARE FACTORY WIRED FOR 240 VOLT OPERATION.

IN CASES WHERE EXCESSIVE VOLTAGE DROP IN A STREET LIGHTING CIRCUIT IS A PROBLEM, A SUPPLY VOLTAGE OF 240/480 MAY BE USED. A SUPPLY VOLTAGE OF 240/480 CAN BE OBTAINED FROM TWO SINGLE PHASE POLE-MOUNTED DISTRIBUTION TRANSFORMERS CONNECTED AS SHOWN ON DRAWING CD315-2. IF A SINGLE PHASE PAD-MOUNTED DISTRIBUTION TRANSFORMER WITH A 240/480 VOLT SECONDARY IS REQUIRED, THE TRANSFORMER MUST BE ORDERED FROM THE MANUFACTURER (SEE DRAWING CD315-2).

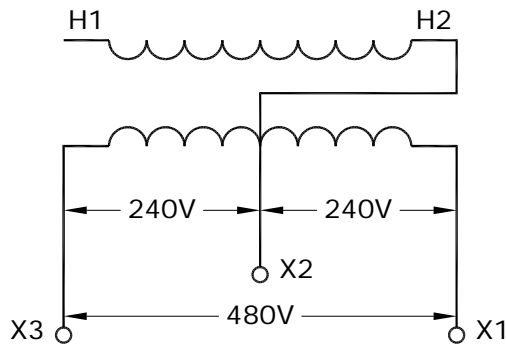
CAUTION:

PRIOR TO CONNECTING LUMINAIRES TO A 240 VOLT SUPPLY CIRCUIT IT IS IMPORTANT TO CHECK THE INTERNAL CONNECTIONS TO THE TERMINAL BLOCK TO ENSURE THAT THE UNIT IS PROPERLY CONNECTED FOR 240 VOLT OPERATION.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28				<b>SUPPLY VOLTAGES FOR STREET LIGHT CIRCUITS</b>	
DRAWN W.B./CAD	CHECKED W.C.	DATE 88-08	<b>CD 315-1</b>		SHT 0001 OF 1
					REV 00



SECONDARY VOLTAGE 240/480V GROUNDED. TWO SINGLE-PHASE POLE-MOUNTED TRANSFORMERS WITH 120/240V SECONDARIES.



SECONDARY VOLTAGE 240/480V GROUNDED. SINGLE-PHASE PAD-MOUNTED TRANSFORMER AS SUPPLIED BY MANUFACTURER

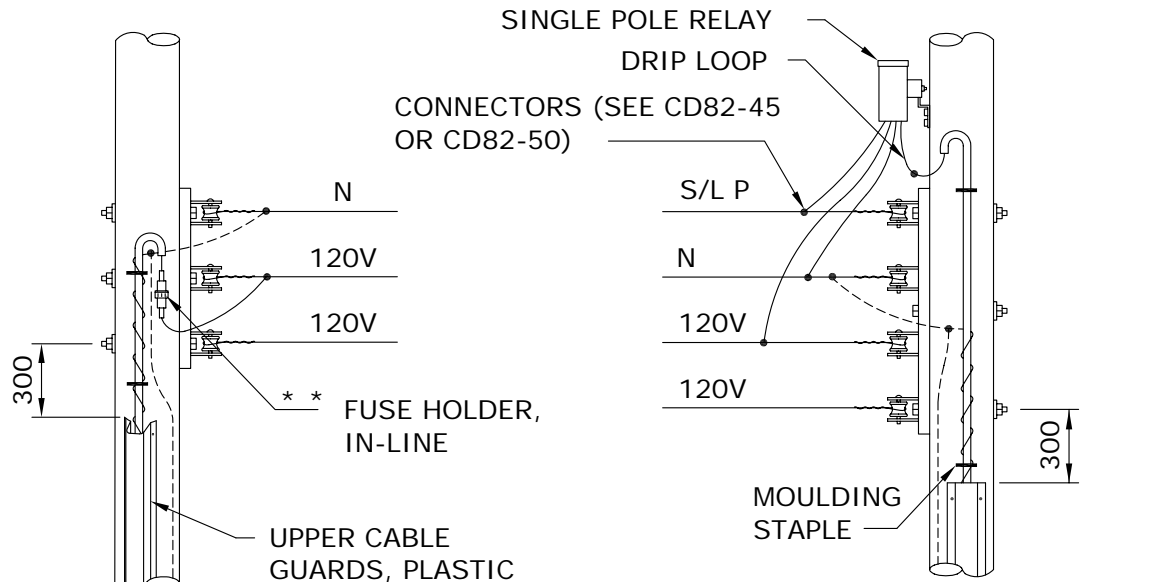
SAFETY PRECAUTION

1. SINGLE PHASE PAD MOUNTED TRANSFORMERS WITH ABOVE SECONDARY VOLTAGES TO HAVE WARNING SIGN "**CAUTION - 240/480V SECONDARY - SEE NAMEPLATE**", STENCILLED ON THE OUTSIDE OF THE TRANSFORMER NEAR NAMEPLATE.
2. NAMEPLATES OF MODIFIED TRANSFORMERS TO BE REVISED.

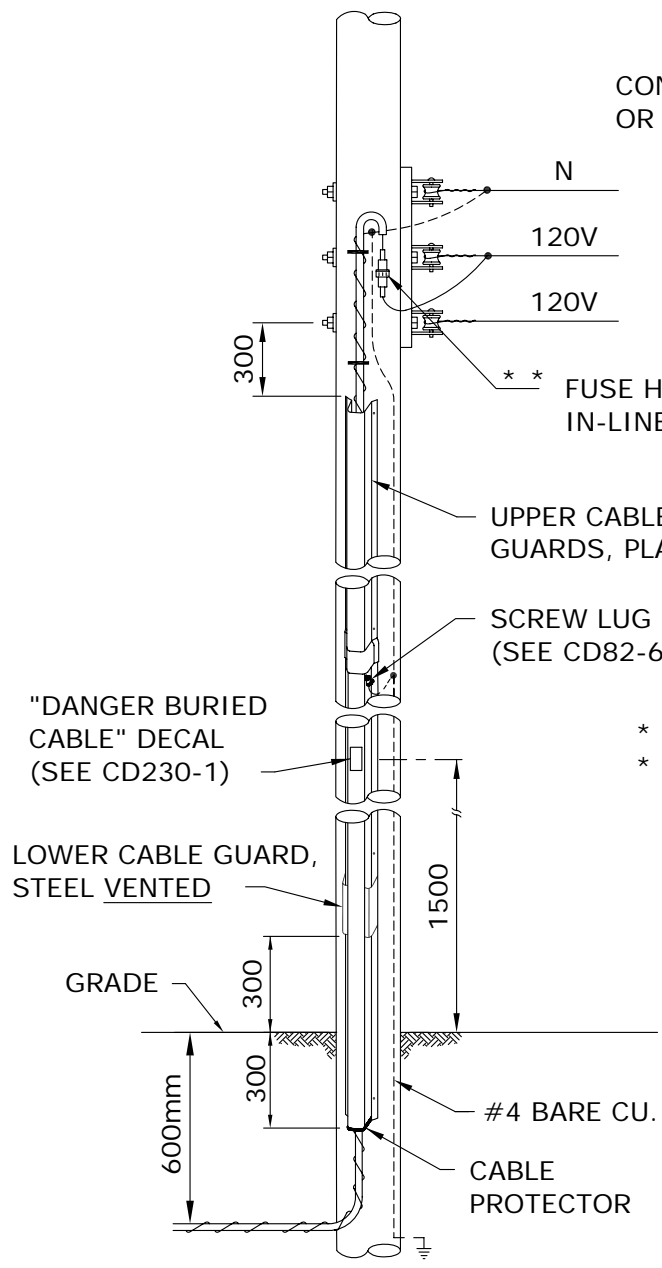
PURCHASE OF 240/480 VOLT TRANSFORMER

1. INCLUDE ABOVE WARNING SIGN REQUIREMENT IN PURCHASE DESCRIPTION.

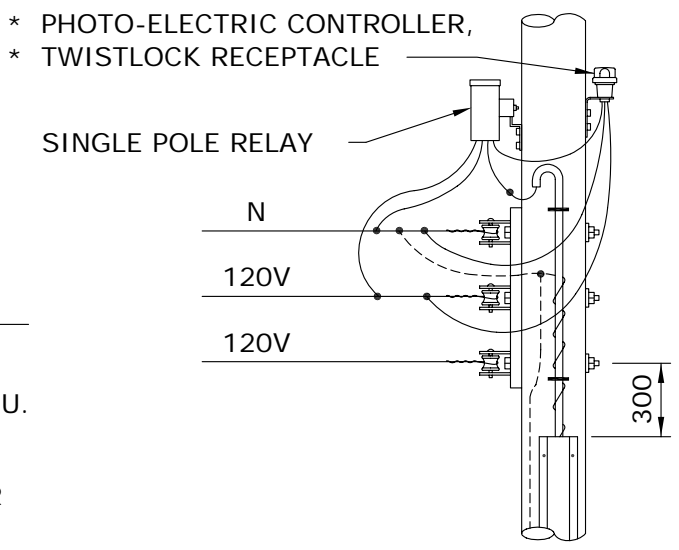
APPROVED	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS		
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28			<b>240/480 VOLT SUPPLY FOR STREET LIGHT CIRCUITS</b>		
	13-01	2			REVISED DIAGRAM
	90-04	1			DROPOUT DELETED
DRAWN W.B./CAD	CHECKED L.D./D.O.	DATE 88-08	<b>CD 315-2</b>		
			SHT 0001 OF 1	REV 02	



**STREET LIGHT PILOT WIRE CONTROLLED RELAY**



**IN-LINE FUSE PROTECTED**



**P.E. CELL CONTROLLED RELAY**

\*\* USED WHERE POLY ISN'T USED

\* USED WHERE ST./LT. PILOT DOES NOT EXIST

**NOTES:**

1. REFER TO DRAWING CD200-63 FOR CABLE GUARD INSTALLATION DETAILS.
2. INSTALL A GROUND ROD AT THE LAST POLE ON THE STREET LIGHT CIRCUIT.
3. DIMENSIONS SHOWN ARE MILLIMETRES.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28	99-08	3	SHOW VENTED CABLE GUARD, SHEET 2 DELETED	<b>DIP POLE FOR UNDERGROUND STREET LIGHTING CIRCUIT</b>	
	94-04	2	DWG. REFERENCE CHANGED		
	92-06	1	NOTE 1		
DRAWN R.L.B./CAD	CHECKED K.C.H.	DATE 88-08	<b>CD 315-5</b>		SHT 0001 OF 1
					REV 03

CONTROL METHODS

1. LUMINAIRES CONTROLLED INDIVIDUALLY BY PHOTO-ELECTRIC CELL

THE PREFERRED METHOD FOR PROVIDING ON/OFF CONTROL OF A STREET LIGHT LUMINAIRE IS TO INSTALL A PHOTO-ELECTRIC CELL ON EACH LUMINAIRE, IF LUMINAIRES ARE MOUNTED ON HIGHER POLES (IN EXCESS OF 10.7 M OR 35 FT.) WHERE IT IS DIFFICULT TO REACH THE LUMINAIRE WITH THE LOCAL DISTRICT BUCKET TRUCK, CONSIDERATION SHOULD BE GIVEN TO USING A PHOTO-ELECTRIC CONTROLLED EXTERNALLY-MOUNTED RELAY SYSTEM.

2. PHOTO-ELECTRIC CONTROLLED EXTERNALLY-MOUNTED RELAY

SEVERAL LUMINAIRES CAN BE CONTROLLED SIMULTANEOUSLY BY INSTALLING A PHOTO-ELECTRIC CONTROLLED, EXTERNALLY MOUNTED RELAY, ON A WOOD POLE (SEE CD315-11) OR ON A STEEL STREET LIGHT POLE (SEE CD315-12). SINGLE POLE (SINGLE CIRCUIT) RELAYS ARE AVAILABLE WITH EITHER A 30 AMP OR A 60 AMP RATING. A BY-PASS SWITCH MAY BE INSTALLED TO PROVIDE A MEANS OF ACTIVATING THE STREET LIGHT CIRCUIT FOR DAYLIGHT MAINTENANCE PURPOSES.

3. STREET LIGHT RELAY USING STREET LIGHT CONTROL

ACTIVATING SUCCESSIVE SECTIONS OF STREET LIGHTING CIRCUITS BY MEANS OF A SERIES OF RELAYS (KNOWN AS A CASCADE CONTROLLED SYSTEM) IS NO LONGER USED AS A CONTROL METHOD. HOWEVER, SOME CASCADE CONTROLLED RELAY SYSTEMS REMAIN IN SERVICE. THE CONNECTION DIAGRAMS FOR A CASCADE CONTROLLED RELAY SYSTEM ARE SHOWN ON DRAWING CD315-14. DOUBLE POLE (DOUBLE CIRCUIT) RELAYS ARE NO LONGER PURCHASED, THEREFORE, DOUBLE POLE RELAYS WHICH FAIL MUST BE REPLACED WITH TWO SINGLE POLE RELAYS. BOTH THE SINGLE AND DOUBLE POLE OLDER STYLE RELAYS HAVE A 5 AMP FUSE PROTECTING THE RELAY COIL.

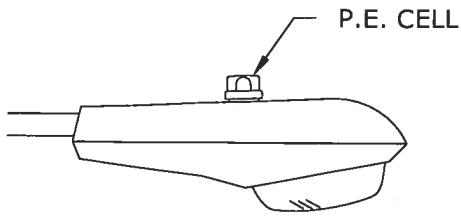
4. STREET LIGHT RELAY USING PILOT WIRE CONTROL

PILOT WIRE CONTROL SYSTEMS ARE NO LONGER USED FOR NEW CONSTRUCTION. HOWEVER, SOME PILOT WIRE CONTROL SYSTEMS REMAIN IN SERVICE. THE CONNECTION DIAGRAMS FOR PILOT WIRE CONTROL SYSTEMS ARE SHOWN ON DRAWING CD315-15. DOUBLE POLE (DOUBLE CIRCUIT) RELAYS ARE NO LONGER PURCHASED. THEREFORE, DOUBLE POLE RELAYS WHICH FAIL MUST BE REPLACED WITH TWO SINGLE POLE RELAYS.

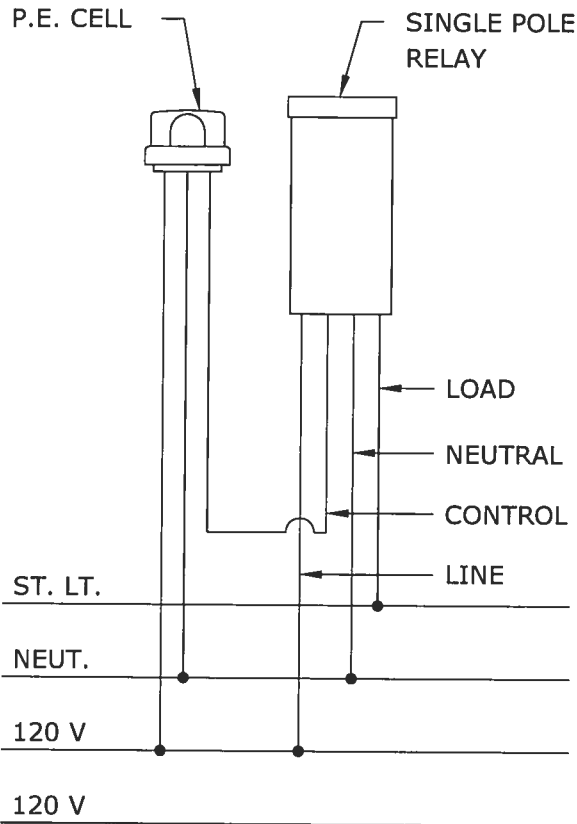
5. PHOTO-ELECTRIC CONTROLLED RELAY IN BASE OF STANDARD

COMPACT RELAYS, MOUNTED IN THE BASE OF STEEL STREET LIGHT STANDARDS ARE NO LONGER USED FOR NEW CONSTRUCTION. THE COMPACT RELAY IS ACTIVATED VIA THE PHOTO-ELECTRIC CONTROLLER ON THE LUMINAIRE. IF A COMPACT RELAY FAILS AN EXTERNALLY-MOUNTED RELAY AND PHOTO-ELECTRIC CONTROLLER SHOULD BE INSTALLED (SEE CD315-12 AND CD315-13).

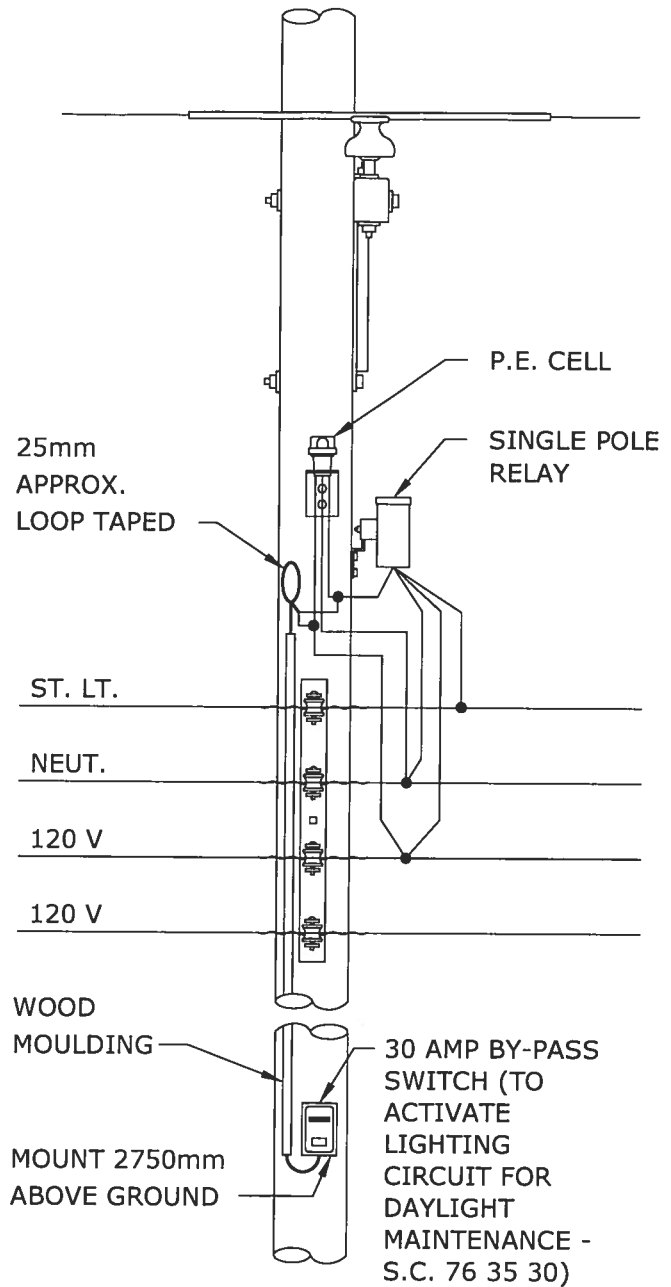
APPROVED	REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS		
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28			<b>CONTROL METHODS FOR STREET LIGHT CONTROLS</b>		
DRAWN W.B./CAD	CHECKED W.C.	DATE 88-08	<b>CD 315-10</b>		SHT 0001 OF 1
				REV 00	



INDIVIDUALLY CONTROLLED LUMINAIRE



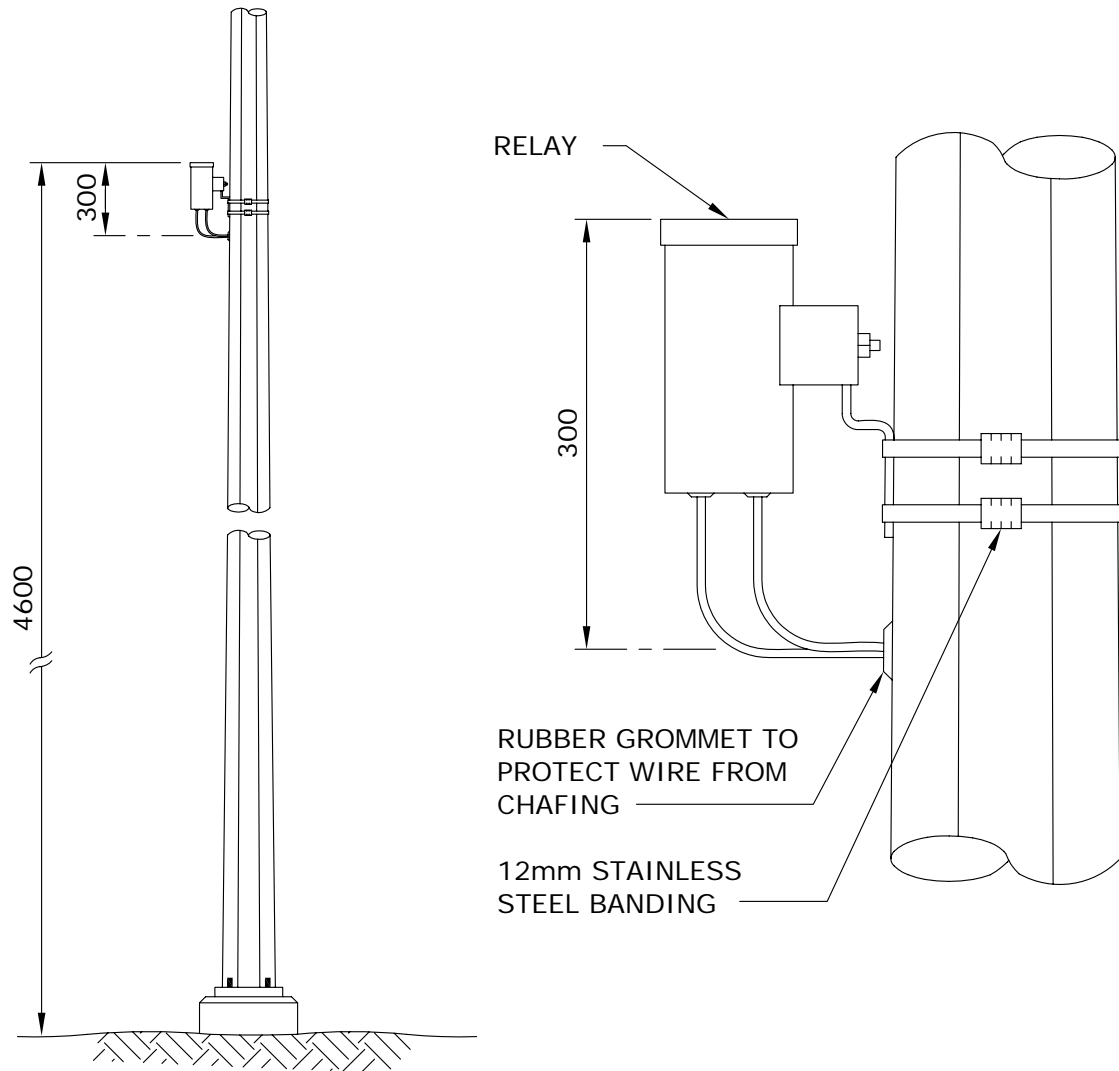
SINGLE POLE (SINGLE CIRCUIT) RELAY CONNECTIONS



SINGLE POLE (SINGLE CIRCUIT) RELAY C/W BY-PASS SWITCH

**NOTE:**  
P.E. CELL MUST BE MOUNTED SO THAT CELL WINDOW FACES NORTH.

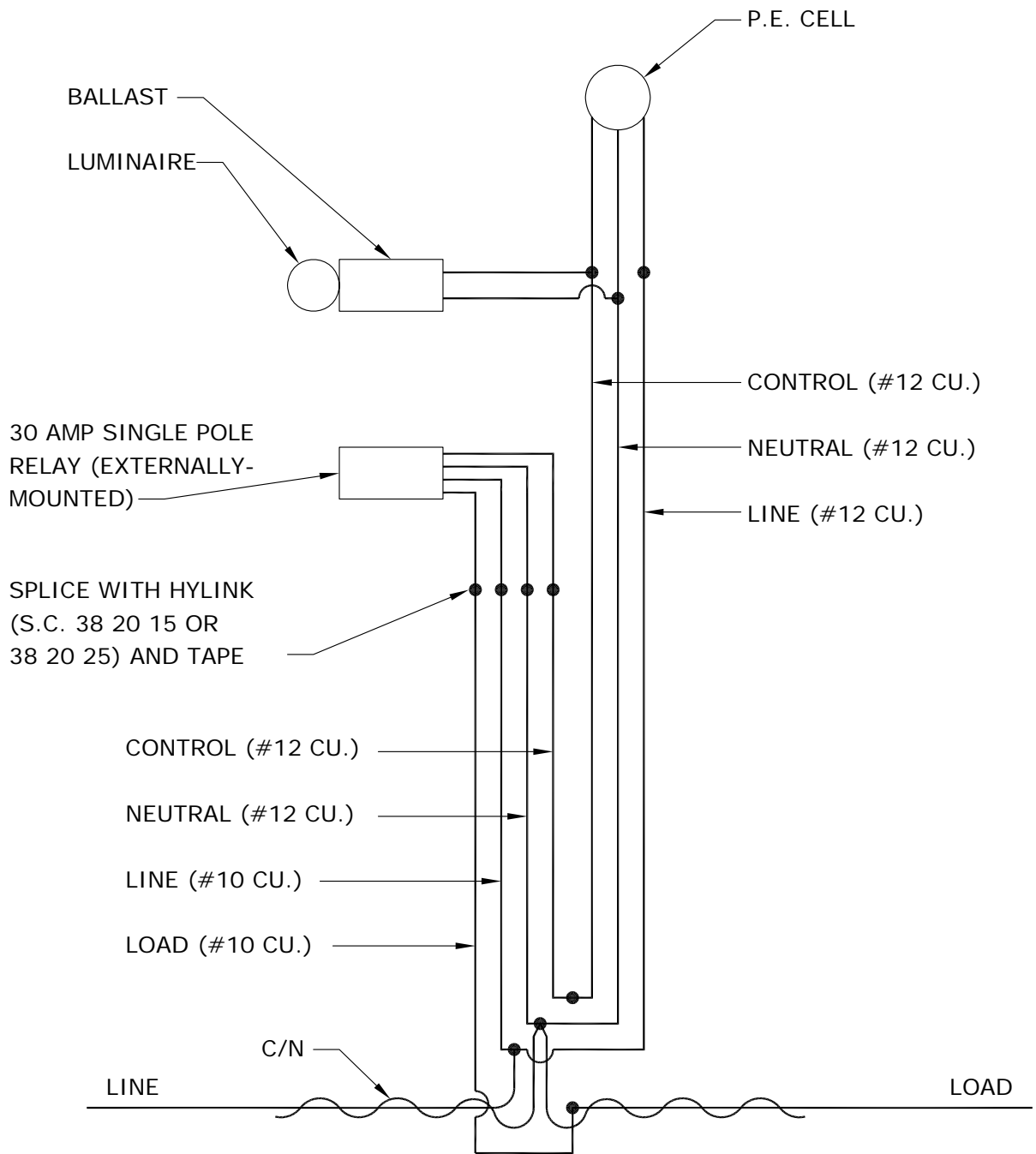
APPROVED	REVISIONS	MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28		<b>PHOTO-ELECTRIC CELL, RELAY AND BY-PASS SWITCH CONNECTION DIAGRAM</b>	
DRAWN W.B./CAD	CHECKED W.C.	DATE 88-09	<b>CD 315-11</b>
			SHT 0001 of 1 REV 00



**NOTES:**

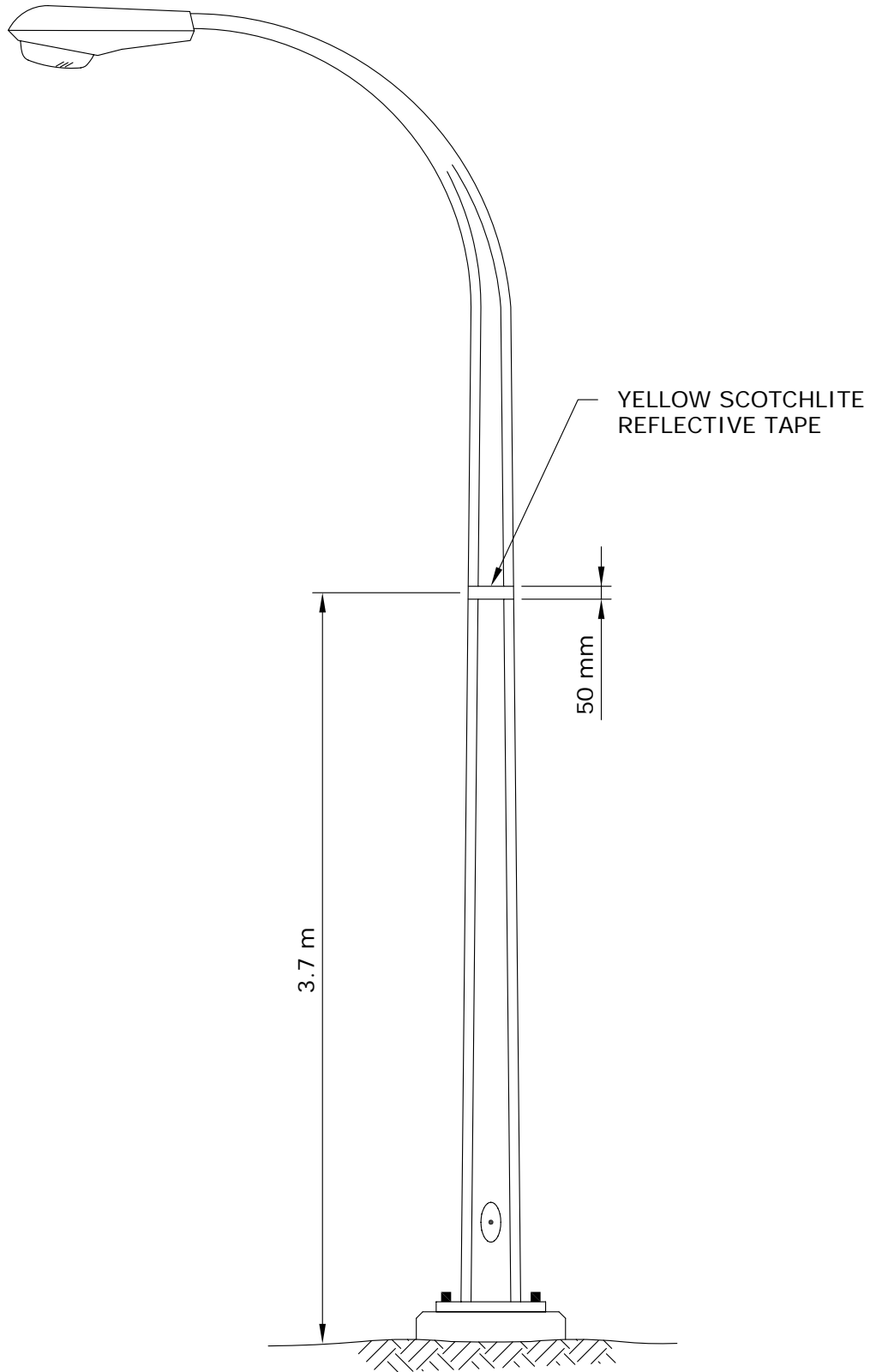
1. DRILL 25mm HOLE AT A POINT 4.3m ABOVE FINISHED GRADE.
2. INSTALL RUBBER GROMMET IN HOLE.
3. BAND RELAY TO POLE USING 12mm STAINLESS STEEL BANDING MATERIAL SO THAT THE TOP OF THE RELAY IS 300mm ABOVE THE CENTRE OF THE HOLE.
4. CONNECT RELAY LEADS TO 4.3m LENGTHS OF EQUAL SIZED CONDUCTOR AND PUSH SPLICES INSIDE POLE.
5. TAPE EXPOSED RELAY LEADS INTO A BUNDLE.
6. DIMENSIONS SHOWN ARE MILLIMETRES.

APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS					
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28				<b>INSTALLATION OF EXTERNALLY-MOUNTED RELAY</b>					
DRAWN W.B./CAD	CHECKED W.C.	DATE 88-09	<b>CD 315-12</b>		<table border="1"> <tr> <td>SHT</td> <td>REV</td> </tr> <tr> <td>0001 OF 1</td> <td>00</td> </tr> </table>	SHT	REV	0001 OF 1	00
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APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28		94-03   1   MAXIMUM RELAY SIZE		<b>CONNECTION SCHEMATIC FOR EXTERNALLY-MOUNTED RELAY</b>	
DRAWN W.B./CAD	CHECKED W.C.	DATE 88-09	SHT 0001 OF 1		REV 01





APPROVED		REVISIONS		MANITOBA HYDRO DISTRIBUTION STANDARDS	
ORIGINAL DRAWING SEALED BY E.H. WIEBE 89-04-28				<b>IDENTIFICATION OF FIRST STREET LIGHT STANDARD CONNECTION TO CIRCUIT</b>	
DRAWN W.B./CAD	CHECKED W.C.	DATE 88-09	<b>CD 315-35</b>		
			SHT		REV
			0001 OF 1		00