SECTION 31 – GENERAL

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
31-i	7/18	31-61	7/15	31-75	7/15
31-ii	7/15	31-62	7/15	31-76	7/15
31-1	7/17	31-63	7/15	31-77	7/15
31-2	7/17	31-64	7/15	31-78	7/15
31-51	7/15	31-65	7/15	31-79	7/15
31-52	7/15	31-66	7/15	31-80	7/16
31-53	7/15	31-67	7/15	31-81	7/16
31-54	7/15	31-68	7/15	31-82	7/15
31-55	7/15	31-69	7/15	31-83	7/15
31-56	7/15	31-70	7/15	31-84	7/15
31-57	7/15	31-71	7/15	31-85	7/18
31-58	7/15	31-72	7/15	31-NOTES	7/18
31-59	7/15	31-73	7/15		
31-60	7/15	31-74	7/15		

SECTION 32 – CONDUIT

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
32-i	7/21	32-4	7/18	32-9	7/13
32-ii	7/21	32-5	7/18	32-10	7/13
32-1	2/06	32-6	7/15	32-11	7/18
32-2	7/08	32-7	7/08	32-NOTES	7/21
32-3	7/08	32-8	7/21		

SECTION 33 – MANHOLES/HANDHOLES

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
33-i	7/22	33-100	7/13	33-121	7/19
33-ii	7/22	33-101	7/19	33-122	7/09
33-1	7/19	33-102	7/19	33-123	7/09
33-2	7/19	33-103	7/21	33-124	7/21
33-3	7/21	33-104	7/21	33-125	7/21
33-4	7/21	33-105	7/21	33-126	7/21
33-5	7/19	33-106	7/21	33-127A	7/22
33-6	7/19	33-107	7/21	33-127B	7/22
33-7	7/20	33-108	7/21	33-127C	7/22
33-8	7/19	33-109	7/21	33-128A	7/22
33-9	7/19	33-110	7/21	33-128B	7/22
33-10	7/18	33-111	7/21	33-129A	7/22
33-11	7/20	33-112	7/21	33-129B	7/21
33-12	7/22	33-113A	7/21	33-130	7/21
33-12A	7/22	33-113B	7/22	33-131A	7/21
33-13	7/21	33-113C	7/21	33-131B	7/21
33-14	7/21	33-113D	7/21	33-132	7/21
33-15	7/21	33-BLANK	7/19	33-133	7/21
33-16	7/21	33-114	7/21	33-134	7/21
33-17	7/19	33-115	7/21	33-135	7/21
33-BLANK	7/19	33-116	7/21	33-138	7/22
33-97	7/19	33-117	7/21	33-139	7/22
33-98	7/19	33-120A	7/21	33-140	7/22
33-99	7/19	33-120B	7/21	33-NOTES	7/22

SECTION 34 – TOOLS AND DIES

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
34-i	7/11	34-103	7/11	34-109	7/11
34-ii	2/06	34-104	7/11	34-110	7/11
34-1	7/11	34-105	7/11	34-111	7/11
34-100	7/11	34-106	7/11	34-NOTES	7/11
34-101	7/11	34-107	7/11		
34-102	7/11	34-108	7/11		

SECTION 35 – CABLES

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
35-i	7/19	35-10	7/09	35-21	7/19
35-ii	7/19	35-11	7/09	35-22	7/19
35-1	7/09	35-12	7/09	35-23	7/16
35-2	7/09	35-13	7/09	35-24	7/16
35-3	7/15	35-14	7/09	35-25	7/09
35-4	7/15	35-15	7/09	35-26	7/09
35-5	7/19	35-16	7/19	35-27	7/09
35-6	7/19	35-17	7/09	35-NOTES	7/19
35-7	7/15	35-18	7/09		
35-8	7/09	35-19	7/09		
35-9	7/09	35-20	7/09		

SECTION 36 – CONNECTORS/SPLICES

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
36-i	7/20	36-11	1/18	36-23	7/18
36-ii	2/06	36-12	7/18	36-24	7/18
36-1	7/17	36-13	7/18	36-25	7/18
36-2	7/17	36-14	7/18	36-26	7/18
36-3	7/17	36-15	7/18	36-NOTES	7/20
36-4	7/15	36-16	7/18	36-NOTES	7/18
36-5	7/20	36-17	7/18		
36-6	7/09	36-18	7/18		
36-7	7/18	36-19	7/18		
36-8	1/07	36-20	7/18		
36-9	7/18	36-21	7/18		
36-10	7/09	36-22	7/18		

SECTION 37 – TERMINATIONS

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
37-i	7/18	37-7	7/10	37-15	7/18
37-ii	2/06	37-8	1/07	37-16	7/18
37-1	7/10	37-9	1/07	37-17	7/18
37-2	7/10	37-10	7/10	37-18	7/18
37-3	7/14	37-11	7/10	37-19	7/15
37-4	7/15	37-12	1/07	37-20	7/15
37-5	7/20	37-13	1/10	37-NOTES	7/20
37-6	1/07	37-14	7/10	37-BLANK	7/15

SECTION 38 – SWITCHES/SWITCHGEAR

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
38-i	7/22	38-30	7/19	38-105	7/09
38-ii	7/22	38-31	7/19	38-106	7/09
38-1	7/08	38-32	7/19	38-107	7/09
38-2	7/20	38-33	7/19	38-110	7/08
38-3	7/21	38-34	7/21	38-111	7/08
38-4	7/21	38-35	7/22	38-112	7/15
38-5	7/22	38-36	7/22	38-113	7/08
38-6	7/21	38-37	7/22	38-114	7/15
38-7	7/21	38-38	7/19	38-120	7/19
38-8	7/20	38-39	7/21	38-121	7/19
38-9	7/20	38-40	7/19	38-122	7/19
38-10	7/21	38-41	7/19	38-140	7/20
38-11	7/19	38-42	7/21	38-141	7/20
38-12	7/19	38-43	7/18	38-142	7/20
38-13	7/21	38-44	7/19	38-143	7/22
38-14	7/21	38-45	7/19	38-144	7/22
38-15	7/16	38-46	7/20	38-145	7/19
38-16	7/21	38-47	7/19	38-146	7/19
38-17	7/19	38-48	7/22	38-147A	7/22
38-18	7/19	38-49	7/22	38-147B	7/22
38-19	7/16	38-50	7/21	38-147C	7/22
38-20	7/19	38-51	7/21	38-148A	7/22
38-21	7/16	38-52	7/21	38-148B	7/22
38-22	7/16	38-BLANK	7/21	38-149	7/21
38-23	7/19	38-100	7/14	38-150	7/15
38-24	7/19	38-101	7/22	38-200	7/14
38-25	7/19	38-102	7/08	38-204	7/14
38-26	7/19	38-103	7/18	38-206	7/14
38-27	7/19	38-103A	7/20	38-208	7/19
38-28	7/16	38-103B	7/18	38-BLANK	7/21
38-29	7/19	38-104	7/14	38-NOTES	7/22

SECTION 39 – FUSES

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
39-i	7/21	39-4	7/20	39-9	7/20
39-ii	2/06	39-5	2/06	39-NOTES	7/21
39-1	7/12	39-6	7/20		
39-2	1/07	39-7	7/20		
39-3	7/18	39-8	7/21		

SECTION 40 – TRANSFORMERS – UG/UCD

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
40-i	7/20	40-9	7/20	40-59	2/06
40-ii	2/06	40-50	7/08	40-60	1/07
40-1	2/06	40-51	7/13	40-61	2/06
40-2	2/06	40-52	7/08	40-74	2/06
40-3	7/15	40-53	7/13	40-75	2/06
40-4	1/07	40-54	7/20	40-76	2/06
40-5	7/15	40-55	7/12	40-101	7/08
40-6	7/12	40-56	2/06	40-102	1/07
40-7	7/20	40-57	2/06	40-NOTES	7/20
40-8	7/13	40-58	2/06	40-BLANK	7/20

SECTION 41 – TRANSFORMER VAULTS

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
41-i	7/21	41-200	7/20	41-209	7/20
41-ii	2/06	41-201	7/20	41-210	7/20
41-1	7/20	41-202	7/20	41-220	7/20
41-2	7/20	41-BLANK	7/20	41-221	7/20
41-3	7/20	41-204	7/20	41-222	7/20
41-4	7/21	41-205	7/20	41-300	7/21
41-100	7/12	41-206	7/20	41-NOTES	7/21
41-101	7/12	41-BLANK	7/20		
41-BLANK	7/20	41-208	7/20		

SECTION 42 – NETWORKS

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
42-i	7/20	42-18	7/17	42-129	2/06
42-ii	7/21	42-19	7/20	42-130	2/06
42-1	7/15	42-20	7/19	42-131	2/06
42-2	7/15	42-101	7/17	42-134	2/06
42-3	7/18	42-102	2/06	42-135	2/06
42-4	7/16	42-103	2/06	42-136	2/06
42-5	7/15	42-104	2/06	42-137	2/06
42-6	7/15	42-109	7/14	42-138	2/06
42-7	7/15	42-110	2/06	42-139	7/17
42-8	7/15	42-111	2/06	42-140	7/17
42-9	7/16	42-113	2/06	42-145	7/19
42-10	7/15	42-116	2/06	42-146	7/21
42-11	7/18	42-122	7/14	42-146A	7/21
42-12	7/15	42-123	2/06		
42-13	7/14	42-124	7/06		
42-14	7/16	42-125	2/06	42-147	7/19
42-15	7/15	42-126	2/06	42-BLANK	7/20
42-16	7/18	42-127	2/06	42-NOTES	7/21
42-17	7/15	42-128	2/06		

SECTION 43 – THIRD PARTY ATTACHMENTS

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
43-i	7/20	43-1	7/20	43-3	7/20
43-ii	7/18	43-2	7/20	43-NOTES	7/20

SECTION 44 – UNDERGROUND COMMERCIAL DISTRIBUTION

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
44-i	7/20	44-10	7/11	44-111	7/11
44-ii	7/20	44-101	7/08	44-113	7/11
44-1	7/11	44-102	7/11	44-114	7/20
44-2	7/15	44-103	7/11	44-115	7/11
44-3	1/07	44-104	7/14	44-116	7/20
44-4	7/20	44-105	7/11	44-117	7/11
44-5	7/18	44-106	7/11	44-118	7/16
44-6	7/15	44-107	7/11	44-120	7/16
44-7	7/18	44-108	7/11	44-123	7/11
44-8	7/11	44-109	7/07	44-125	7/08
44-9	7/18	44-110	2/06	44-NOTES	7/20

SECTION 45 – UNDERGROUND RESIDENTIAL DISTRIBUTION

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
45-i	7/20	45-23	7/19	45-125	7/16
45-ii	7/19	45-BLANK	7/19	45-126	7/07
45-1	7/14	45-100	2/06	45-127	7/16
45-2	2/06	45-101	7/07	45-128	7/07
45-3	7/15	45-102	7/18	45-129	2/06
45-4	7/07	45-104	2/06	45-130	2/06
45-5	2/06	45-105	2/06	45-131	2/06
45-6	7/15	45-106	2/06	45-132	2/06
45-7	7/16	45-107	2/06	45-133	2/06
45-8	7/16	45-108	1/07	45-134	2/06
45-9	1/07	45-109	2/06	45-137	2/06
45-10	7/20	45-110	2/06	45-138	2/06
45-11	7/20	45-111	2/06	45-139	2/06
45-12	7/20	45-114	2/06	45-140	2/06
45-13	7/17	45-115	2/06	45-141	2/06
45-14	1/07	45-116	7/07	45-142	1/07
45-15	7/16	45-117	7/07	45-143	7/12
45-16	1/07	45-118	2/06	45-144	7/12
45-17	7/17	45-119	2/06	45-NOTES	7/20
45-18	7/11	45-120	2/06	45-BLANK	7/17
45-19	7/11	45-121	7/17		
45-20	7/11	45-122	7/17		
45-21	7/19	45-123	7/17		

45-22	7/19	45-124	7/17		

SECTION 46 – LIGHTING - UG

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
46-i	7/17	46-111	1/07	46-602	7/13
46-ii	7/19	46-112	1/07	46-603	7/09
46-1	7/16	46-301	7/13	46-604	7/13
46-2	7/13	46-302	7/09	46-605	7/09
46-3	1/07	46-303	7/13	46-606	7/13
46-4	7/16	46-304	7/13	46-607	7/13
46-5	1/07	46-305	7/13	46-608	7/09
46-6	1/07	46-306	7/13	46-609	7/13
46-7	1/07	46-307	7/13	46-610	7/09
46-8	7/13	46-308	7/13	46-611	7/09
46-9	1/07	46-309	7/13	46-612	7/13
46-10	7/13	46-310	7/13	46-613	7/09
46-11	7/13	46-311	7/13	46-614	7/13
46-12	1/07	46-312	7/13	46-615	7/09
46-13	1/07	46-313	7/13	46-616	7/13
46-14	7/13	46-314	7/13	46-617	7/09
46-15	1/07	46-315	7/13	46-618	7/13
46-16	7/13	46-316	7/13	46-801	7/09
46-17	7/15	46-317	7/13	46-802	7/13
46-101	7/16	46-401	7/09	46-803	7/09
46-102	7/16	46-402	1/07	46-804	7/13
46-102A	7/21	46-403	7/13	46-805	7/19
46-102B	7/17	46-404	7/09	46-806	7/19
46-102C	7/21	46-405	1/07	46-807	7/17
46-BLANK	7/17	46-406	7/09	46-808	7/17
46-103	7/16	46-407	1/07	46-809	7/19
46-103A	7/17	46-408	7/13	46-810	7/17
46-103B	7/21	46-409	7/13	46-811	7/19
46-103C	7/17	46-410	7/09	46-812	7/19
46-104	1/07	46-411	7/09	46-812A	7/19
46-105	7/13	46-412	7/13	46-813	7/19
46-106	1/07	46-413	7/09	46-814	7/19
46-107	7/13	46-414	7/13	46-815	7/19
46-108	1/07	46-415	7/09	46-816	7/19
46-109	1/07	46-416	7/13	46-817	7/17
46-110	1/07	46-601	7/09	46-NOTES	7/21

SECTION 48 – RISERS

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
48-i	7/21	48-117	7/19	48-353	7/20
48-ii	7/19	48-118	7/19	48-370	7/20
48-1	7/11	48-124	7/18	48-400	7/19
48-2	7/14	48-124A	7/21	48-400M	7/19
48-3	7/20	48-124M	7/19	48-405	7/20
48-4	7/20	48-125	7/18	48-734	7/18
48-5	7/11	48-125M	7/19	48-735	7/18
48-6	7/16	48-126	7/20	48-736	7/18
48-7	7/14	48-126D	7/20	48-737	7/20
48-BLANK	7/17	48-BLANK	7/18	48-738	7/18
48-104	7/18	48-127	7/21	48-739	7/20
48-107	7/18	48-128	7/20	48-1273A	7/20
48-109	7/20	48-335	7/20	48-1277A	7/20
48-110	7/20	48-336	7/21	48-1277B	7/20
48-111	7/18	48-336D	7/21	48-BLANK	7/18
48-112	7/19	48-337	7/20	48-NOTES	7/21
48-115	7/18	48-338	7/20	48-NOTES	7/20
48-115B	7/18	48-340	7/20		
48-116	7/18	48-341	7/20		

SECTION 49 – MATERIALS CATALOG – UG LIGHTING

Page Number	Issue Date	Page Number	Issue Date	Page Number	Issue Date
49-i	7/16	49-SK80	7/14	49-ST02F1	7/13
49-ii	7/19	49-SL10 - SL11	7/16	49-ST04	7/14
49-iii	7/16	49-SL16 - SL19	7/15	49-ST08	7/13
49-iv	7/20	49-SL21 - SL23	7/17	49-SU01	7/18
49-v	7/20	49- SL26	7/13	49-SU02	7/13
49-vi	7/20	49-SL30 – SL31	7/13	49-SW01	7/13
49-vii	7/20	49-SL40 – SL41	7/13	49-SW02	7/13
49-viii	7/17	49-SL46 - SL48	7/15	49-SW03	7/13
49-ix	7/20	49-SL50-1	7/20	49-SW05	7/13
49-x	7/17	49-SL50-2	7/16	49-SW06	7/13
49-SC01 – SC17	7/16	49-SL55 - SL58	7/13	49-SW07	7/13
49-SC20 – SC31	7/13	49-SL60	7/13	49-SW08	7/13
49-SD10	7/13	49-SL66 - SL70	7/13	49-SW09	7/13
49-BLANK		49-SL75 - SL76	7/20	49-SW10	7/13
49-SF01 – SF03	7/13	49-SL80-SL85	7/20	49-SW11	7/13
49-SF10 – SF11	7/13	49-SL90	7/20	49-SW12	7/13
49-SF30 - SF41	7/13	49-SM03	7/20	49-SW50 – SW51	7/18
49-BLANK		49-SM05	7/20	49-SX01 - SX03	7/13
49-SG10	7/13	49-SP10 - SP12	7/16	49-SX10 – SX11	7/15
49-SH01 – SH02	7/13	49-SP10	7/15	49-SX13 – SX20	7/13
49-SH03A – SH0G2	7/17	49-SP15 - SP17	7/13	49-SX21 – SX40	7/13
49-SH04 - SH05	7/13	49-SP20	7/13	49-SX41 – SX50	7/13
49-SJ03	7/13	49-SP30	7/20	49-SX60 – SX61	7/13
49-SJ04 - SJ05	7/13	49-SP35	7/20	49-SX62 - SX64	7/16
49-SJ06A-SJ06B	7/19	49-SQ03 – SQ12	7/16	49-SX65 – SX69	7/13
49-SJ10 – SJ11	7/13	49-SR02 – SR05	7/16	49-SX80 – SX81	7/13
49-SJ12 – SJ13	7/17	49-SR11 – SR20	7/15	49-SX82 - SX90	7/13
49-SJ20 – SJ21	7/17	49-SR21 - SR22	7/13	49-SY4 – SY6	7/13
49-SK03-1	7/13	49-SR23 - SR30	7/13	49-SY6 - SZ2	7/15
49-SK03-2	7/13	49-BLANK	7/13	49-SZ03 - SZ04	7/14
49-SK05H-SK06H	7/19	49-ST01	7/14	49-SZ05 - SZ06	7/14
49-SK10	7/16	49-ST01X1 - ST01X5	7/13	49-SZ07 - SZ08	7/14
49-SK20	7/13	49-ST01X6	7/13		
49-SK50 - SK60	7/13	49-ST01X7 - ST01X8	7/13		
49-SK70 – SK71	7/13	49-ST02	7/13		

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50-i	7/13	50-F8A1 – F8A600	7/13	50-UC7G	7/16
50-ii	7/13	50-F8E100-F9A600	7/13	50-UC7G1	7/16
50-iii	7/16	50-F10A06-F11B10	7/15	50-UC8JR – UC9G4	7/16
50-iv	7/16	50-F12C1 – F12C23	7/19	50-UC11BC	7/20
50-v	7/19	50-F13C1 – F14A25	7/16	50-UC11BH	7/20
50-vi	7/19	50-F15A10–F16O20	7/13	50-UC11BJ	7/16
50-vii	7/19	50-F17A – F18	7/13	50-UC11BK-UC11BL	7/16
50-viii	7/19	50-F19E03-F20E15	7/20	50-UC11E	7/16
50-ix	7/19	50-F21E15-F22E40	7/13	50-UC12BL-UC12BR	7/18
50-x	7/19	50-F23E05-F24E25	7/18	50-UC12F	7/16
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Supersedes 7/11 Issue – Added new sections 31.0 and 31.1.

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31.2 DEFINITIONS

The following sources were used as a reference to define the following terms:

1. IEEE Standard Dictionary of Electrical & Electronic Terms – IEEE STD 100
2. The Lineman's and Cableman's Handbook
3. National Electrical Code
4. National Electrical Safety Code

A

AAC - (All Aluminum Conductor) A conductor made wholly of 1350 alloy aluminum.

AAAC - (All Aluminum Alloy Conductor) A conductor made wholly of 5005-H19 or 6201-T81 higher strength alloy aluminum.

ACSR - (Aluminum Conductor Steel Reinforced) A composite conductor made up of a combination of aluminum and steel wires. In the usual construction the aluminum wires surround the steel wires.

ACTUAL SPAN - The horizontal distance between two adjacent structures. The distance can be either to the structure ahead, Actual Span ahead, or to the back structure, Actual Span back. The Actual Span affects sags and clearances from the conductors to the ground.

ALIVE - Electrically connected to a source of potential difference, or electrically charged so as to have a potential difference from that of the ground. **Note:** The term "alive" is sometimes used in place of the term "current-carrying", where the intent is clear, to avoid repetitions of the longer term. (IEEE-100)

AMPACITY - The current-carrying capacity, expressed in amperes, of an electrical conductor under stated thermal conditions. (Per NESC)

ANCHOR - A device that serves as a reliable support to hold an object firmly in place. The term "anchor" is normally associated with cone, plate, screw, or concrete anchors, but terms "stub", "deadman", and "anchor log" are usually associated with pole stubs or logs set or buried in the ground to serve as temporary anchors. The latter are often used at pull and tension sites. (IEEE-100)

ANCHOR GUY MARKER - A protective cover over the guy, often a length of plastic or metal shaped to a semicircular or tubular section and equipped with a means of attachment to the guy. (IEEE-100)

ANODE - An electrode through which current enters any conductor of the nonmetallic class. (IEEE-100)

ARRESTER - See Surge Arrester

AWG - (American Wire Gauge) The standard system used for designating wire diameter, also referred to as the Brown and Sharpe wire gauge. This system is based on a direct correlation between gauge number, cross section, weight, and the DC resistance of conductors.

B

BAY-O-NET FUSE - A pad mount transformer fuse, used to protect the line-side system from damage caused by transformer faults. Provides transformer protection from overloading and secondary fault current.

BIL - (Basic Lightning Impulse Insulation Level) A specific insulation level expressed in kilovolts of the crest value of a standard lightning impulse. (IEEE-100)

BOLLARD - A series of short posts set at intervals to delimit an area (as a traffic island) or to exclude vehicles

BONDING - The permanent joining of metallic parts to form an electrically conductive path that will assure electrical continuity and the capacity to conduct safely any current likely to be imposed. (IEEE-100)

The electrical interconnecting of conductive parts, designed to maintain a common electrical potential. (NESC)

BOOST - Raise or attempt to raise voltage.

BUCK - Lower or attempt to lower voltage.

BUCKARM - A crossarm placed approximately at right angles to the line crossarm and used for supporting branch or lateral conductors or turning large angles in line conductors. (IEEE-100)

BUSHING PLUG - An interface for a transformer/switch that allows cable to be attached with an elbow connector.

C

CABLE - A conductor with insulation, or a stranded conductor with or without insulation and other coverings (single-conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable). (OSHA, NESC, IEEE-100)

CABLE JACKET - A protective covering over the insulation, core, or sheath of a cable. (IEEE-100)

CABLE RACK - A device usually secured to the wall of a manhole, cable raceway, or building to provide support for cables. (IEEE-100)

CABLE SHEATH - A conductive protective covering applied to cables. **Note**: A cable sheath may consist of multiple layers, of which one or more is conductive. (IEEE-100)

CATHODE - An electrode through which current leaves any conductor of the nonmetallic class. (IEEE-100)

CATHODIC PROTECTION - Reduction or prevention of corrosion by making a metal, the cathode in a conducting medium by means of a direct electric current. (IEEE-100)

CIRCULAR MIL - A unit of area equal to π/4 of a square mil (= 0.7854 square mil). The cross-sectional area of a circle in circular mils is therefore equal to the square of its diameter in mils. A circular inch is equal to one million circular mils. **Note**: One mil equals 0.0001 inches. There are 1974 circular mils in a square millimeter.

CLEARANCE - The clear distance between two objects measured surface to surface.(OSHA, NESC)

CONDUCTOR - A material, usually in the form of a wire, cable, or bus bar, suitable for carrying an electric current. (OSHA)

CONDUCTOR INSULATIONS -

BR	Butyl rubber
EPR	Ethylene propylene rubber
XLPE	Cross-linked polyethylene
TRXLPE	Tree-retardant polyethylene
PILC	Paper Insulated, lead covered
VC	Varnish Cambric

CONDUCTOR, BARE - One having no covering or insulation whatsoever. (IEEE-100)

CONDUCTOR COMPACT - A round stranded conductor having all layers stranded in the same direction and successively passed through forming dies that forms the round conductor strands into a diamond-like shape. This results in a smoother, more nearly circular outer surface and effectively eliminates the void between individual wire strands.

CONDUCTOR COMPRESSED - A concentric stranded conductor which, after completion of the stranding operation, is passed through forming dies that compress the strands of the outer layer into a diamond-like shape. This results in a smoother, more nearly circular outer surface, and reduces the void between individual strands in the outer layer.

CONDUCTOR CONCENTRIC - A single straight core wire strand surrounded by one or more layers of helically wound wires in a fixed round geometric arrangement. Each layer after the first has six more strands than the preceding layer and is applied in a direction opposite to that of the layer under it.

CONDUCTOR COVERED - A conductor covered with a dielectric having no rated insulating strength or having a rated insulating strength less than the voltage of the circuit in which the conductor is used.

CONDUCTOR INSULATED - A conductor covered with a dielectric (other than air) having a rated insulated strength greater than or equal to the voltage of the circuit in which it is used. (NESC)

CONDUIT SYSTEM - Any combination of duct, conduit, conduits, manholes, handholes and/or vaults joined to form an integrated whole. (IEEE-100)

CONNECTOR - A coupling device employed to connect conductors of one circuit or transmission element with those of another circuit or transmission element. (IEEE-100)

CONTINUOUS LOAD - A load where the maximum current is expected to continue for three (3) hours or more.

CORE LOSS, TRANSFORMER - The measured power loss, expressed in watts, attributable to the material in the core and associated clamping structure of a transformer that is excited, with no connected load, at a core flux density and frequency equal to that in the core when rated voltage and frequency is applied and rated load current is supplied. (IEEE-100)

CURRENT CARRYING PART - A conducting part intended to be connected in an electric circuit to a source of voltage. **Note:** Non-current carrying parts are those not intended to be so connected. (OSHA)

CURRENT LIMITING FUSE - A fuse that, when it is melted by a current within its specified current-limiting range, abruptly introduces a high arc voltage to reduce the current magnitude and duration. **Note:** The values specified in standards for the threshold ration, peak let-through current, and I^2t characteristic are used as the measures of current-limiting ability. (IEEE-100)

CURRENT LIMITING FUSE CARRYING - A pad mount transformer fuse that limits the potential for catastrophic failure of the transformer, due to internal faults.

CUTOUT - An assembly of a fuse support with either a fuse holder, fuse carrier, or disconnect blade. When a fuse holder or fuse carrier is used, this device is used to automatically interrupt the flow of current through any particular apparatus or instrument. (IEEE-100)

D

DEAD - Isolated, tagged, tested de-energized and grounded. (Safety Manual)

DEAD-FRONT (TRANSFORMERS & SWITCHGEAR) – Without live parts exposed to a person on the operating side of the equipment. (IEEE-100)

DEADEND GUY - An installation of line or anchor guys to hold the pole at the end of a line. (IEEE-100)

DE-ENERGIZED - The absence of normal operating voltages associated with the operation of the system or control circuits. (Safety Manual)

Disconnected from all sources of electrical supply by open switches, disconnectors, jumpers, taps, or other means. **Note:** De-energized conductors or equipment could be electrically charged or energized through various means, such as induction from energized circuits, portable generators, lightning, etc. (NESC)

DEMAND - The load integrated over a specific interval of time. (IEEE-100)

DISCONNECT - A device having a disconnecting blade for use as a disconnecting or isolating switch. (IEEE-100)

DUCT - A single enclosed raceway for conductors or cables. (NESC)

DUCT BANK - An arrangement of conduit providing one or more continuous ducts between two points. (IEEE-100)

DUCT SEALING - The closing of the duct entrance for the purpose of excluding water, gas, or other undesirable substances. (IEEE-100)

DUPLEX CABLE - A cable composed of two (2) insulated single conductors or one (1) insulated conductor and one (1) bare neutral conductor twisted together. (IEEE-100)

DUTY - Continuous Duty – Operation at a substantially constant load for an indefinitely long time.

Intermittent Duty – Operation for alternate intervals of:
1) load and no load; or
2) load and rest; or
3) load, no load, and rest.

Periodic Duty - Intermittent operation in which the load conditions are regularly recurrent.

E

EFFECTIVELY GROUNDED - Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to limit the buildup of voltages to levels below that which may result in undue hazard to persons or to connected equipment. (NESC)

An alternating-current system or portion thereof may be said to be effectively grounded when, for all points on the system or specified portion thereof, the ratio of zero-sequence reactance to the positive-sequence reactance is less than three and the ratio of zero-sequence resistance to positive-sequence reactance is less than one for any condition of operation and for any amount of connected generator capacity. (IEEE-100)

ELBOW - A cable to apparatus connector.

ENCLOSED - Surrounded by case, cage, or fence designed to protect the contained equipment and limit the likelihood, under normal conditions, of dangerous approach or accidental contact by persons or objects. (NESC)

EXTRA-HIGH VOLTAGE SYSTEM - See Voltage Systems

F

FAULT CURRENT - A current that flows from one conductor to ground or to another conductor owing to an abnormal connection (including an arc) between the two. **Note:** A fault current flowing to ground may be called a ground fault current. (IEEE-100)

FEEDER - A set of conductors originating at a main distribution center and supplying one or more secondary distribution centers, one or more branch-circuit distribution centers, or any combination of these two (2) types of equipment. (IEEE-100)

FEED-THRU - A device to electrically connect elbows or other accessories.

FUSE - An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it. (IEEE-100)

G

GROUND - A conducting connection, whether intentional or accidental, by which an electric circuit or equipment is connected to the earth or to some conducting body of relatively large extent that serves in place of the earth. (IEEE-100)

GROUND CURRENT - Current flowing in the earth or in a grounding connection. (IEEE-100)

GROUND GRID - A system of grounding electrodes consisting of interconnected bare cables buried in the earth to provide a common ground for electrical devices and metallic structures. (IEEE-100)

GROUND MAT - A system of bare conductors, on or below the surface of the Earth, connected to a ground or a ground grid to provide protection from dangerous voltages. (IEEE-100)

GROUND ROD - A rod that is driven into the ground to serve as a ground terminal, such as a copper-clad rod, solid copper rod, or galvanized iron pipe or rod. (IEEE-100)

GROUNDING TRANSFORMER - A transformer intended primarily to provide a neutral point for grounding purposes. **Note:** It may be provided with a Delta winding in which resistors or reactors are connected. (IEEE-100)

GUARDED - Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats or platforms, designed to limit the likelihood, under normal conditions, of dangerous approach or accidental contact by persons or objects. **Note:** Wires that are insulated but not otherwise protected are not normally considered to be guarded. See exceptions under applicable rules. (NESC)

GUY - A tension member having one end secured to a fixed object and the other end attached to a pole, crossarm, or other structural part that it supports. (IEEE-100)

H

HANDHOLE - An access opening, provided in equipment or in a below-the-surface enclosure in connection with underground lines, into which personnel reach but do not enter, for the purpose of installing, operating, or maintaining equipment or cable or both. (NESC)

HIGH VOLTAGE SYSTEM - See Voltage Systems.

I

IMPEDANCE VOLTAGE (TRANSFORMER) - The voltage required to circulate rated current through one of two specified windings of a transformer when the other winding is short-circuited, with the windings connected as for rated voltage operation. **Note:** It is usually expressed in per unit or percent, of the rated voltage of the winding in which the voltage is measured. (IEEE-100)

INRUSH CURRENT (TRANSFORMER) - The maximum root-mean-square or average current value, determined for a specific interval, resulting from the excitation of the transformer with no connected load, and with essentially zero-source impedance, and using the minimum primary turns tap available and its rated voltage. (IEEE-100)

INSULATING CAP- A cap that is used for insulating, shielding and sealing a bushing plug.

INSULATION- That which is relied upon to insulate the conductor from other conductors or conducting parts or from ground (as applied to cable). (NESC)

INSULATOR - Insulating material in a form designed to support a conductor physically and electrically separate from another conductor or object. (IEEE-100)

ISOLATED NEUTRAL SYSTEM - A system that has no intentional connection to ground except through indicating, measuring, or protective devices of very high impedance. (IEEE-100)

J

JACKET - A protective covering over the insulation, core, or sheath of a cable. (NESC)

L

LATERAL CONDUCTOR - A wire or cable extending in a general horizontal direction at an angle to the general direction of the line conductor. (IEEE-100)

LAY (CABLE) - The helical arrangement formed by twisting together the individual elements of a cable. (IEEE-100)

LIGHTNING ARRESTER - See Surge Arrester.

LIVE - See Alive.

LIVE FRONT (TRANSFORMERS & SWITCHGEAR) - With live parts exposed to a person on the operating side of the equipment.

LOAD FACTOR - The ratio of the average load over a designated period of time to the peak load occurring in that period. (IEEE-100)

LOAD LOSSES (TRANSFORMER) - Those losses which are incident to the carrying of a specified load. Load losses include I^2R loss in the winding due to load and eddy currents, stray loss due to leakage fluxes in the windings, core clamps, and other parts; and the loss due to circulating current (if any) in parallel windings, or in parallel winding strands. (IEEE-100)

LOCATION -

Damp Location – Partially protected locations under canopies, marquees, roofed open porches, and like locations; and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold-storage warehouses.

Dry Location – A location not normally subject to dampness or wetness. Any location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.

Wet Location – Installations underground or in concrete slabs or masonry in direct contact with the earth, and locations subject to saturation with water or other liquids such as vehicle washing area, and locations exposed to weather and unprotected.

LOSS FACTOR - The ratio of the average power loss to the peak-load loss during a specified period of time. (IEEE-100)

LOW VOLTAGE - See Voltage Systems.

LUG - A wire connector device to which the electrical conductor is attached by mechanical pressure or solder. (IEEE-100)

LUMINAIRE - A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply. (IEEE-100)

M

MANDREL - A tapered or cylindrical axle used to pull through conduit for inspections.

MANHOLE - A subsurface enclosure that personnel may enter and is used for the purpose of installing, operating, and maintaining submersible equipment and cable. (NESC)

MANUAL - Operated by mechanical force, applied directly by personal intervention. (IEEE-100)

MANUAL OPERATION - Operated by hand without using any other source of power. (IEEE-100)

MEDIUM VOLTAGE SYSTEM - See Voltage System.

MULTI- GROUNDED NEUTRAL SYSTEM - A distribution system of the 4 wire type where all transformer neutrals are grounded, and neutral conductors are directly grounded at frequent points along the circuit. (IEEE-100, NESC)

A system of conductors in which a neutral conductor is intentionally grounded solidly at specified intervals. A multigrounded or multiple grounded systems may or may not be effectively grounded. (NESC)

N

NAMEPLATE - A plaque giving the manufacturer's name and the rating of the equipment to which it is attached. (IEEE-100)

NETWORK - An aggregation of interconnected conductors consisting of feeders, mains, and services. (IEEE-100)

NEUTRAL CONDUCTOR - The conductor that is intended to be so energized, that, in the normal steady state, the voltages from every other conductor to the neutral conductor, at the terminals of entry of the circuit into a delimited region, are definitely related and usually equal in amplitude. (IEEE-100, NESC)

A system conductor other than a phase conductor that provides a return path for current to the source. Not all systems have a neutral conductor. An example is an ungrounded delta system containing only three energized phase conductors. (NESC)

NO-LOAD LOSSES - Those losses which are incident to the excitation of the transformer. No-load (excitation) losses include core loss, dielectric loss, conductor loss in the winding due to exciting current, and conductor loss due to circulating current in parallel windings. These losses change with the excitation voltage. (IEEE-100)

NOMINAL SYSTM VOLTAGE - See Voltage, Nominal.

NON-EFFECTIVELY GROUNDED - An alternating-current system or portion thereof may be said to be non effectively grounded when, for all points on the system or specified portion thereof, the ratio of zero-sequence reactance to the positive-sequence reactance is greater than three and the ratio of zero-sequence resistance to positive-sequence reactance is greater than one for any condition of operation and for any amount of connected generator capacity.

NOT EFFECTIVELY GROUNDED - Not permanently connected to earth through a ground connection or connections of sufficiently high impedance and not having sufficient current-carrying capacity to prevent the building up of voltages that may result in undue hazard to connected equipment or to persons.

NOVOID X - Filling compound for G & W porcelain potheads and armored cable joint boxes.

O

OFC - Oil Fused Cutout.

OPEN WIRE - Single conductor, bare, covered or insulated, and separated by air from other conductors, e.g, not a cable.

P

PAD-MOUNTED - A general term describing equipment positioned on a surface-mounted pad located outdoors. **Note**: The equipment is usually enclosed with all exposed surfaces at ground potential. (IEEE-100)

PAD-MOUNTED TRANSFORMER - A transformer utilized as part of an underground distribution system, with enclosed compartment(s) for high voltage and low voltage cables entering from below and mounted on a foundation pad. (IEEE-100)

PARKING STAND - A bracket designed for installation on an apparatus, suitable for holding accessory devices, such as insulated parking bushing and grounding bushing. (IEEE-100)

PILC- Paper Insulated Lead Covered Cable

POLE-TYPE TRANSFORMER - A transformer that is suitable for mounting on a pole or similar structure. (IEEE-100)

POTHEAD - A device that seals the end of a cable and provides an insulated exit for the conductor or conductors. (IEEE-100)

POWER FUSE - A fuse consisting of an assembly of a fuse support and a fuse unit or fuseholder that may or may not include the refill unit or fuse link. **Note:** The power fuse is identified by the following characteristics: (1) Dielectric withstand (basic impulse insulation level) strengths at power levels; (2) Application primarily in stations and substations; (3) mechanical construction basically adapted to station and substation mounting. (IEEE-100)

PRESSURE RELIEF DEVICE - A means for relieving internal pressure in a transformer, possibly preventing explosive shattering of the tank or tank cover, following prolonged passage of fault current due to external faults or internal transformer faults. (IEEE-100)

PULLING EYE - A device that may be fastened to the conductor or conductors of a cable or formed by or fastened to the wire armor and to which a rope may be directly attached in order to pull the cable into or from a duct. (IEEE-100)

PUSH BRACE - A supporting member, usually of timber placed between a pole or other structural part of a line and the ground or a fixed object. (IEEE-100)

Q

QUADRUPLEX CABLE - A cable composed of four (4) insulated single conductors or three (3) insulated conductors and one (1) bare neutral conductor twisted together.

R

RADIAL SYSTEM - A system in which independent feeders branch out radially from a common source of supply. (IEEE-100)

RISER POLE - Pole on which overhead wires connect to underground cable.

RULING SPAN - A calculated deadend span length, which will have the same changes in conductor tension due to changes of temperature and conductor loading, as will be found in a series of spans of varying lengths between deadends. (IEEE-100)

S

SAG - The distance measured vertically from a conductor to a straight line joining its two (2) points of support. Unless otherwise stated, the sag referred to is the sag at the midpoint of the span. (IEEE-100)

SECONDARIES - Circuits 600 volts and below.

SEPARATION - The distance between two objects, measured surface to surface, and usually filled with a solid or liquid material. (NESC)

SERVICE DROP - The overhead conductors between the electric supply or communication line and the building or structure being served. (NESC)

SERVICE ENTRANCE CONDUCTORS, OVERHEAD SYSTEM – The service conductors between the terminals of the service equipment and point usually outside the building, clear of building walls, where jointed by tap or splice to the service drop. (NEC)

SERVICE ENTRANCE CONDUCTORS UNDERGROUND SYSTEM - The service conductors between the terminals of the service equipment and the point of connection to the service lateral. **Note:** Where service equipment is located outside the building walls there may be no service-entrance conductors, or they may be entirely outside the building. (NEC)

SERVICE LATERAL - The underground service conductors between the street main, including any risers at a pole or other structure or from transformers, and the first point of connection to the service-entrance conductors in a terminal box, meter, or other enclosure with adequate space, inside or outside the building wall. Where there is no terminal box, meter, or other enclosure with adequate space, the point of connection shall be considered to be the point of entrance of the service conductors into the building. (NEC)

SIDE BREAK SWITCH - A switch in which the travel of the blade is in a plane parallel to the base of the switch. (IEEE-100)

SIDEWALL PRESSURE - The crushing force exerted on a cable during installation. (IEEE-100, NESC)

SOLIDLY - GROUNDED — Grounded through all adequate ground connection in which no impedance has been inserted intentionally. **Note:** Adequate as used herein means suitable for the purpose intended. (IEEE-100)

SPACER CABLE - A type of electric supply-line construction consisting of an assembly of one or more covered conductors, separated from each other and supported from a messenger by insulating spacers. (IEEE-100, NESC)

SPAN LENGTH - The horizontal distance of two (2) adjacent supporting points of a conductor. (IEEE-100)

SPLICE - A physical connection of two (2) or more conductors to provide electrical continuity. (IEEE-100)

SPLICE TYPES- Double Wye: also known as a double double or an H splice, splices four cables together.

Modula/Separable: A joint that is built that can be easily taken apart by mechanical means.

Normal: A splice of two similar cables.

Reducing: A type of splice that will join two different sizes of cable together.

Reducing/Transition: To splice a PILC cable to a smaller solid dielectric cable.

Transition: Splicing together PILC cable to solid dielectric cable.

Trifurcating: Splicing a 1-3/C cable to a 3-1/C cable.

Trifurcating/Transition: Splicing a 1- 3/C PILC cable to 3-1/C solid dielectric cable.

Wye: Splicing 3 cables together.

STEP-DOWN TRANSFORMER - A transformer in which the energy transfer is from a higher voltage circuit to a lower voltage circuit. (IEEE-100)

STEP-UP TRANSFORMER - A transformer in which the energy transfer is from a lower voltage circuit to a higher voltage circuit. (IEEE-100)

SUBMARINE CABLE - A cable designed for service under water. **Note:** Submarine cable is usually a lead-covered cable with a steel armor applied between layers of jute. (IEEE-100)

SUBMERSIBLE TRANSFORMER - A transformer so constructed as to be successfully operable when submerged in water under predetermined conditions of pressure and time. (IEEE-100)

SUBWAY TRANSFORMER - A submersible-type distribution transformer suitable for installation in an underground vault. (IEEE-100)

SURGE ARRESTER - A protective device for limiting surge voltage on equipment by discharging or bypassing surge current; it prevents continued flow of follow current to ground, and is capable of repeating these functions as specified. (IEEE-100)

SWEEP - A manufactured bend installed at pad mounted equipment locations.

SWITCH -	Disconnecting or Isolation Switch -	A mechanical switching device used for changing the connections in a circuit or equipment from the source of power. **Note:** It is required to carry normal load current continuously, and also abnormal or short-circuit currents for short intervals as specified. It is required to open or close circuits either when negligible current is broken or made, or when no significant change in the voltage across the terminals of each of the switch poles occurs.
	Load-Interrupter Switch -	A disconnecting or isolating switch equipped with an interrupter and designed to interrupt currents not in excess of the continuous-current rating of the switch.
	Regulator Bypass Switch -	A specific device or combination of devices designed to bypass a regulator.

T

TERMINAL -	A conducting element of equipment or a circuit intended for connection to an external conductor. (IEEE-100)
TERMINAL CONNECTOR -	A connector used for attaching a conductor to a lead, terminal block, or stud of electric apparatus. (IEEE-100)
TERMINAL PAD -	A usually flat conducting part of a device to which a terminal connector is fastened. (IEEE-100)
TERMINATOR -	An insulator used to protect each cable conductor passing through the device and provide complete external leakage insulation between the cable conductor(s) and ground.
TERMINATOR /POTHEAD -	A device that seals the end of a cable and provides insulated egress for the conductor or conductors. (IEEE-100)
TIE LINE -	A transmission/distribution line connecting two (2) or more power systems. (IEEE-100)
TOTAL LOSSES -	The sum of the no-load and load losses, excluding losses due to accessories. (IEEE-100)
TRIPLEX CABLE -	A cable composed of three (3) insulated single conductors or two (2) insulated single conductors and a bare neutral conductor twisted together. (IEEE-100)

U

ULTRA HIGH VOLTAGE SYSTEM -	See Voltage System
UNGROUNDED -	A system, circuit, or apparatus without an intentional connection to ground except through potential indicating or measuring devices or other very high impedance devices. (IEEE-100)
UNIGROUNDED NEUTRAL SYSTEM -	A system of conductors in which one conductor is intentionally grounded solidly at a specific location, typically at the source.

V

VAULT - A structurally sound enclosure, including all side, top, and bottom, above or below ground where entry is limited to personnel qualified to install, maintain, operate, or inspect the equipment or cable enclosed. The enclosure may have openings for ventilation, personnel access, cable entrance, and other openings required for operation of equipment in the vault. (NESC)

VOLTAGE, - NOMINAL A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (as 120/240, 480Y/277, 600, etc.). The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment. See "Electric Power Systems and Equipment – Voltage Ratings (60 Hz)" (ANSI C84.1-82, IEEE-100)

VOLTAGE - SYSTEMS

Low-Voltage System - An electric system having a maximum root-mean-square alternating-current voltage of 1000 volts or less. (IEEE-100)

Medium Voltage System - An electric system having a maximum root-mean-square alternating-current voltage above 1000 volts to 72,500 volts. (IEEE-100)

High Voltage System - An electric system having a maximum root-mean-square alternating current voltage above 72,500 volts to 240,000 volts. (IEEE-100)

Extra-High Voltage System - An electric system having a maximum root-mean-square alternating current voltage above 240,000 volts to 800,000 volts. (IEEE-100)

Ultra-High Voltage System - An electric system having a maximum root-mean-square alternating current voltage above 800,000 volts to 2,000,000 volts. (IEEE-100)

VOLTAGE TO - GROUND For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded. For ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit. (IEEE-100)

W

WEIGHT SPAN - Distance to the low point in the Actual Span ahead + distance to the low point in the Actual Span back. The weight span is a calculated term used to determine the vertical loading in crossarms and poles from the weight of ice coated conductors.

WIND SPAN - ½ Actual Span ahead + ½ Actual Span back. The wind span is a calculated term used to determine the transverse loading on the pole from the wind on ice coated conductors.

WOUND - Single Wound – One cable wound on a reel.
Triple Wound – Three cables in parallel wound on a reel.

31.3 NO TRESPASSING SIGNS

31.3.10 General

This Section covers the specification and installation of a “No Trespassing” sign on substation gates and other fenced entrances to Company property.

31.3.20 Application

“No Trespassing” signs shall be installed at all locations on Company property where unauthorized entry is prohibited. Locations may include substations, control house buildings, etc.

31.3.30 Specifications

The 8 inch x 18 inch sign shall be constructed out of 63 mil thick aluminum plate. It shall have a painted white background on which “NO TRESPASSING” shall be printed in black with 2 inch high letters. The sign shall have six ¼ inch diameter holes for fence mounting.

Table 1
Standard Items

Item Description	Std. Item
“NO TRESPASSING” Sign	P23NT
8 Inch Stainless Steel Ties	P27T

Figure 1
“NO TRESPASSING” Sign

31.3.40 Installation

At substations, install the “NO TRESPASSING” sign on the fenced gates using stainless steel ties. The field will determine mounting options for other locations. The sign should be mounted so as to be clearly visible to anyone approaching the facility. Also ensure that the appropriate territory specific decal is affixed in the space provided on the sign.

31.4 PADMOUNT SIGNS

31.4.10 General

All distribution pad-mounted equipment containing energized parts shall be marked with a warning decal and a danger decal.

A. Warning Decal

This decal will be mounted on the outside of the equipment by the manufacturer on all new purchased pad mount equipment. Figure 2 shows the decal (Std. Item P25P).

For existing equipment not having warning or danger decals, the Company shall install these decals at the time of their on-site inspection.

Switchgear or transclosures with doors front and back shall have warning decals both front and back.

Supersedes 7/11 issue – Update Figure 2.

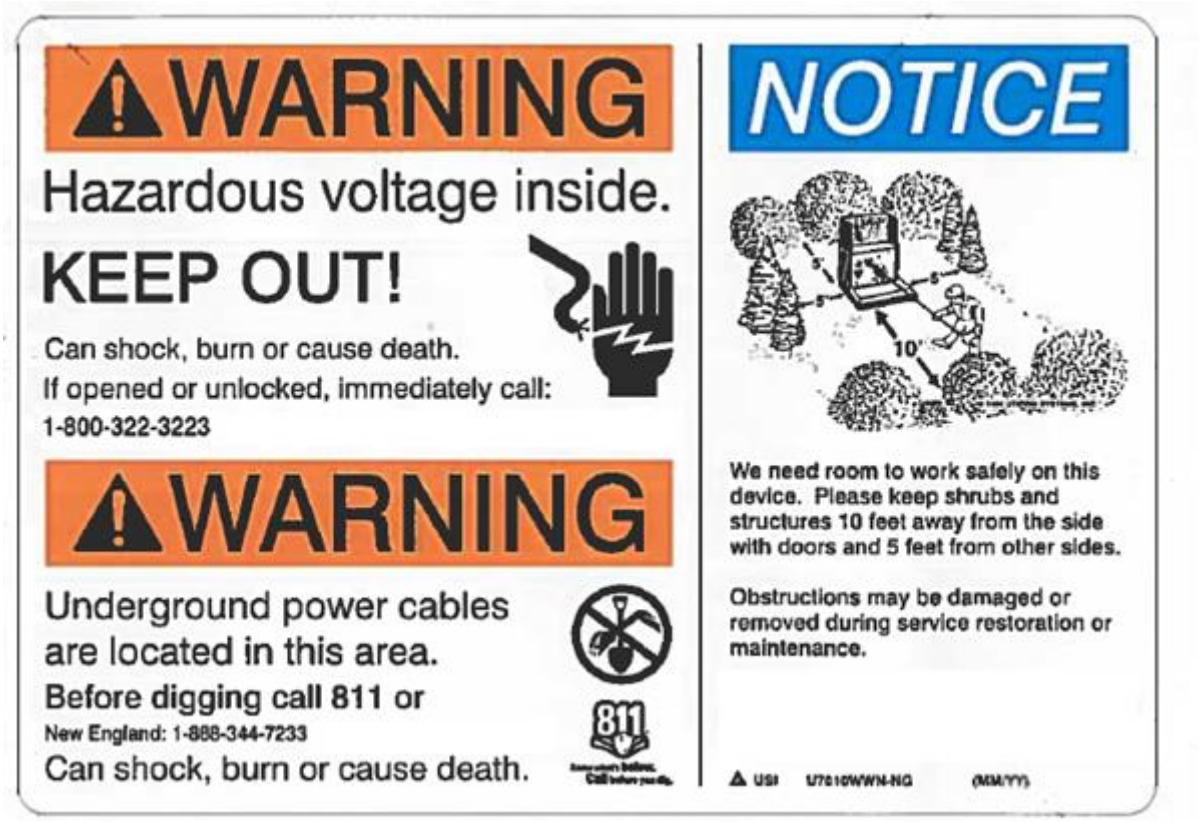
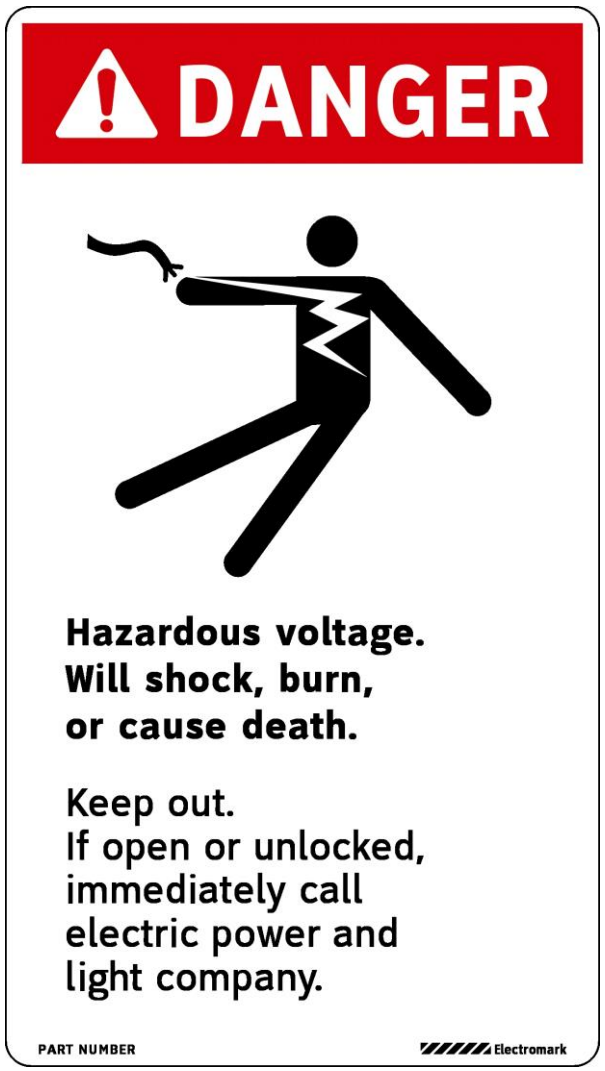


Figure 2

B. Danger Decal

This decal shall be mounted on the inside of the equipment. Multi-compartment equipment shall have a decal in each compartment.



Supersedes 7/11 Issue – Updated Figure 3.

Figure 3

The manufacturer shall install the danger decals (Std. Item P25PD) on all newly purchased pad-mounted equipment. See Figure 3 above for details.

For existing equipment not having warning or danger decals, the Company shall install these decals at the time of their on-site inspection.

Switchgear with barriers on the inside of the compartment areas shall have the danger decal installed on the front side of each barrier.

C. Warning Decal For Step Down Padmounted Transformers

This decal will be mounted on the outside of the equipment by the manufacturer on all new purchased pad mount equipment.

Figure 4 shows this decal in detail (Std. Item P25ST).

Figure 4

.

D. Caution Decal for a containment barrier when installed below a concrete pad for Oil Filled Padmount Equipment.

This decal shall be installed by the field when an oil containment barrier is installed below a concrete pad for oil filled padmount equipment.

The decal shall be placed on the most visible location on the front door of the padmount transformer.

Figure 5 shows this decal in detail (Std. Item P25PC).

Figure 5

E. Live Front Decal for Livefront Style Padmount Equipment.

This decal shall be installed in the primary compartments door channel area. This decal adds awareness to the worker before accessing the live front primary compartment of a padmounted transformer.

Figure 6 shows this decal and the decal installed in detail (Std. Item P25PL).

Figure 6

F. Normal Open Decal for Padmount Equipment.

This N.O. label is an abbreviation for normal open and is to be used to label the open point in a loop feed underground system.

This peel off decal shall be installed on the upper center portion of the front door of padmount equipment.

Figure 7 shows this decal in detail (Std. Item P25PNO)

Figure 7

G. Warning Sign for Padmount Equipment - Tie Point Not in Phase.

This sign shall be installed on all not in phase open tie points.

This magnetic decal shall be installed inside the primary compartment door area of padmount equipment.

Figure 8 shows this decal in detail (Std. Item P22P1)

Figure 8

H. Caution Sign for Padmount Equipment - Feeder Tie Point.

This sign shall be installed on all in phase open tie points.

This magnetic decal shall be installed inside the primary compartment door area of padmount equipment.

Figure 9 shows this decal in detail (Std. Item P22P2)

Figure 9

31.4.20 Equipment Numbering

Where applicable, pad-mounted equipment numbers shall be attached to each piece of equipment. Use 1¼ inch x 1 inch pressure sensitive mylar markers.

31.4.30 Mounting Locations

The recommended mounting locations for the signs and equipment numbers are illustrated in Figure 10. If the danger decal cannot be mounted in the recommended areas, then mount them in the most visible area when the doors are open

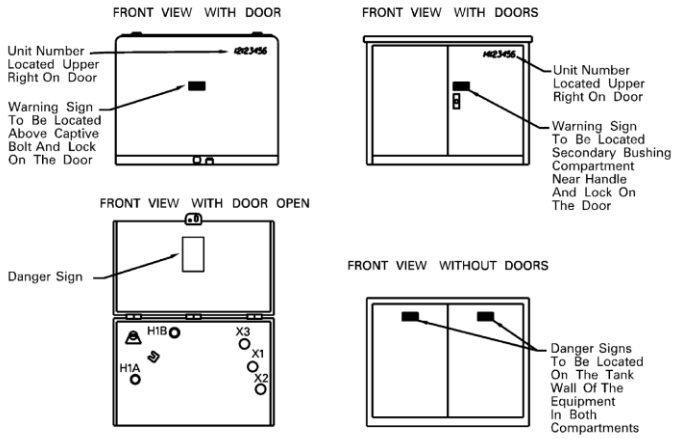


Figure 10

31.4.40 Alternate Mounting Locations

The recommended mounting locations for the signs and equipment numbers are illustrated below. If the warning decal cannot be mounted in the recommended areas, then mount them in the most visible area when the doors are open.

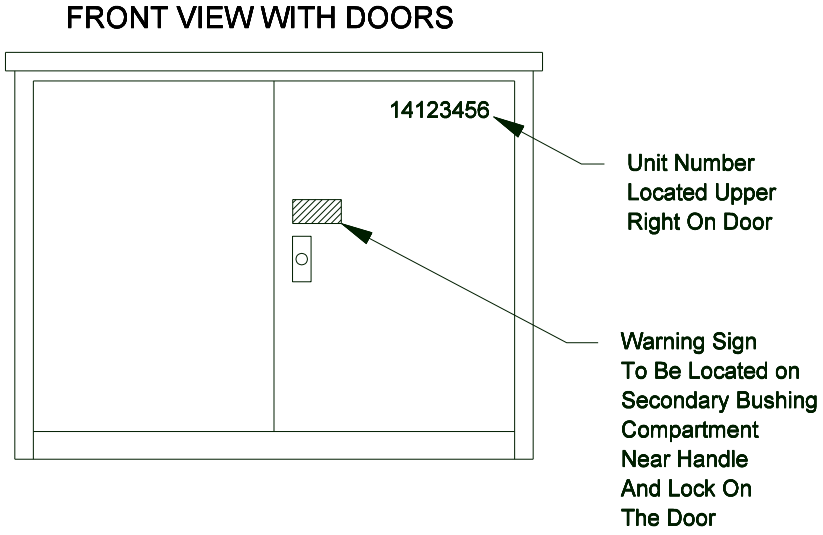


Figure 11

31.5 ACCIDENT PREVENTION SIGNS

SIGN A

Figure 12

Std. Item P23A1 – 8 inches high x 18 inches wide high intensity reflective sign on rigid aluminum base. For use on substation fences, gates, and masonry walls; at R/W and substation access roadway and fences; and building vault masonry walls.

Std. Item P23A2 – 8 inches high x 18 inches wide high intensity reflective sign with removable backslit liner. For use on metal substation doors and panels, and building vault doors.

SIGN B

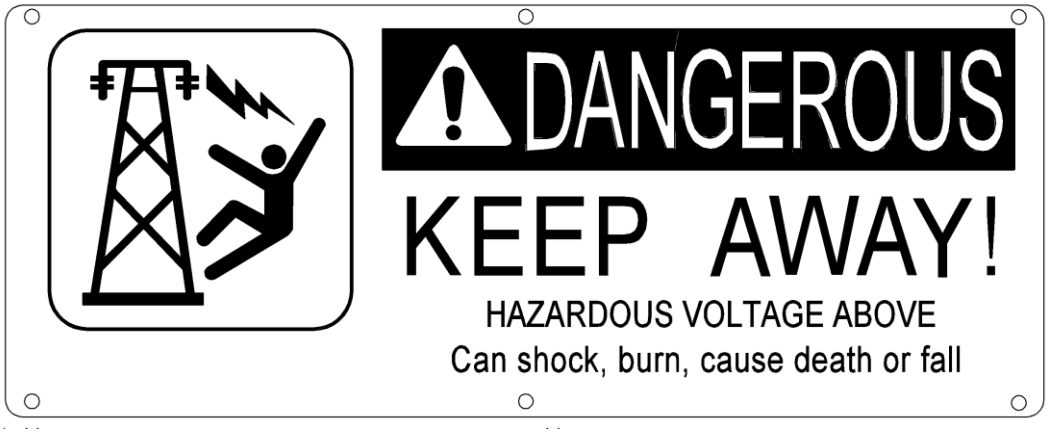


Figure 13

Std. Item P23B1 – 8 inches high x 18 inches wide high intensity reflective sign on rigid aluminum base. For use on metal towers and structures on rights-of-way. .

Std. Item P23B2 – 8 inches high x 18 inches wide high intensity reflective sign on flexible aluminum base. For use on wood poles and structures on rights-of-way. .

Std. Item P23B3 – 8 inches high x 18 inches wide high intensity reflective sign with removable backslit liner. For use on metal poles on rights-of-way.

SIGN C

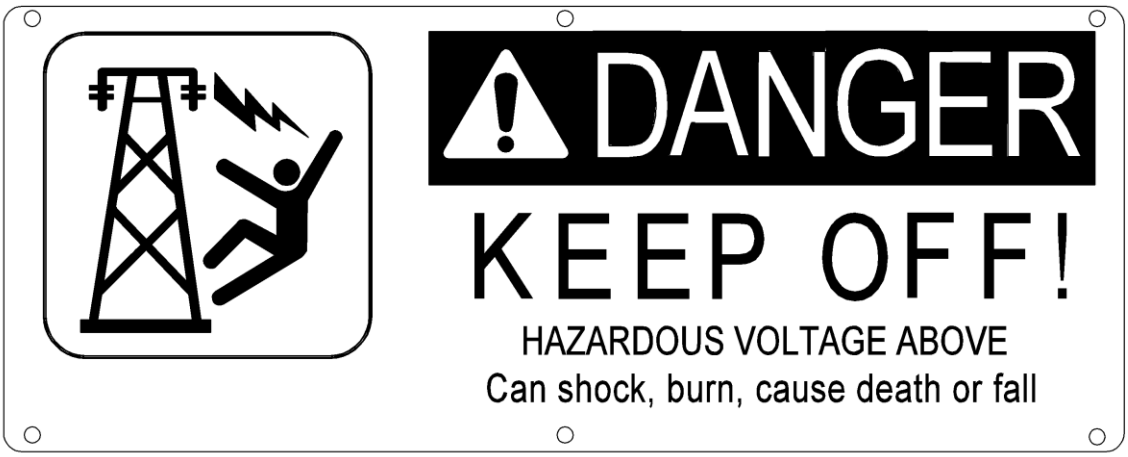


Figure 9

Std. Item P23C1 – 8 inches high x 18 inches wide high intensity reflective sign on rigid aluminum base. For use on metal towers and structures on rights-of-way. USE IN, RI

Std. Item P23C2 – 8 inches high x 18 inches wide high intensity reflective sign on flexible aluminum base. For use on wood poles and structures on rights-of-way. USE IN, RI.

Std. Item P23C3 – 8 inches high x 18 inches wide high intensity reflective sign with removable backslit liner. For use on metal poles on rights-of-way. USE IN, RI AND .

Installation – The sign shall be mounted so as to be clearly visible to anyone approaching the facility or structure. Ensure that the appropriate territory specific decal is affixed in the space provided on the sign.

Exception: No decal is required at locations where property and fence is owned by the customer.

Table 2

Device To Be Signed	Sign	Std. Item	State	Sign Type	Placement / Attachment
7' chain link fence enclosing open type structures, metal-clad gear, or indoor stations.	'A'	P23A1	All	High intensity reflective sign on rigid aluminum base.	Eye level on outside of fence/fasten to approved bracket using nonferrous fasteners - See notes below.
4' chain link fence enclosing locked metal-clad station.	'A'	P23A1	All	High intensity reflective sign on rigid aluminum base.	As high as possible on outside of fence/fasten to approved bracket using nonferrous fasteners - See notes below.
7' chain link fence gate as part of fence enclosing open type structures, metal-clad gear or indoor stations.	'A'	P23A1	All	High intensity reflective sign on rigid aluminum base.	Eye level - center and outside of gate/fasten to approved bracket using nonferrous fasteners - See notes below.
Locked metal door - indoor station enclosed by chain link fence; in masonry wall serving as part of fence enclosing station.	'A'	P23A2	All	Reflective self-adhesive sign with removable backslit liner.	Eye level - center and outside of door/clean metal surface remove backslit liner, apply sign.
Locked metal doors & panels of metal-clad stations enclosed by chain link fence.	'A'	P23A2	All	Reflective self-adhesive sign with removable backslit liner.	Eye level - center and outside of door panel/clean metal surface, remove backslit liner, apply sign.
Masonry walls adjacent to locked metal door - indoor station enclosed by chain link fence which serves as part of fence surrounding stations.	'A'	P23A1	All	High intensity reflective sign on rigid aluminum base.	Eye level - nonhinged side of door/use approved masonry fasteners - See notes below.
Access roadway gate, chain, cable, and fence.	'A'	P23A1	All	High intensity reflective sign on rigid aluminum base.	Midpoint of chain or eye level on outside of fence/use nonferrous wire or bracket with nonferrous fastenings.

Accident Prevention Signs For Substations

Notes (For Tables 2, 3 and 4):

1. Appropriate company name decals shall be applied indoors to above signs prior to sign installation.
2. Appropriate signs required by state law shall be strictly adhered to.
3. Sign placement along fence perimeters not to exceed 50 feet.
4. All station gates are to be signed.
5. All fence and wall sections adjacent to gates and doors shall be signed on the non-hinged side of the gate or door, where practical.
6. Tower signs shall not be free swinging - rigid mounting means are required.

Table 3
Accident Prevention Signs For Rights-Of-Way

Device To Be Signed	Sign	Std. Item	State	Sign Type	Placement / Attachment
All metal towers & structures	'C'	P23C1	RI	High intensity reflective signs on rigid aluminum base	10'-15' above ground - minimum of two signs on opposite sides/rigid attachment - detail by Transmission Department
All steel poles	'C'	P23C3	RI	High intensity reflective signs with removable backslit liner	10'-15' above ground - opposite sides/ detail by Transmission Department
All wood poles & structures	'C'	P23C2	RI	High intensity reflective signs on flexible aluminum base	10'-15' above ground - opposite sides/ aluminum roofing nails
Access roadway gate, chain, cable, fence	'A'	P23A1	All	High intensity reflective signs on rigid aluminum base	Midpoint of chain or eye level on outside of fence/use nonferrous wire or bracket with nonferrous fasteners

Table 4
Accident Prevention Signs For Building Vaults

Device To Be Signed	Sign	Std. Item	State	Sign Type	Placement / Attachment
Locked metal door at vault entrance	'A'	P23A2	All	High intensity reflective signs with removable backslit liner	Eye level, center and outside of door/remove backslit liner, apply sign
Masonry wall adjacent to vault entrance door	'A'	P23A1	All	High intensity reflective signs on rigid aluminum base	Eye level, non-hinged side of door/approved masonry fasteners

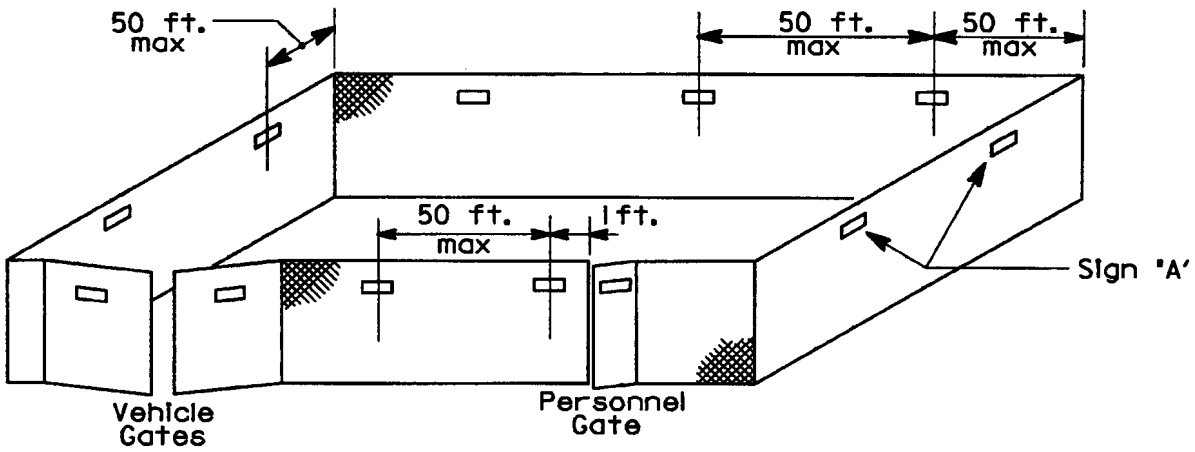


Figure 15
Posting Substations Enclosed With Chainlink Fence

Notes:

1. Sign chainlink fences using sign “A”.
2. Place all signs as close to eye level as possible. Attach signs as level as possible.
3. Sign all gates at eye level with sign at gate center.
4. Fence sides that contain no gates should have symmetrical sign placement as much as is possible.
5. Maximum distance between signs along fence perimeter not to exceed 50 feet.
6. Refer to Figure 15 for fastening detail.
7. Sign unhinged side of single gates at eye level one foot from gate post.
8. Remove old signs and return to stores for disposal.
9. On stations where customer owns fence and property and the Company owns equipment inside the fence – do not install Company name decal to sign.

31.6 UNDERGROUND CABLE SIGN

Underground cable marker used in locations for identifying permanently buried electric cables. The marker shall be used in right of ways for an added method to identify cables are buried below. They should be spaced approximately every 200 feet.

Figure 16 shows this decal in detail (Std. Item P22R1)

Figure 16

31.7 CONCRETE

31.7.10 General

Use reinforced and plain concrete, when job specifications are not being issued. Not for use when placing concrete underwater (Tremie concrete).

31.7.20 Materials

Cement shall be a standard brand of Portland Cement Type II conforming to ASTM C150. If concrete is to be in contact with sea water or soils other than clean gravel, or if job conditions require earlier strength development than Type II provides, notify Standards Engineering for use of a higher strength or high-early strength concrete.

Sand shall be sharp and clean and shall conform to ASTM C33, latest revision.

Coarse aggregate shall be of gravel, crushed gravel or crushed stone and conform to ASTM C33, latest revision.

Water shall be from a potable water supply or tested and approved by Standards Engineering, assuring it is clean and free from injurious amounts of oil, acids, alkali, organic materials, or other harmful substances.

31.7.30 Ready-Mix Concrete

Ready-mix concrete shall be proportioned at the plant. Mixing and delivery shall be in accordance with ASTM C94, latest revision. Mixes shall conform to Table 6 for minimum 28 day strength, nominal maximum size aggregate, and slump.

An air-entraining agent shall be added to concrete mixes in which the surface will be exposed to the elements. Air-entraining agents shall not be used in duct bank installations. No other admixtures shall be used without approval of Standards Engineering. Air- entrainment content shall be as follows:

Table 5

Mix M2 and M3:	7.0% plus or minus 2.0%
Mix M4:	5.0% plus or minus 1.5%
Mix M5:	4.5% plus or minus 1.5%
Mix M6:	6.0% plus or minus 1.0%
Mix M7:	6.0% plus or minus 1.0%

NOTE: M2 and M3 mix with added air-entrainment shall not be used in ductline applications.

The purchaser reserves the right to make tests at any time on materials used and concrete furnished by the ready-mix concrete supplier. The batch plant, equipment, and operating procedures are subject to inspection and approval by Standards Engineering or their qualified representative.

Table 6

Mix Number	Strength Minimum 28 Day (Lbs./Square Inch)	Aggregate Maximum Size Nominal	Slump Not More Than	Typical Applications
M1	2,000	1-½"	2"	Bedrock and Floor Fill
M2	2,000	½"	2"	Duct Lines – Tier Method
M3	2,000	½"	6"	Duct Lines – Unit Method
M4	3,000	1-½"	2"	Footings, Slabs on Ground, Foundation Walls, and Pile Caps
M5	3,000	1"	2"	Floor and Roof Slabs on Forms
M6	4,000	1"	2"	Hi-Strength Slabs and Walls
M7	5,000	1"	2"	Hi-Strength Slabs and Walls

Concrete Mixes

Note: If a greater slump is required, contact Standards Engineering for an additive to meet the specific job requirements.

Ready-mix concrete shall be ordered in accordance with this Section. The cubic yards, delivery point, time schedule, and applicable mix number for the particular application shall be specified on the order.

Delivery of a concrete batch in excess of the rated mixer drum capacity is cause for rejection. The latest drum inspection certificate should be available for verification.

31.7.40 Delivery And Mixing

In the event that delivery of concrete is called for when the air temperature is below 40 degrees Fahrenheit, the following shall apply:

A. When the air temperature is between 30 degrees Fahrenheit and 40 degrees Fahrenheit, the concrete shall be delivered in excess of 55 degrees Fahrenheit.

B. When the air temperature is between 0 degrees Fahrenheit and 30 degrees Fahrenheit the concrete shall be delivered at a temperature in excess of 60 degrees Fahrenheit.

In hot weather concrete shall be delivered at a temperature which will not cause difficulty from loss of slump, flash set, or cold joints. Discharge of concrete at the job site shall be completed within one hour of adding the mixing water.

31.7.50 Forms

Formwork shall be designed and constructed in accordance with the American Concrete Institute's "Recommended Practice For Concrete Formwork", ACI 347, of latest date.

Forms shall be built substantially; true to form, lines, dimensions, and grades shown. They shall be braced and tied to maintain position and shape, without yielding to pressure of fluid concrete or other forces, including those produced by vibratory compaction.

Forms shall be constructed of ¾ inch BB grade plywood supported with 2 x 4 studs on 16 inch centers. Forms shall not exceed a 10 foot pour height and form tie spacing shall not exceed 2 feet. Form ties and accessories, manufactured by Richmond Screw Anchor Company or equal, shall be used. Prefabricated forms are allowed after approval by Standards Engineering. The forms shall be vertical and symmetrical and in the largest sizes practicable. Sheets showing torn grain, worn edges, hole patches, or other defects, which impairs the texture of the concrete surface, shall not be used. Forms shall be treated with approved form oil, before erection or reinforcing steel placement, to prevent adhesion of the concrete.

Forms shall be mortar-tight. For surfaces which will be exposed, the form faces shall be smooth and mortar-tight.

Forms shall be removed carefully to avoid damage to the concrete surfaces. The removal time is governed by the concrete's condition, curing temperature, curing time, and the forces the new concrete may be subjected. Under favorable curing conditions, forms may be removed no sooner after placement than the following:

C. 7 days for supported floor and roof slabs

D. 48 hours for wall and columns

E. 24 hours for footing walls and piers

F. 12 hours for underground duct lines

If high-early strength concrete is used, the above time periods may be reduced by one-half.

These periods presented are the cumulative number of days or fractions thereof, not necessarily consecutive, during which the concrete temperature is above 50 degrees Fahrenheit. Whenever formwork is removed during the curing period, the exposed concrete shall be repaired immediately, finished, and cured as specified under Section 31.4.70.

31.7.60 Placement

Concrete shall not be placed until the forms, previously poured concrete surfaces, reinforced steel, and embedded parts have been cleaned of laitance, loose or defective concrete, soil on rock surface, and any other foreign materials.

All concrete placed when the air temperature is above 45 degrees Fahrenheit shall be placed at the coolest temperature as practicable. Concrete placement is not permitted when hot weather conditions prevent proper placement and consolidation. Concrete will not be accepted if its temperature is in excess of 80 degrees Fahrenheit.

When the mean daily temperature falls below 40 degrees Fahrenheit, the minimum concrete temperature shall be 55 degrees Fahrenheit and as close to this minimum as possible.

When the air temperature is below 40 degrees Fahrenheit, provide suitable protection so the concrete can be maintained at a minimum of 50 degrees Fahrenheit throughout the curing period. The protection and heat source, shall maintain the required temperature and moisture conditions without injury due to concentration of heat. All materials which the concrete contacts such as reinforcing, forms, ground, etc., shall be free of frost prior to placement.

Concrete temperature changes during and immediately following the curing period shall be as uniform as possible and shall not exceed 5 degrees Fahrenheit in any one hour, nor 40 degrees Fahrenheit in any 24 hour period. When heaters are used, prevent local surface heating and drying and provide adequate ventilation to prevent carbonation damage to exposed concrete surfaces. Thermostatic temperature controls shall be provided to control the heated enclosures to 50 degrees Fahrenheit. Temperatures exceeding 80 degrees Fahrenheit are to be avoided.

Concrete shall not be allowed to fall from the end of a chute, tube, or bucket more than 5 feet to point of deposit and shall have a fall free from obstructions. Chutes shall be metal or metal-lined. Pumping equipment, pipelines, procedures, etc., shall be in accordance with ACI 304R, latest revision, and Standards Engineering shall be consulted for mix design of any pumped application. Conveying equipment for pumped concrete shall be of suitable kind, without "Y" sections and with adequate pumping capacity. No aluminum pipe shall be used. Placement shall be controlled so there is no separation in the discharged concrete. The maximum loss of slump in pumping equipment shall be 1½ inches.

Concrete shall be deposited as near to its final position as possible to avoid long flows in the forms. Concrete shall not be moved more than 10 feet from point of deposit. Concrete shall be placed in successive horizontal layers, ranging in thickness from 6–15 inches, maximum. Concrete shall be placed within 1½ hours after addition of cement to the aggregate.

Where conditions make it difficult to place concrete uniformly and perform compaction at the bottom of forms, batches of mortar containing the same proportion of cement to sand as in the concrete mix shall be deposited first and spread over the cleaned surface to a depth of approximately 1 inch.

Segregated, unworkable, and excessive slump concrete shall not be placed or, if placed, shall be removed and wasted as directed. High slump concrete resulting from addition of approved additives is acceptable for placement. Free water accumulating on new concrete during placement shall be removed as directed by the Engineer.

Placement and compaction methods shall ensure homogeneous concrete with maximum consolidation without segregation. Consolidate concrete by internal vibration, spading, or rodding by working it thoroughly around reinforcement, embedded items, and into corners of forms to eliminate all air or stone pockets which cause honeycombing, pitting, or planes of weakness. Concrete contacting all formed surfaces shall be spaded manually to eliminate air bubbles.

Place horizontal construction joints at uniform vertical spacing unless otherwise shown on the drawings. Concrete shall not be placed to a depth of more than 10 feet in any 24 hour period, unless approved by Standards Engineering. All concrete placements shall be such as to keep cold joints from forming.

Whenever work is suspended on any section for more than one hour, the horizontal edges of the concrete next to the forms shall be brought to a plane perpendicular to the form face, and treated so no irregular, rough, or feathered edge joints show in the finished work. Before placing the next lift, clean the joint surface and remove all laitance. Immediately before placing new concrete wet the joint surface and remove all standing water.

Unless adequate weather protection is provided, do not place concrete during rain, sleet, or snow.

31.7.70 Curing

Protect freshly deposited concrete from premature drying and hot or cold temperatures. Maintain a constant temperature throughout the curing period without drying.

All exposed concrete surfaces shall be kept continuously moist overnight by ponding, sprinkling, or by use of an approved membrane type curing compound, which conforms to ASTM C309, latest revision, and applied in conformance with the manufacturer's recommendations.

Curing shall continue, using one of the above methods or waterproof paper, for a 7 day period (3 days for high-early strength concrete) maintaining the concrete at a minimum temperature of 50 degrees Fahrenheit as is practical. Protective covering with tarpaulins, hay, straw, etc. shall be provided to retard moisture evaporation during hot weather and to prevent rain damage before hardening. Protective covering shall be available for immediate use at all times.

During the curing period, the concrete shall be protected from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.

31.7.80 Surface Finish

All surface fins shall be removed. Exposed concrete surfaces shall not be given any special treatment to enhance appearance, such as rubbing with a stone, without permission of Standards Engineering.

31.7.90 Loading Of Concrete

Normal concrete structures shall not be subjected to external loads in less than:

1. Four days for foundations, manhole floors, and walls.

2. Seven days for floors, roofs, and columns.Each concrete placement shall be allowed to set 48 hours before addition of a subsequent pour upon it. If high-early cement is used this time period may be reduced by one-half.

Trenches containing concrete encased duct lines constructed on undisturbed original ground may be backfilled not less than two hours after placement. Compaction by light tamping equipment may proceed immediately. Loading of the backfill by heavy equipment or traffic is not permitted before 12 hours after placement.

31.7.100 Waterproofing

Waterproofing is provided by the density of the concrete mix and the thickness of concrete. Care must be used in placing and compacting the concrete to eliminate all voids and potential leakage paths. When structures less than 8 inches thick must be waterproof, consult Standards Engineering to revise the mix design to achieve the desired waterproof result.

Note: If a greater slump is required, contact Standards Engineering for an additive to meet the specific job requirements.

31.8 CONSTRUCTION GUIDELINES FOR COMPLIANCE FOR DISTRIBUTION AND SUB TRANSMISION STANDARDS

As part of the construction audit review, questions have been raised as to when existing construction shall be brought in compliance with current Distribution Standards. The following is a general outline as to what the Company expectations are with regard to this matter.

New Construction – All new construction shall be built to current PPL Distribution Standards.

Existing Construction – Existing construction or maintenance work (i.e., outside of complete structure replacement, reconductoring or conversions) does not require that the existing structure be brought in compliance with the current Distribution Standards provided that the work being done maintains the integrity of the original structure's construction. Safety concerns (such as clearances) or potential reliability issues at the structure shall be addressed as part of the work that is being performed.

Emergency Construction – Emergency or temporary construction does not require that the existing structure be brought in compliance with the current Distribution Standards provided that the work being done maintains the integrity of the original structure's construction. Critical safety concerns that may result in undue hazard or potential harm to Company personnel or to the general public shall be addressed as part of the emergency work that is being performed. Potential reliability issues or general safety concerns at the structure shall be reported to local supervision. Emergency or temporary construction shall be brought into compliance with Distribution Standards as soon as practical.

New Standard

Note 1: During structure replacement, reconductoring, or conversion work, all minimum clearances and separations per current Distribution Standards shall be followed.

Note 2: In all cases, work being completed on any given structure shall be in compliance with PPL Electric Operating Procedures as well as all applicable federal, state or local law / ordinance. (e.g., For the case where a driven ground rod is found to be missing on a required structure, appropriate permissions (e.g., Dig Safe, Dig Safely) must be acquired prior to correcting the situation.

Some examples of safety or potential reliability concerns include, but are not limited to:

- **Safety**
  - Clearances
  - Potted porcelain cutout on pole
  - Missing guy marker(s)
  - Missing structure or switch number
  - Missing equipment locks
- **Reliability**
  - Improper bonding and grounding
    - Missing or exposed ground rod(s)
    - Street lighting
    - Metallic Riser conduits
    - Guy wire (wye system)
    - Switch handles
    - Control cabinets
    - Equipment tank/mounts
    - Spacer cable supports (tangent, C and E-brackets)
    - Arresters (flexible braid utilized for arrester disconnector)
    - Secondary neutral
    - Down ground molding
  - Potted porcelain cutout on pole
  - Missing surge arrester(s)
  - Missing animal guard(s)

Version	Date	Modification	Author(s)	Approval by (Name/Title)
3.2	7/18	• New section 31.8		
3.1	7/16	• Update to section 31.7 • Updated header throughout section		
3.0	7/15	• Added new sections 31.0 and 31.1. • Renumbered sections and page numbers throughout section. • Updated Figures 2 and 3 on pages 31-65 and 31-66, respectively.		
2.0	7/11	• Minor updates, modified document for documentum, several pages text shift • Added new decals • Added underground cable markers • Added concrete mix M7		
1.0	07/07	• Modified definitions to match OH construction book • Added new decals		

Supersedes 7/19 Issue- Updated Table 7 on Page 32-8

32.0 GENERAL

The following Standard is to be followed when designing and installing direct buried (DB) conduit systems. This Standard shall apply to primary and secondary systems installed by both the Company and/or customers.

32.1 APPLICATION

Direct Burial (DB) conduit is to be used where ducts are to be direct buried or encased in concrete. The amount of ducts should provide for present and future planned installations by the Company and need to include spare ducts (unoccupied and designated as a spare for emergency replacements). The minimum number of ducts shall be two. If inner duct is needed, Standards Engineering shall be contacted.

Routes through unstable materials such as mud, shifting soils, etc., or through highly corrosive soils, shall be avoided. If construction in these soils can not be avoided, the conduit system shall be constructed in such a manner as to minimize movement and/or corrosion.

32.2 TYPE

Ducts are to be purchased in 20 foot lengths. They are to have a bell end or coupling on one end. See Table 1.

Type	Size	Std. Item
Direct Buried (DB)	2”	UK6A2
	3”	UK6A3
	4”	UK6A4
	5”	UK6A5
	6”	UK6A6

Table 1 - Std Item Numbers for DB Conduit

32.3 BENDING

32.3.10 Bends within a Duct Bank Section:

PVC conduit has the ability to be bent without any heating of the material. Therefore hot bending will not be used for the installation of conduits. The degree of cold bending will be a function of temperature. Bends that exceed the cold bending availability will be made with 5 degree couplings. The minimum length of duct segments between single 5 degree couplings is 40 inches. This construction yields a 40 foot radius of curvature, which is the minimum requirement for any size conduit. If a tighter radius is required, consult Standards Engineering.

32.3.20 Sweeps at Equipment:

Sweeps needed at equipment locations, e.g. pad-mount transformers, shall be made using manufactured sweeps. Acceptable sweeps are listed in Table 5. The radius of the sweep shall be a minimum of 24 inches for 2 inch conduit, 36 inches for 3 – 5 inch conduit and 48 inches for 6 inch conduit. 90 degree conduit “elbows” shall not be used; the radius of these bends are not adequate and will cause damage to cable insulation.

32.4 SPACING

32.4.10 Ductbanks

Spacers must provide a 1½ inch minimum separation between ducts (except 6 inch ducts which require 2 inches of separation) and 3 inches between the ducts and the surface of the ductbank. Spacers lock vertically and horizontally. Intermediate spacers shall be used as a cap on the top tier of a duct back to prevent floating during encased burial installations. Spacers shall be placed at 5 – 8 foot intervals and shall be placed at each coupling. See Table 2 for duct bank dimensions and Table 3 for spacer information. See Figures 1 thru 6 and 2A thru 5A for typical ductbank configurations. If special circuit loading conditions are required by Distribution Design, consult Standards Engineering for assistance with ductbank configuration.

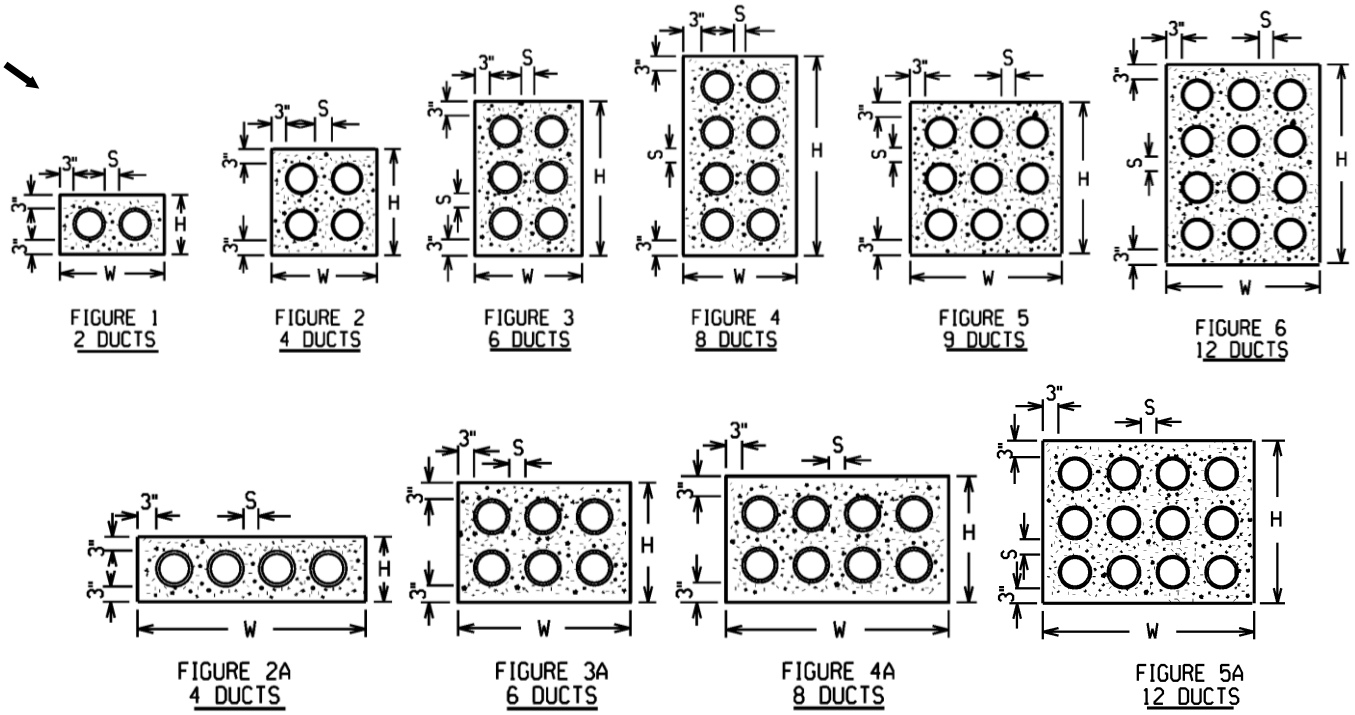


FIGURE 1 2 DUCTS | FIGURE 2 4 DUCTS | FIGURE 3 6 DUCTS | FIGURE 4 8 DUCTS | FIGURE 5 9 DUCTS | FIGURE 6 12 DUCTS

FIGURE 2A 4 DUCTS | FIGURE 3A 6 DUCTS | FIGURE 4A 8 DUCTS | FIGURE 5A 12 DUCTS

Dimensions in Inches									
Figure	4" Duct			5" Duct			6" Duct		
	W	H	S	W	H	S	W	H	S
1	16 ½	10 ½	1½	18 ¾	11 ¾	1½	21 ¼	12 ¾	2
2	16 ½	16 ½	1½	18 ¾	18 ¾	1½	21 ¼	21 ¼	2
2A	28½	10 ½	1½	32 ¾	11 ¾	1½	38 ½	12 ¾	2
3	16 ½	22 ½	1½	18 ¾	25 ¾	1½	21 ¼	30	2
3A	22 ½	16 ½	1½	25 ¾	18 ¾	1½	30	21 ¼	2
4	16 ½	28 ½	1½	18 ¾	32 ¾	1½	21 ¼	38 ½	2
4A	28 ½	16 ½	1½	32 ¾	18 ¾	1½	38 ½	21 ¼	2
5	22 ½	22 ½	1½	25 ¾	25 ¾	1½	30	30	2
5A	28 ½	22 ½	1½	32 ¾	25 ¾	1½	38 ½	30	2
6	22 ½	28½	1½	25¾	32 ¾	1½	30	38 ½	2

Table 2 - Duct Bank Spacing

Supersedes 2/06 Issue - Added Figure 5, updated dimensions in Table 2.

Size	Intermediate	Base
3"	UK5E	UK4E
4"	UK5F	UK4F
5"	UK5G	UK4G
6"	UK5H	UK5H

Table 3 - Conduit Spacer Std Item Numbers

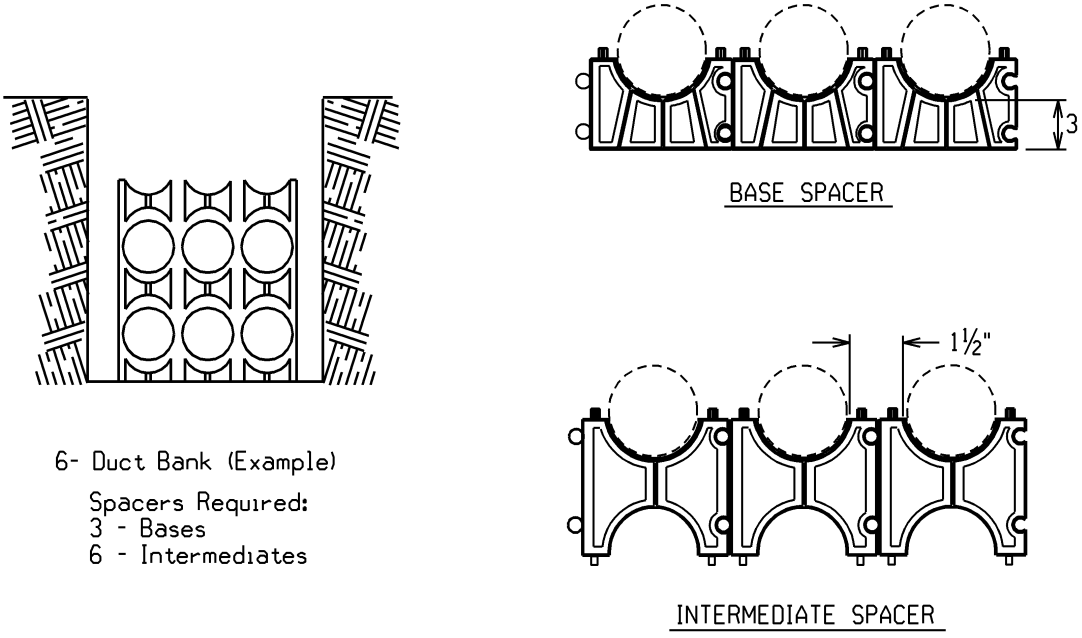


Figure 6

32.4.20 Ductbank Face (In Manholes)

The spacing is increased at the manhole face to allow the cables within the ducts to enter the manhole freely without being too close to the cables from the adjacent ducts and to allow for the use of bell end conduit.

Use the following table and Figure 7 as a guideline for installing ducts at the manhole face:

	6" Conduit	5" Conduit	4" Conduit
Spacing between conduits (S)	9"	9"	8"
Spacing between conduit and edge of ductbank (E)	6"	6"	6"

Table 4 - Spacing at Ductbank Face (in Manholes)

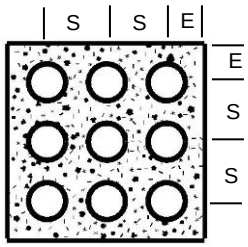


Figure 7

Supersedes 2/06 Issue - Added 32.4.2, re-numbered Tables.

32.5 FITTINGS

Fittings and accessories will be joined with PVC cement (Std. Item UK6S). Additional fittings can be found in the Section 50–Materials Catalog.

Description	2"	3"	4"	5"	6"
Adapter (PVC-Square Tile)	-	-	UK7SA	-	-
Adapter - Female (Threaded)	UK6F2	UK6F3	UK6F4	UK6F5	UK6F6
Adapter – Male (Threaded)	-	UK7M3	-	-	-
Adapter Coupling - Flexible (4"-5")	-	-	UK7F	UK7F	-
Bend - 90°[(a)]	UK6B2A	UK6B3	UK6B4	UK6B5	UK6B6
Bend - 90°, 48"R	-	UK6B3A	UK6B4	UK6B5	UK6B6A
Bell End	UK6E2	UK6E3	UK6E4	UK6E5	UK6E6
Coupling – Straight	UK6C2	UK6C3	UK6C4	UK6C5	UK6C6
Coupling – Split	-	UK7CC3	UK7CC4	-	-
Coupling - 5° Female x Male	UK6D2	UK6D3S	UK6D4S	UK6D5S	UK6D6S
Coupling - 5° Female x Female	-	UK6D3	UK6D4	UK6D5	UK6D6
Duct - Split[(b)(c)]	-	-	UK7S4	-	-
Plug	UK6G2	UK6G3	UK6G4	UK6G5	UK6G6
Reducer - 4" to 3" male x male	-	UK7E	-	-	-
Reducer - 4" to 3" male x female	-	UK7D	-	-	-

(a) Minimum radius for 2 inch is 24 inches; for 3 inch, 4 inch and 5 inch is 36 inches; and for 6 inch is 48 inches.
(b) Type DB.
(c) Use cable tie (Std. Item UK7ST) where needed. Cable ties included with split duct furnished by Carlon.

Table 5 - Conduit Fittings

32.6 PITCH

Ducts are to pitch toward manholes and have a minimum slope of no less than 3 inches per 100 feet.

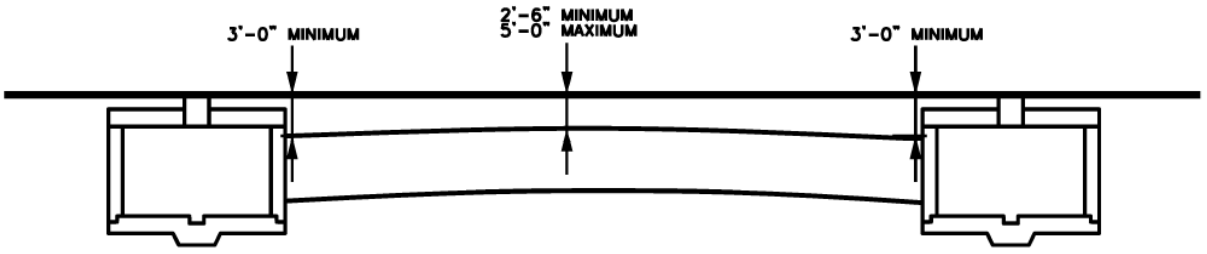


Figure 8

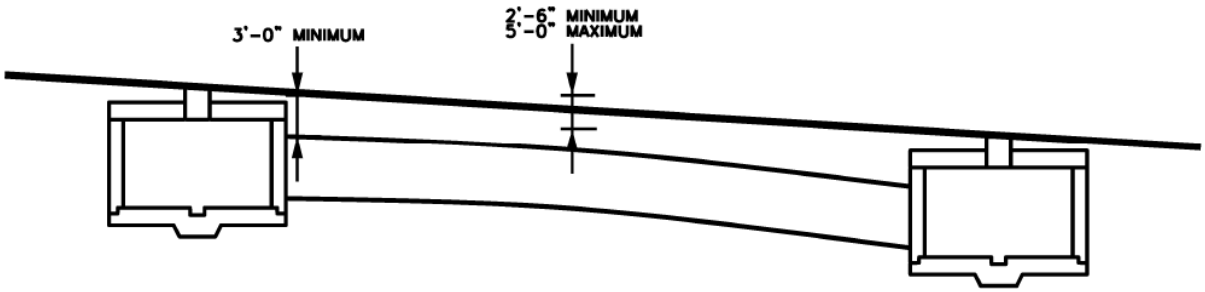


Figure 9

Supersedes 7/08 Issue – Update to figures 8 and 9.

32.7 BURIAL DEPTHS

Burial depth is defined as "The distance between the top of the cable or conduit and the surface under which is installed". The following burial depths apply to all primary voltage cables and conduits.

The **maximum burial depth** at the center of the conduit or cable span shall be 60 inches. Please consult with Standards Engineering for exceptions to maximum burial depths.

The **minimal burial depth** at the center of the conduit span between the top of the completed conduit, conduit bank or direct buried cable and grade shall be 30 inches. If these minimum burial depths **cannot** be achieved due to ledge, solid rock or other considerable conditions, the following exceptions will apply for all installations both in public ways and private property:

32.7.10 For Duct Applications:

The minimum burial depth can be reduced to 21 inches. Supplemental protection is required to prevent potential damage. The conduit shall be encased in concrete. The concrete envelope is to be a minimum of 3 inches thick in all directions around the conduit. Minimum cover over the concrete encasement shall not be less than 18 inches.

32.7.20 For Direct Buried Applications:

The minimum burial depth can be reduced to 21 inches. Supplemental protection is required to prevent potential damage. The cable must be placed in a properly sized PVC-DB conduit encased in concrete. The concrete envelope is to be a minimum of 3 inches thick in all directions around the conduit. Minimum cover over the concrete encasement shall not be less than 18 inches.

Supersedes 7/08 Issue – Update to 32.7 and 32.8

32.8 CLEARANCES

Clearances between the conduit concrete envelope and major subsurface pipes or structures shall be a minimum of 6 inches; clearances to services and laterals shall be a minimum of 2 inches. Electric conduit crossing above other utilities must have suitable support under the electric conduit, on each side of the other utility line, to maintain the minimum clearance if the other utility's facilities ever have to be dug out.

Type	Clearance Min (in.)
Communication Systems	12[1]
Natural Gas Lines	12
Sewers, Sanitary and Storm	12
Water Lines	12
Fuel Lines	Opposite side of Street[2]
Steam Lines	Opposite side of Street or 8 feet with insulation
Rail Road Crossings	50[3]

Notes:

1. 3 inches of concrete or 4 inches of masonry is also acceptable.
2. Where this is not practical, clearance shall be sufficient to allow the use of pipe maintenance equipment.
3. Maybe reduced by agreement of concerned parties, but in no case shall it be less than 6 inches from ballast.

Table 6 - Clearances Required From Other Utilities

32.9 EXCAVATION

Excavation for an entire run shall be completed prior to conduit installation to preclude encountering unexpected obstructions. The trench shall be excavated and trimmed in such a way that backfill is not required to establish the proper line of grade. The trench bottom shall be solid, undisturbed earth. Earth showing extensive signs of peat, cinders, rubble, frozen material, or any conditions not suitable for a stable foundation, shall be reported to Standards Engineering for recommendation. Small pockets (up to 1 cubic yard) of unsuitable soil shall be excavated and replaced with compacted gravel (maximum 2 inches of stone). Where the earth walls of the trench are firm enough to sustain themselves, and all OSHA requirements are met, they may be used as the forms for concrete encasement. The walls of these trenches shall be carefully trimmed to allow the proper thickness (minimum 3 inches) of concrete around the outside conduits. The walls shall not be so wide as to require an excessive amount of concrete to fill the trench. If shoring and/or sheeting are necessary, they shall be placed as required to maintain the excavation and shall be removed prior to concrete encasement and/or as the backfilling progresses so that all shoring is removed as the job is completed. This can only be applied to a 2-conduit (side by side) formation.

Excess excavation material shall be removed from the job site as soon as possible.

32.10 INSPECTION

Company inspectors shall perform on-site inspection of the installation after the duct sections are compete and prior to pouring concrete or backfilling any portion of the installation.

32.11 CONCRETE

Shall be in accordance with Section 31 – General; mix M3 without air entrainment agents. Concrete mix shall be a minimum of 2000 psi. When the interval between pours is greater than 2 hours, #4 reinforcing bars 6 feet long shall be installed in the corners and between ducts on the top and bottom rows.

32.12 BACKFILL

Concrete will be cured for a minimum of 12 hours before backfilling over it. Before any backfill is installed, a Company employee or representative shall inspect and approve the duct construction and backfill material. Flowable fill is a viable backfill if available and when deemed necessary.

32.12.10 Direct Buried Duct Systems

Backfill material shall consist of sand or earth, or a mixture which may contain rocks, provided the rocks do not exceed 2 inches in any dimension and have no sharp edges. Additionally, the rocks shall not comprise more than 50% of the backfill material by volume. Backfill material shall be adequately compacted in 6-inch lifts. Peat, cinders, rubble and frozen material are not suitable backfill material.

32.12.20 Concrete Encased Duct Systems

Backfill within 6 inches of the top of the concrete shall be free of solid material greater than 4 inches maximum dimension, or, with sharp edges likely to cause damage. The balance of backfill shall be free of solid material greater than 8 inches, maximum dimension. Backfill material shall be adequately compacted in 6-inch lifts. Peat, cinders, rubble and frozen material are not suitable backfill material.

Supersedes 7/15 Issue – Revised 32.9 and 32.12.

32.13 WARNING TAPE

Warning tape (Std. Item UT8) shall be installed 12–18 inches below finished grade and directly above electric conduit.

32.14 MANDREL

An approved flexible mandrel, no less than ¼ inch smaller in diameter than the duct nominal inside diameter, shall be pulled through all completed ducts. 2,500 pound rated pulling tape, often referred to by the trade name "Muletape" (Std. Item T4A), shall be left in all conduits. One such tape manufacturer would be Arnco Corporation, manufacturer number DLWP25.

32.15 REPAIR

Repairs of occupied conduits shall be made from PVC loc-duct (Std. Item UK9A), of the same outside diameter, wall thickness and approximate length as the damaged section. Split couplings (Std. Item UK9C) shall also be the same dimensions as the damaged section and used along with PVC loc-duct (Std. Item UK9A). Place plastic strap (Std. Item UK9S) around the loc-duct, 12 inches from the end of the coupling and another strap 12 inches from the end of the top half section of loc-duct. Apply duct seal (Std. Item S3) and/or vinyl tape (Std. Item 1WBP) to seal all slots and openings.

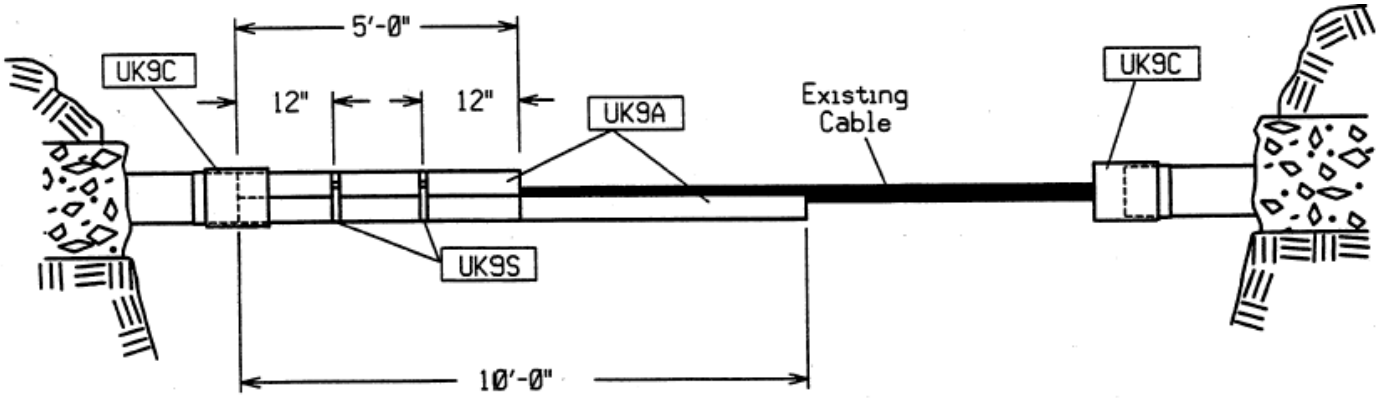


Figure 10

32.16 DUCT SIZING FOR 3 SOLID DIELECTRIC PARALLEL CABLES

Cables are required to have ¾ inch clearance through the conduit. Also multiple cables might have a possibility of jamming. Table 7 will aid in the selection of the proper conduit size for 3 parallel conductors. "NO" means the conduit is not suitable for the conductors, "YES" means the conduit is suitable for the conductors.

Acceptable conduit size was selected by determining jamming possibility and a ¾ inch clearance. Jamming was calculated using the formula D/d. Where D = inside diameter of duct and d = single cable nominal OD. If D/d ratio is greater than 2.8 and less than 3.2 there is a possibility that the cables may jam. Actual clearance (c) is calculated using the following formula:

$$c = \frac{D}{2} - 1.366 * d + \frac{D-d}{2} * \sqrt{1 - \left(\frac{d}{D-d}\right)^2}$$

Voltage	Conductor Size	Conductor OD	4-Inch Conduit			5-Inch Conduit			6-Inch Conduit		
			PVC DB, ID=4.258	PVC Sch 40, ID=4.026	Steel, ID=4.026	PVC DB, ID=4.258	PVC Sch 40, ID=4.026	Steel, ID=4.026	PVC DB, ID=4.258	PVC Sch 40, ID=4.026	Steel, ID=4.026
5 kV	4/0 CU	1.12	YES	YES	YES	YES	YES	YES	YES	YES	YES
	500 CU	1.43	NO	NO	NO	YES	YES	YES	YES	YES	YES
15 kV	2 AL	1.015	YES	YES	YES	YES	YES	YES	YES	YES	YES
	2 CU	1.015	YES	YES	YES	YES	YES	YES	YES	YES	YES
	4/0 CU	1.24	YES	YES	YES	YES	YES	YES	YES	YES	YES
	350 CU	1.42	NO	NO	NO	YES	YES	YES	YES	YES	YES
	500 CU *Rd	1.426	NO	NO	NO	YES	YES	YES	YES	YES	YES
	500 CU	1.55	YES	YES	YES	YES	YES	YES	YES	YES	YES
	750 AL	1.74	NO	NO	NO	NO	NO	NO	YES	YES	YES
	1000 AL	1.98	NO	NO	NO	YES	YES	YES	NO	NO	NO
	1000 CU	1.98	NO	NO	NO	YES	YES	YES	NO	NO	NO
25 kV	1/0 CU	1.5	YES	YES	YES	YES	YES	YES	YES	YES	YES
	3/0 CU *Rd	1.28	YES	NO	NO	YES	YES	YES	YES	YES	YES
	4/0 CU	1.43	NO	NO	NO	YES	YES	YES	YES	YES	YES
	350 AL	1.6	YES	NO	NO	YES	NO	NO	YES	YES	YES
	350 CU	1.58	YES	YES	YES	YES	NO	NO	YES	YES	YES
	350 CU *Rd	1.41	NO	NO	NO	YES	YES	YES	YES	YES	YES
	400 CU	1.47	NO	YES	YES	YES	YES	YES	YES	YES	YES
	500 AL	1.795	NO	NO	NO	NO	NO	NO	YES	YES	YES
	500 CU	1.665	YES	NO	NO	NO	NO	NO	YES	YES	YES
	500 CU *Rd	1.58	YES	YES	YES	YES	NO	NO	YES	YES	YES
	750 AL	1.93	NO	NO	NO	YES	YES	YES	YES	NO	NO
	1000 AL	2.16	NO	NO	NO	YES	NO	NO	YES	YES	YES
	1000 CU	2.16	NO	NO	NO	YES	NO	NO	YES	YES	YES
35 kV	1/0 AL	1.45	NO	YES	YES	YES	YES	YES	YES	YES	YES
	2/0 CU	1.53	YES	YES	YES	YES	YES	YES	YES	YES	YES
	500 CU	1.96	NO	NO	NO	YES	YES	YES	NO	NO	NO
	500 CU *Rd	1.7	YES	NO	NO	NO	NO	NO	YES	YES	YES
	750 CU	2.09	NO	NO	NO	YES	NO	NO	NO	NO	NO
	1000 AL	2.31	NO	NO	NO	NO	NO	NO	YES	YES	YES
	1000 CU	2.31	NO	NO	NO	NO	NO	NO	YES	YES	YES

Supersedes 7/17 issue - Revised Table 7 (1000 KCMIL 25 Kv)

Table 7 - Appropriate Conduit Size for use with Standard Cables

Rd* = reduced diameter. These cables shall only be used when standard sized cables do not fit in conduit.

Note:

Table 7 is based on the jamb ratio and clearance formulas from section 32.16 using common conductor OD's and common inner diameters of PVC DB, PVC Schedule 40 and steel conduit. Be aware that these values could differ by manufacturers. Always verify dimensions.

32.17 BRIDGE AND OVERPASS CONDUIT SUPPORT SYSTEM GUIDELINES

This standard is intended as a guideline for the installation of PPL conduits in or on bridges and overpasses. The final conduit support system design will be the responsibility of the Project Engineer.

32.17.10 Process

1. PPL personnel need to coordinate with the regulating body of the bridge or overpass to secure occupancy rights on the structure, to assure that the proper load limits are designed for, and to meet the project construction timetable.
2. PPL's Engineering Planning Department shall specify system requirements, e.g. size and number of conduits. Spare conduits shall be included in the design.
3. Design should have no sharp bend of conduits. Design should minimize cable pulling tension.
4. Final design shall be stamped by a professional engineer registered in the state where the construction is taking place.
5. PPL design acceptance should include review by but not limited to Underground, Distribution Design, Construction Standards, Engineering Planning and Project Management Departments.

32.17.20 Type – Conduit Specification

1. Conduit material shall be type Heavy Wall (HW) Reinforced Thermosetting Resin Conduit (RTRC) in conformance with NEMA TC-14. The conduit and fittings shall have fire resistance properties in accordance with test procedures of Underwriters Laboratories UL 2515.
2. Conduits shall be joined by bell and spigots manufactured integrally as part of the conduit. Adhesive shall be recommended by the conduit manufacturer.
3. Field bending of the conduit shall be accomplished by use of fittings made of the same material as the conduit.
4. Conduit and fittings shall have an ultraviolet inhibitor.

32.17.30 Expansion/Deflection Fitting

1. Expansion/deflection fittings shall be installed in/at all structural expansion joints or at 200 feet maximum spacing, whichever is the lesser distance and on the bridge side of the abutments.
2. Expansion/deflection joints shall be located no closer than 12" from any support.
3. The expansion and deflection setting shall be determined by the Project Engineer.
4. Expansion/deflection fittings shall only be installed on straight portions of conduit runs.
5. Double bell (B-B) stop couplings shall be installed at bridge abutments.

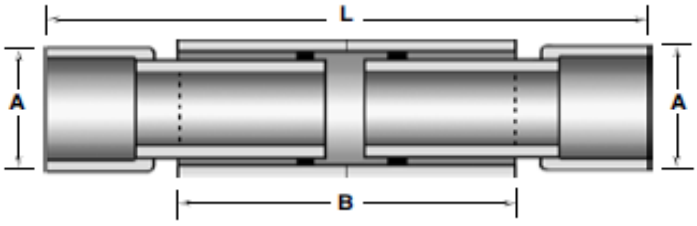


Figure 11 – Expansion / Deflection Joint

32.17.40 **Hanger Supports**

1. The conduit support system may be made up of anchor hangers and intermediate hangers. All conduit support hardware shall be fiberglass with the exception of bolts. All bolts shall be hot dipped galvanized in accordance with ASTM A153. Attachment of supports to bridge needs to be determined and designed by the Project Engineer.
2. Anchor hangers are required where more than one expansion joint is installed. Anchor hangers have adjustable braces and shall be installed at the midway point between expansion/deflection joints. Split stop rings restrict conduit movement and shall be installed at all anchor hangers.
3. Intermediate conduit hanger supports shall be at 10-12 foot maximum spacing.
4. Squares that enclose conduit in supports should be approximately ½" larger than the OD of the conduit.
5. Support shall permit conduit to expand and contract with temperature and bridge.
6. When needed, windows, sleeves and casings should be designed to permit the conduit to pass through bridge abutments in the same alignment as the hanger support. Such design will make rolling or bending the conduit unnecessary.

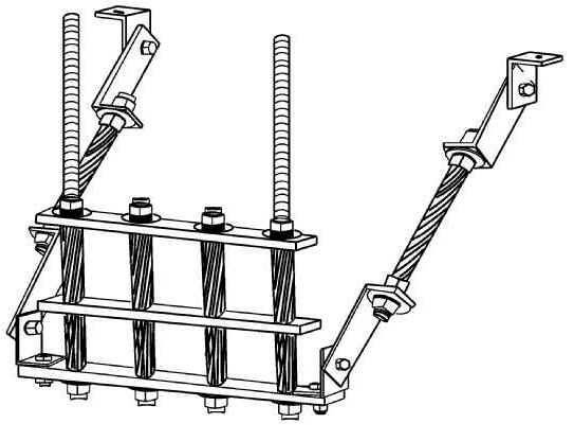


Figure 12 - Anchor Hanger

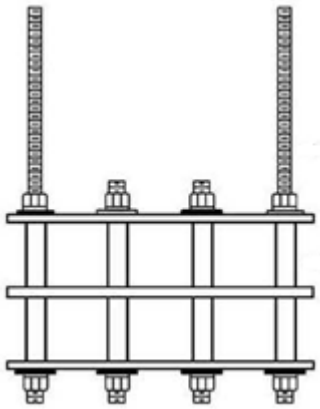


Figure 13 - Intermediate Hanger

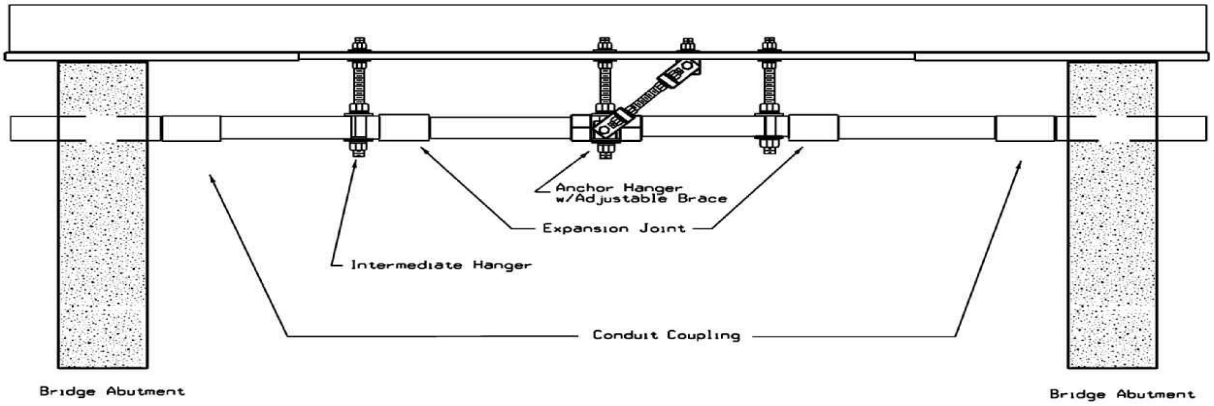


Figure 14 – Typical Bridge and Overpass Conduit Support System

Added Section 32.17 BRIDGE AND OVERPASS CONDUIT SUPPORT SYSTEM GUIDLINES

32.18 CONDUIT VENTILATION OF SPARE RISER

To add natural exchange of air in manhole and duct system conduit ventilation is available. Spare conduit from the manhole to the riser pole sweep can now be transformed into a ventilated riser. A 10 foot conduit (Std Item UK30_) can be installed onto the sweep and then vent cap (Std Item UK63V_) . See figure 15 below.

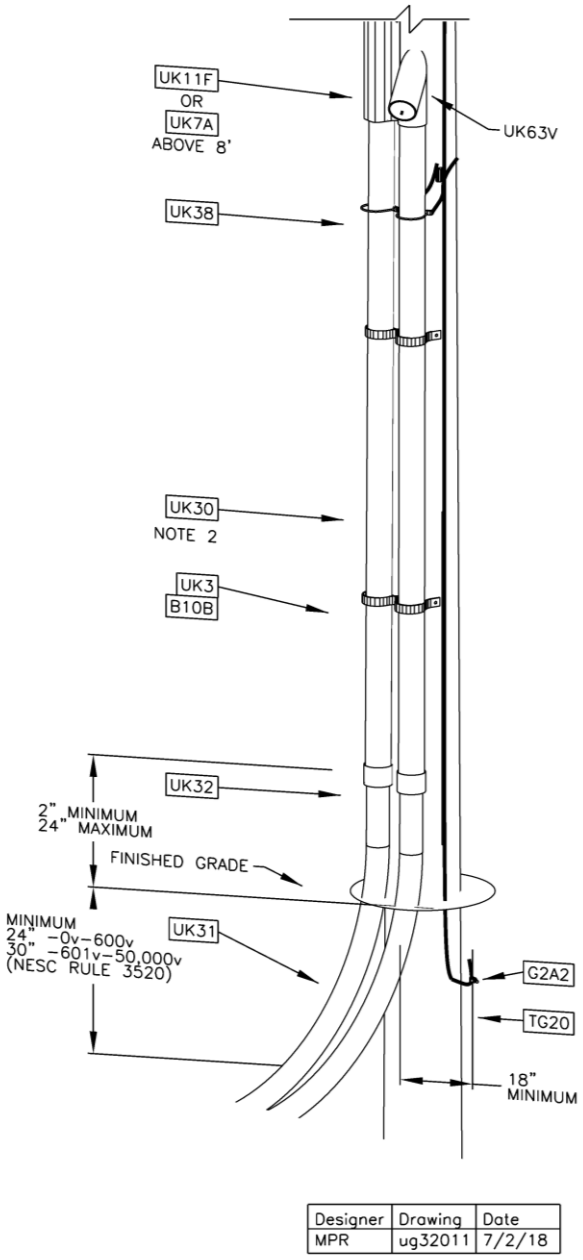


Figure - 15

Version	Date	Modification	Author(s)	Approval by (Name/Title)
8	7/21	• Revised Table 7 – 1000 kcmil 25 kV	REDACTED	REDACTED
7	4/19	• Revised Section 32.7 - Burial Depth • Revised Section 32.8 - Clearances	REDACTED	REDACTED
6	7/18	• Update to 32.7 added max burial depth. • Updates to figures 8 and 9. • New Standard Section 32.18.	REDACTED	REDACTED
5	7/17	• Revised Table 7.	REDACTED	REDACTED
4	7/15	• Added std. item for mule tape in 32.14	REDACTED	REDACTED
3	7/13	• Added 500 kcm cable, 35kV to Table 7. • Added bridge and overpass support system guidelines.		REDACTED
2	7/10	• Updated Table 7 to reflect actual conduit inner diameter sizes.	REDACTED	REDACTED
1	07/08	• Changed 32.4 from “Spacers” to “Spacing.” • Added Figure 5, updated dimensions in Table 2 • Added section 32.4.2, re-numbered Tables • Re-numbered Figures and Table, text shift due to formatting	REDACTED	REDACTED

33.0 HANDHOLES / MANHOLES

The following Standard is the practice to be followed when designing and installing underground handholes and manholes. This Standard shall apply to primary and secondary systems installed by both the Company and a customer/developer. Distribution handholes shall be used where the use of manholes is not required. The criteria for use of the various handholes and manholes are as follows:

A. Light Duty Handhole URD Direct Burial system– 17x30 inch Cover – High density plastic, used for secondary services (600 volts and below) Refer to Page 33-100 for construction details – (Std Item UR10F).

Light Duty Handhole URD Conduit system– 17x30 inch Cover – Polymer concrete, with fiberglass flared sidewalls, used for secondary services (600 volts and below) Refer to Page 33-101 for construction details – (Std Item UR10G).

B. Heavy Duty Rectangular Handhole - 26 inch Cover - Where the ultimate use of the handhole, including the number, size, voltage and type of cables/conductors to be installed, meets the following criteria – (Std Item UM19).

1. Use of single conductor cables only.
2. Secondary mains and services requiring intermediate locations in the cable run, or additional space in the handhole, for cable pulling, due to duct length, or, for service laterals.
3. Primary services (13.8 kV maximum) from either an underground or overhead system requiring additional locations in the cable run for cable pulling due to duct length.

Refer to Page 33-102 for construction details.

C. Manholes – All other uses require a full size manhole – See Section 33.0.20

D. Primary Pull Splice Box – 30 x 60 inch Cover – Polymer concrete, used for primary up to 15kV class. Pull box can facilitate up to, two three phase circuits up to #2. For cables larger than #2, installation shall be in a large pull box or manhole – (Std Item UR6)

E. Large Primary Pull Splice Box – 48 x 96 inch Cover - Polymer concrete, used for primary up to 15kV class. Pull box can facilitate up to 500kcmil cables – (Std Item UR7)

Supersedes 7/13 Issue – Added new 48x96 pull box in text.

33.0.10 Handholes

A. Location

Light Duty Handholes are only allowed in sidewalk or grass areas for building services or street lighting.
Heavy Duty Handholes may be installed in roadways, driveways, sidewalks or grassed areas. It is preferable to place them away from high traffic locations as much as possible, to avoid and minimize potential contact with pedestrians.

B. Maximum Conductor Size

Maximum conductor size which is to be installed in a handhole is indicated in Table 1.

Table 1

Voltage	Handhole	Conductor Size
600 V	Light Duty	500 kcmil
600 V	Heavy Duty	500 kcmil
5 – 15 kV	Heavy Duty	4/0

C. Maximum Number Of Cables

The maximum number of cables (not including secondary taps) in Table 1 shall be two sets of three 1/C phase conductors and one 1/C neutral conductor per set. Where the number of secondary taps is sufficient to cause congestion in the handhole and make the installation of a second set of cables undesirable then only one set of cables shall be installed.

Leave sufficient cable in handhole to permit making cable joint above grade over the handhole.

33.0.20 Manholes

Specify for each manhole:

1. Standard Item number of each manhole.

2. Duct formation (Refer to Section 32 – Conduit).

3. Manhole chimney shall be a minimum of two layers of brick or an adequate number of precast concrete rings to allow for future grade changes. The maximum distance between the underside of the manhole roof and final grade shall be less than 3 feet. See drawing 33-97 for dimension “G”.

4. A 36 inch manhole frame (Std. Item UM14F) with a 26 to 36 inch manhole ring (Std. Item UM14R) and a 26 inch manhole cover (Std. Item UM14C) shall be used for new construction. Set frame to proper grade with mortar or rubber grading rings (Std Item UM15D_).

A. Furnishing Material

Any material required to be furnished by the customer shall comply with the Company Material Specifications.

B. Preparation For Installation

Fill bottom of excavated hole with a minimum of 1 foot of well compacted crushed bank gravel.

C. Foreign Structures

All parts of the manhole structure should have at least 6 inches clearance from all pipes and structures.

D. Duct Entrances

Duct entrances shall be constructed such that end bells are flush with manhole walls. Any voids around end bells shall be filled in with grout.

1. Formation – Project plans shall specify the duct entrance formation, depth of duct bank and size required or show special arrangements when this is required. Refer to Pages 33-103 thru 33-140 for manhole duct entrance construction drawings.

2. Relative Location – Ducts with staggered alignment are to have opposite formations on opposite walls.

Supersedes 7/15 Issue – Text update 33.0.20 -3.

3. Bell ends shall be used on all ducts, entering a manhole or handhole, if bell ends are missing install fairleaders to protect cable egress.

4. Vertical reinforcing rods are to be bent out to support incoming ducts. If not possible, reinforcing bars shall be drilled and doweled 12" into the manhole to support incoming ducts. The duct bank concrete may need to be extended to the bottom of the manhole to get the required dowel depth in the manhole. Use a minimum of three ¾ inch Number 6 bars, 24 inches long.

E. Placing Frame, Ring And Cover

Use minimum of two courses of brick, or an adequate number of precast concrete pieces, and set the frame to grade on a bed of mortar or rubber grading ring (Std Item UM15D__). Mound concrete around brick and cover base of frame with one inch of concrete.

F. Field Changes

If a contractor finds it impossible to hold to the accepted plans, or these Standards, Distribution Engineering shall be contacted for modifications

G. Pulling Eyes

Two pulling eyes, one 6 inches below the ceiling and one 6 inches above the floor shall be installed in the opposite wall from each duct entrance. Install pulling eye horizontally as shown in Detail Z on Pages 33-103 thru 33-140.

33.1 CAST IN PLACE MANHOLES

If a precast manhole cannot be used, refer to this Section for cast in place manholes. Stamped approved drawings shall be furnished for the installation by the person requesting the installation.

Specify for each manhole:

1. Duct formation, depth and size.
2. Dimensions "H" and "G" (shown in drawing 33-97).
3. Grade.
4. Unistrut for cable racks if desired.
5. Reinforcing.

33.1.10 Concrete & Reinforcing

Concrete shall be mix M6, 4,000 pounds per square inch minimum, in accordance with Section 31 – General. Reinforce as indicated on the latest current version of the Material Specifications. Use steel bars of the deformed type conforming to ASTM A615 – Grade 60.

33.1.20 Construction Joints

Construction joints shall be thoroughly cleaned and grouted immediately before placing the wall and roof slab against the surface.

33.1.30 Furnishing Material

All material required to be furnished by the customer shall comply with the Company Material Specifications.

33.1.40 Foreign Structures

All parts of the manhole structure shall have at least a 6 inch clearance from all pipes and structures.

33.1.50 Floor

Place a concrete slab with minimum thickness of 8 inches and conforming to the overall dimensions of the particular manhole

A. SUMP – 12 inch square and 4 inch deep shall be installed directly below the center of the manhole opening. **Note**: 2 inch minimum floor thickness is maintained at the bottom of the sump.

B. PITCH – 1 inch from all sides to drain towards sump.

C. RECESS FOR ALL WALLS of 2 inches as shown on the drawings shall be provided.

D. REINFORCING when specified shall be installed as shown on the plans for the particular manhole. Locate 2 inches (clear) from the top surface.

33.1.60 Walls

Walls of concrete 12 inches thick shall be used. A "V" shaped recess 3 inches x 1½ inch shall be provided and centered in the top of the walls to lock with the roof slab. To prevent future leakage, form ties shall be of the water-seal type, or where exterior ends of ties are to be left in place, the ties shall be sealed and covered after removal of forms.

33.1.70 Duct Entrances

Duct faces shall be recessed 6 inches and duct lines shall extend 2 inches into the wall.

A. Formation – Project plans shall specify the duct entrance formation, depth and size of conduit required as shown in Conduit - Section 32; page 32-2 Figures 1 thru 6 and 2a thru 5a or show a special arrangement when this is required.

B. Duct Bank Face – Duct bank face space formation of the conduits is shown in Section 32, page 32-3 figure 7 and Table 4. The spacing allows adequate space for the cables within the ducts to enter the manhole freely without being too close to the cables from the adjacent ducts and to allow enough separation for the use of bell ends.

C. Relative Location – Ducts with staggered alignment are to enter manholes so that opposite formations are of opposite hand when viewed from the center of the manhole.

D. End Bells shall be used on all ducts.

E. Reinforcing Bars shall be used to lock the duct line to the manhole walls. Use three ¾ inch Number 6 bars a minimum of 24 inches long.

Supersedes 7/19 Issue – Text Shift

33.1.80 Pull Irons

Two pull irons, one 6 inches below the ceiling and one 6 inches above the floor shall be installed in the opposite wall from each duct entrance. Install eye horizontally as shown in Detail Z on Pages 33-103 thru 33-133.

33.1.90 Roof Slab

The roof slab shall have a minimum thickness of 12 inches of reinforced concrete plus a 2 inch pitch from the opening to the edges.

A. Reinforcing shall be installed as shown on the plans. Note the 2 inch clearance requirement of the reinforcing from manhole ceiling surface.

B. Opening of 3 feet 2 inches by 3 feet 2 inches with 3 inch downward bevel shall be provided.

33.1.100 Chimneys

Chimneys, when required to increase the height of manhole openings, shall be constructed of either brick or precast concrete.

33.1.110 Placing Frame And Cover

Use minimum of two courses of brick, or an adequate number of precast concrete pieces, and set the frame to grade on a bed of mortar or rubber grading ring (Std Item UM15D__). Mound concrete around brick and cover base of frame with one inch of concrete.

33.1.120 Dimensions "H" And "G"

Dimensions "H" and "G" shall be given on Project Plans for each manhole.

A. "H", which represents the head room, varies with the number of ducts, but should not be less than 6 feet 6 inches. If it exceeds 7 feet 6 inches, additional reinforcing in the walls may be required.

B. "G" varies with height of the manhole frame and height of the brick required. A minimum of two courses of brick, or equivalent precast concrete rings (Std Item UM15__), should be provided for in this dimension to allow for changes in grade. To adjust frame to final height use mortar or rubber grading rings (Std Item UM15D_).

C. Dimensions "F", as noted on duct plans, will influence dimensions "H"and "G".

33.1.130 Brick Walls & Rails Or Structural Steel Roofs

This construction is discouraged, but may be used if it is determined to be absolutely necessary. In such cases, refer to Distribution Engineering for complete design. Brick shall be solid (not cored) and shall conform to A.S.T.M. specifications C-32, Grade MA.

33.1.140 Field Changes

If the customer/developer finds it impossible to hold to plans or these Standards, the division engineer/project engineer shall be contacted for modifications.

33.1.150 Unistrut

Unistrut shall be 1 5/8" x 1 5/8" galvanized steel (Std.Item ID UM18D4), installed horizontally 18" from top and bottom, 6" from ends on walls without duct entrances. During concrete pour Unistrut shall be covered and sealed with tape. This covering or tape shall be removed and unistrut cleaned out after concrete has cured.

33.2 MANHOLE GROUND BUS / EQUIPMENT GROUNDING

For the purpose of the requirements of this section, the term 'manhole' is defined as an enclosure which has an interior height greater than six feet. Some areas of the company have traditionally called enclosures with less height by different titles, including manhole, which is causing confusion on these grounding requirements. A ground bus / anode system is only required in an enclosure which has an interior height greater than six feet or if there are switching devices installed. In locations where there are manholes with an interior height of less than six feet, a ground bus / anode system can be installed if required by the local engineering or operations.

Supersedes 7/18 Issue – Text Shift.

33.2.10 Grounding And Bonding

All conductive material in the manhole / vault shall be connected to the ground bus. Bonding / grounding of the equipment enhances personnel safety when working in the manhole. Grounding of all neutrals provides quicker clearing during cable faults and limits the damage caused by the excessive fault current flowing on the cable concentric neutral or shield.

New manholes will be constructed per this standard. Existing manholes will be upgraded to meet this standard when substantial new construction is performed. Refer to Pages 33-114 and 33-115 for grounding detail.

33.2.20 Equipment To Be Grounded

All conductive material in the manhole shall be solidly connected to the ground bus, including but not limited to:

A. Cable concentric neutral.

B. Separate neutrals.

C. Cable rack stanchion.

D. Switch bases.

E. Transformer and other equipment cases.

F. Switches

33.2.30 Connection To Earth

Each manhole ground bus is to have a minimum two connections to an earth ground. Connections to the earth ground are to be made with 4/0 bare copper wire (Std. Item W19G).

New precast manholes have 2 – 4/0 copper ground leads, connected to the reinforcing bars (rebar), which are to be connected to the ground bus. This connection is considered to effectively ground the manhole to earth, so ground rods are not required. If additional manhole sections are needed due to the depth of the manhole the additional 4/0 copper ground leads (tails) shall also be bonded to the ground bus. All 4/0 copper ground leads (tails) that are inside the manhole shall be bonded to the ground bus. See 33-115.

When new precast manholes are installed within substation fence layouts, then the external ground leads (i.e. 33-117 detail "Y") shall be bonded to the substation grounding system.

Existing manholes, without the bonds to the rebar, are to have two ground rods installed at diagonal ends through the floor of the manhole. The ground rods (Std. Item TG20) are to be installed as close to the corner of the manhole as possible, to prevent a trip hazard in the manhole. See 33-114.

Exterior ground grid shall be required for new installations of manholes with submersible switches installed or switchgear manholes with pad mounted switches installed, see 38-101.

33.2.40 Manhole Ground Bus

The manhole ground bus shall be 4/0 bare copper (Std. Item W19G), run along the top of the cable rack stanchions. The manhole ground bus shall make a complete loop around the manhole. Connections between the manhole ground bus and earth are to be made with 4/0 leads and compression connectors (Std. Item S14K).

The manhole ground bus is to be supported by the connectors on the cable stanchions. Tinned connectors are required between galvanized steel and copper to prevent corrosion. Use Std. Item C18B connector for new installations with heavy duty manhole racks. Other versions of this connector are available (Std. Items C18A, C18C) for retrofit or light duty racks. For Uni-strut racks, use Std. Item C18B connector and a spring nut (Std. Item US1N).

All connections to the manhole ground bus are to be made as high as possible to minimize submerged connections, therefore minimizing corrosion of the connections.

33.2.50 Anode

Magnesium anodes (Std. Item UA17) shall be located in manholes and connected to the ground bus to reduce corrosion. There shall be two anodes in each manhole, unless other equipment exists (such as switches / transformers / etc.). Two additional anodes shall be installed for each piece of equipment installed in the manhole. The maximum number of anodes required in a manhole is 6.

The two anodes for general protection shall be located in diagonally opposite corners of the manhole.

The two additional anodes for equipment protection shall be located immediately adjacent to the equipment to be protected.

All anodes are to have their #12 lead connected to the ground bus with a compression connector (Std. Item C21).

Supersedes 7/19 Issue – Text update section 33.2.30

33.2.60 Cable Splices

Connect bonds from each cable splice to the manhole ground bus, using a properly sized compression connector.

Bonding wires from new splices will be #4 solid tinned (Std. Item W11F1) copper, two leads per splice – use compression connector (Std. Item S14H).

Existing splice bonds shall be connected to the bus with compression connector Std. Item S14 of the proper size to accommodate the existing bonding conductor.

Refer to the Section 36 – Connectors/Splices for splice bonding wire specifics.

33.2.70 Equipment Bonds

Equipment located in the manhole will have two #4 solid, tinned bond wire (Std. Item W11F1) or equivalent, connected from the bonding connection point on the equipment to the manhole ground bus. Use compression connector (Std. Item S14) at the bus end.

33.2.80 Neutrals

Concentric neutral cables without splices may pass through the manhole without bonding to the manhole ground bus. If bonding of the neutral is needed, use grounding kit Std. Item UR89G. Use #4 solid tinned (Std. Item W11F1) for the ground lead. Follow the manufacturer's instructions for installation of the kit.

Concentric neutral cables with splices shall be bonded to the manhole ground bus. New splices shall be bonded with two #4 solid tinned copper (Std. Item W11F1), connected to the ground bus with Std. Item S14H connector.

All neutral conductors shall be connected to the ground bus.

Neutrals of 4/0 copper and smaller shall be separately connected to the ground bus. Use Std. Item S14 compression connector of the appropriate size.

Neutrals larger than 4/0 copper shall have a 4/0 tap, W19G, connected to the manhole ground bus with Std. Item S14K compression connector.

Supersedes 7/13 Issue – Text shift.

33.3 MANHOLE CONDUIT SEALING

The chart below shows when conduit sealing is used. All services shall be sealed. Sealing the rest of the conduits will fall into local operating practices in manhole ventilation techniques.

Conduit type	Conventional UG sealing required	Conventional UG sealing recommended	Network UG sealing required	Network UG sealing recommended
Primary		Water or Fire Stop		Fire Stop
Secondary		Water or Fire Stop		Fire Stop
Spare MH		Water Stop		Fire Stop
Service MH end	Fire Stop		Fire Stop	
Service Cust. end	Water Stop		Fire Stop	
Spare for service	Fire Stop		Fire Stop	

The chart below shows the type and use of sealants available

Sealant	Fire Stop	Water Stop
SEALANT INFORMATION		
STANDARD ITEM		
STORAGE TILL USE	UPRIGHT, ROOM TEMP	ROOM TEMP
USE	SHAKE CAN FOR 30 SECONDS INSERT NOZZLE DISPENSE UPSIDE DOWN	REMOVE CAP FROM RESIN TUBE, INSERT NOZZLE WITH RESIN CAP LOAD INTO CUALKING GUN AND DISPENCE.

33.3.10 CONDUIT SEALING SERVICES TO BUILDINGS

Service conduit sealing shall be required on all network and conventional manhole conduits to stop the flow of water and fire into buildings. Fire-stop service conduit sealing is required at the manhole end for all service conduits. For the building end of the service conduits the following apply; network service conduits shall be sealed with fire-stop sealing and conventional underground service conduits shall be sealed with water-stop conduit sealant. Additionally, fire stop in needed in any conduit that terminates to a customer or terminates within a customer's building. Before sealing, clean cables and conduits with cable cleaner degreaser (Std Item UC80F). Wipe dry with a towelette (Std Item UC80D). See figures below for installation details

Supersedes 7/15 Issue – Text shift.

Fire-stop sealant installation




Install rags for backing at least 3 inches into clean conduit for small cables, dispense foam until conduit filled

Water stop sealant installation




Install foam backing 6 inches into clean conduit, install second foam backing at conduit opening. Dispense resin into conduit between foam until it overflows out of foam.

33.3.20 CONDUIT SEALING IN CONVENTIONAL UNDERGROUND AREAS

Where appropriate based on manhole ventilating techniques, water stop Conduit sealing with (Std Item S4) for primary, secondary and spare conduits may be required. Sealing will prevent the flow of water, dirt and gases into the manhole. Sealing is recommended at block intersections to minimize the potential of an event spreading. See figures below for installation.

Water stop sealant installation

Install foam backing 6 inches into clean conduit, install second foam backing at conduit opening. Dispense resin into conduit between foam until it overflows out of foam.

33.3.30 CONDUIT SEALING IN NETWORK UNDERGROUND AREAS

Where appropriate based on manhole ventilating techniques fire Stop Conduit sealing with (Std Item UF20) for primary, secondary and spare conduits. Sealing will prevent the burning of cables into the conduits, flow of water, dirt and gases into the manhole. For conduits with fire proof primary cable installed fire-stop foam shall be installed out of conduit far enough to cover the cable until it overlaps with fireproofing tape. Sealing is recommended at block intersections to minimize the potential of an event spreading, however local operating areas can add more sealing stop points to further reduce the potential of an event spreading. See figures below for installation.

Fire-stop sealant installation

Clean conduits, cables and install fire-proofing tape. Dispense foam until conduit filled, extend spaying foam around cables until foam has overlapped the fire-proofing tape.

Supersedes 7/13 Issue –Section 33.3 Updates

33.4 NUMBERING SPECIFICATIONS

All manholes, pullboxes and handholes are to be numbered in the field to provide for correct determination of work location. The number of each manhole, pullbox or handhole shall be provided by local operations engineers / planners. To number a manhole / heavy duty handhole, install the numbers on the chimney of the manhole such that it is readily visible from above after removal of the cover. Polyethylene numbers / letters / tag holders are to be used. Select item from Section 50 – Materials Catalog (Std. Item UP21P). Fasten the tag holder to the chimney with masonry fasteners. For numbering pullboxes and URD style handholes, install the numbers on the top of the cover. Reflective Vinyl labels are to be used (Std Item P21L/N). If placing the numbers on the top of the cover is an issue, install the numbers in a visible location on the inside wall. New manhole frames have tag holder pre-installed as shown below.

Supersedes 7/19 Issue – Update to text in 33.5

33.5 SWITCHGEAR COLLAR SEALING

New installations of switchgears installed over manholes are recommended to be sealed to minimize moisture into the switchgear. Existing installation should be sealed when feasible. Sealing the area can be accomplished by either of the following:

Installing styrafoam (STD Item UF30) in the collar open area and foaming around the styrafoam to seal opening.

Installing cardboard into the opening of the switchgear collar between the cables and the walls of the collar opening. Spray expanding foam (STD Item UF10) 1” to 2” thick into area stuffed with cardboard to the bottom collar opening area this will allow room for cable tags. Foam will make an airtight seal. See figure below for expanding foam in collar and around terminator.

33.6 MANHOLE USES

Listed below are some of the different applications for the various manholes besides conventional manholes with just cable installed. To properly house the equipment, several manholes are listed below. Depending on the application the appropriate manhole will need to be selected.

Sidewalk Satellite Manhole 6'x10' (STD ItemUM28) – can be used for the installation of some of the submersible switches, for feasibility of the switch being chosen for the application, conduct a field audit with the proper operations groups.

Switchgear Manhole 6'x13' (STD Item UM20_) - use of collars A, or B for the installations of conventional padmounted switchgears at the 15 and 27kV class,15kV class auto transfer livefront padmounted switchgear and 15kV class scada ready padmounted switchgear.

Switchgear Manhole 6'x13' (STD Item UM20C) – use of collar C for the installations of conventional padmounted recloser at the 15 and 27kV class and the switch pad Std Item US34A.

Switchgear Manhole 6'x13' (STD Item UM20D) – use of collar D for the installations of the 3, 4 and 5 style padmounted switchgear at the 15kV class.

Switchgear Manhole 6'x13' (STD Item UM20F) – use of collar F for the installations of the 3 style padmounted switchgear at the 27kV class.

Switchgear Manhole 6'x13' (STD Item UM20M) – use of collar M for the installations of conventional padmounted metering at the 15 and 27kV class and 15kV class Hi Duty padmounted recloser.

Switchgear Manhole 7'x14' (STD Item UM21) - use of collar J for the installations of the 25kV class elbow style switchgear and conventional 4 way padmounted switchgears at the 38kV class.

Switchgear Manhole 7'x14' (STD Item UM21) - use of collar J1 for the installations of the conventional 1 way padmounted switchgears at the 38kV class.

Switchgear Manhole 7'x14' (STD Item UM21) - use of collar J2 for the installations of the Nova style padmount reclosers all voltage classes.

Switchgear Manhole 7'x14' (STD Item UM21) - use of collar J3 for the installations of the 35kV class padmounted metering.

Auto Switchgear Manhole 8'x14' (STD Item UM35) - use of collar S for the installations of advanced automated padmounted switchgear at all voltage classes.

Switchgear Manhole 6'x13' (STD Item UM20E) – can be used for the installation of some of the submersible switches and wall mounted link boxes. For feasibility of the chosen application, conduct a field audit with the proper operating groups.

Manhole Double Entry 6'x14' (STD Item UM32) – can be used for the installation of some of the submersible switches and wall mounted link boxes. For feasibility of the chosen application, conduct a field audit with the proper operating groups.

Manhole Double Entry (with hatch) 6'x19' (STD Item UM31) – can be used for the installation of any submersible switch and wall mounted link boxes. For feasibility of the chosen application, conduct a field audit with the proper operating groups.

Medium Size Manhole 5'x9' (STD Item UM39) - can be used for cables up to and including 500kcmil

Supersedes 7/20 Issue – Text updates and added manholes.

Double Switchgear Manhole 6'x20'-6" (STD Item UM30) - can be used for the installation of some of the submersible switches and wall mounted link boxes. For feasibility of the chosen application, conduct a field audit with the proper operating group.

XL Switchgear Manhole 7'x18' (STD Item UM41) - use of collar K for the installations of the 40ka hi duty padmounted recloser at the 25kV class.

XL Switchgear Manhole 7'x18' (STD Item UM41) - use of collar K1 for the installations of the 20ka hi duty padmounted switchgear at the 25kV class.

MANHOLE AND COLLAR APPLICATION TABLE

Manhole Std ID	Manhole Description	Material Spec	Drawings	Switchgear Std ID	Manhole Collar Std ID
UM20A	Switchgear MH	MS3467	33-111, 112, 113A, 113B, 113C and 113D	US39H US39I US45 US45SS US45CL US45A US45ASS US45C	A
UM20B				US45B US36H US38H6 US37 US37H	B
UM20C				US50 US51A US51B	C
UM20D				US45D2 US45D6 US45E US45F	D
UM20F				US46D6	F
UM20M				US39M US39N US54P15	M
UM21	Large Switchgear MH	MS3474	33-126, 127A, 127B	US38H US38H6 US46 US46A	J
				US38G	J1
				US52A US52B US52C	J2
				US39O	J3

7/21 Issue – Updated table.

ness Use

UM30	Double Switchgear MH	MS3475	33-134, 135	Same as UM20 with Appropriate Collar*	**
UM31	Double Entry Switchgear MH	MS3471	33-124, 125	Same as UM20 with Appropriate Collar*	**
UM35	Auto Switchgear MH	MS3476	33-128, 129A, 129B	US39L US39LD US39J US39K	S
				Same as UM20A**	SA
UM41	XL Switchgear MH	MS3479	33-138, 139, 140	US54P25	K
				US37I	K1

** Switchgear that uses manhole UM20 can also use UM30 or UM31

* Switchgear that uses UM20A can also use UM35 with collar SA

New Page – Added manholes to table.

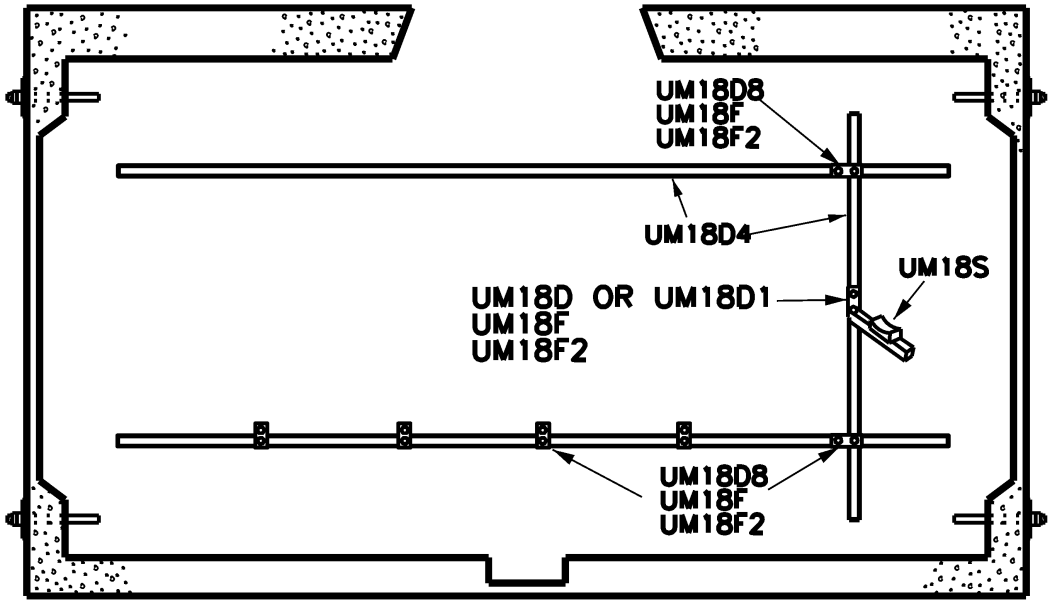
33.7 Manhole Racks

Several different racking systems are available for use (STD Items UM16 thru UM18) Racks for manholes are to be used for supporting cable and other equipment used in the underground system with unistrut being the preferred choice for new construction. The use of securing racks should be on a solid wall to ensure proper support. Hollow block and brick walls can't guarantee a secure mounting means and careful consideration should be used for installation of any racks.

Unistrut is embedded in all new manholes horizontally and shall be used for mounting cable racks in all manholes. Unistrut (STD item UM18D4) is to be mounted perpendicular with support stanchion, screws and nuts (STD items UM18D8, UM18F2 and UM18F). Cable support racks (STD item UM18D_) are to be mounted along the wall where applicable to the vertically installed unistrut. Insulators (STD item UM18A or UM18B) shall be installed into the racks to hold and directly support the cable being installed. See Figure below.

For existing manholes without unistrut embedded in the wall, use "Z" shaped support stanchions (STD Item UM18D8) to mount the vertical unistrut member to the horizontal unistrut member shown in the figure below. V notch style cable supports (maintenance only) require the use of insulators UM17L (flat) and UM17M (curved).

An alternate nonconductive racking method is also available and does not require insulators. This method consists of a 36" support stanchion (UM17N4), 12" bracket arm (UM17N5), 16" bracket arm (UM17N6) and19" bracket arm (UM17N7). The stanchions can be mounted using ½" anchor bolts (U7B1).



33.8 MANHOLE ROOF MAINTENANCE

There are a few precast roof replacements available. They are shown on 33-122 and 33-123. Specific jobs or maintenance may also require rebuilding existing roofs. Refer to Distribution Engineering Services for further assistance with the application or your local underground engineer. The following list can be used as a guide for roof replacement.

1. Mark out road for a road cut. The marking should be 18" around the perimeter of the existing manhole roof. The 18" will facilitate the use of an 18" backhoe bucket.

2. Build plywood platform inside of the manhole to protect any and all cables and equipment. The plywood platform should be supported by 2x4's.
3. Saw Cut Road – This is typically performed by a contractor.
4. The elevation of the existing manhole frame and cover needs to be evaluated to determine the amount of material that needs to be jack hammered above the roof. Jack hammer the 18" perimeter around the existing manhole roof and any asphalt and city base that is on top of the manhole roof. Remove the debris (city base, asphalt, over pour etc.).
5. If the existing roof is pre-cast roof: Drill the roof in 4 points to facilitate the removal. The drilling locations are typically within a few feet of each corner. If the existing roof is a beam roof: Break the frame and cover out, break out the small concrete portions between the "I" beams, break out and sling outer roof sections and remove. Determine if the keyways can be filled in or a coarse of brick needs to be removed. This is a field decision based on the final elevation needed.
6. Remove the plywood platform from inside the manhole. Clean out any other debris inside the manhole.
7. Check the elevation of the existing walls. The walls should be leveled with mortar. Install two layers of black concrete sealant on top of the walls. This will help to seal the area between the roof and the walls.
8. Set the new pre-cast roof.
9. Survey the area between the new roof and the existing walls to determine if there are any voids between the roof and the walls. Fill in any voids with mortar from inside or outside the manhole.
10. Set the manhole frame and cover to the proper elevation.
11. Pour a concrete donut around the roof from the top of the roof to the edge of the 18" excavation. This will secure the roof in place.
12. Pour concrete around the frame & cover from the top of the ear on the frame to the roof.
13. Install tar paper on the top of the roof if the elevation is below the city base.
14. If the elevation of the roof is below the city base fill the area between the roof and the bottom of the city base with #2 run of crusher.
15. Pour city base per the city/town specifications.

    Install asphalt per the city/town specifications. During the winter months tar paper should be installed on top of the city base and then concrete should be pour to the elevation of the road. When the weather permits break out the concrete between the top of the city base and road and replace with asphalt.

Supersedes 7/19 Issue – Text Shift

33.9 MANHOLE CHIMNEY GRADING

All manhole chimneys shall have a minimum of two courses of brick base or equivalent and rubber grading rings to adjust the level for final grade before installing the manhole frame ring and cover. For existing installations where the grade around the standard 6' 6" high manhole is changing, the maximum allowable chimney height shall be such that the distance between the underside of the manhole roof and final grade is 3 feet or less, as shown in 33-97.

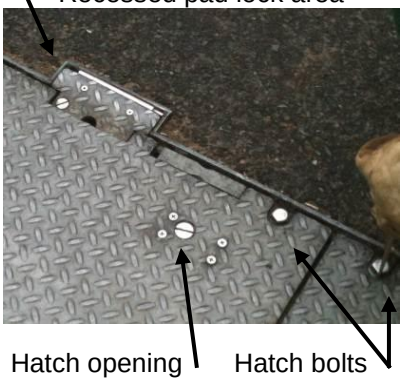
33.10 MANHOLE / VAULT HATCHES

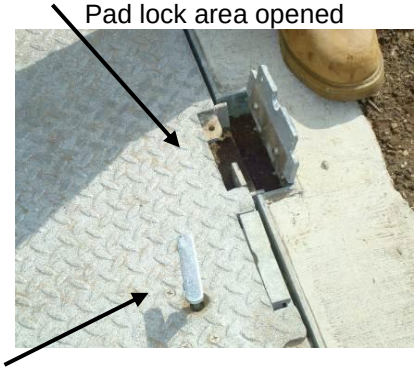
Manholes with large equipment utilize hatches. All new hatches are required to be bolted down and locked. The figures below illustrate the hatch features. To access hatch area, remove padlock in recessed padlock area. In recessed padlock area remove T Lock wrench. Unbolt hatch bolts from hatch corners. Unscrew T lock cover and insert T lock wrench. To open hatch rotate T lock wrench 90 degrees and apply upward pressure onto hatch lifting handle. Open hatch past 90 degrees till it locks open. Check hatch locked open by pushing it inward, at this time the locking lever will hold hatch open.

Standard item UM31 installed in side walk

Hatch opened, large access area

Switch installed in manhole





T wrench installed into hatch lock opener, if wrench is missing a large flathead screw driver can be used.

View of locked open hatch, to close latch, push locking arm inward then apply pressure onto hatch to close it

33.10.10 Hatch Securement

Several older hatches that are not equipped with a prefabricated locking method as shown above, can be locked by making a locking wire using (Std Items W60) and ferrules (Std Item W60S) as shown below.

Supersedes 7/15 Issue – Text shift

33.11 Manhole Ventilation

To promote the natural exchange of air in the manhole and duct systems, ventilation methods are available. The ventilation shall be isolated by neighboring blocks in the downtown areas. At the block ends conduit sealing will be strategically placed by local operations to minimize the effect of a major event from spreading into the entire system. For Network systems additional stops may be added in between blocks to further minimize an event from spreading.

For existing manholes, the following is recommended.

A) In existing manholes ventilation can be added through the use of spare conduits going to riser poles. See Section 32.18 for details

B) In existing manholes ventilation can be added through the use of vented covers (STD Item UM12NE and UM12NY). The covers can be replaced into existing standard frames, however field inspection will be required to determine if the frame and chimney are worn and if the whole structure will be needed to be replaced.
It is recommended to install a vented cover where feasible within every five manholes. It may be necessary to use more or less depending on if the location is poor.

For new manholes the following is recommended.

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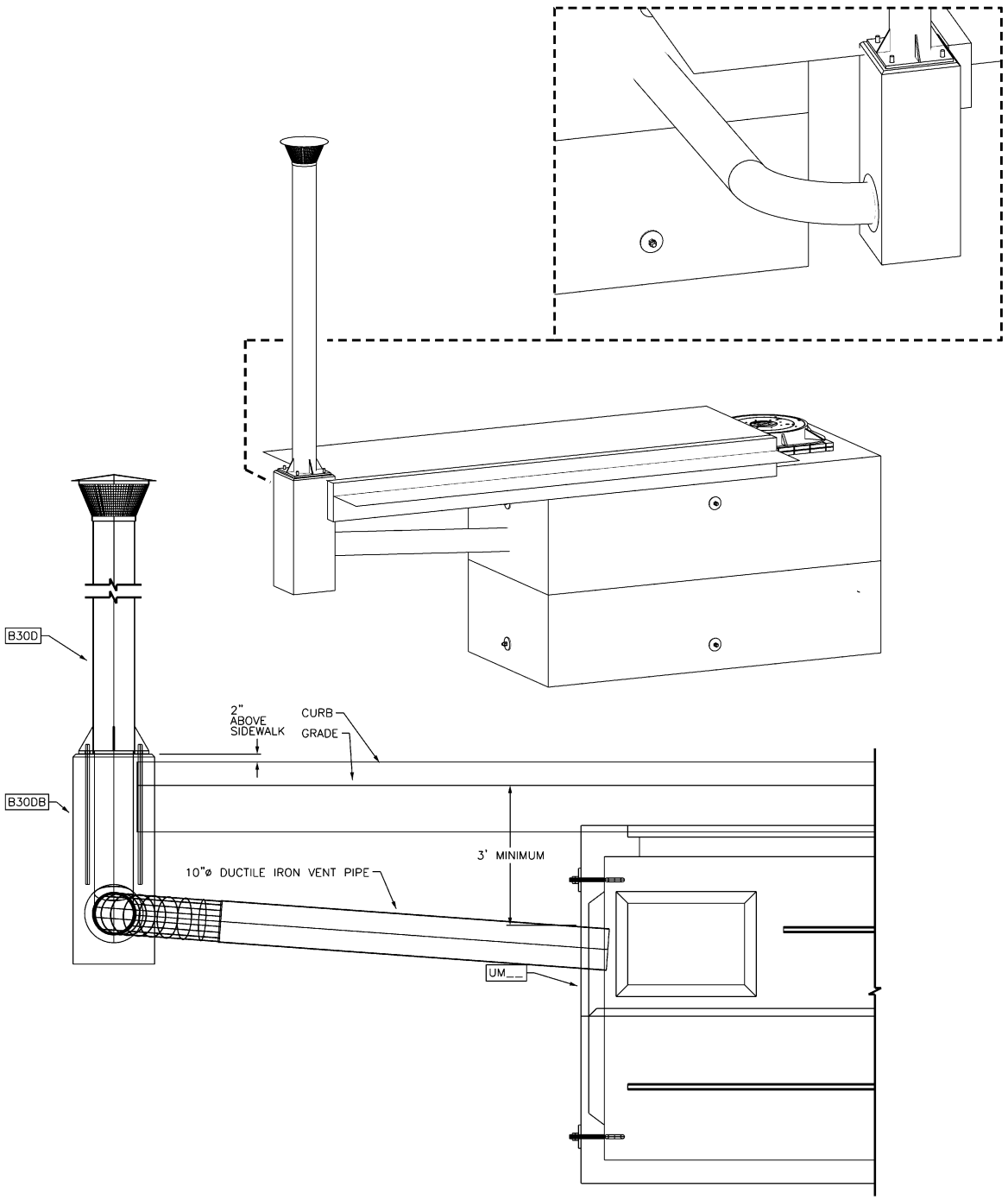
A) For a new manhole installed in a network or conventional manhole and duct systems with no other ventilation systems in the next adjacent manhole, two vents will be required. The vents shall be installed at opposite ends of the manhole to promote natural air flow.

B) For a new manhole installed in a network or conventional manhole and duct system with ventilation in the next adjacent manhole one vent will be required.

Typical installation is shown below.

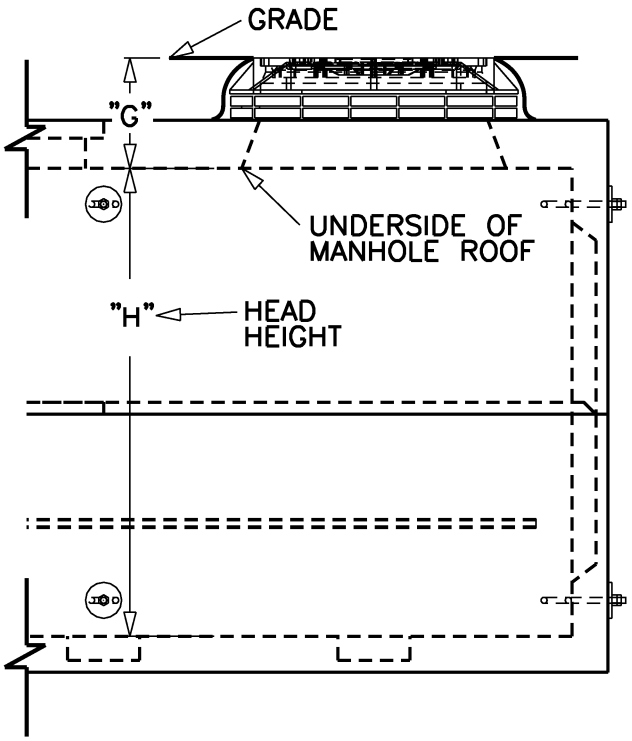
I

Supersedes 7/18 Issue – Updated text in 33.11-A.

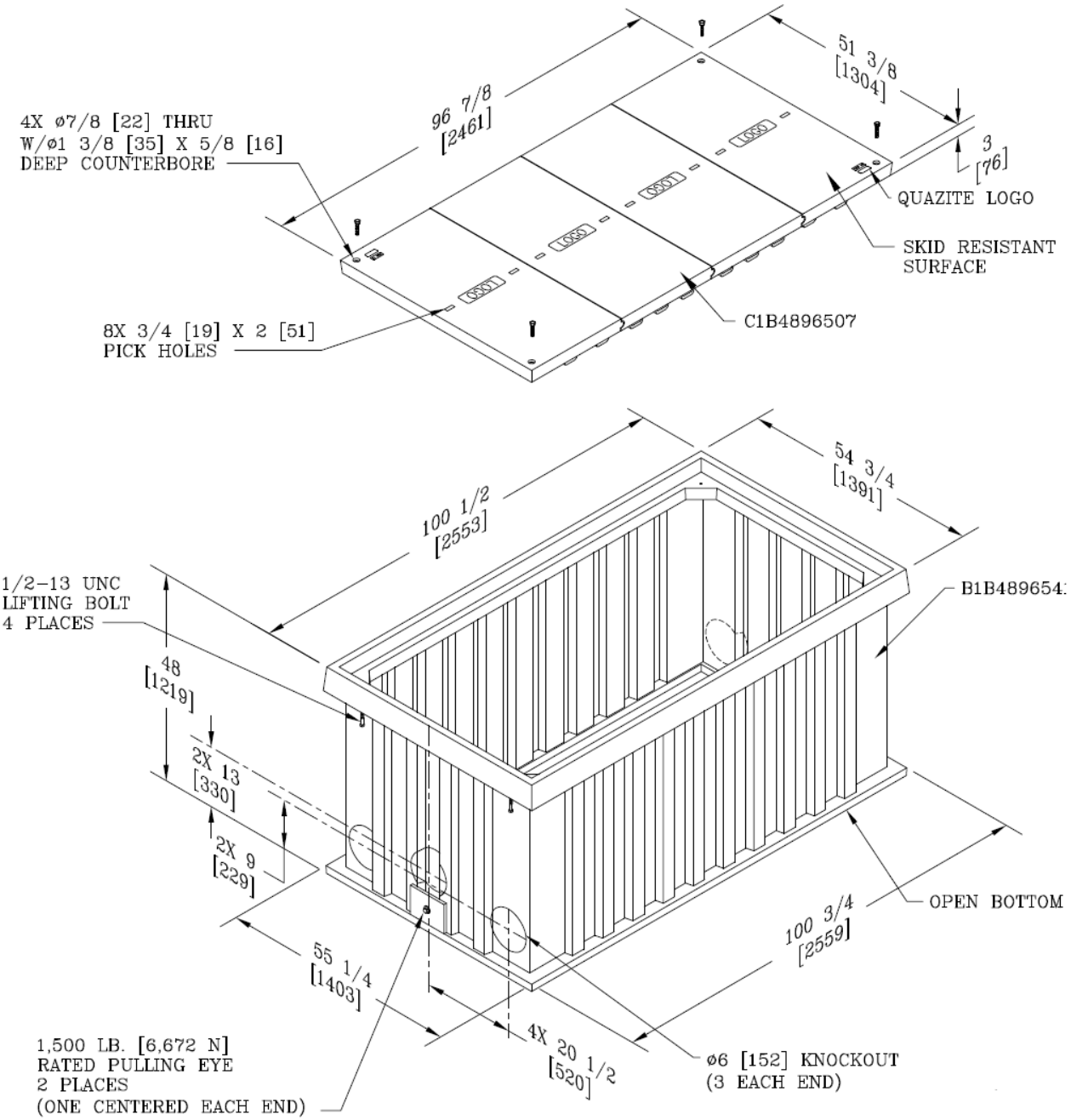


Supersedes 7/18 Issue – Drawing Update.

7/19 Issue – New Drawing



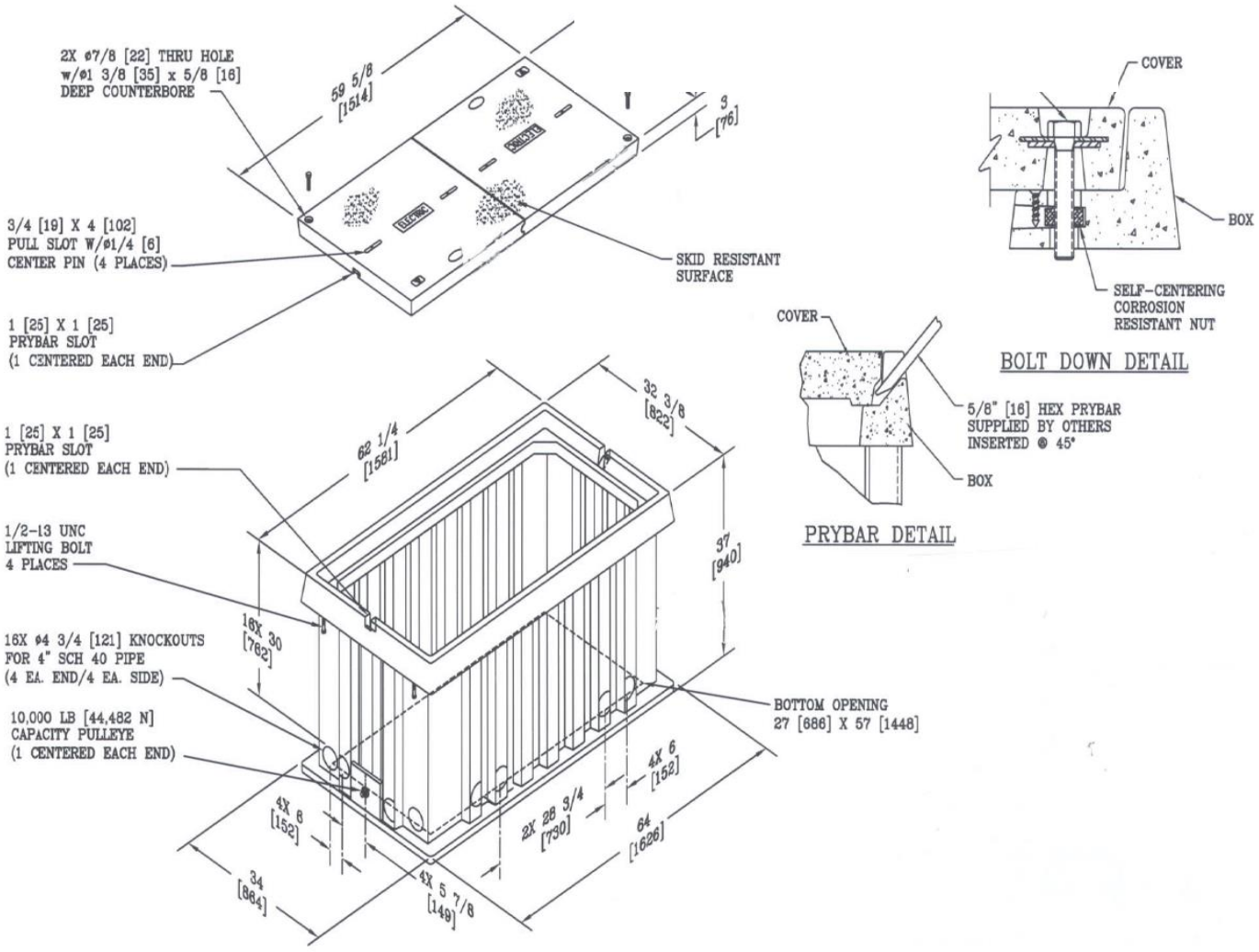
MANHOLE DETAIL - DIMENSIONS “H” AND “G”



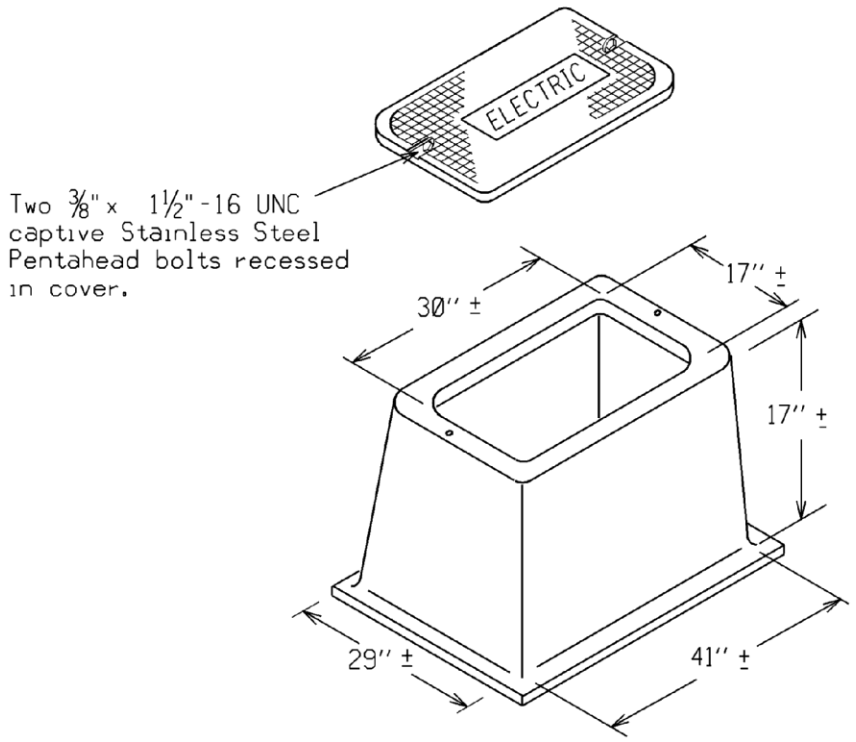
7/19 Issue - New Drawing

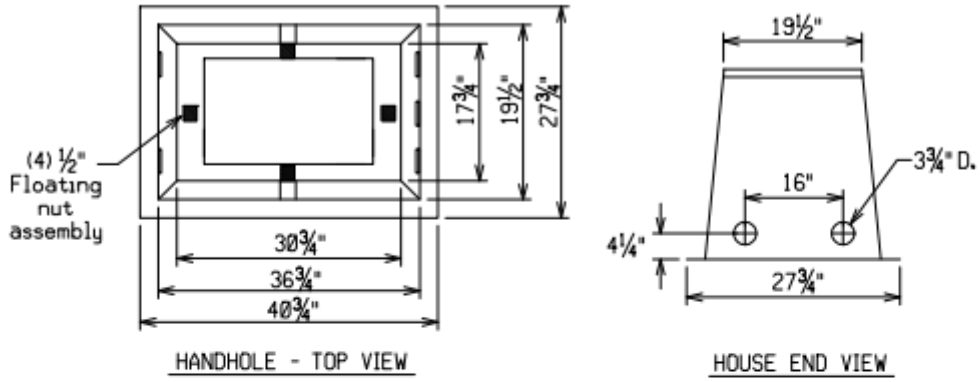
POLYMER CONCRETE LARGE PULL BOX HEAVY DUTY 48” X 96”			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/19	**33-98**		

Supersedes 7/13 Issue – Correction to title block.



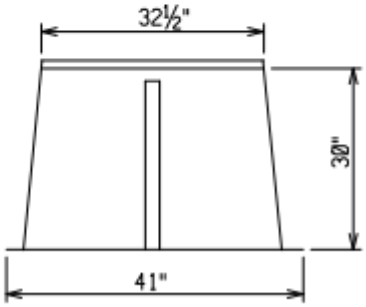
POLYMER CONCRETE PULL BOX HEAVY DUTY RECTANGULAR 30” X 60”			
ppl	**UNDERGROUND CONSTRUCTION STANDARD**	**PAGE NUMBER**	**ISSUE**
		33-99	**7/19**



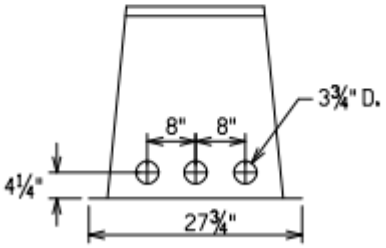


HANDHOLE - TOP VIEW

HOUSE END VIEW

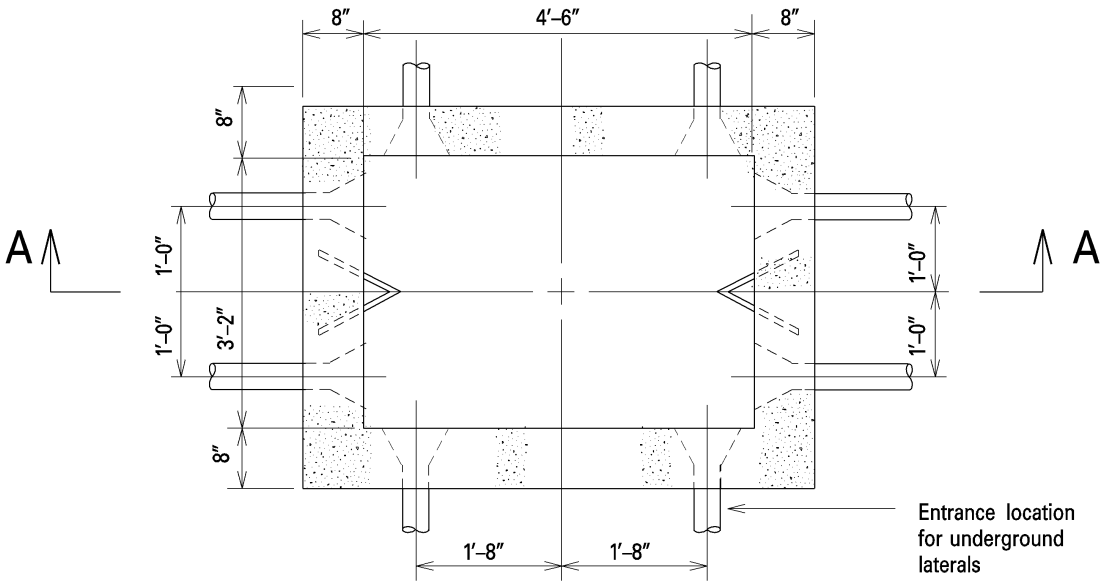


SIDE VIEW

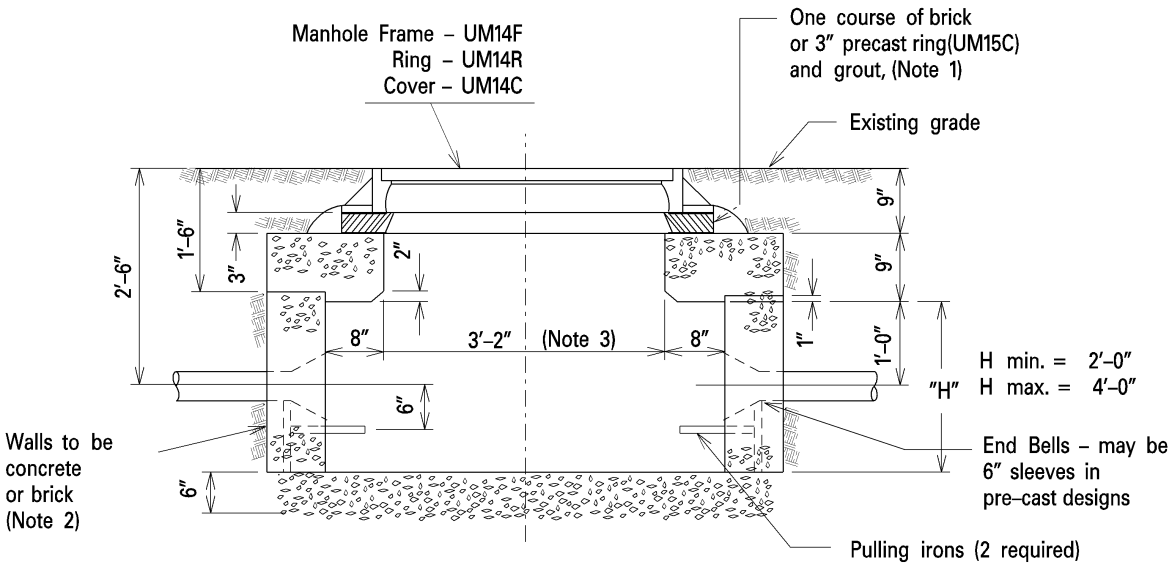


STREET END VIEW

Supersedes 7/17 issue. – Corrected title block.



PLAN VIEW



SECTION A–A

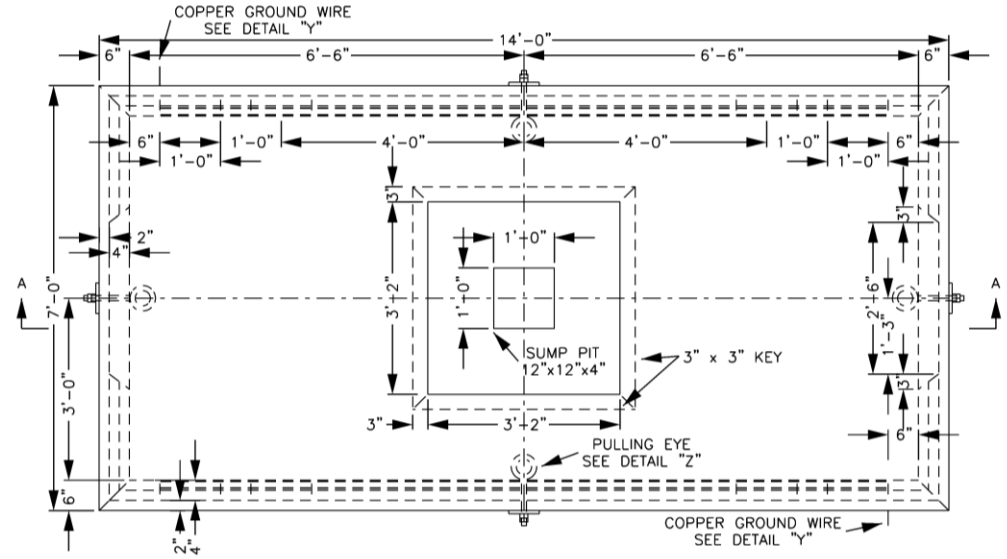
Supersedes 1/07 issue. – Corrected title block.

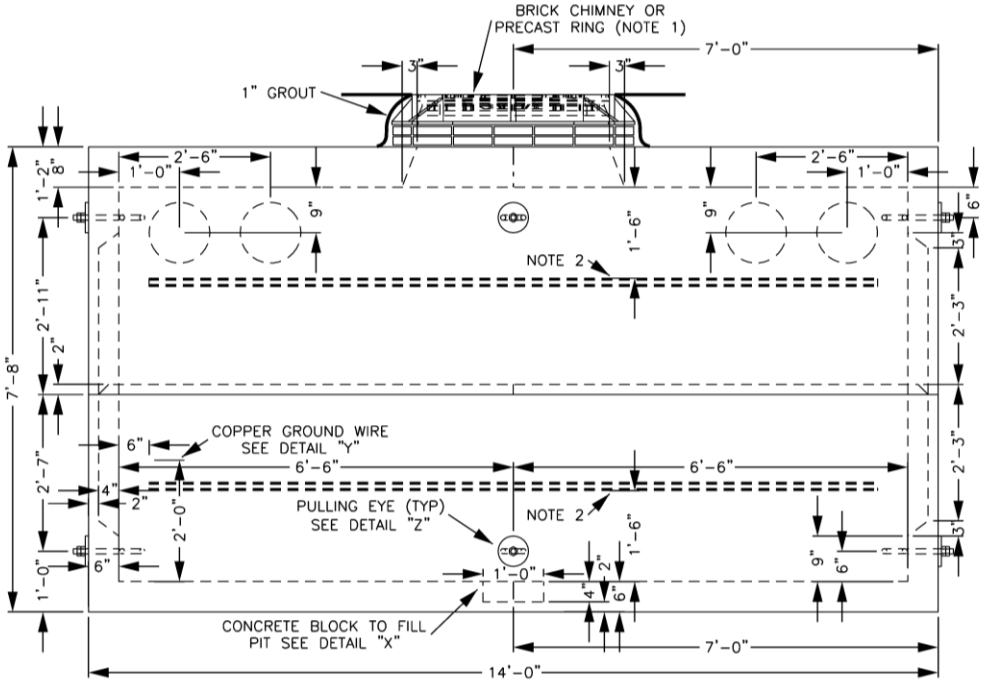
Notes:

1. Chimney height is kept to a minimum to facilitate placing completed splices in handhole from above grade.
2. Concrete minimum strength - See Section 31.4.30.
3. Roof opening 3’ 2” inches x 3’ 2”.

PRECAST CONCRETE HANDHOLE RECTANGULAR HEAVY DUTY HANDHOLE FOR 26” COVER			
ISSUE	**PAGE NUMBER**		
7/19	**33-102**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl

Supersedes 7/19 Issue – Updated pulling eyes.

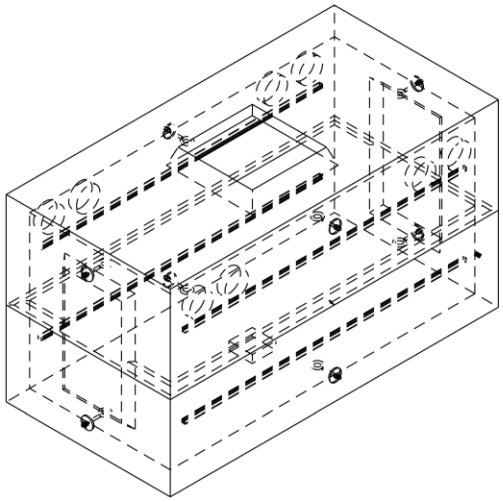


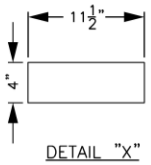


NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–$\frac{5}{8}$"X1–$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

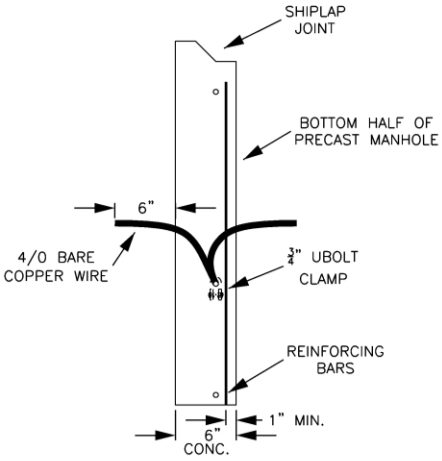
Designer	Drawing	Date
MPR	MS3462–1	10/30/20
	33–103	
	UM22	

PRECAST CONCRETE MANHOLE
2 WAY DISTRIBUTION – 6 FEET X 13 FEET (INSIDE)

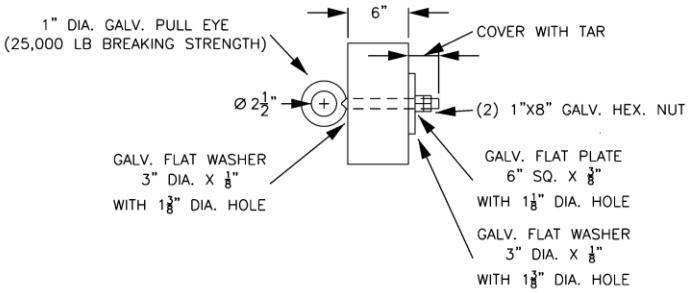




DETAIL "X"
1 REQUIRED



DETAIL "Y"
2 REQUIRED



DETAIL "Z"
8 REQUIRED

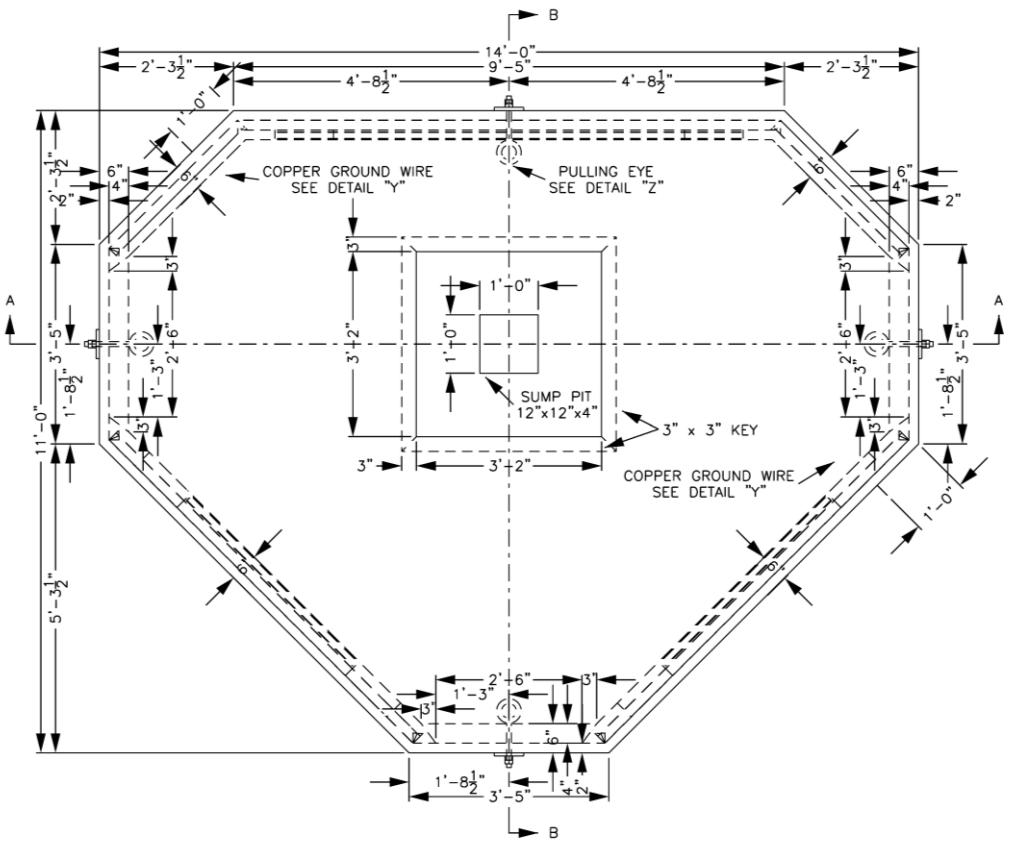
Supersedes 7/19 Issue – Updated pulling eyes.

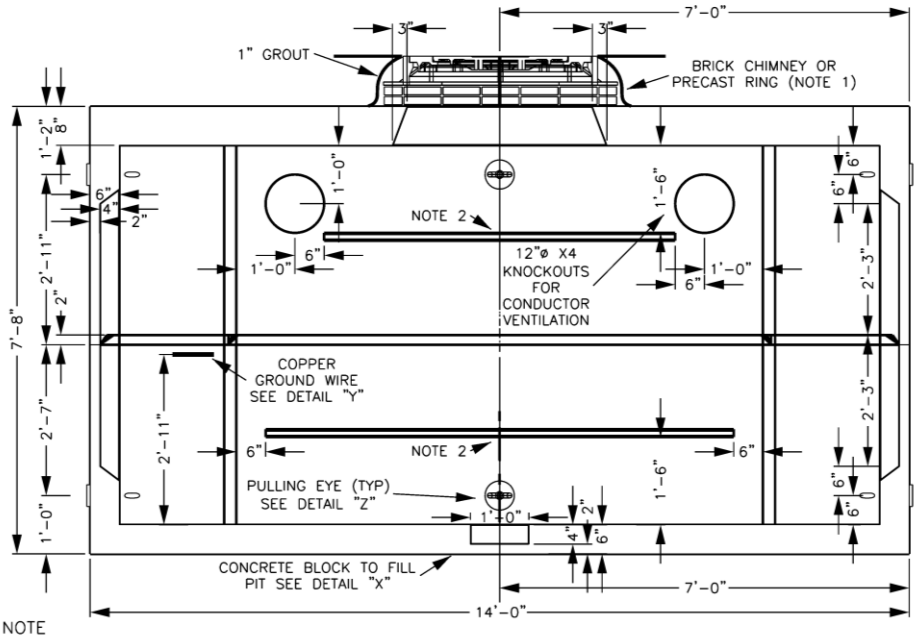
Designer	Drawing	Date
MPR	MS3462-2	10/30/20
	33-104	
	UM22	

PRECAST CONCRETE MANHOLE
2 WAY DISTRIBUTION – 6 FEET X 13 FEET (INSIDE)

ISSUE	PAGE NUMBER		
7/21	33-104	UNDERGROUND CONSTRUCTION STANDARD	ppl

Supersedes 7/19 Issue – Updated pulling eyes.

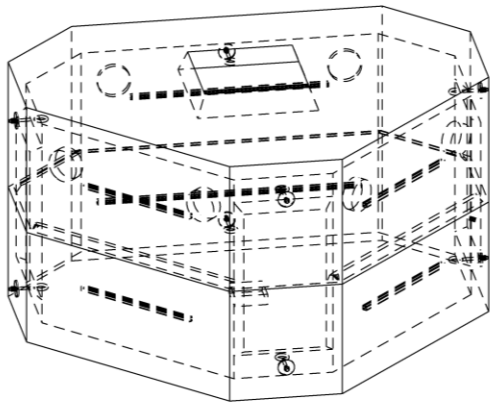


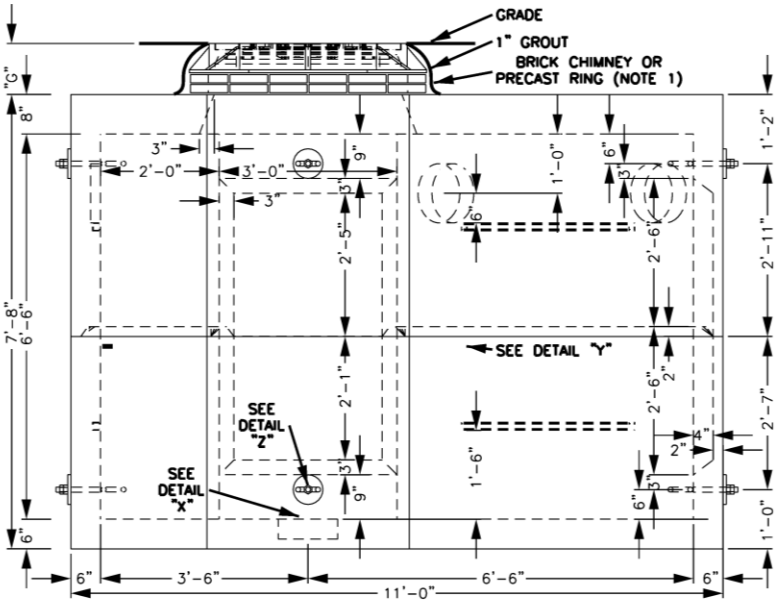


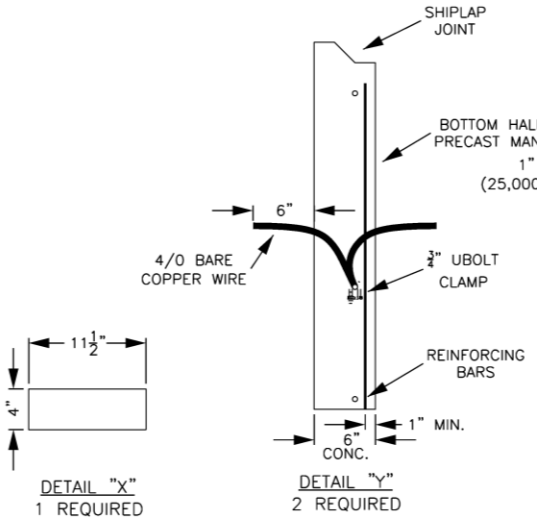
NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–⅝"X1–⅝" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

Designer	Drawing	Date
MPR	MS3464–1	10/30/20
	33–105	
	UM23	

PRECAST CONCRETE MANHOLE
3 WAY DISTRIBUTION – 10 FEET X 13 FEET (INSIDE)

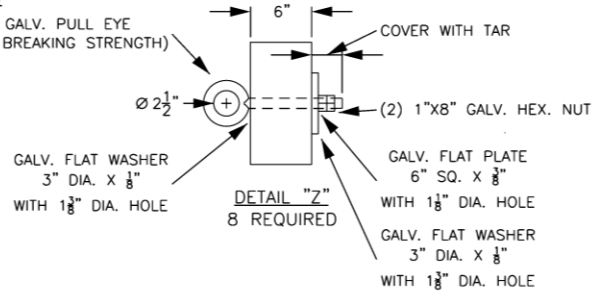






DETAIL "X"
1 REQUIRED

DETAIL "Y"
2 REQUIRED



DETAIL "Z"
8 REQUIRED

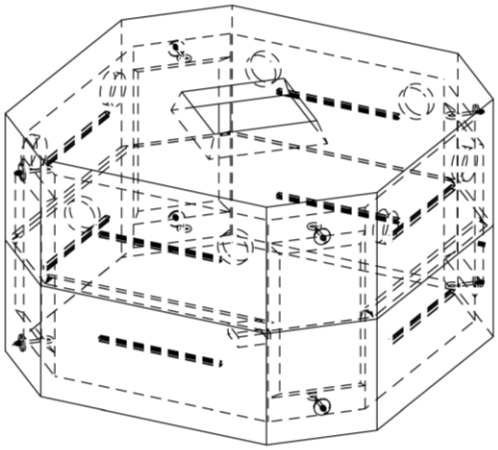
Designer	Drawing	Date
MPR	MS3464-2	10/30/20
	33-106	
	UM23	

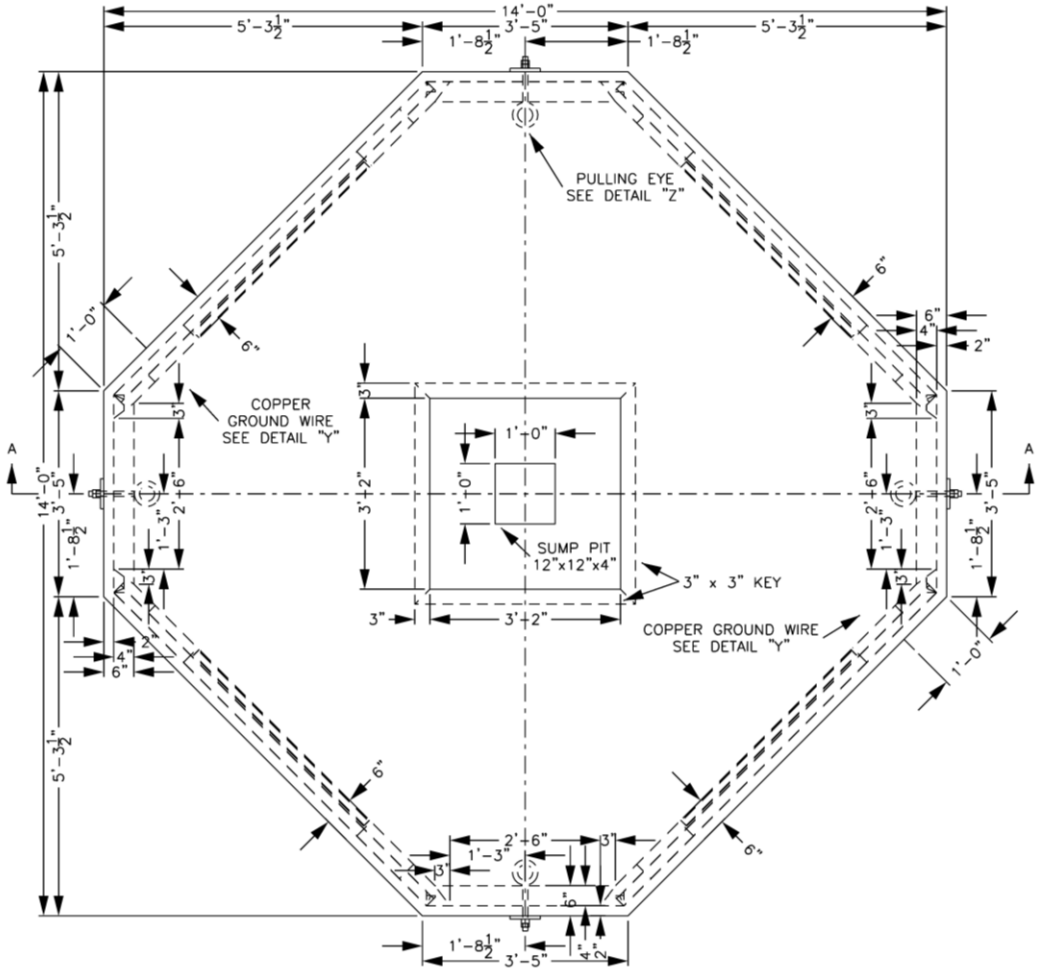
Supersedes 7/19 Issue – Updated pulling eyes.

PRECAST CONCRETE MANHOLE
3 WAY DISTRIBUTION – 10 FEET X 13 FEET (INSIDE)

ISSUE	PAGE NUMBER	UNDERGROUND CONSTRUCTION STANDARD	ppl
7/21	33-106		

Supersedes 7/19 Issue – Updated pulling eyes.

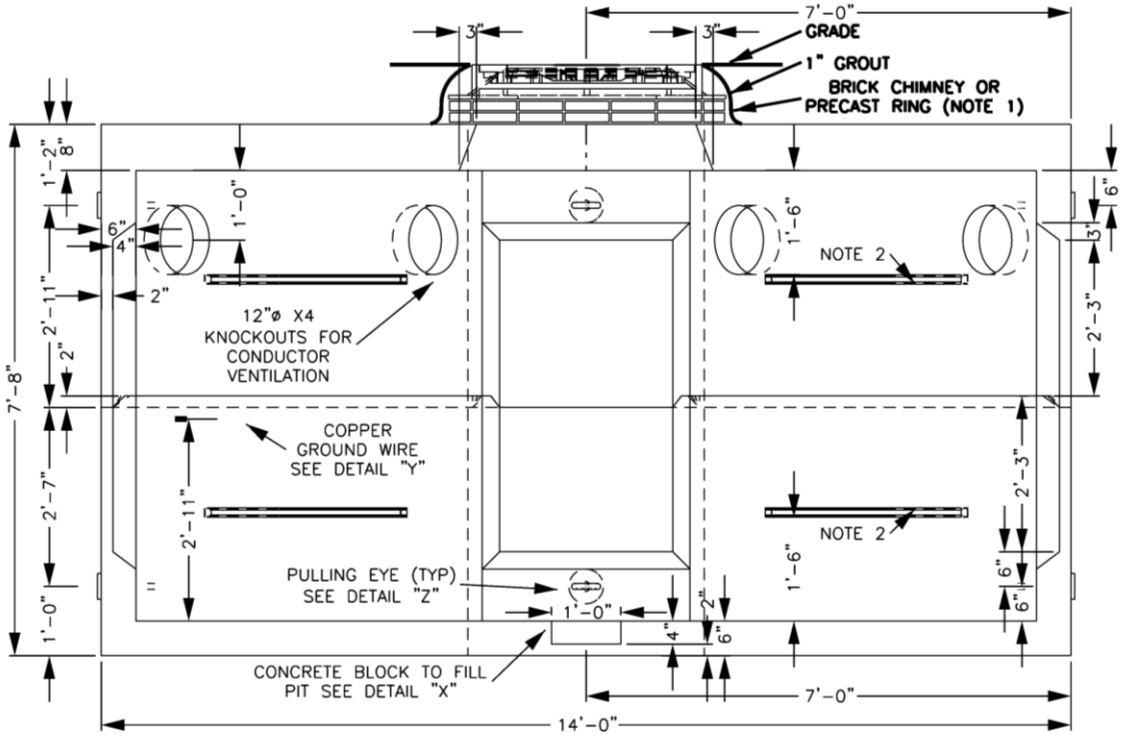


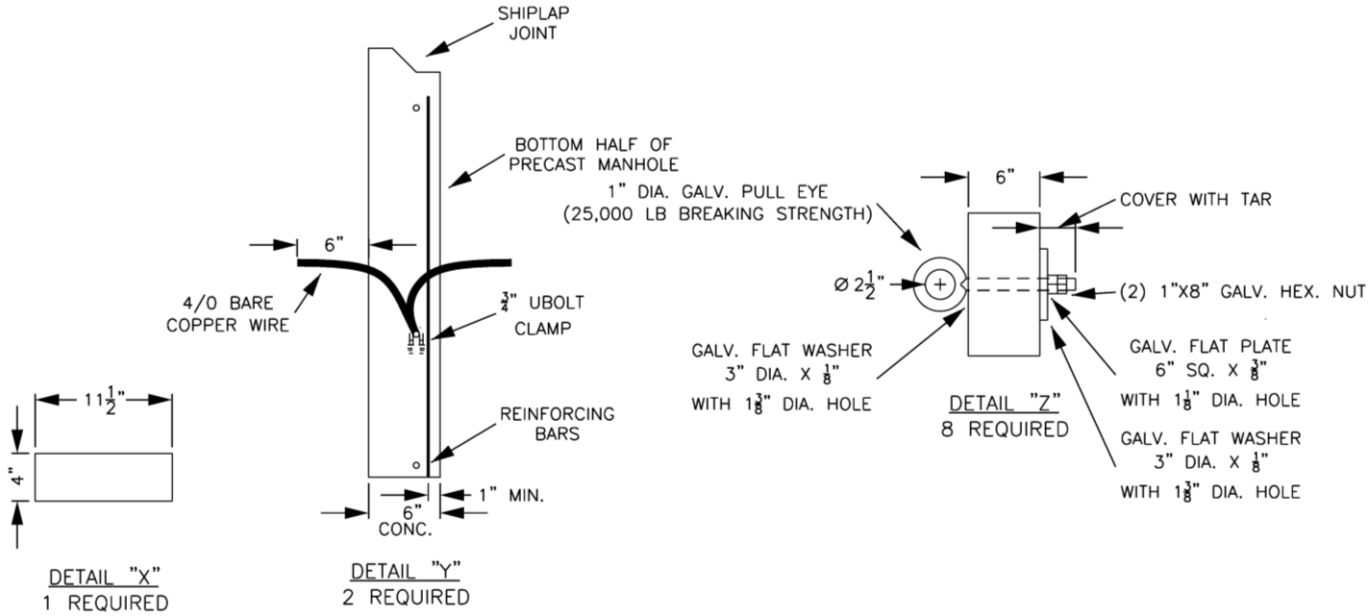


NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–⅝"X1–⅝" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

Designer	Drawing	Date
MPR	MS3465–1	3/15/19
	33–107	
	UM24	

PRECAST CONCRETE MANHOLE
FOUR WAY DISTRIBUTION – 13 FEET X 13 FEET (INSIDE)





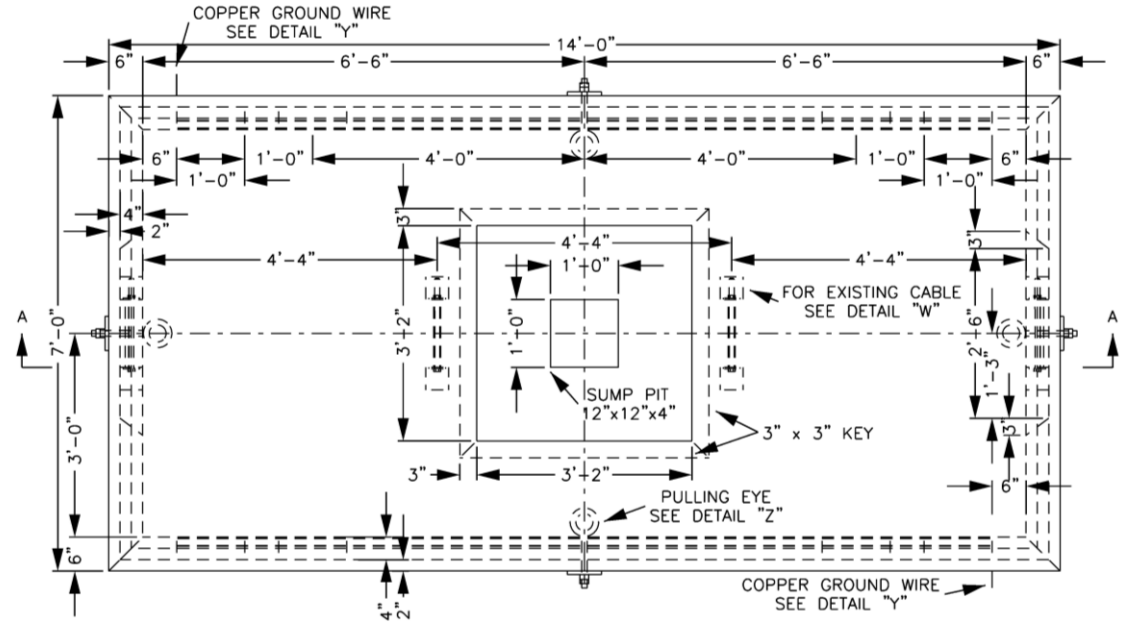
Designer	Drawing	Date
MPR	MS3465-2	10/30/20
	33-108	
	UM24	

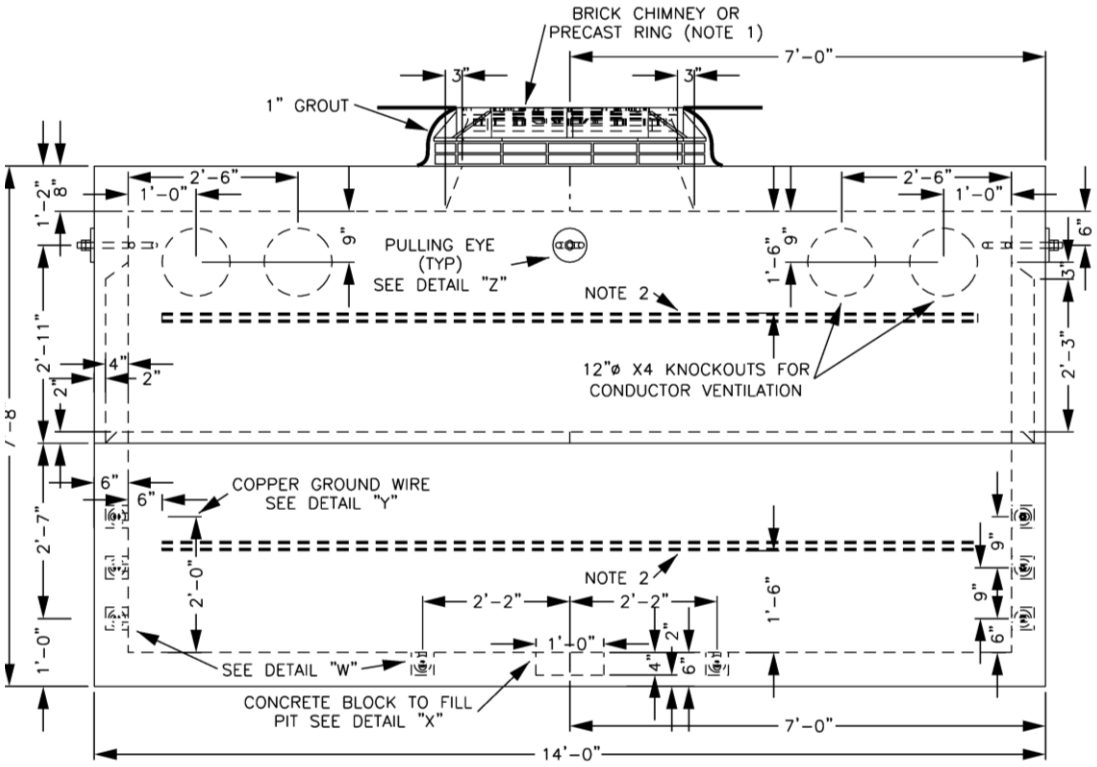
Supersedes 7/19 Issue – Updated pulling eyes.

PRECAST CONCRETE MANHOLE
FOUR WAY DISTRIBUTION – 13 FEET X 13 FEET (INSIDE)

ISSUE	PAGE NUMBER		
7/21	33-108	UNDERGROUND CONSTRUCTION STANDARD	ppl

Designed For Use Around Existing Cables





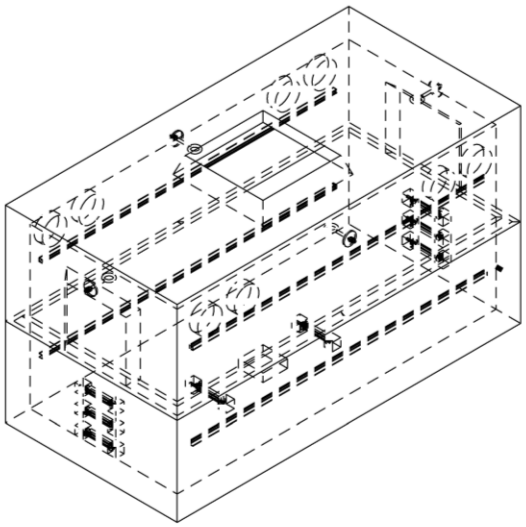
Supersedes 7/19 Issue – Updated pulling eyes.

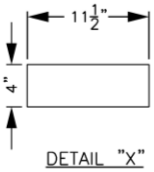
NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–⅝"X1–⅝" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH TINNED CONNECTOR AND 4/0 CABLE.

Designer	Drawing	Date
MPR	MS3466–1	10/30/20
	33–109	
	UM22S	

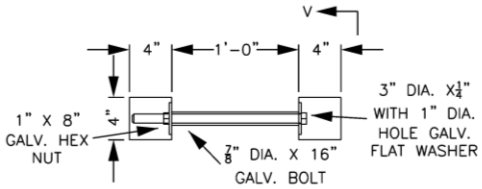
PRECAST CONCRETE MANHOLE
TWO WAY SPLIT BOTTOM DISTRIBUTION – 6 FEET X 13 FEET (INSIDE)

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	33-109	7/21

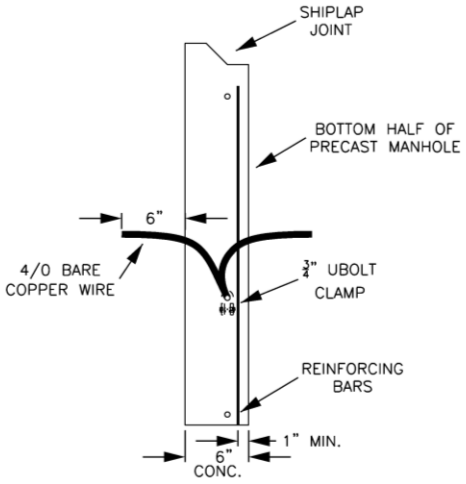




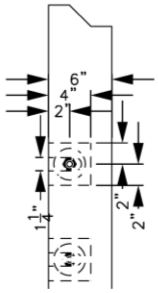
DETAIL "X"
1 REQUIRED



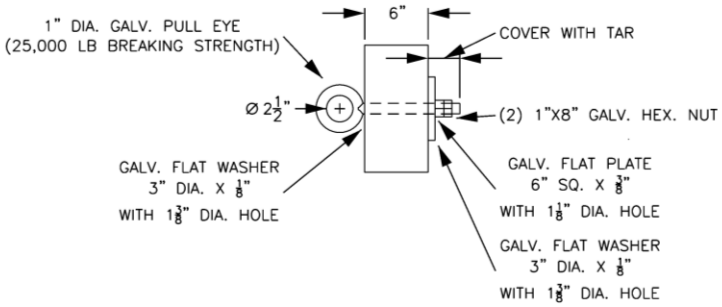
DETAIL "W"
8 REQUIRED



DETAIL "Y"
2 REQUIRED



DETAIL "V"



DETAIL "Z"
4 REQUIRED

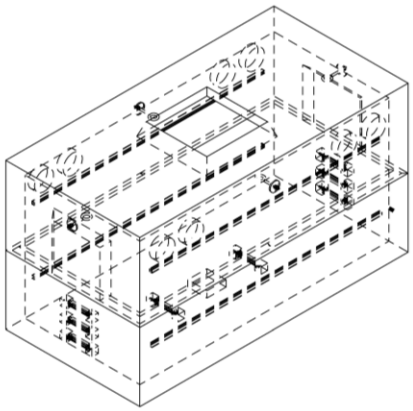
Designer	Drawing	Date
MPR	MS3466-2	10/30/20
	33-110	
	UM22S	

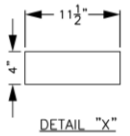
Supersedes 7/19 Issue – Updated pulling eyes.

PRECAST CONCRETE MANHOLE
TWO WAY SPLIT BOTTOM DISTRIBUTION – 6 FEET X 13 FEET (INSIDE)

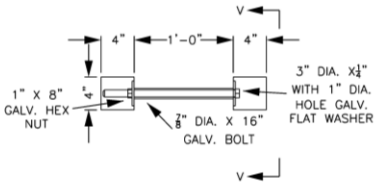
ISSUE	PAGE NUMBER		
7/21	33-110	OVERHEAD CONSTRUCTION STANDARD	ppl

Supersedes 7/19 Issue – Updated pulling eyes.

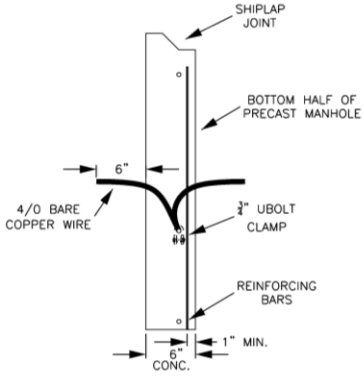




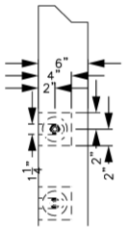
DETAIL "X"
1 REQUIRED



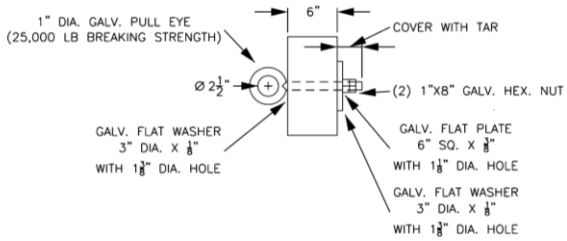
DETAIL "W"
8 REQUIRED



DETAIL "Y"
2 REQUIRED



DETAIL "V"

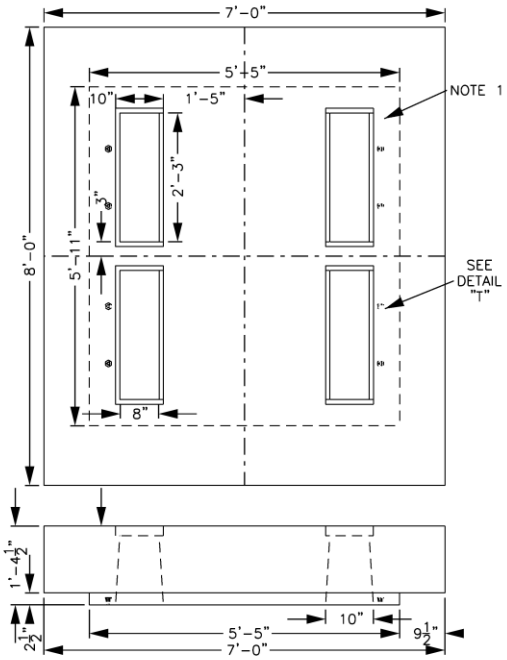


DETAIL "Z"
4 REQUIRED

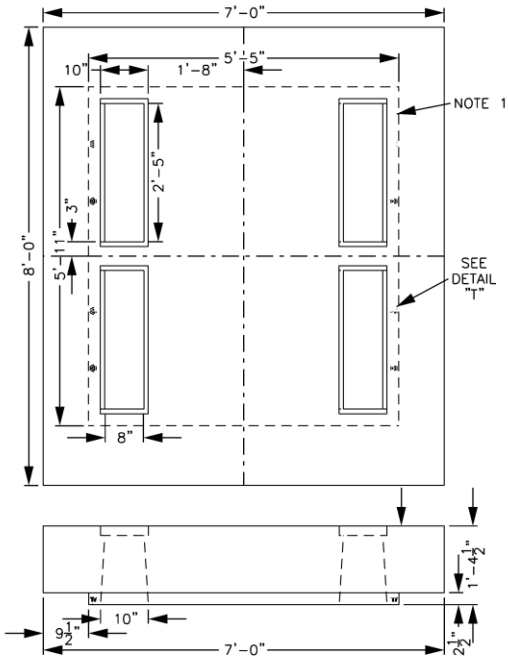
Designer	Drawing	Date
MPR	MS3466-2	10/30/20
	33-110	
	UM22S	

	Std. Item
With Specified Collar "A"	UM20A
With Specified Collar "B"	UM20B
With Specified Collar "C"	UM20C
With Specified Collar "D"	UM20D
With Specified Collar "E"	UM20E
With Specified Collar "F"	UM20F
With Specified Collar "M"	UM20M

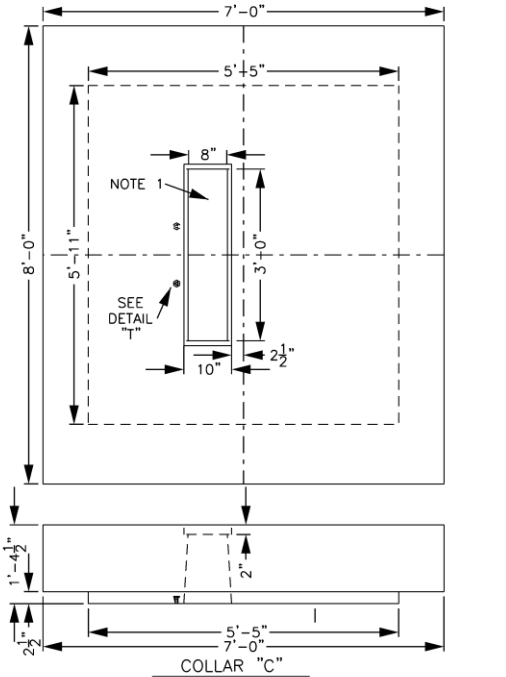
PRECAST CONCRETE MANHOLE
SWITCHGEAR MANHOLE – 6 FEET X 13 FEET (INSIDE)



COLLAR "A"
15KV SWITCHGEAR



COLLAR "B"
25/35KV SWITCHGEAR



COLLAR "C"

CONVENTIONAL PADMOUNT RECLOSER 15/27KV CLASS AND SWITCH PAD STANDARD US34A

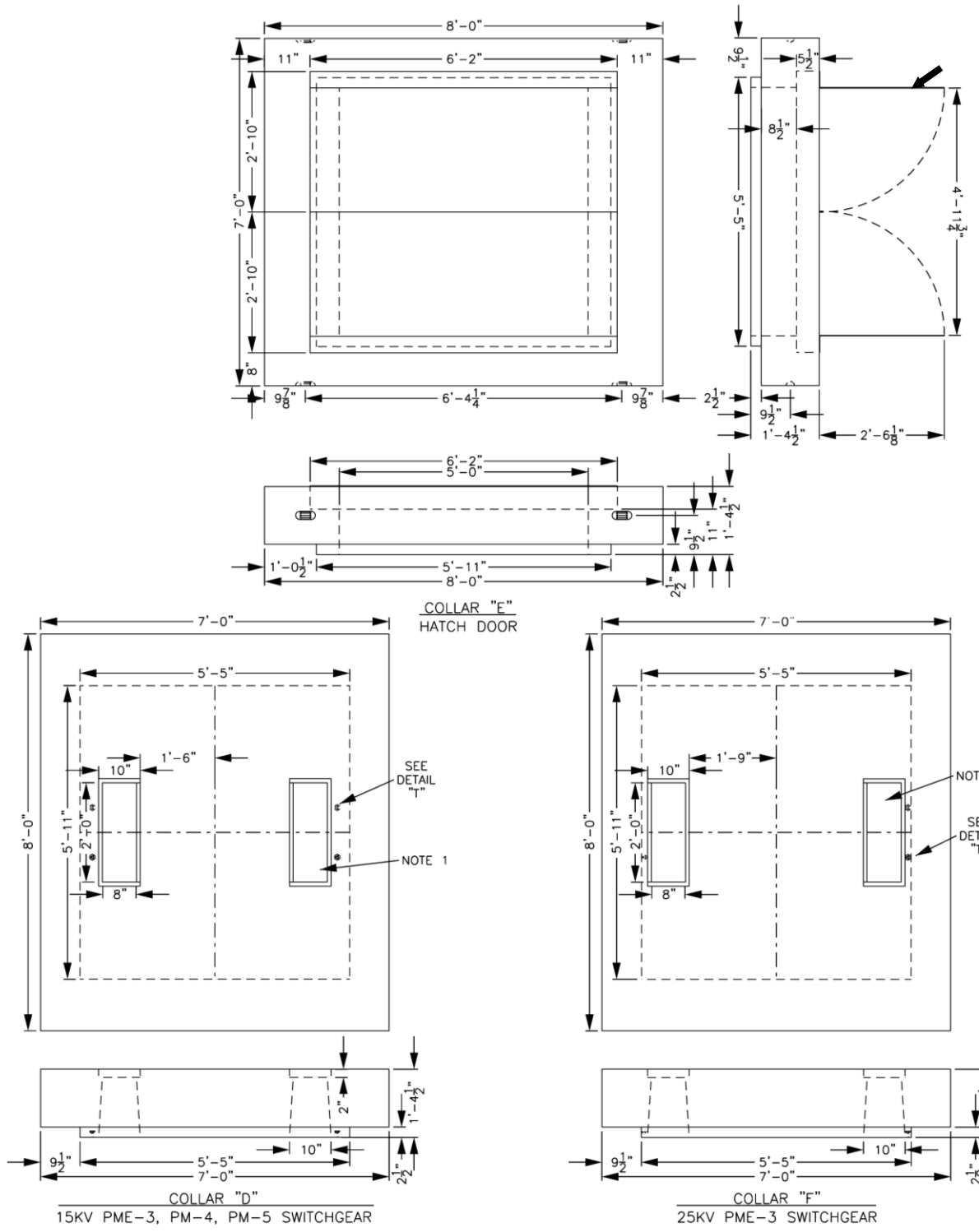
NOTE:
1. EXTRUDED POLYSTYRENE (XPS) RIGID FOAM INSULATION RECCESSED IN CABLE OPENING WHERE 1" X 1" KEY X 2" DEEP IS SHOWN. SEE SECTION 3 MATERIALS FOR FURTHER DETAILS.

Designer	Drawing	Date
MPR	MS3467-2	4/30/21
	33-112	
	UM20	

Supersedes 7/20 Issue –Update to drawings

PRECAST CONCRETE MANHOLE
SWITCHGEAR MANHOLE – 6 FEET X 13 FEET (INSIDE)

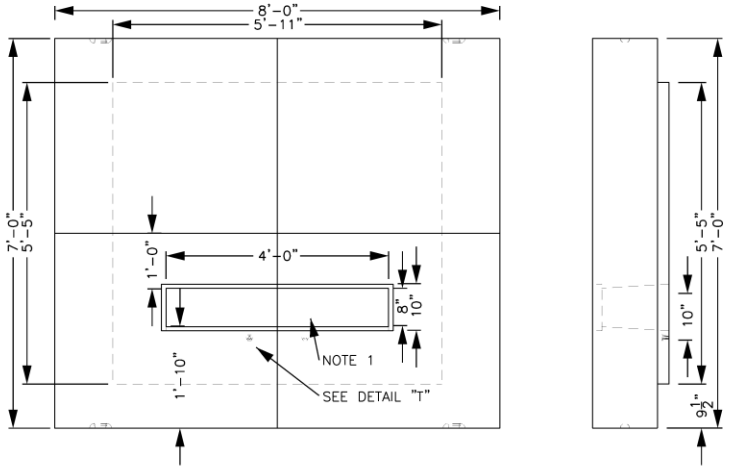
Supersedes 7/20 Issue – Updated drawings.



NOTE:
1. EXTRUDED POLYSTYRENE (XPS) RIGID FOAM INSULATION RECCESSED IN CABLE OPENING WHERE 1" X 1" KEY X 2" DEEP IS SHOWN. SEE SECTION 3 OF THE SPECIFICATION FOR FURTHER DETAILS.

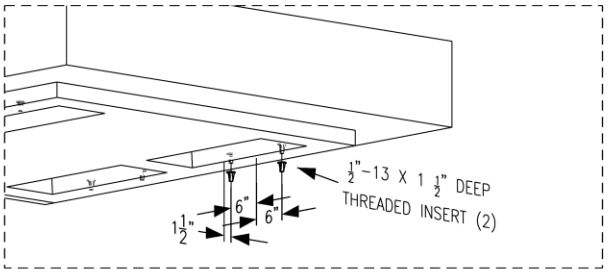
Designer	Drawing	Date
MPR	MS3467-3	4/30/21
	33-113A	
	UM20	

PRECAST CONCRETE MANHOLE
SWITCHGEAR MANHOLE – 6 FEET X 13 FEET (INSIDE)



COLLAR "M"

FOR PRIMARY METERING 15/27KV CLASS AND HI DUTY RECLOSER 15KV CLASS



DETAIL "T"

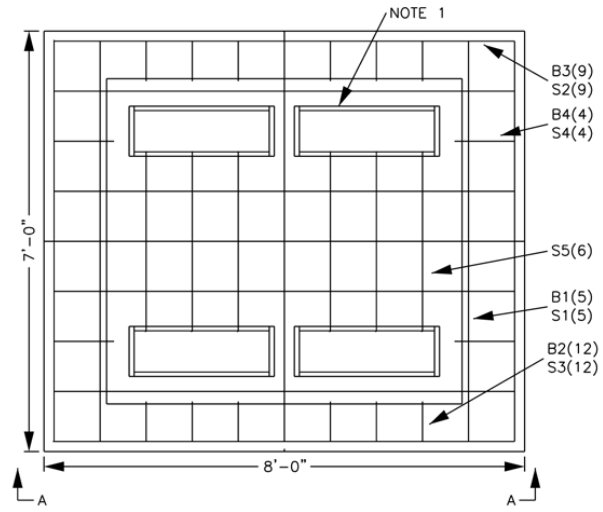
NOTE:
1. EXTRUDED POLYSTYRENE (XPS) RIGID FOAM INSULATION RECCESSED IN CABLE OPENING WHERE 1" X 1" KEY X 2" DEEP IS SHOWN. SEE SECTION 3 MATERIALS FOR FURTHER DETAILS.

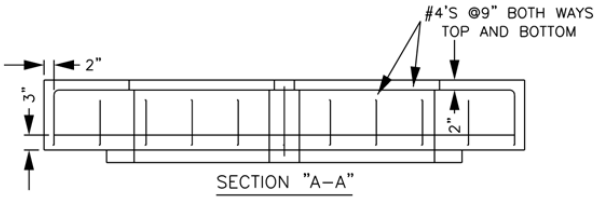
Designer	Drawing	Date
MPR	MS3467-4	11/24/21
	33-113B	
	UM20	

Supersedes 7/21 Issue – Updated drawings.

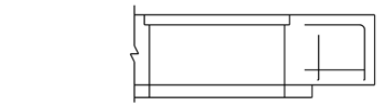
PRECAST CONCRETE MANHOLE SWITCHGEAR MANHOLE – 6 FEET X 13 FEET (INSIDE)			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/22	**33-113B**		

7/19 Issue – New Drawing

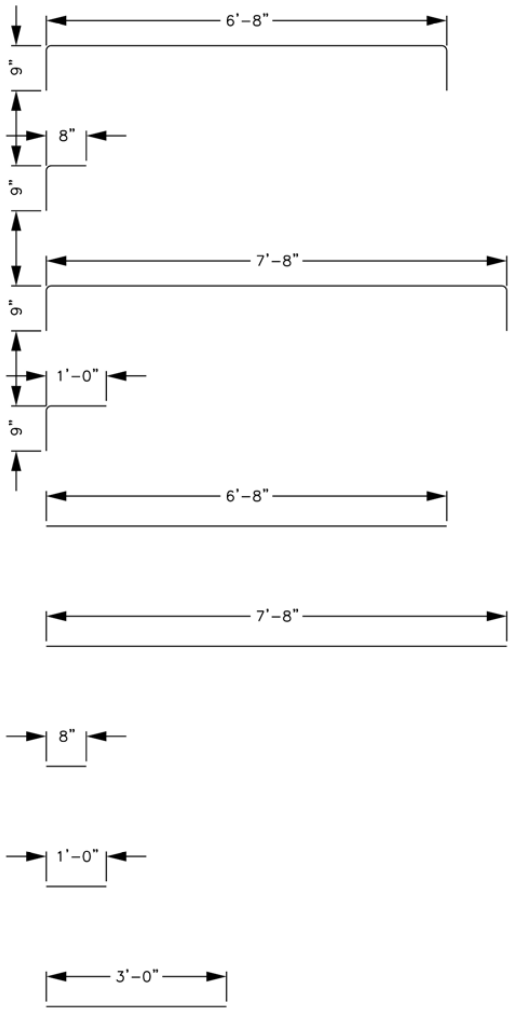




SECTION "A-A"

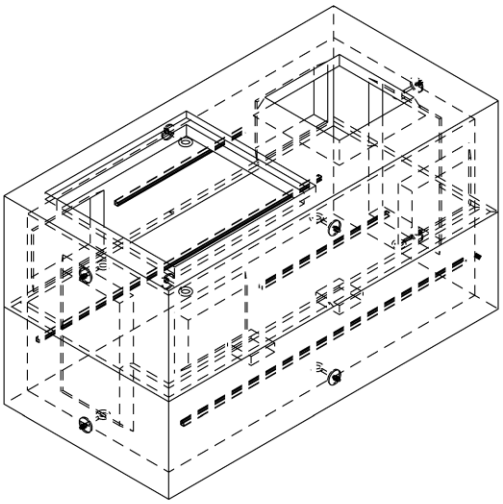


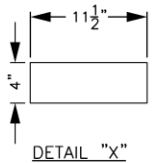
TYPICAL DETAIL AT OPENING



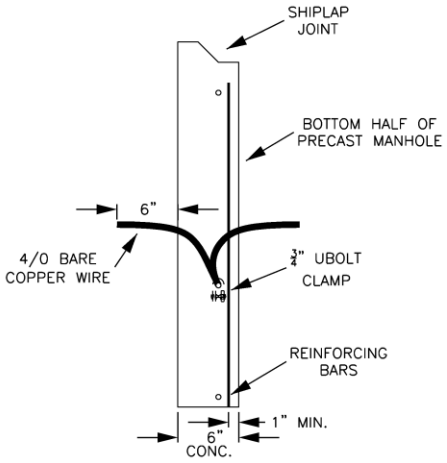
Designer	Drawing	Date
MPR	MS3467-5	6/15/19
	33-113C	
	UM20	

PRECAST CONCRETE MANHOLE
SWITCHGEAR MANHOLE – 6 FEET X 13 FEET (INSIDE)

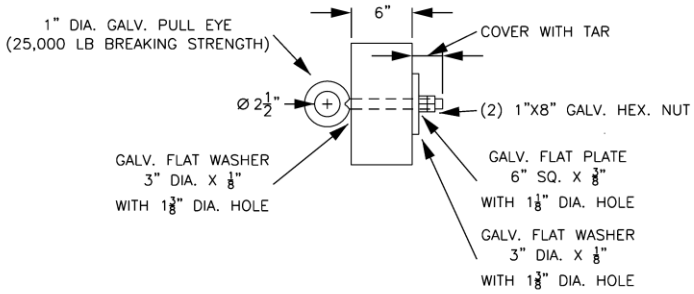




DETAIL "X"
2 REQUIRED



DETAIL "Y"
2 REQUIRED



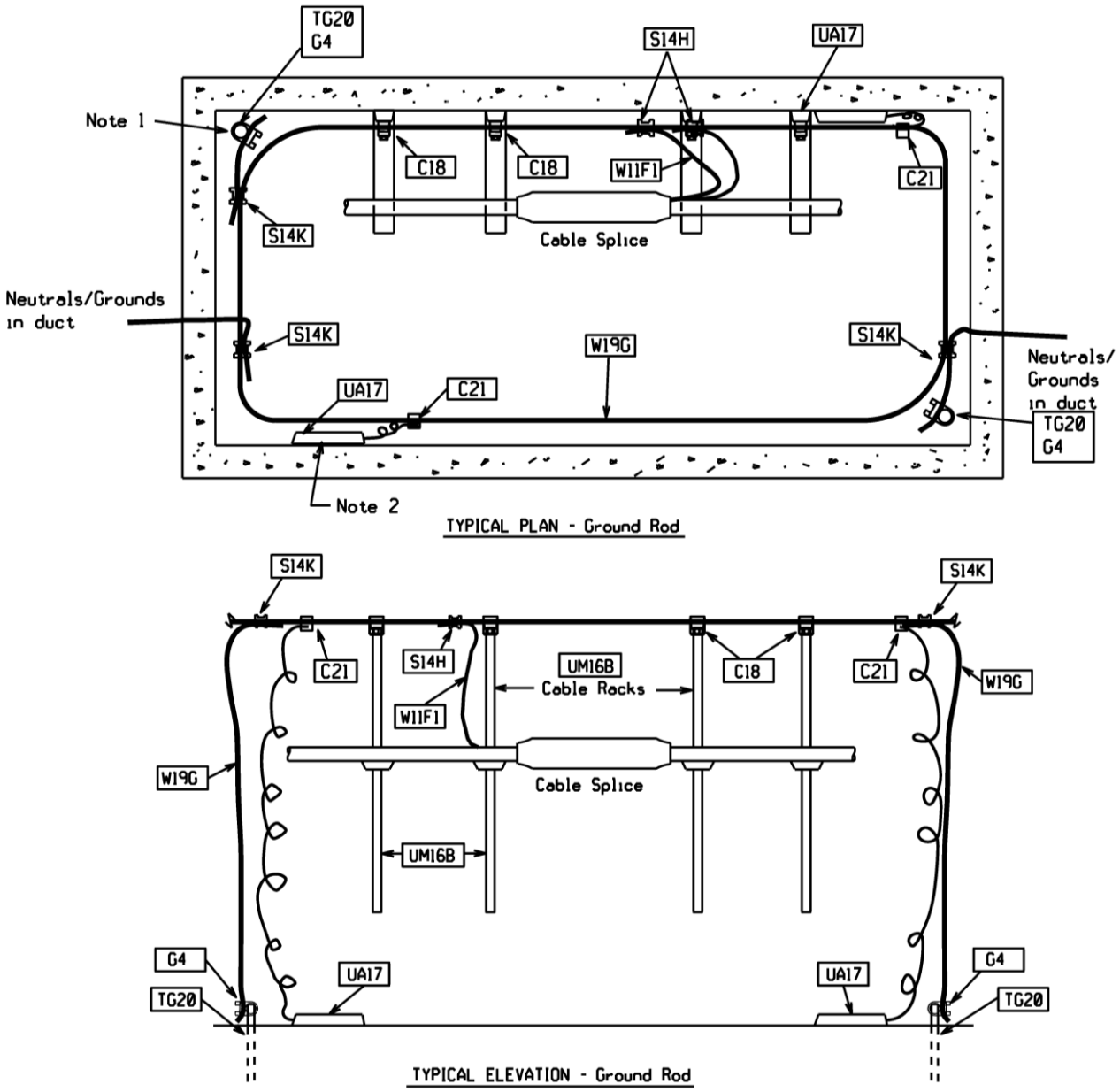
DETAIL "Z"
8 REQUIRED

Designer	Drawing	Date
MPR	MS3467-6	10/30/20
	33-113D	
	UM20	

Supersedes 7/19 Issue – Updated pulling eyes.

PRECAST CONCRETE MANHOLE
SWITCHGEAR MANHOLE – 6 FEET X 13 FEET (INSIDE)

ISSUE	PAGE NUMBER		
7/21	33-113D	UNDERGROUND CONSTRUCTION STANDARD	ppl



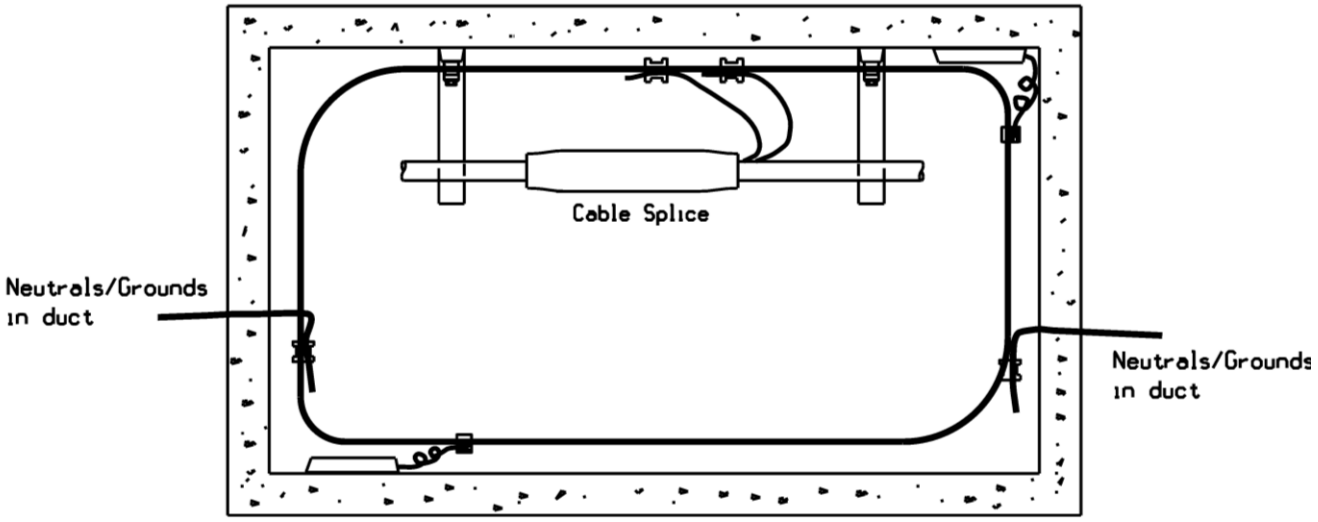
Note 1. Drive ground rod in corner of manhole - connect to ground bus
Note 2. Install anode in 2 corners of M.H. connect ground lead

Designer	Drawing	Date
MPR	ug33114	10/30/20

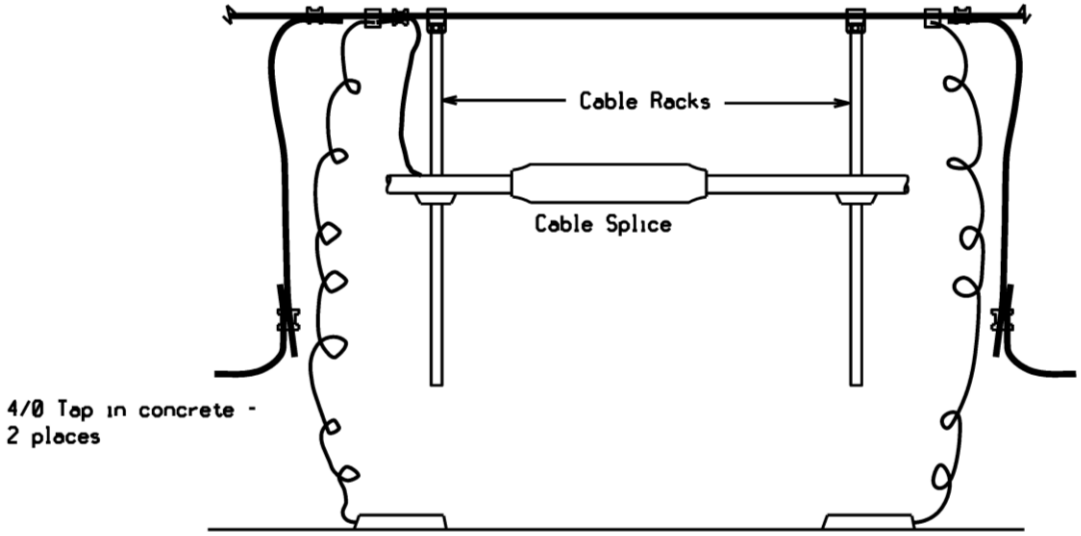
Note 1. Drive ground rod in corner of manhole – connect to ground bus. Existing manholes, without the bonds to the rebar, are to have two ground rods installed at diagonal ends through the floor of the manhole. The ground rods are to be installed as close to the corner of the manhole as possible, to prevent a trip hazard in the manhole.

Note 2. Install anode in 2 corners of manhole, connect to ground lead.

Supersedes 7/16 Issue – updated concrete pattern



TYPICAL PLAN - Ground on Rebar



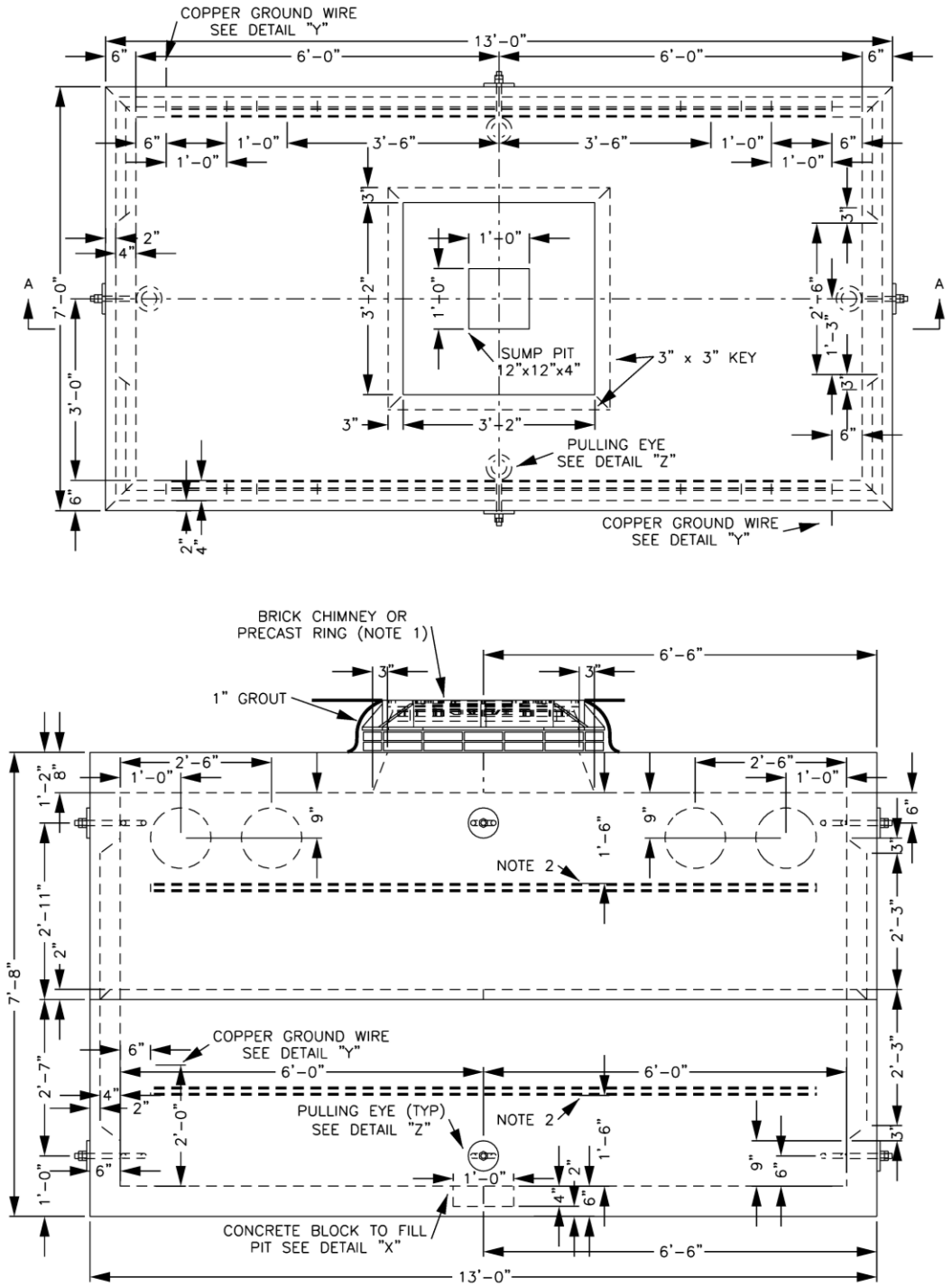
TYPICAL ELEVATION - Ground on Rebar

Note 1. 4/0 Tail poured in concrete 2 places
Note 2. Install annode in 2 corners of M.H. connect ground lead

Designer	Drawing	Date
MPR	ug33115	10/30/20

Supersedes 7/16 Issue – Updated concrete pattern

Note 1. 4/0 tail poured in concrete in 2 places.
Note 2. Install anode in 2 corners of manhole, connect to ground lead.



NOTE
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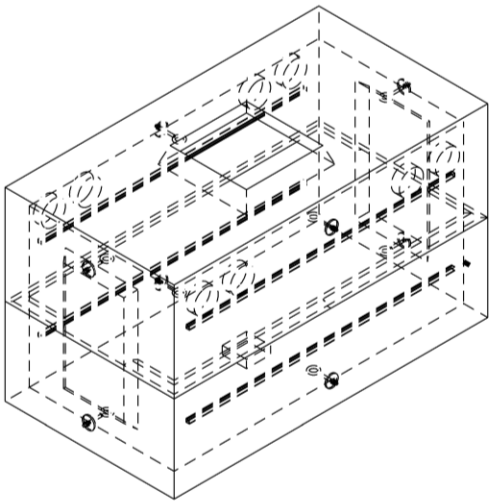
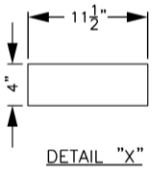
2. INSTALL 1–$\frac{5}{8}$"X1–$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

Designer	Drawing	Date
MPR	MS3468–1	10/30/20
	33–116	
	UM25	

Supersedes 7/19 Issue – Updated pulling eyes.

Supersedes 7/19 Issue – Updated pulling eyes.





DETAIL "X"
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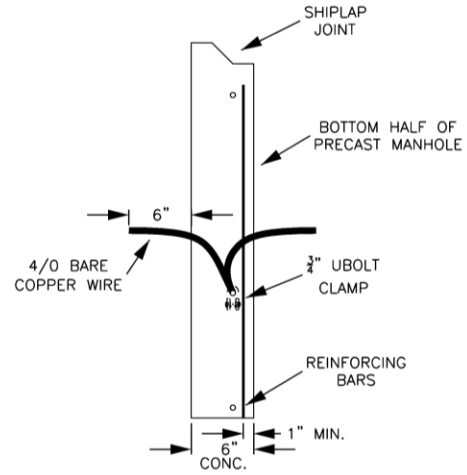
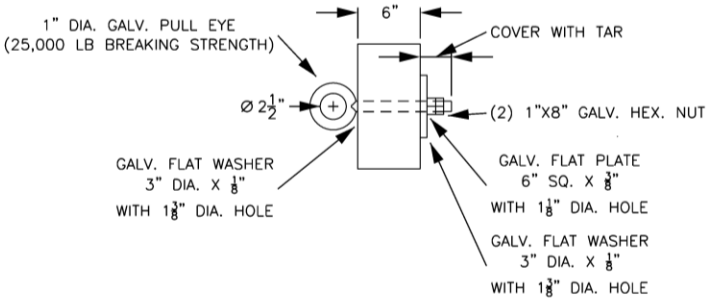


DETAIL "Y"
2 REQUIRED



DETAIL "Z"
8 REQUIRED

Designer	Drawing	Date
MPR	MS3468-2	10/30/20
	33-117	
	UM25	

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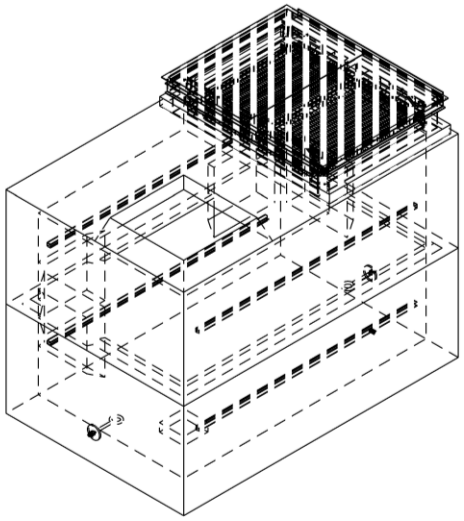
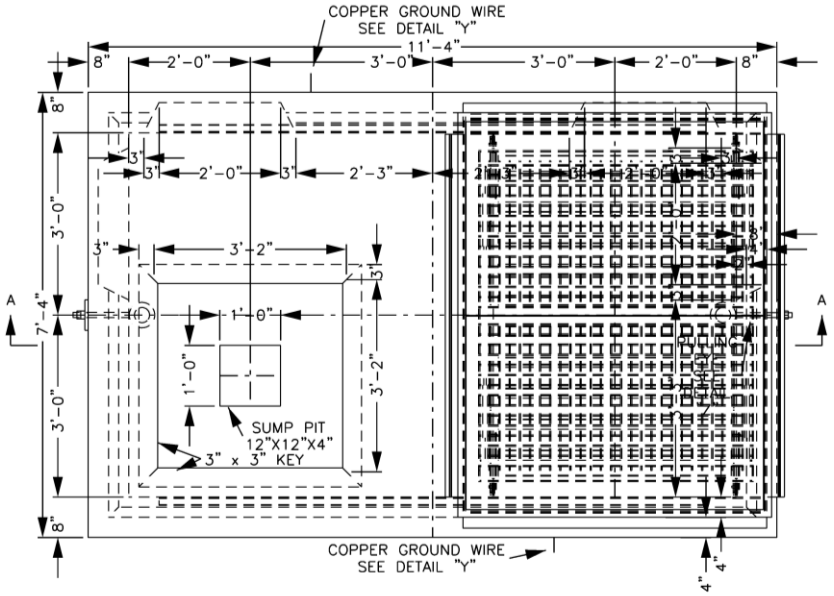
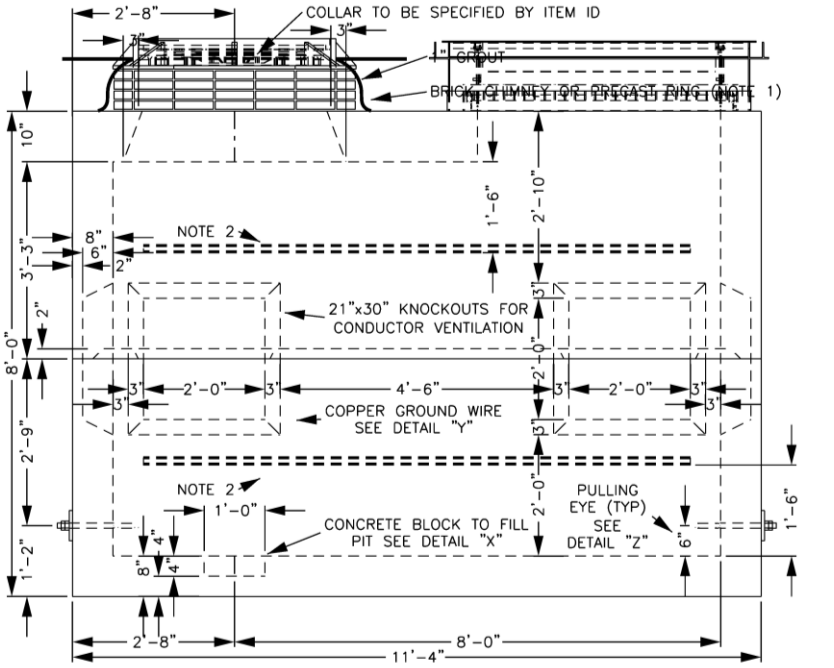


ISOMETRIC VIEW





NOTE
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2. INSTALL 1–$\frac{5}{8}$"X1–$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

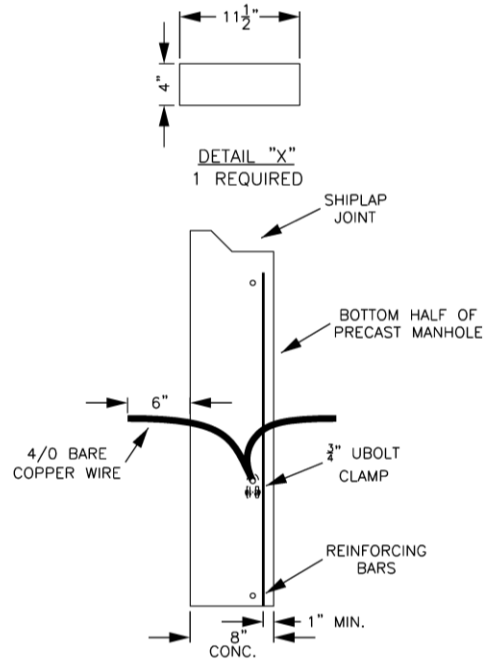
Designer	Drawing	Date
MPR	MS3469–1	10/30/20
	33–120A	
	UM28	

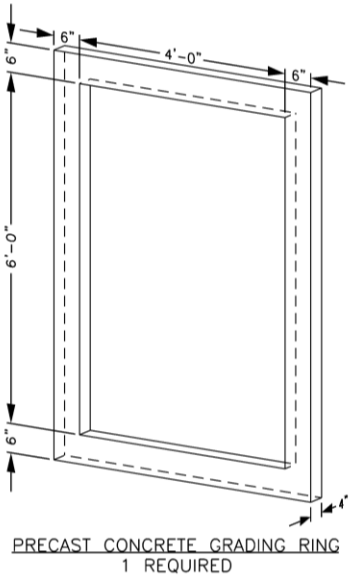
Supersedes 7/19 Issue – Updated pulling eyes.

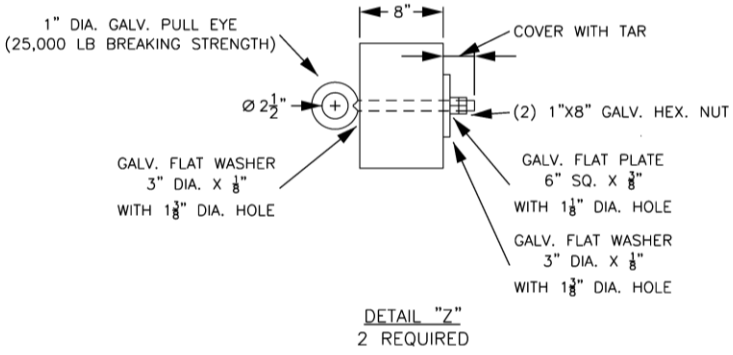
PRECAST CONCRETE MANHOLE
SATELLITE SIDEWALK MANHOLE 6' X 10' (INSIDE)

ISSUE	PAGE NUMBER	UNDERGROUND CONSTRUCTION STANDARD	ppl
7/21	33-120A		

Supersedes 7/19 Issue – Updated pulling eyes.



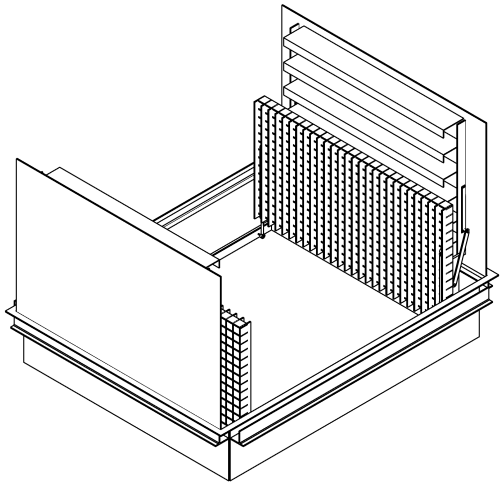


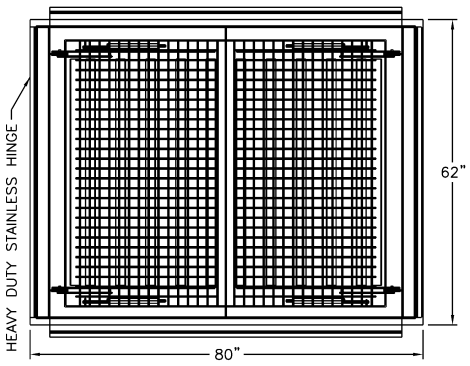


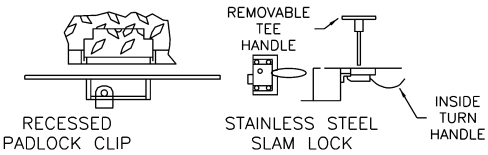
Designer	Drawing	Date
MPR	MS3469-2	10/30/20
	33-120B	
	UM28	

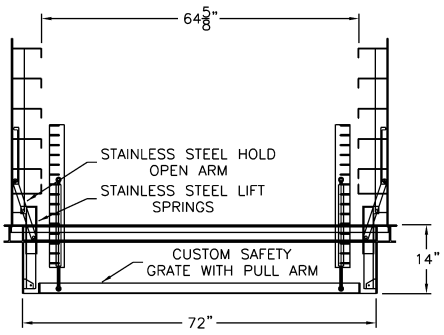
Hatch top and side views

PRECAST CONCRETE MANHOLE SATELLITE SIDEWALK MANHOLE 6' X 10' (INSIDE)			
ppl	**UNDERGROUND CONSTRUCTION STANDARD**	**PAGE NUMBER**	**ISSUE**
		33-120B	**7/21**









UM15H
HATCH USED FOR UM28 SIDEWALK MANHOLE

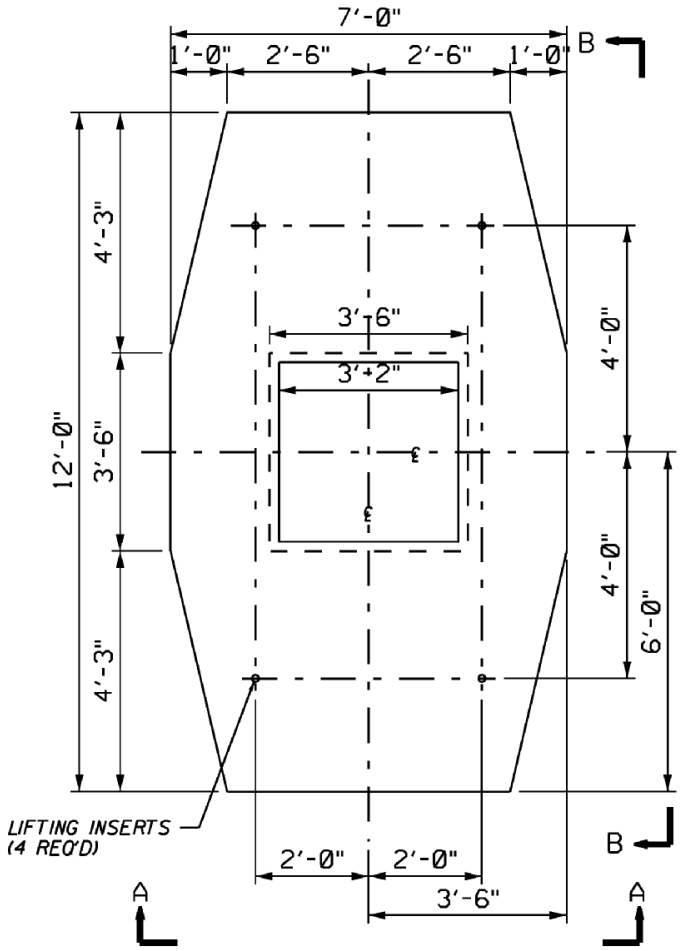
Designer	Drawing	Date
MPR	MS3480	7/15/19
	33–121	
	UM15H	

Notes:
1. Construction joint to be sealed with asphalt or equivalent.
2. Grading rings to be installed to build up hatchway for final grade.
3. Hatch to be cast into place at final grade

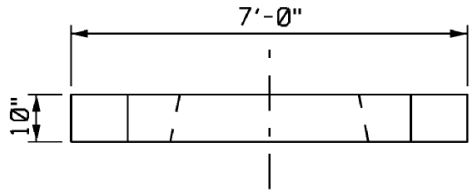
PRECAST CONCRETE MANHOLE SATELLITE SIDEWALK MANHOLE 6’ X 10’ (INSIDE)			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/19	**33-121**		

Notes:

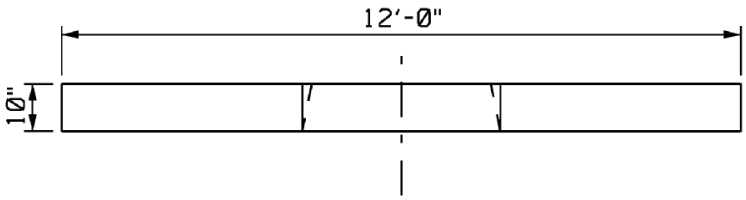
1) This item shall be used as a replacement for an existing deteriorated Barrel roof.
2) See MS 3470 for reinforcing schedule.
3) Roof shall be cast in around existing walls.



ROOF SLAB & INSERT PLAN



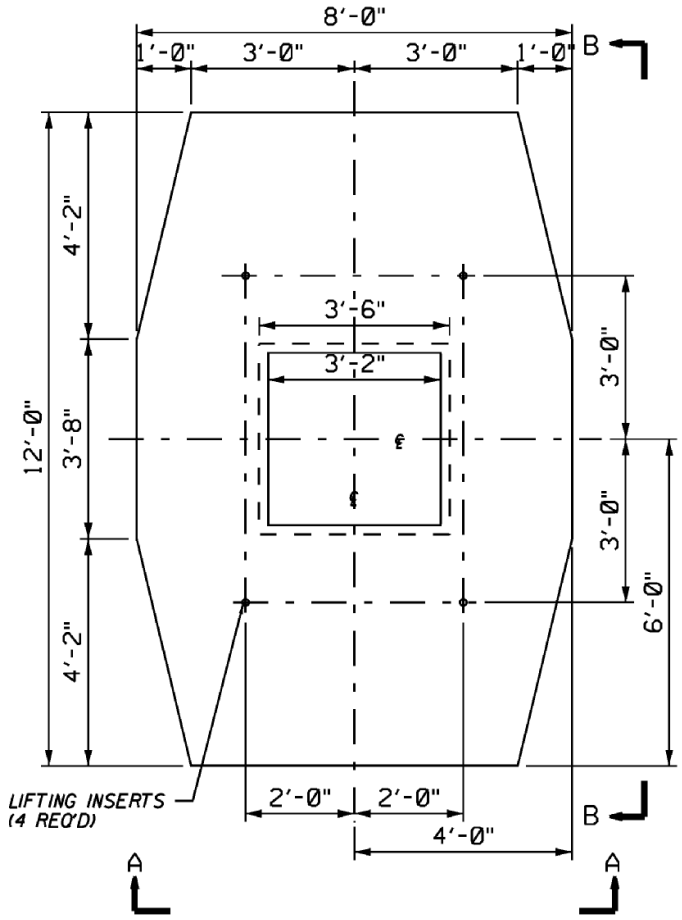
SECTION A-A



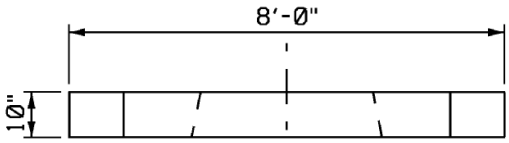
SECTION B-B

7/09 Issue - New Standard

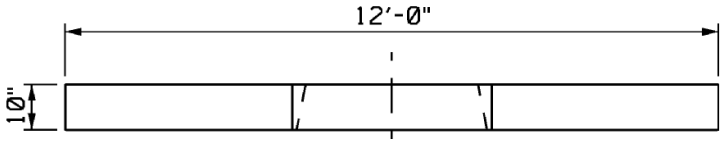
PRECAST CONCRETE BARREL ROOF 8 FEET X 12 FEET MAINTENANCE ITEM			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		33-122	7/09



ROOF SLAB & INSERT PLAN



SECTION A-A



SECTION B-B

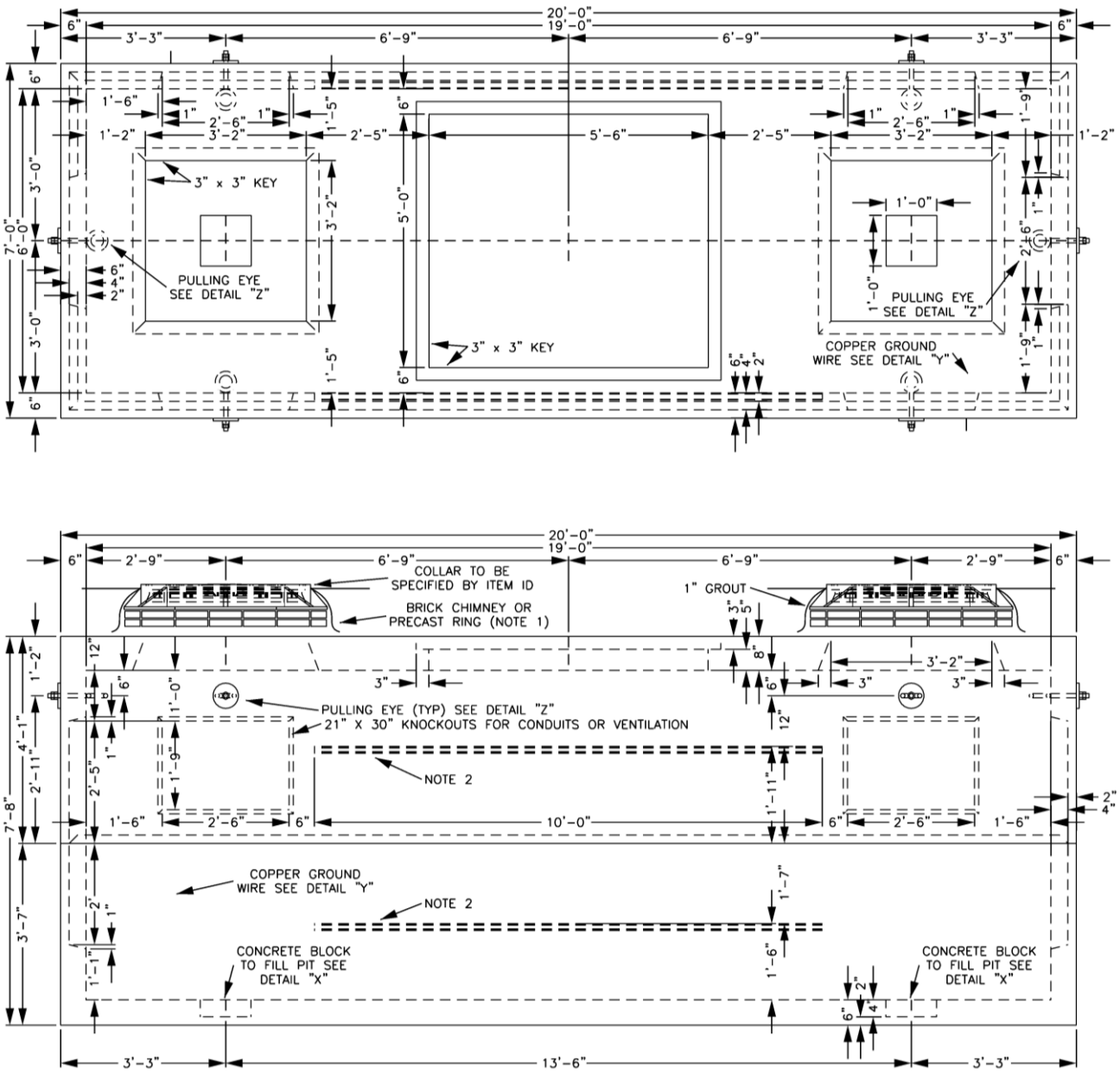
Notes:

1) This item shall be used as a replacement for an existing deteriorated Barrel roof.
2) See MS3470 for reinforcing schedule.
3) Roof shall be cast in around existing walls.

PRECAST CONCRETE BARREL ROOF 8 FEET X 12 FEET MAINTENANCE ITEM			
ISSUE	**PAGE NUMBER**		
7/09	**33-123**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl

7/09 Issue - New Standard

Supersedes 7/19 Issue – Updated pulling eyes.



NOTE
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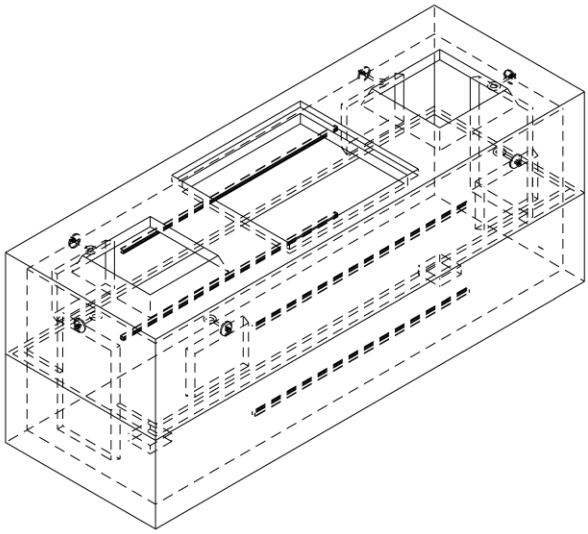
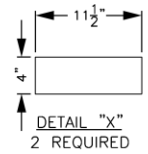
Designer	Drawing	Date
MPR	MS3471–1	10/30/20
	33–124	
	UM31	

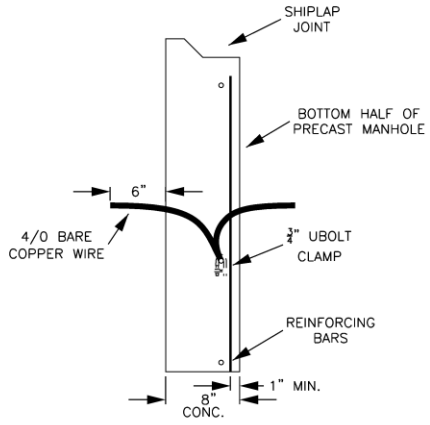
PRECAST CONCRETE MANHOLE – DOUBLE ENTRY ROOF 6'x19' (INSIDE)

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	33-124	7/21

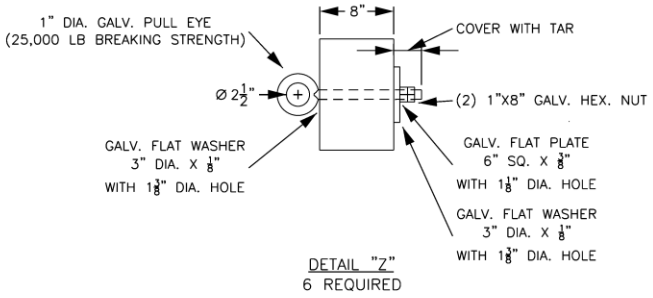




DETAIL "X"
2 REQUIRED



DETAIL "Y"
2 REQUIRED



DETAIL "Z"
6 REQUIRED

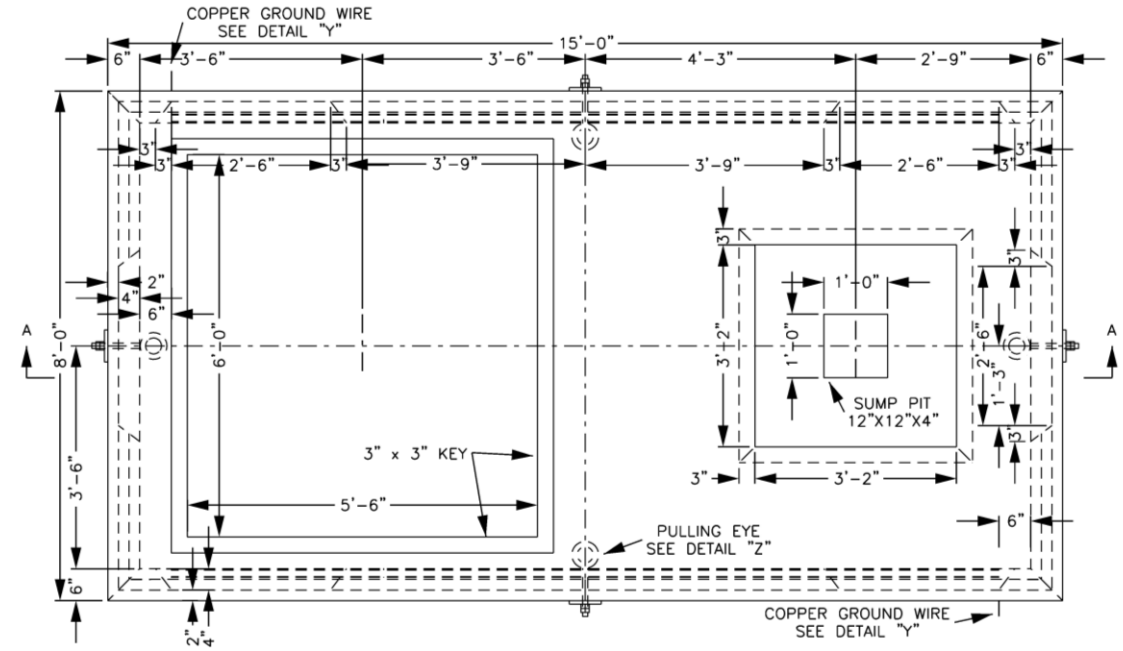
Designer	Drawing	Date
MPR	MS3471–2	10/30/20
	33–125	
	UM31	

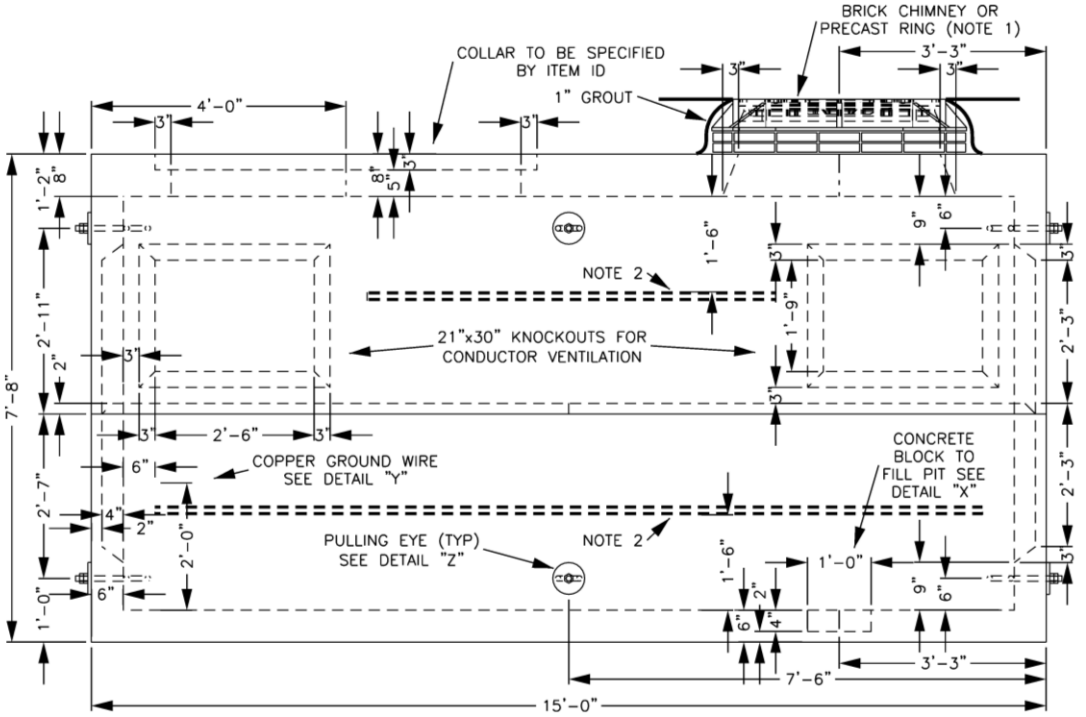
Supersedes 7/19 Issue – Updated pulling eyes.

PRECAST CONCRETE MANHOLE – DOUBLE ENTRY ROOF 6'x19' (INSIDE)

ISSUE	PAGE NUMBER		
7/21	33-125	UNDERGROUND CONSTRUCTION STANDARD	ppl

Supersedes 7/19 Issue – Updated pulling eyes.





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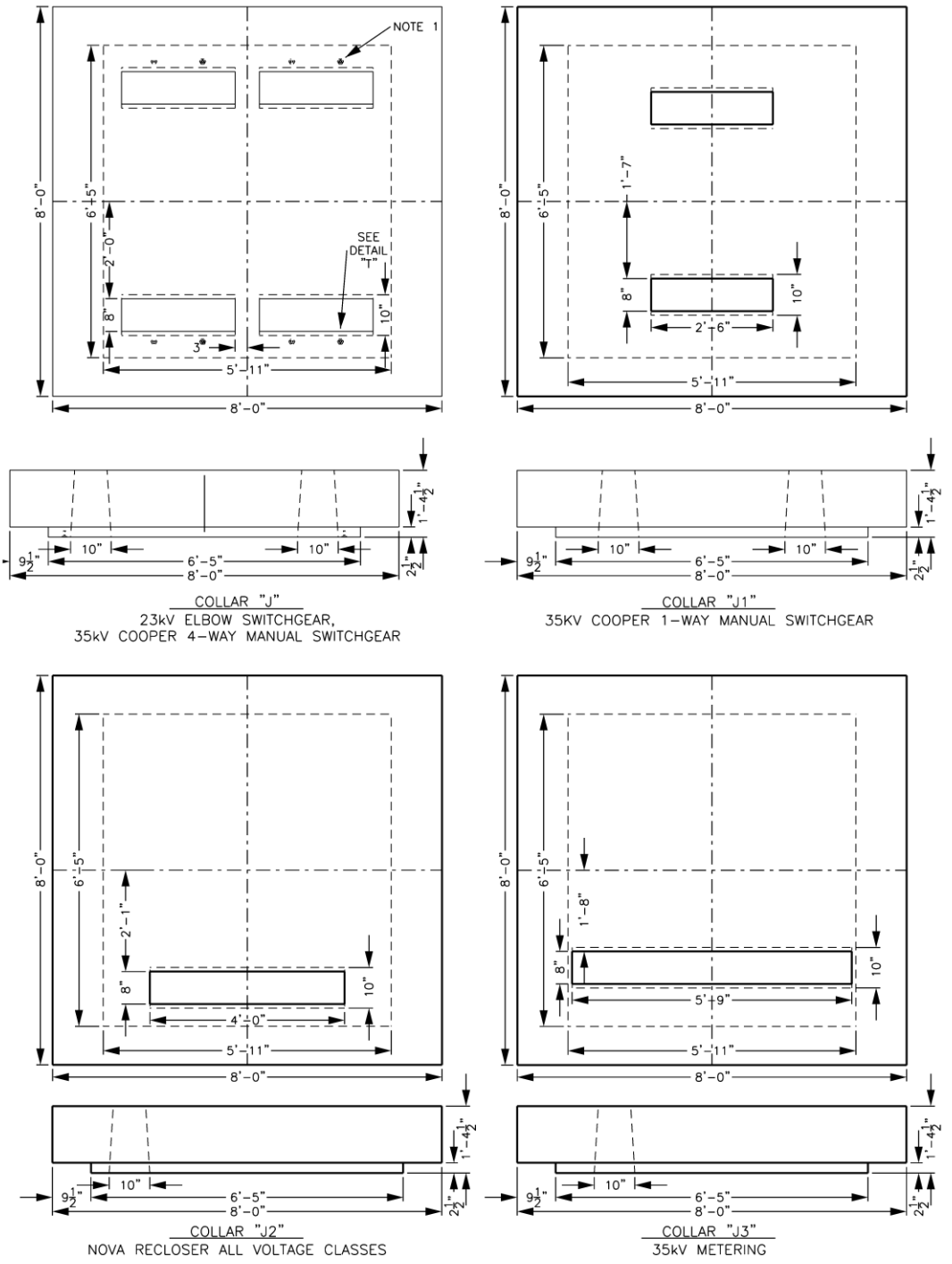
Designer	Drawing	Date
MPR	MS3474–1	6/15/19
	33–126	
	UM21	

PRECAST CONCRETE MANHOLE – SWITCHGEAR MANHOLE 7'x14' (INSIDE)

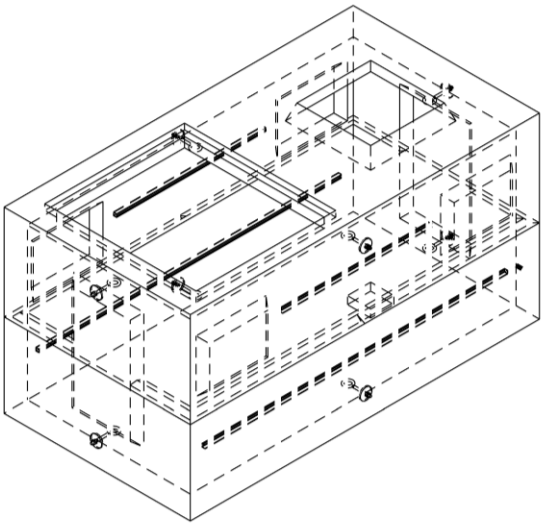


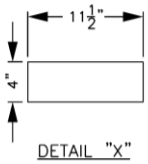
Designer	Drawing	Date
MPR	MS3474-2	10/18/21
	33-127A	
	UM21	

Supersedes 7/21 Issue – Updated drawing.

PRECAST CONCRETE MANHOLE – SWITCHGEAR MANHOLE 7'x14' (INSIDE)

Supersedes 7/19 Issue – Updated pulling eyes.





DETAIL "X"
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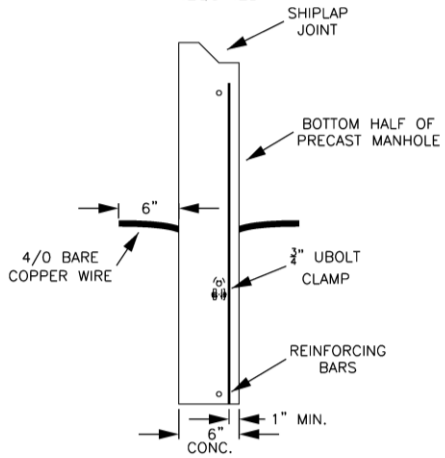
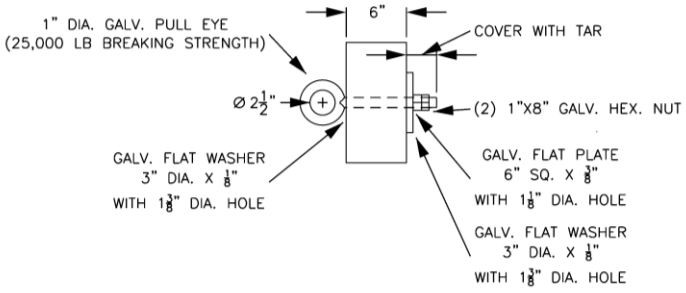


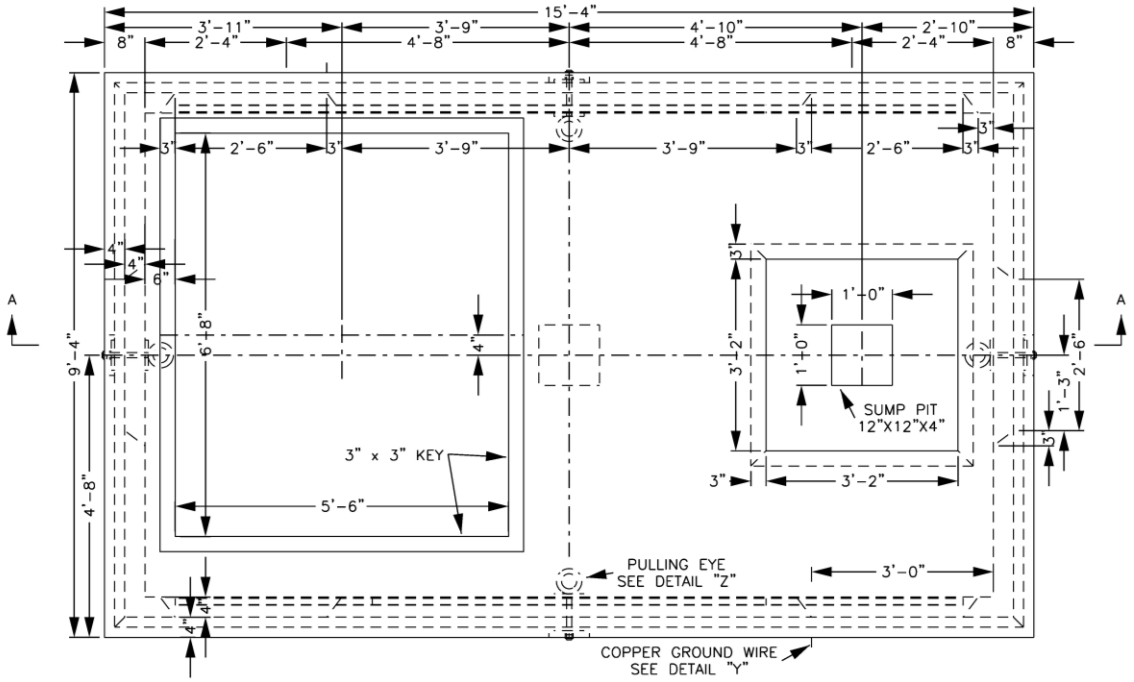
DETAIL "Y"
2 REQUIRED

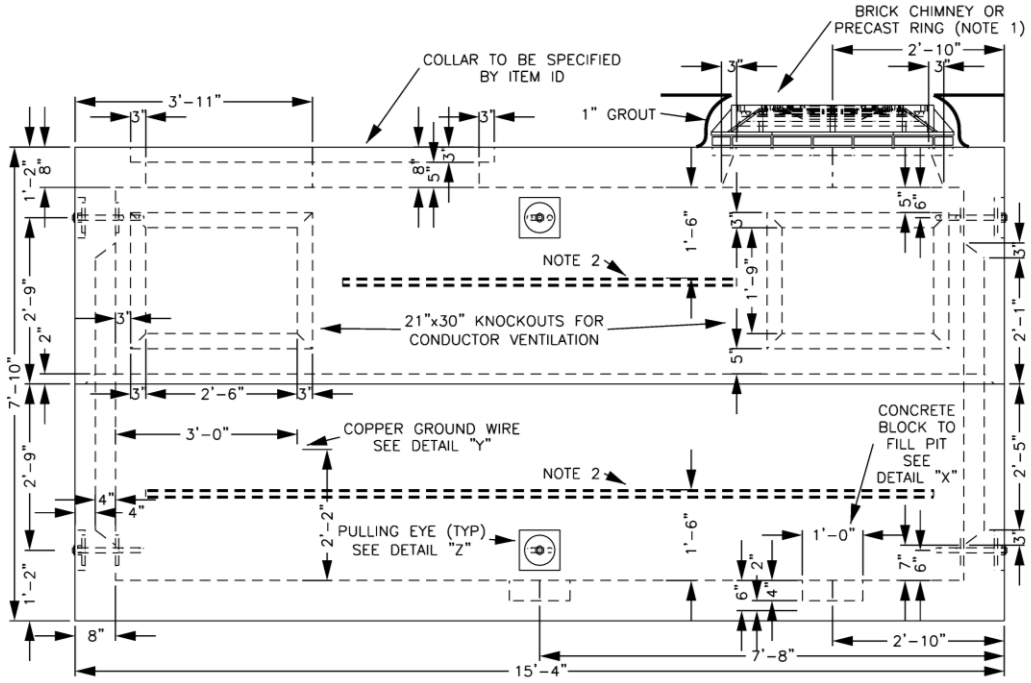


DETAIL "Z"
8 REQUIRED

Designer	Drawing	Date
MPR	MS3474-3	10/30/20
	33-127B	
	UM21	

PRECAST CONCRETE MANHOLE – SWITCHGEAR MANHOLE 7'x14' (INSIDE)





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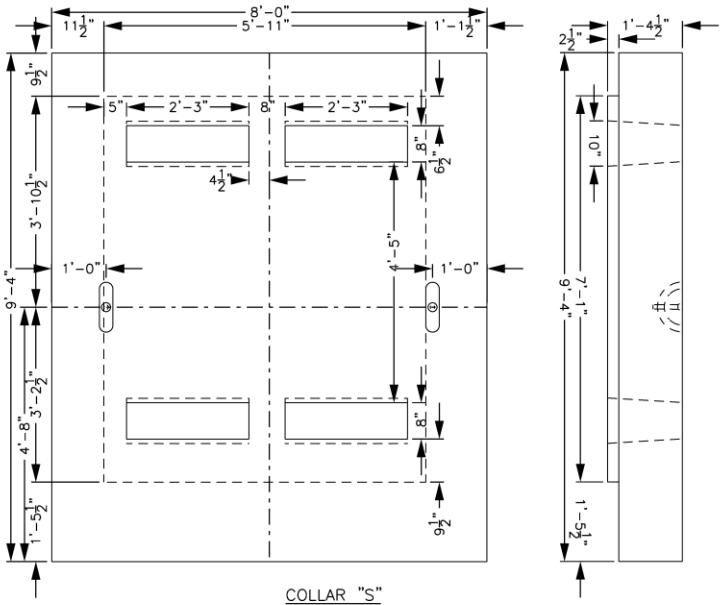
Designer	Drawing	Date
MPR	MS3476–1	10/30/20
	33–128	
	UM35	

Supersedes 7/19 Issue – Updated pulling eyes.

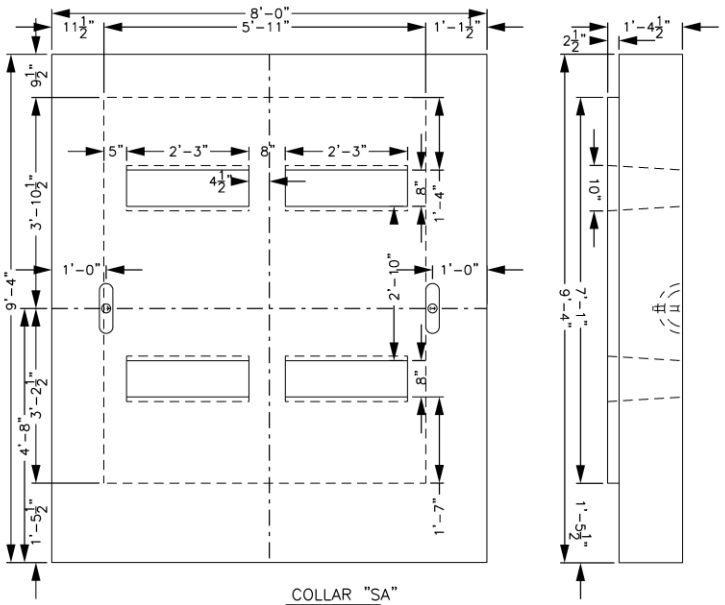
PRECAST CONCRETE MANHOLE – LARGE SWITCHGEAR MANHOLE- 8' X14' (INSIDE)

ISSUE	PAGE NUMBER	UNDERGROUND CONSTRUCTION STANDARD	ppl
7/21	33-128		

Supersedes 7/21 Issue – Updated drawing note collar S



COLLAR "S"
15, 27 AND 38KV CLASS AUTOMATIC SWITCH GEAR
STD. ITEMS US39L, US39J AND US39K

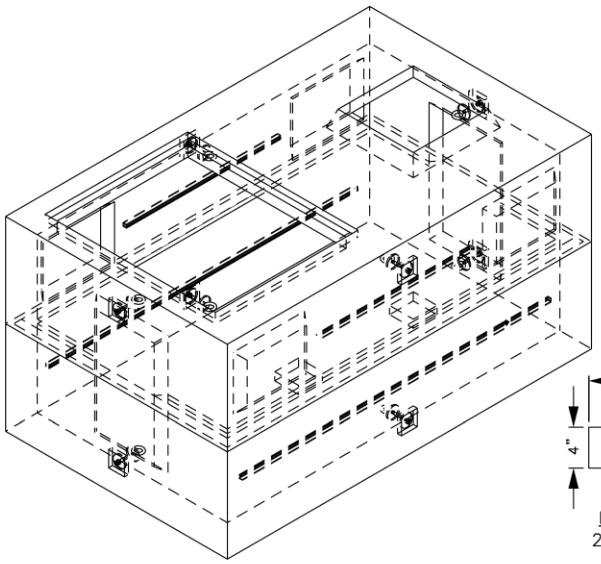


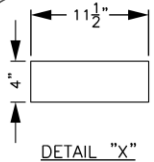
COLLAR "SA"
15KV CLASS MANUAL SWITCH GEAR STD. ITEMS US45, US45SS, US45CL,
US45A, US45ASS, AND US45C

Designer	Drawing	Date
MPR	MS3476-2	12/1/21
	33-129A	
	UM35	

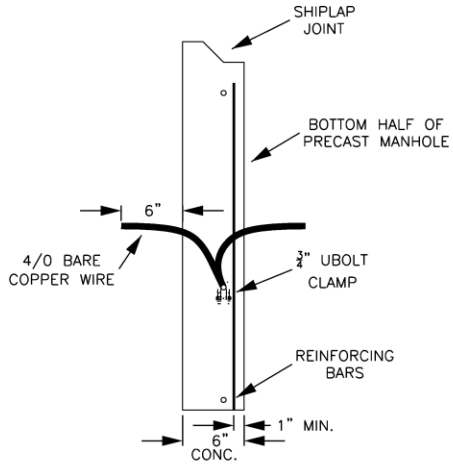
PRECAST CONCRETE MANHOLE – LARGE SWITCHGEAR MANHOLE 8' X14' (INSIDE)

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	33-129A	7/22

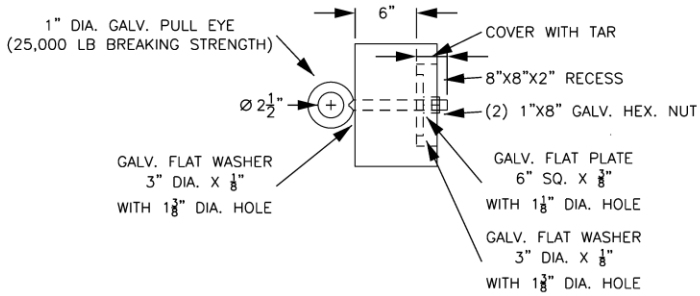




DETAIL "X"
2 REQUIRED



DETAIL "Y"
2 REQUIRED



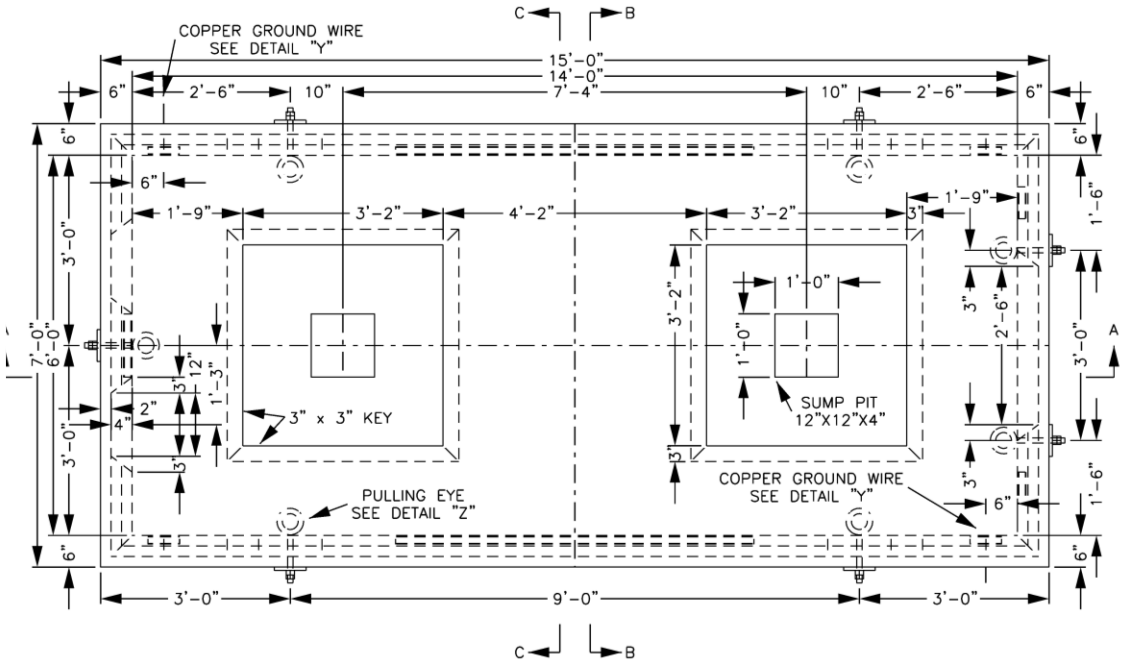
DETAIL "Z"
8 REQUIRED

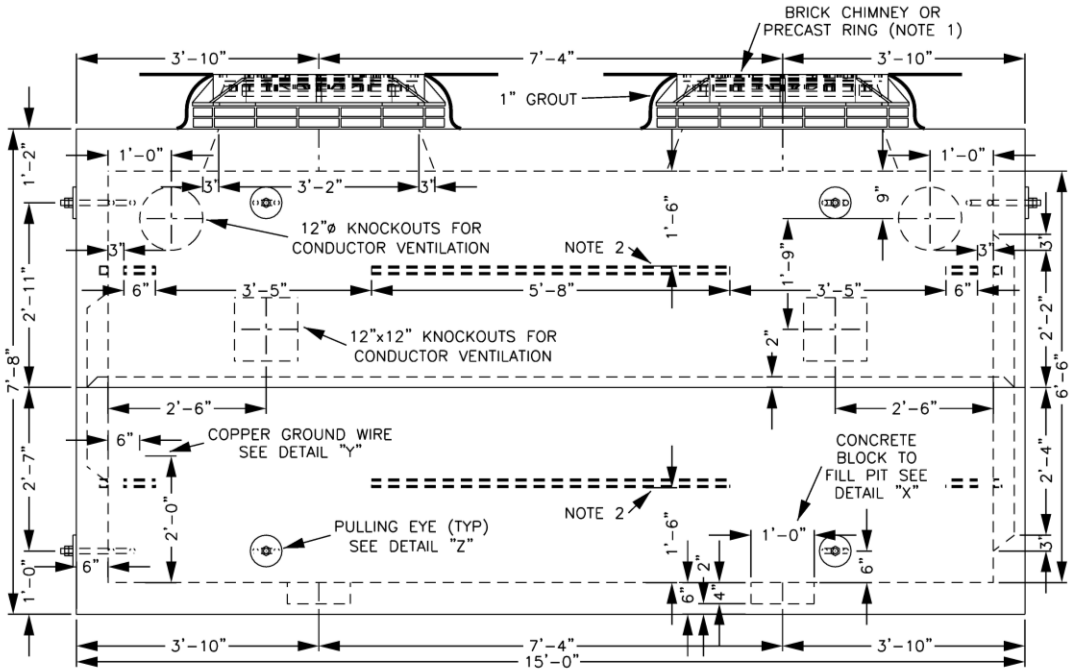
Designer	Drawing	Date
MPR	MS3476-3	10/30/20
	33-129B	
	UM35	

Supersedes 7/19 Issue – Updated pulling eyes.

PRECAST CONCRETE MANHOLE – SWITCHGEAR MANHOLE- 8' X14' (INSIDE)

Supersedes 7/19 Issue – Updated pulling eyes.



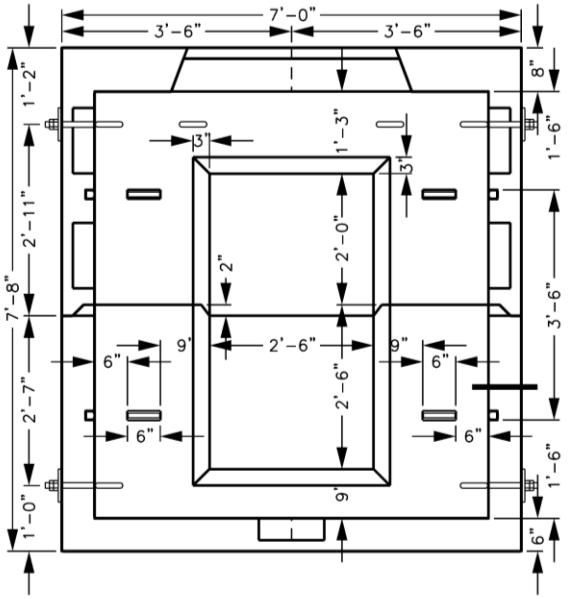


Section A–A

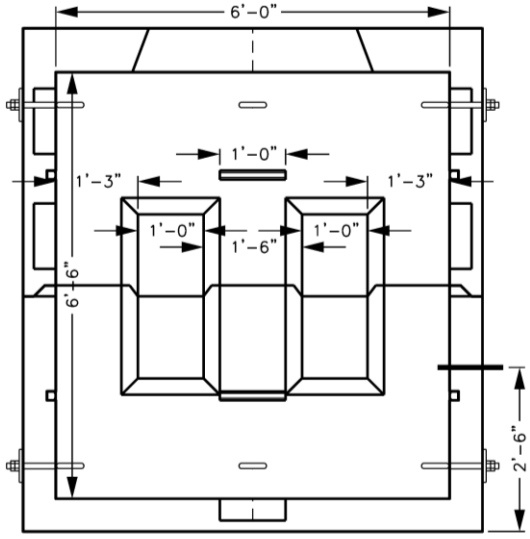
NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL $1-\frac{5}{8}$"X$1-\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

Designer	Drawing	Date
MPR	MS3472–1	10/30/20
	33–130	
	UM32	

PRECAST CONCRETE MANHOLE – DOUBLE ENTRY MANHOLE 6' X14' (INSIDE)



Section B–B



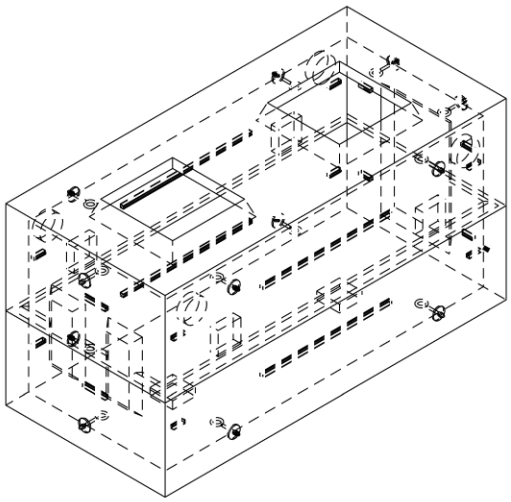
Section C–C

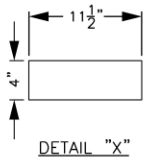
Supersedes 7/19 Issue – Updated pulling eyes.

Designer	Drawing	Date
MPR	MS3472–2	3/15/19
	33–131A	
	UM32	

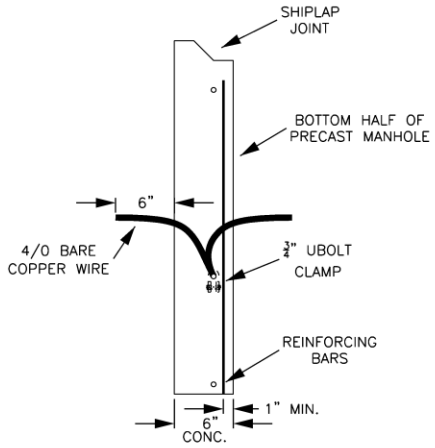
PRECAST CONCRETE MANHOLE – DOUBLE ENTRY MANHOLE 6' X14' (INSIDE)			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/21	**33-131A**		

Supersedes 7/19 Issue – Updated pulling eyes.

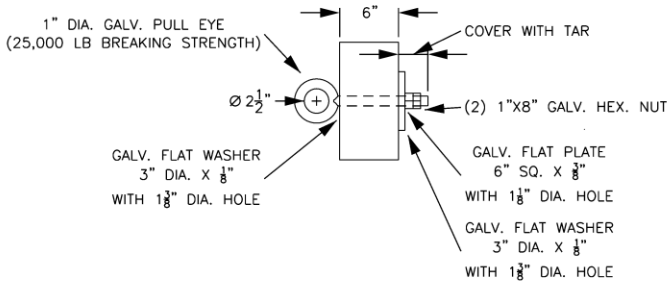




DETAIL "X"
1 REQUIRED



DETAIL "Y"
2 REQUIRED

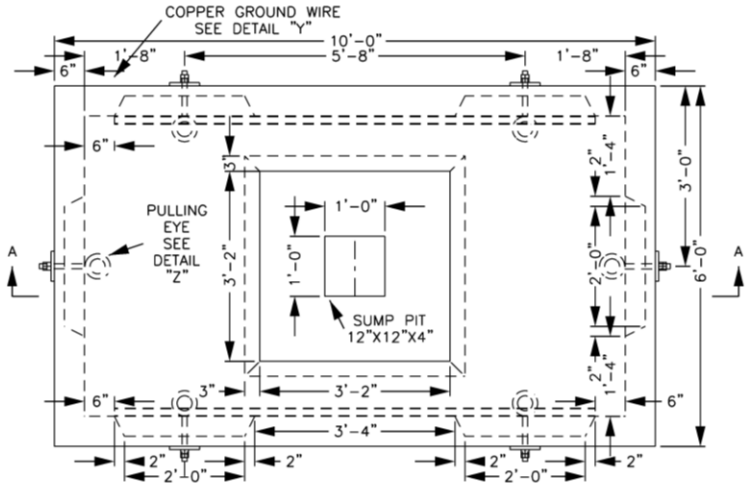


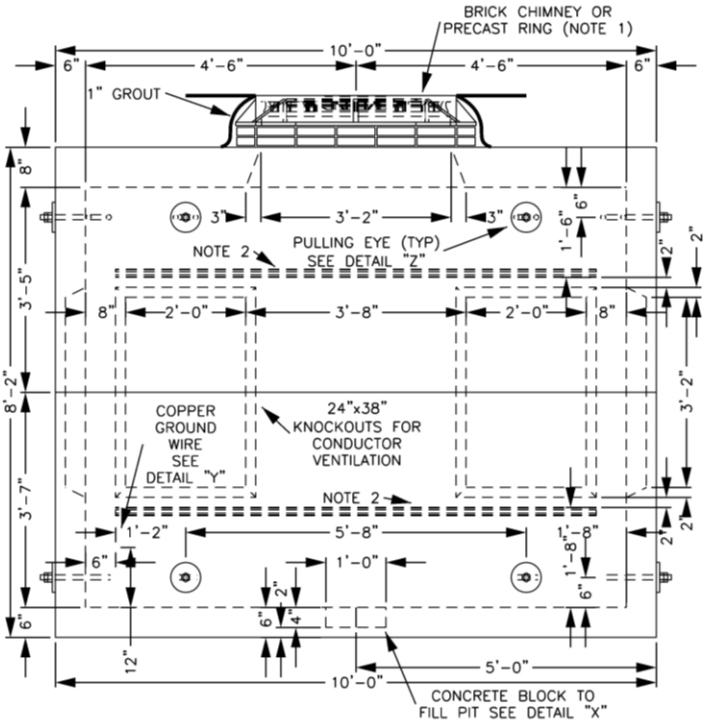
DETAIL "Z"
8 REQUIRED

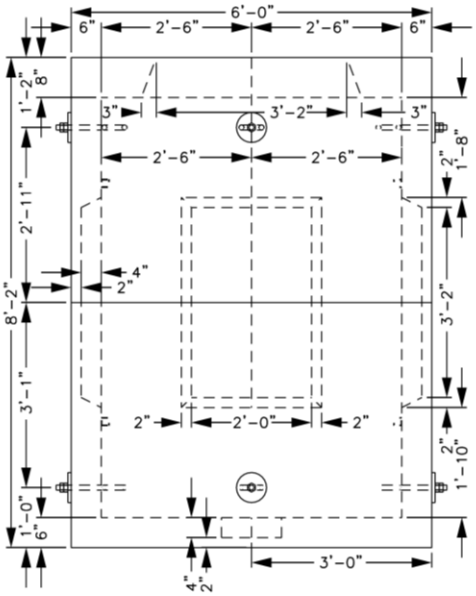
Designer	Drawing	Date
MPR	MS3472-3	10/30/20
	33-131B	
	UM32	

PRECAST CONCRETE MANHOLES – DOUBLE ENTRY MANHOLE 6' X14' (INSIDE)

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	33-131B	7/21







NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–$\frac{5}{8}$"X1–$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

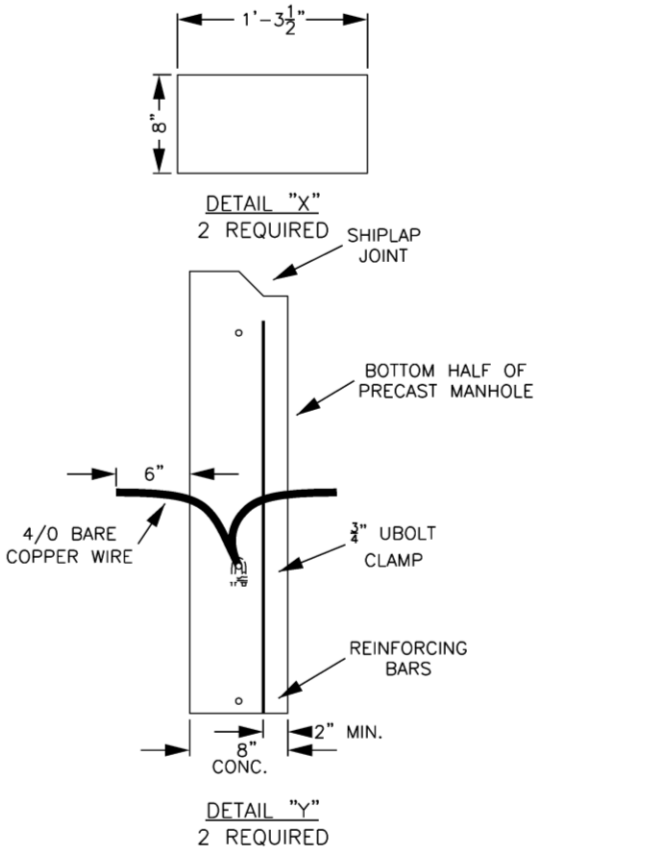
Designer	Drawing	Date
MPR	MS3478–1	3/15/19
	33–132	
	UM39	

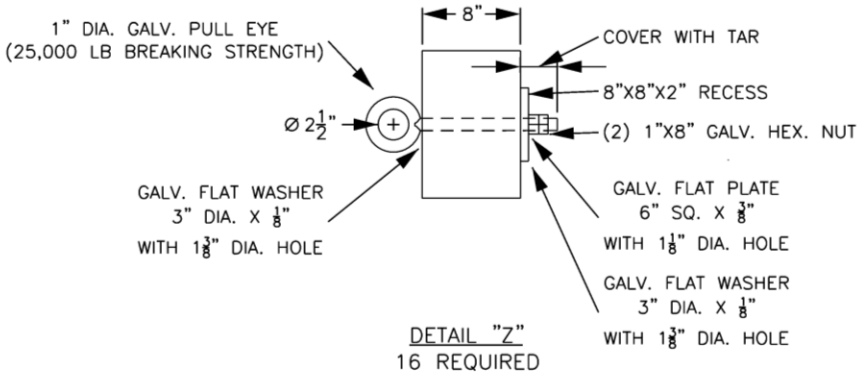
Supersedes 7/19 Issue – Updated pulling eyes.

PRECAST CONCRETE MANHOLE – 4-WAY MEDIUM SIZE MANHOLE- 5' x 9' (INSIDE)

ISSUE	PAGE NUMBER	UNDERGROUND CONSTRUCTION STANDARD	ppl
7/21	33-132		

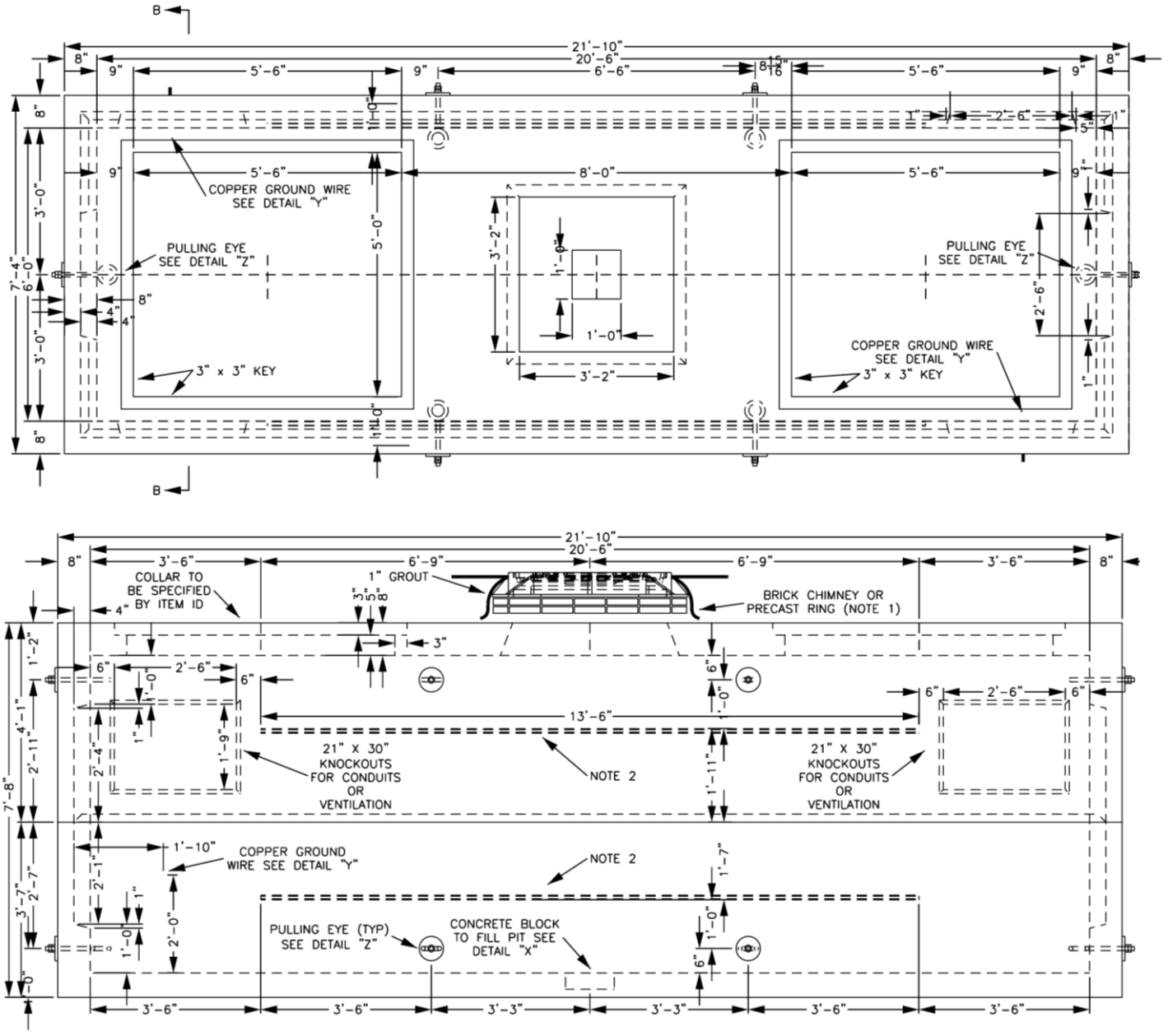
Supersedes 7/19 Issue – Updated pulling eyes.





Designer	Drawing	Date
MPR	MS3478-2	10/30/20
	33-133	
	UM39	

PRECAST CONCRETE MANHOLE – 4-WAY MEDIUM SIZE MANHOLE- 5' x 9' (INSIDE)



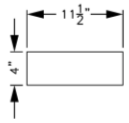
NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–$\frac{5}{8}$"X1–$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

Designer	Drawing	Date
MPR	MS3475–1	10/30/20
	33–134	
	UM30	

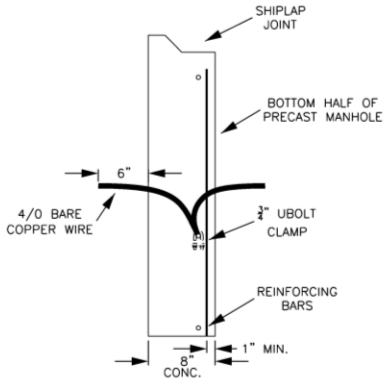
Supersedes 7/19 Issue – Updated pulling eyes.

PRECAST CONCRETE MANHOLE – DOUBLE SWITCHGEAR MANHOLE 6' x 20'–6" (INSIDE)

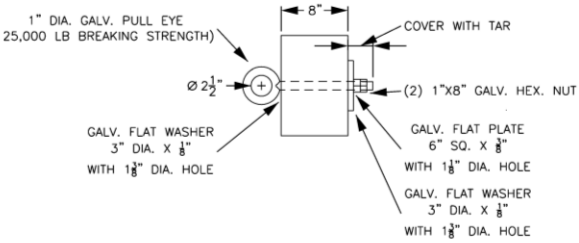
Supersedes 7/19 Issue – Updated pulling eyes.



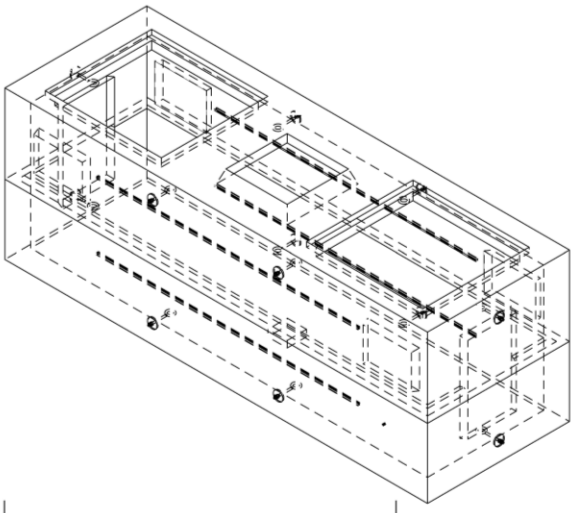
DETAIL "X"
1 REQUIRED

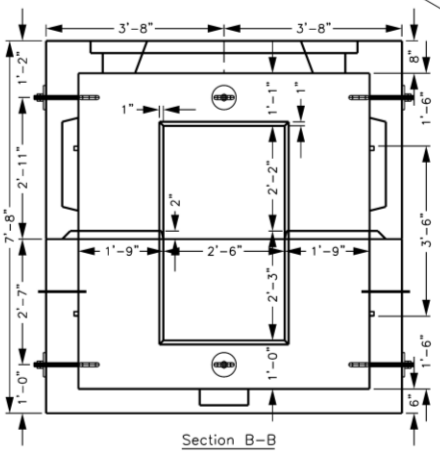


DETAIL "Y"
2 REQUIRED



DETAIL "Z"
12 REQUIRED



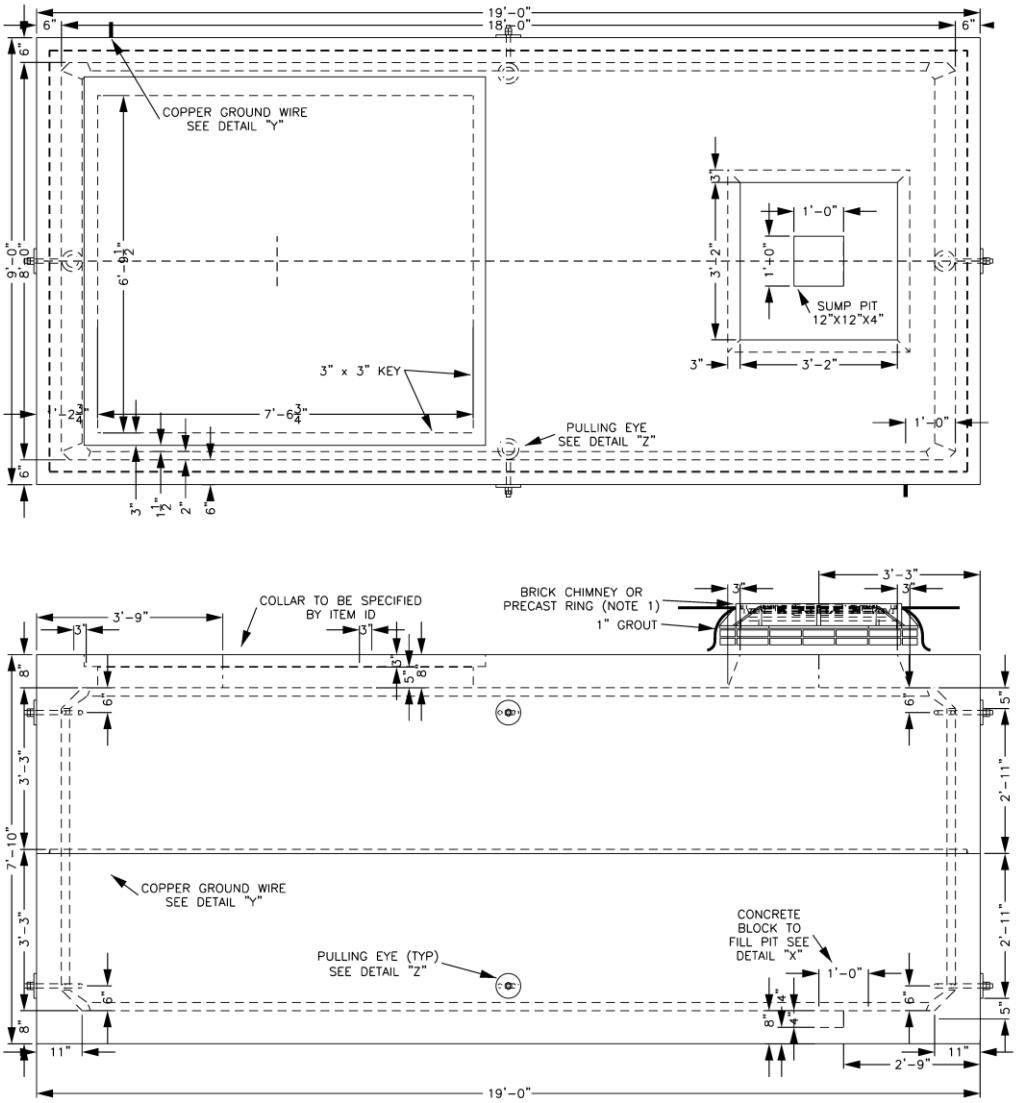


Section B–B

Designer	Drawing	Date
MPR	MS3475–2	10/30/20
	33–135	
	UM30	

PRECAST CONCRETE MANHOLE – DOUBLE SWITCHGEAR MANHOLE 6' x 20'–6" (INSIDE)

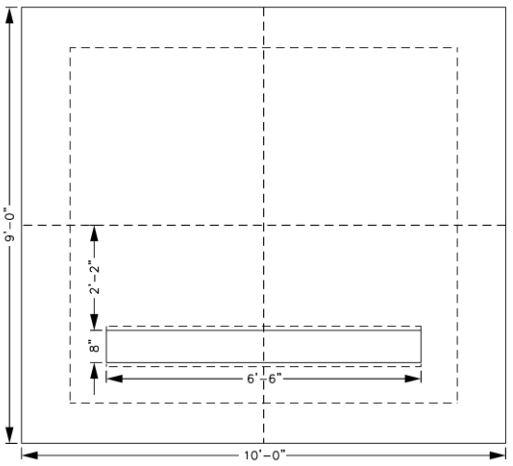
		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	33-135	7/21

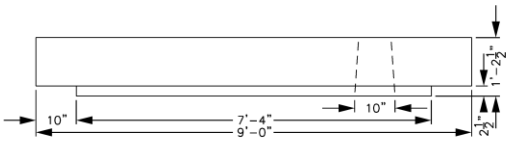


Designer	Drawing	Date
MPR	MS3479-1	11/16/21
	33-141	
	UM41	

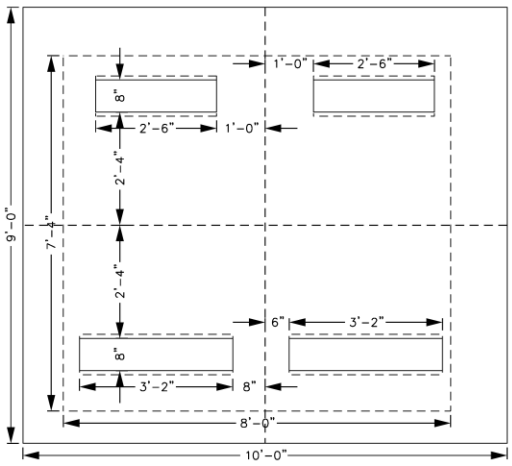
Supersedes 7/21 Issue –Large metering moved to 33-127A, new XL manhole created.

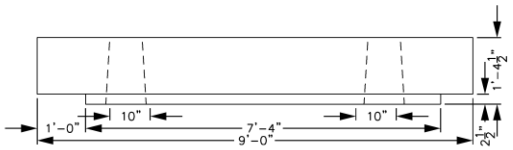
PRECAST CONCRETE MANHOLE – XL SWITCHGEAR MANHOLE 8' x 18' (INSIDE)





COLLAR "K"
HI DUTY RECLOSER US54P27



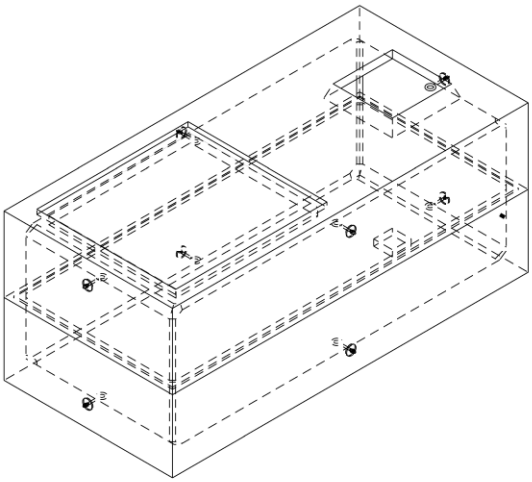


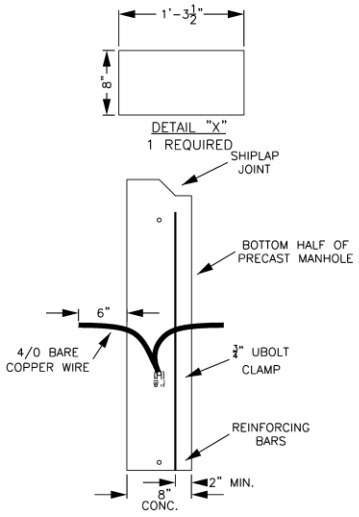
COLLAR "K1"
25kV CLASS HI DUTY LIVEFRONT SWITCHGEAR

Designer	Drawing	Date
MPR	MS3479-2	11/10/21
	33-142	
	UM41	

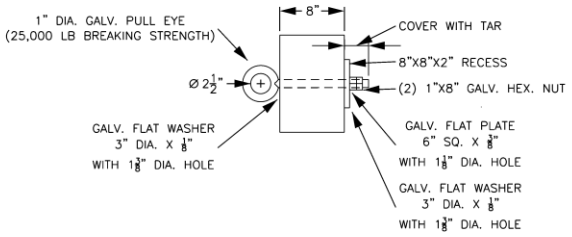
Supersedes 7/21Issue – New drawing for XL manhole.

PRECAST CONCRETE MANHOLE – XL SWITCHGEAR MANHOLE 8' x 18' (INSIDE)





DETAIL "Y"
2 REQUIRED



DETAIL "Z"
8 REQUIRED

Designer	Drawing	Date
MPR	MS3479-3	11/10/21
	41-	
	UM41	

Supersedes 7/21 Issue – Updated drawing.

PRECAST CONCRETE MANHOLE – XL SWITCHGEAR MANHOLE 8' x 18' (INSIDE)			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/22	**33-140**		

Version	Date	Modification	Author(s)	Approval by (Name/Title)
9.1	7/22	• Update section 33.6 manhole uses and table. • Update drawing 33-101, 33-113B 33-127A and 33-129A. • Drawings 33-138 thru 140 replaced, large metering manhole replaced by XL switchgear manhole.		
9	7/21	• Updated 33.0.20.D.4 doweling requirements • Updated manhole/collar application table • Updated drawings 33-103 thru 33-113D, 33-116 thru 33-120B and 33-124 thru 33-140		
8.1	7//20	• Update to sections 33.2.30, 33.5 and 33.6. • Update to drawing 33-112, 33-113A 33-113B, 33-127A and 33-129 • Added drawings 33-138 THRU 140 • Added manhole collar application table to 33.6		
8	7/19	• Update to Manhole use for collar M page 33-12 • Update drawings on pages 33-17, 33-103 thru 33-113D, 33-116 thru 33-121, and 33-124 thru 33-135 • Added drawings 33-97 and 33-98 • Updated drawing on page 33-13 • Added large splice box info to 33-1 • Changed reference to final grade in 33.0.20 #2 • 33-3 Added info on using reinforcing rods to support incoming ducts • 33-14 Added info for double switchgear manhole • General formatting revision		
7	7/18	• Updated manhole drawings • Added drawings 33-134 and 33-135 • Corrected reference to UM39 on 33-12		
6.1	7/18	• Added 33.0.20 G. • Updates to 33.3 conduit sealing. • Update to 33.5 • Update to 33.6 • New Section 33.11 manhole ventilation. • Drawing updates 33-111 and 33-113B		

Version	Date	Modification	Author(s)	Approval by (Name/Title)
6	7/17	• Updated 33.7 to include more information for manhole racks • Updated 33-101 to match material spec		
5	7/16	• Updated 33.2 to clarify use of ground leads. • Revised 33.8 roof maintenance. • Drawing 33-112 updated. • Drawing 33-114 added second anode and ground rod to detail. • Drawing 33-115 added second anode to lower detail. • Drawings 33-126 and 127 replaced with clearer version.		
4	7/15	• Update to 33.0, 33.1, 33.2, 33.6 33.7 and 33.11 • Drawing 33-113 replaced collar D with collar M. • New Drawing 33-126 switchgear manhole 35kV • New Drawing 33-128 switchgear manhole advanced pad mounted • New Drawing 33-130 double entry manhole • New Drawing 33-132 5'x9' manhole • Added additional fire stop requirement in 33.3.10.		
3	7/13	• Updates to 33.0, 33.1, 33.3, 33.4, 33.5. 33.7. 33.8 and 33.9 • New section 33.10 • New Drawings 33-99 and 33-100 • Drawing Updates 33-113, 33-114, 33-115, 33-120 and 33-121.		
2	7/10	• Minor update to 33.0		
1	07/09	• Updated sections 33.1.10, 33.1.70 and 33.3. 4 • Inserted 33.5, 33.6, 33.7and 33.8 (new sections). • Drawing updates pages 33-103 thru 33-111and 33-113. • New drawings on pages 33-116 thru 33-125.		

Supersedes 7/07 Issue - Added Page 34-111.

GENERAL

This Standard is a list of tools and dies to be used when splicing and terminating underground primary and secondary conductors. The number of crimps for each half of the connector is indicated in the table.

34.0 CONNECTORS

All connectors will be tinned and have center oil/water stop. Connectors will be roll marked with crimp lines and die information. Copper connectors are to be used only on copper conductors. Aluminum connectors are used on aluminum conductors, and aluminum to copper transition splices. Reducing connectors shall be of a one piece design, inserts shall not be used. Conductors must be cut square. It is essential to wire brush both aluminum and copper conductors until they are clean and bright. Use different brushes for aluminum and copper, as the copper particles caught in the brush will deposit on aluminum conductors and corrode that conductor. Tables in this Section are for cables with concentric, compressed round or compact conductor stranding only. Other types of stranding may require different connectors.

If other connector sizes are needed, contact Standards Engineering.

34.1 CRIMPING

Circumferential crimping is required on aluminum and is preferred on copper connectors. Crimp the connector, working from the center out. Crimp lugs, working from the top of the barrel to the open end. Make crimps between the guide marks. Die-less indent presses are acceptable and shall be calibrated according to manufacturer's recommendations.

34.2 INSULATING

Where insulating is required, any excess inhibitor from the conductor and connector must be removed before proceeding to insulate. Do not remove inhibitor from the barrel of the connector prior to insertion of the conductor. All voids must be filled with inhibitor. Remove only the inhibitor that is pushed out of the connector barrel after insertion of the conductor and crimping.

34.3 ADAPTERS

Y-35 dies can be used on Y-46 tool. Use Burndy U die with Burndy adapter P-UADP.

Supersedes 2/06 Issue – Update 34.0 & 34.2

CONNECTOR, COMPRESSION, COPPER								
Description	Tinned copper compression connector with center oil / water stop. Designed for joining copper conductors end to end. These connectors are selected to meet the dimensional requirements of all high voltage splice kits used in the company. Splice shall be in accordance with ANSI C119.4, Class A, Class 2 min.							
Wire Size	**BCT 500 / PATMD6814V**		**Y35 / 12 Ton**		**Y46 / 15 Ton**		**Die Index**	**Std. Item**
	Die	****Crimp**	**Die**	****Crimp**	**Die**	****Crimp**		
4	W4CRT	2	U4CRT	2			8	UC60A
2	W2CRT	2	U2CRT	2	*	2	10	UC60B
1/0	W25RT	4	U25RT	2	*	2	12	UC60C
2/0	W26RT	4	U26RT	2	*	2	13	UC60D
4/0	W28RT	4	U28RT	2	*	2	15	UC60E
250 / 250 Comp	W29RT	4 4	U29RT	2	*	2	16	UC60F
300 / 300 Comp	W30RT	2	U30RT	4	*	4	17	UC60H
350 / 350 Comp	W31RT	2	U31RT	4	*	4	18	UC60K
400 Comp	W32RT	2	U32RT	4	*	4	19	UC60L
500 / 500 Comp	W34RT	2	U34RT	4	*	4	20	UC60M
750			U39RT	4	P39RT	4	24	UC60P
1000				4	P44RT	4	27	UC60R

* Use PUADP-1 Adapter with “U” dies in Y-46 Hypress
** Crimps are defined as per side of connector

Supersedes 7/07 Issue – General Revision & Update, Added Die Index Column

CONNECTOR, COMPRESSION, ALUMINUM								
Description	Tinned aluminum compression connector with center oil / water stop. Designed for joining 2 aluminum conductors or copper to aluminum conductors end to end. These connectors are selected to meet the dimensional requirements of all high voltage splice kits used in the company. Splice shall be in accordance with ANSI C119.4, Class A, Class 2 min.							
Wire Size	**BCT 500 / PATMD6814V**		**Y35 / 12 Ton**		**Y46 / 15 Ton**		**Die Index**	**Std. Item**
	Die	****Crimp**	**Die**	****Crimp**		****Crimp**		
2	W241	2	U25ART	2	*	2	296	UC61A
1/0	W241	2	U25ART	2	*	2	296	UC61B
4/0	W660	4	U28ART	2	*	2	298	UC61C
350	W31ART	4	U31ART	4	*	4	299	UC61D
500	**	--	U34ART	4	*	4	300	UC61E
750	**	--	U39ART2	4	*	4	936	UC61F
1000	**	--	U39ART2	4	*	4	936	UC61G

* Use PUADP-1 Adapter with “U” dies in Y-46 Hypress
** Crimps are defined as per side
Note: Do Not use BCT500 on aluminum conductor larger than 350.

Supersedes 7/07 Issue – General Revision & Update, Added Die Index Column

CONNECTOR, COMPRESSION, COPPER REDUCING								
Description	Tinned copper compression connector with center oil / water stop. Designed for joining two different size copper conductors end to end. These connectors are selected to meet the dimensional requirements of all high voltage splice kits used in the company. Splice shall be in accordance with ANSI C119.4, Class A, Class 2 min.							
Wire Size	**BCT 500 / PATMD6814V**		**Y35**		**Y46**		**Die Index**	**Std. Item**
	Die	****Crimp**	**Die**	****Crimp**	**Die**	****Crimp**		
2 Str. to 3 Sol.	W2CRT	2					10	UC62A1
2 to 1/0	W25RT	2	U25RT	1	*	2	12	UC62A2
2 to 4/0	W28RT	2	U28RT	1	*	2	15	UC62A3
2 to 350	W31RT	4	U31RT	2	*	2	18	UC62A4
2 to 500	W34RT	2	U34RT	2	*	2	20	UC62A5
1/0 to 4/0	W28RT	2	U28RT	1	*	2	15	UC62B1
1/0 to 350	W31RT	4	U31RT	2	*	2	18	UC62B2
2/0 to 4/0	W28RT	2	U28RT	1	*	2	15	UC62C1
2/0 to 350	W31RT	4	U31RT	2	*	2	18	UC62C2
3/0 to 4/0	W28RT	2	U28RT	1	*	2	15	UC62D1
4/0 to 250	W29RT	4	U29RT	2	*	2	16	UC62E1
4/0 to 300	W30RT	4	U30RT	2	*	2	17	UC62E2
4/0 to 350	W31RT	4	U31RT	2	*	2	18	UC62E3
4/0 to 450	W33RT	4	U33RT	2	*	2	326	UC62E4
4/0 to 500	W34RT	4	U34RT	2	*	2	20	UC62E5
250 to 350	W31RT	4	U31RT	2	*	2	18	UC62F1
250 to 500	W34RT	4	U34RT	2	*	2	20	UC62F2
300 to 500 Comp.	W34RT	4	U34RT	2	*	2	20	UC62G1
350 to 500 / 500 Comp	W34RT	4	U34RT	2	*	2	20	UC62H1
350 to 750			U39RT	2	P39RT	2	24	UC62H2
450 to 500 Comp.	W34RT	4	U34RT	2	*	2	20	UC62J1
500 / 500 Comp to 750	--	--	U39RT	2	P39RT	2	24	UC62K2
500 / 500 Comp to 1000	--	--	--	--	P44RT	2	27	UC62K4
750 to 1000	--	--	--	--	P44RT	2	27	UC62L1

Supersedes 7/07 Issue – General Revision & Update, Added Die Index Column

* Use PUADP-1 Adapter with "U" dies in Y-46 Hypress
** Crimps are defined as per side

CONNECTOR, COMPRESSION, ALUMINUM REDUCING								
Description	Tinned aluminum compression connector with center oil / water stop. Designed for joining 2 aluminum conductors or copper to aluminum conductors end to end. These connectors are selected to meet the dimensional requirements of all high voltage splice kits used in the company. Splice shall be in accordance with ANSI C119.4, Class A, Class 2 min.							
Wire Size	**BCT 500 / PATMD6814V**		**Y35**		**Y46**		**Die Index**	**Std. Item**
	Die	****Crimp**	**Die**	****Crimp**	**Die**	****Crimp**		
2 Str. to 3 Sol.	W241		U25ART	2	*	2	296	UC63A
2 to #6	W241		U25ART	2	*	2	296	UC63B
2 to 1/0	W241		U25ART	2	*	2	296	UC63C
2 to 4/0	W660		U28ART	2	*	2	298	UC63D
1/0 to 2/0	W245		U26ART	2	*	2	297	UC63N
1/0 to 4/0	W660		U28ART	2	*	2	298	UC63E
1/0 to 350	W31ART	4	U31ART	2	*	2	299	UC63F
4/0 to 350	W31ART	4	U31ART	2	*	2	299	UC63G
4/0 to 500			U34ART	4	*	4	300	UC63H
350 to 500			U34ART	4	*	4	300	UC63J
500 to 750			U39ART-2	4	P39ART-2	4	936	UC63K
500 to 1000			U39ART-2	4	P39ART-2	4	936	UC63L
750 to 1000			U39ART-2	4	P39ART-2	4	936	UC63M

* Use P-UADP-1 Adapter with “U” dies in Y-46 Hypress
** Crimps are defined as per side

Supersedes 2/06 Issue – General Revision & Update, Added Die Index Column

LUG, TERMINAL, COPPER

$^{9}/_{16}$" Holes X 1¾" Spacing

Description	Tinned copper lug with NEMA 2 or 4 hole pad ($^{9}/_{16}$" holes @ 1¾" spacing). Lugs are sealed to prevent water intrusion into the cable. For use on copper cable terminations.

Wire Size	BCT 500 / PATMD6814V		Y35		Y46		Die Index	Std. Item
	Die	**Crimp	Die	**Crimp	Die	**Crimp		
4	W4CRT	2	U4CRT	2	*	2	8	UL15A
2	W2CRT	2	U2CRT	2	*	2	10	UL15B
1/0	W25RT	4	U25RT	2	*	2	12	UL15C
2/0	W26RT	4	U26RT	2	*	2	13	UL15D
4/0	W28RT	4	U28RT	2	*	2	15	UL15E
350	W31RT	4	U31RT	2	*	2	16	UL15K
500	W34RT	4	U34RT	4	*	4	20	UL15M
500 (Stacking)	W34RT	4	U34RT	4	*	4	20	UL15MS
600	**	--	U36RT	4	*	4	22	UL15N
750	**	--	U39RT	4		4	24	UL15P
1000 2 Hole	**	--	--	--	P44RT	4	27	UL15R
1000 4 Hole	**	--	--	--	P44RT	4	27	UL15R4

* Use PUADP-1 Adapter with "U" dies in Y-46 Hypress
** Do Not Use BCT 500 on Copper Conductors Over 500 kcmil

Supersedes 7/10 Issue – General Revision & Update, Added Die Index Column

Supersedes 7/10 Issue – General Revision & Update, Added Die Index Column

LUG, TERMINAL, ALUMINUM

$^{9}/_{16}$" Holes X 1¾" Spacing

Description	Tinned aluminum lug with NEMA 2 or 4 hole pad ($^{9}/_{16}$" holes @ 1 ¾" spacing). Lugs are sealed to prevent water intrusion into the cable. For use on aluminum cable terminations.

Wire Size	BCT 500 / PATMD6814V		Y35		Y46		Die Index	Std. Item
	Die	**Crimp	Die	**Crimp	Die	**Crimp		
4	W162	4	U4CABT	2	*	2	375	UL16A
2	W239	4	U2CABT	2	*	2	348	UL16B
1/0	W241	4	U25ART	2	*	2	296	UL16C
2/0	W245	4	U26ART	2	*	2	297	UL16D
4/0	W660	4	U28ART	2	*	2	298	UL16E
350	W31ART	4	U31ART	2	*	2	299	UL16K
500	**	--	U34ART	4	*	4	300	UL16M
600	**	--	U36ART	4	*	4	473	UL16N
750	**	--	U39ART-2	4	*	4	936	UL16P
1000 2 Hole	**	--	--	--	P44ART	4	302	UL16R
1000 4 Hole	**	--	--	--	P44ART	4	302	UL16R4

* Use PUADP-1 Adapter with "U" dies in Y-46 Hypress
** Do Not Use BCT 500 on Aluminum Conductors over 350 kcmil

TOOLS LISTED IN THIS SECTION CAN ALSO BE FOUND IN THE ON-LINE TOOL CATALOG SECTION OF THE SKY.
http://mawbrapp16v/ToolCatalog

END STRIPPER
Utility Tool Model WS 5 and WS 6
Bushing Application Table

Conductor Size	Voltage Class kV	Insulation Thickness Inches	Diameter Over Insulation ± 0.30 Inches	Tool	Bushing Model # (insulation only)	Bushing Model # (over semicon)
1/0	5	0.115	0.650	WS 5	0.675	0.750
500 kcmil	5	0.115	1.090	WS 5	1.125	1.175
750 kcmil	5	0.115	1.280	WS 6	1.300	1.375
#2	15	0.175	0.695	WS 5	0.700	0.775
4/0	15	0.175	0.920	WS 5	0.950	1.000
350 kcmil	15	0.175	1.080	WS 5	1.125	1.175
500 kcmil	15	0.175	1.210	WS 6	1.225	1.325
750 kcmil	15	0.175	1.400	WS 6	1.425	1.500
1000 kcmil	15	0.175	1.545	WS 6	1.575	1.650
1/0	25	0.260	0.940	WS 5	0.975	1.025
4/0	25	0.260	1.090	WS 5	1.125	1.175
350 kcmil	25	0.260	1.260	WS 6	1.300	1.350
500 kcmil	25	0.260	1.390	WS 6	1.425	1.500
1000 kcmil	25	0.260	1.725	WS 6	1.750	1.850
1/0	35	0.345	1.110	WS 5	1.125	1.200
2/0	35	0.345	1.155	WS 6	1.175	1.250
1000 kcmil	35	0.345	1.900	WS 50	1.925	--

Supersedes 7/10 Issue – Add Column for Insulation Only Bushing.

Supersedes 2/06 Issue – Added Tools, Updated Tool Information, Page Shift

CABLE INSULATION END STRIPPER	
	
Description	For 600 Volt to 35 kV cables, adjustable strip lengths up to 2.5". For use on XLPE and EPR cable insulation.
Tool Catalog Number	MHTUG01
Manufacturer	Ripley Company
Catalog Number	Model WS5B for insulation OD of 0.26" to 1.25" Model WS6 for insulation OD of 0.96" to 1.90"

EXTENSION FOR CABLE INSULATION END STRIPPER	
	
Description	Accessory for WS-6 to increase the strip length to 5.5". Also allows use of the SW2 ratchet wrench.
Tool Catalog Number	NS0000286
Manufacturer	Ripley Company
Catalog Number	WA3

RATCHET WRENCH FOR WS6	
	
Description	Ratchet wrench for WS6 Stripper. Requires WA3 accessory.
Tool Catalog Number	0000588
Manufacturer	Ripley Company
Catalog Number	WA3

ADJUSTABLE JACKET STRIPPER	
	
Description	Universal tool for end stripping or mid spanning outer jackets or insulation. Dual position jaw for cable sizes from½ in. to 2½ in. (12.7 to 63.5 mm) cable O.D. Compact design for tighter work space requirements.
Tool Catalog Number	MHTUG02
Manufacturer	Ripley Company
Catalog Number	WS64-U

ADJUSTABLE BLADE SEMI-CON SCORER	
	
Description	Designed to score the semi-conductive shield of high voltage cable without nicking or damaging the cable. Adjustable blade depth for variations in thickness of 0.001” to 0.100”
Tool Catalog Number	0000158
Manufacturer	Reliable Equipment
Catalog Number	Model 1700-SS

Supersedes 2/06 Issue – Updated Tool Information, Page Shift.

Supersedes 7/07 Issue – Updated Tool Information, Page Shift

LOAD BREAK PROBE WRENCH	
	
Description	Holds the load break probe and acts as a handle while positioning and installing the probe into the threaded eye of the elbow crimp connector. Preset torque rating of 10 ft-lb.
Tool Catalog Number	0000166
Manufacturer	Reliable Equipment
Catalog Number	Model #LPW1525R/TK120X-N for 15 & 25 kV Model #LPW35R/TK120X-N for 35 kV

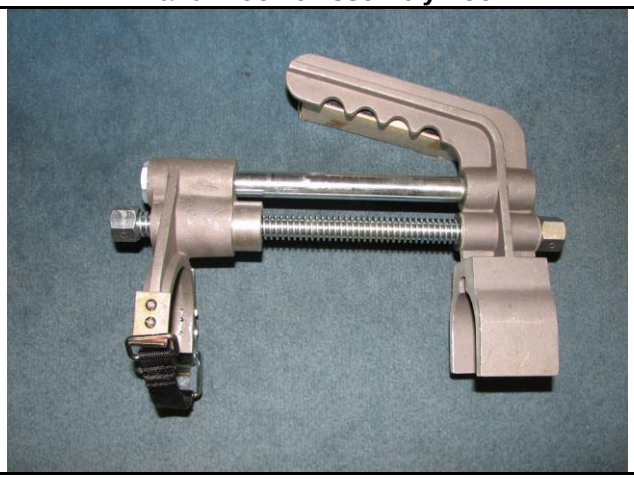
LOAD BREAK BUSHING INSERTION TOOL	
	
Description	For 200 Amp Bushing Well Insert with internal hexagon socket drive. Preset torque setting of 15 ft-lb. Secures Bushing Well Insert for positive installation and removal.
Tool Catalog Number	0000182
Manufacturer	Utility Tool Co.
Catalog Number	Model #LBIT-1T

URD INSULATION CHAMFER TOOL	
	
Description	Creates a 45 bevel approximately 0.125 in. long. For pre-molded splices, elbows and terminations.
Tool Catalog Number	0000554
Manufacturer	Ripley
Catalog Number	Model # IC1 for cable O.D. range 0.650 – 1.260 Model # IC2 for cable O.D. range 1.250 – 1.875 Model # CB163 is a replacement Blade

Cable Adapter / Dead Break Elbow Installation Tool	
	
Description	Installs cable adapters required for 600 amp dead break elbows and premolded Y and H joints. Also installs 600 amp dead break elbow bodies. See Tool Catalog for more information.
Tool Catalog Number	NS0000236
Manufacturer	Speed Systems
Catalog Number	600 TAT

New Page – Added Tools, Updated Tool Information, Page Shift.

New Page – Additional Tools

Y and H Joint Assembly Tool	
	
Description	Assembles premolded Y and H joints. Includes strap to hold tool in place during use. See Tool Catalog for more information.
Tool Catalog Number	NS0000160
Manufacturer	Richards
Catalog Number	P6JAT3

Torque Wrench / Assembly Tool for 600 Amp Dead Break Elbows	
	
Description	Assembles 600 amp Dead Break Elbows. Preset Torque rating. Includes tool for new style connector plugs. See Tool Catalog for more information.
Tool Catalog Number	NS0000075
Manufacturer	Ripley
Catalog Number	TRW5060

Version	Date	Modification	Author(s)	Approval by (Name/Title)
2	07/11	• Update Index Page 34-i • Add Die Index and correct Die Information on Pages 34-100, 34-101, 34-102, 34-103, 34-104, 34-105 • Update Tool Information, Add Tools – Pages 34-107, 34-108, 34-109 • Add new Pages – Additional Tools – Pages 34-110, 34-111		
1	07/10	• Add Standard Item UL15MS Page 34-104 • Correct Crimping Information for Standard Item UL16P on Page 34-105 • Corrected link to Tool Catalog on page 34-106		

Supersedes 7/16 Issue – Updated 35.3, 35.4 and 35.5

35.0 GENERAL

Cables for use in the Company underground system are available in a variety of types. Conductor material is either copper or aluminum. Stranding on most cables is standard or compressed. Compact stranding is used only for special, reduced diameter cables. Insulation for secondary cables is XLPE, except jacketed EPR for network secondary conductors. New medium voltage (1 kV to 35 kV) cable is insulated with EPR (Ethylene Propylene Rubber). Existing stock of XLPE insulated cables can be used up. In service XLPE cables will remain until end of useful life. All medium voltage cables are shielded and include a polyethylene jacket over the concentric neutrals. Single conductor URD cables for direct burial have a semi-conductive jacket to allow random lay with communication cables. Concentric neutrals are #14 copper wire with the exception of reduced diameter cables which use flat strap neutrals. All concentric neutrals are sized to be equal to 1/3 of the ampacity of the conductor. All cables have surface printing indicating the conductor size and material, the voltage rating, the year of manufacture, and the manufacturer. Some cables have footage and phase markings.

All cable installations which are funded and installed by the company shall be placed in conduits. This requirement includes substation feeder get away cables, main line feeder cables (where cables are needed for clearance), customer requests to move facilities underground for aesthetics, etc. This requirement does not apply to URD and UCD installations where the customer is required to make a contribution to construction. These URD and UCD installations may remain with direct buried cables until these requirements are changed by the appropriate regulatory agencies. However, conduit installation is preferred by the company and is allowed if the customer desires to install conduit or if the earth conditions are extremely rocky.

Duct size needs to be carefully considered to avoid duct jamming issues. Select the proper size of duct per the sizing calculations to avoid cable jamming issues. For example, 15kV, 1000 MCM cable fits in 5” conduit but jams in 6” conduit. Duct size calculations are shown in 35.10.20 and also in the Section 32 – Conduit.

The vast majority of standard cables are stocked in lengths of 1000 circuit feet per reel. The notable exception is the #2 15 kV aluminum URD cable, which is 3000 feet per reel. On large projects, it is preferred to determine the pulling lengths and order the cable cut to those lengths. This will limit the amount of short lengths of cable, which are most often scrapped since they are unusable.

All cables available throughout the Company service territories are listed in the Section 50 – Materials Catalog with the corresponding standard item number UC__. See Tables 1 through 8 below. Aerial cables are listed in Table 9.

Supersedes 1/07 Issue – Update last paragraph of 35.0

35.1 STANDARD PRIMARY CABLES FOR NEW CONSTRUCTION

35.1.10 Medium Voltage Cables (Non-URD)

Standard primary cables for new construction should be selected from Table 1. These cables are rated from 15 kV to 35 kV, standard insulation thickness, concentric neutral and insulating polyethylene jacket. These items are triple conductor parallel lay on the reel with the exception of Std. Item UC12TB, which is single conductor. This cable is intended for all new three-phase underground applications. This cable is suitable for direct burial. This cable is not preferred to be direct buried in random lay with communication cables, but, when done so, a bare #2 ground wire shall be laid in close proximity to the power cable. This bare ground wire must be tied in with all grounds, concentric neutrals and bonded to all other services in the trench. Alternatively, the jacket on the cables can be stripped and a ground rod tied in every 600 feet of cable. Cable with a semi-conducting jacket is preferred for random lay installation with communication cables (See 35.1.20). Additional cable information is available in Section 50 – Materials Catalog.

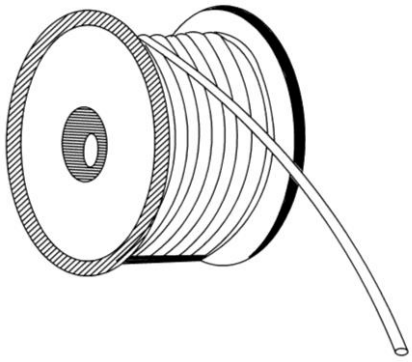


Figure 1
Single Lay Conductor

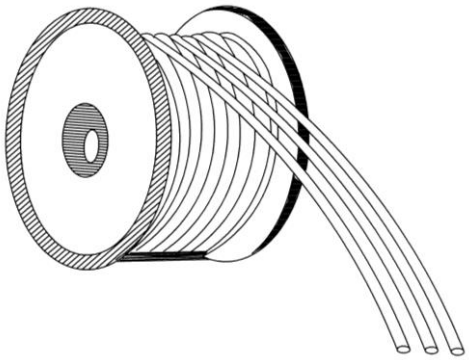


Figure 2
Triple Lay Conductor

Table 1

Voltage (kV)	Conductor	Packaging	Std. Item
15	#2 AL	3-1/C Parallel	UC11BJ
15	#2 CU	1-1/C	UC11BK
15	#2 CU	3-1/C Parallel	UC11BL
15	#4/0 CU	3-1/C Parallel	UC11E
15	350 CU	3-1/C Parallel	UC12F
15	500 AL	3-1/C Parallel	UC12GG
15	500 CU	3-1/C Parallel	UC17
15	750 AL	3-1/C Parallel	UC12HG
15	1000 AL	3-1/C Parallel	UC12TA
15	1000 AL	1-1/C	UC12TB
15	1000 CU	3-1/C Parallel	UC12TC
25	#1/0 CU	3-1/C Parallel	UC23CJ
25	#4/0 CU	3-1/C Parallel	UC23EC
25	350 AL	3-1/C Parallel	UC23FA
25	350 CU	3-1/C Parallel	UC23FJ
25	500 AL	3-1/C Parallel	UC23GA
25	500 CU	3-1/C Parallel	UC23GJ
25	1000 CU	3-1/C Parallel	UC23TC
25	1000 AL	3-1/C Parallel	UC23TA
35	#1/0 AL	1-1/C	UC35C1
35	#1/0 AL	3-1/C Parallel	UC35C3
35	#2/0 CU	3-1/C Parallel	UC35DJ
35	500 CU	3-1/C Parallel	UC35GJ
35	750 CU	3-1/C Parallel	UC35HJ
35	1000 CU	3-1/C Parallel	UC35TC
35	1000 AL	3-1/C Parallel	UC35TJ

Supersedes 1/07 Issue –Updated packaging description, added UC23TC and UC35C1 in Table 1

35.1.20 URD Primary Cables

Primary cables for URD construction shall be selected from standard items as listed in Table 2. Copper conductor cable shall never be used for URD applications. This cable is rated for installation in ducts or direct buried. The cable construction is normal insulation thickness, concentric neutral with a semi conducting jacket. This jacket makes it suitable for either duct or random lay direct buried installations. It is suitable for random lay with communication cables. This cable is single conductor (1-1/C) lay on the reel. Additional cable data is available in Section 50 – Materials Catalog.

Table 2

Voltage (kV)	Conductor	Std. Item
15	#2 AL	UC11BC

35.2 SECONDARY CABLES

35.2.10 Network Systems

Network UG secondary cable shall be selected from cables listed in Table 3. These cables are copper conductor with ethylene propylene rubber (EPR) insulation and a cross linked heavy duty black chlorinated polyethylene (CPE) thermoset compound jacket. This conductor is good for wet or dry locations, 90 degrees Celsius normal temperature and 130 degrees Celsius emergency. This is a premium cable and shall be used only for network secondary systems. It is available for installation in ducts. Refer to Section 50 – Materials Catalog for packaging details and additional cable data.

Table 3

Conductor Size	Packaging	Std. Item
# 2	1-1/C	UC9B
# 4/0	3-1/C Parallel	UC9E3
# 4/0	4-1/C Parallel	UC9E4
300 kcmil	4-1/C Parallel	UC9F4
500 kcmil	1-1/C	UC9G
500 kcmil	4-1/C Parallel	UC9G4

Supersedes 7/09 Issue – text edit for 35.2.10

35.2.20 Non-Network In Ducts

All conventional (radial feed) UG secondary cable shall be selected from standard items as listed in Table 4. These cables are copper conductor with cross linked polyethylene insulation. The normal installation is in ducts of all types, however with the exception of # 2, this cable can be direct buried if necessary. When installed in ducts, check duct size to determine if adequate space exists and that the jam ratio is not a problem. Cables are available single and triple wound. Identification of the neutral conductor shall be by white tape at all termination and splice locations. Additional cable data is available in Section 50 – Materials Catalog.

Do not use 600 V aluminum secondary/service drop cable in conventional duct and manhole systems (URD secondary construction is an exception).

Table 4

Conductor Size	Packaging	Std. Item
# 2	1-1/C	UC5B
# 1/0	1-1/C	UC5C
# 2/0	1-1/C	UC5D
# 4/0	1-1/C	UC5E
350 kcmil	1-1/C	UC5F
500 kcmil	1-1/C	UC5G
750 kcmil	1-1/C	UC5H
# 1/0	3-1/C parallel	UC5C1
# 2/0	3-1/C parallel	UC5D1
# 4/0	3-1/C parallel	UC5E1
350 kcmil	3-1/C parallel	UC5F1
500 kcmil	3-1/C parallel	UC5G1
750 kcmil	3-1/C parallel	UC5H1

35.2.30 URD

URD secondary cable shall be selected from Std. Items UC8__ as listed in Section 50 – Materials Catalog. These cables consist of cross linked polyethylene insulated aluminum conductors, triplexed together, suitable for installation in ducts or direct buried. The neutral is designated by 3 yellow stripes placed longitudinally along the insulation 120 degrees apart. New installations are in PVC conduit. Older installations may be found direct buried. Additional cable data is available in Section 50 – Materials Catalog.

Supersedes 7/09 Issue –Text edit for 35.2.30.

35.3 REDUCED DIAMETER CABLES

Several medium voltage cables have been specially designed to fit in existing, non-standard duct systems. The available cables are listed in Table 5. All cables are 3-1/C, copper conductor, compact stranding, and flat strap neutrals with polyethylene or polypropylene jacket. Thicknesses of all components have been reduced to allow installation in older, small size ducts. Additional cable data is available in Section 50 – Materials Catalog.

Table 5

Voltage (kV)	Conductor	Std. Item	Minimum Conduit ID
5	500	UC7G1	3”
15	500	UC16G	3 ½”
25	3/0	UC23ED	3 ½”
25	350	UC23GG	3 ½”
25	400	UC23GK	3 ½”
25	500	UC23GL	4”
35	400	UC33GK	4”
35	500	UC33GJ	4”

35.4 REPLACEMENT CABLES for PAPER INSULATED, LEAD COVERED (PILC) CABLES

This section has been removed since use of PILC cables has been discontinued. For replacement and repair of PILC cables, reduced diameter cables in Section 35.3 are installed and spliced using heat shrink transition splices.

Supersedes 7/09 Issue – Modify Table 5 (25kV – 3/0). Removed Section 35.4

35.5 SPECIAL USE CABLES

35.5.10 Jacketed Concentric Neutral

This section has been removed. Solid dielectric cables with a lead sheath have been discontinued. Use standard medium voltage cables in Section 35.1 and 35.3 for replacement and repairs.

35.5.20 PILC

This section has been removed since use of PILC cables has been discontinued. For replacement and repair of PILC cables, reduced diameter cables in Section 35.3 are installed and spliced using heat shrink transition splices. Primary leads for older network transformers that are made of PILC can be replaced by solid dielectric cable using encapsulant re-gel compound.

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35.6 OBSOLETE CABLES

35.6.10 Concentric Neutral

There is one 23kV, 750 kcmil, aluminum, concentric neutral cable (Std. Item UC23HJ) which has been determined as obsolete, use for repair only. It is currently stocked only in Buffalo. There are no plans to order any more cable of this size. It is acceptable to use up the remaining cable for repairs. This cable shall not be used for new construction.

35.6.20 Drain Wire Shield

Most drain wire shielded cables have been determined to be obsolete, with two specific items remaining in inventory for specific location repairs. This cable shall not be used for new construction. Standard, jacketed, concentric neutral cable shall be used for all new construction.

Supersedes 7/09 Issue – Removed Section 35.5.10 and 35.5.20

35.7 AERIAL CABLE

There are several pre-assembled aerial cables available (Std. Item A60__), listed in Table 9. This cable is rated 15 through 35kV, EPR insulated, jacketed concentric neutral, 3 phase construction with an EHS copperweld messenger held together with a covered copper binding tape. Older cable is copper or cupro-nickel tape shielded and may or may not be jacketed. The messenger can be utilized as the neutral conductor. The messenger shall be bonded to the secondary neutral, if present, at every pole. The messenger shall be bonded to a driven ground rod a minimum of every 800 feet. See Section 16 – Aerial/Spacer Cable in the Overhead Construction Standards Manual for installation and sagging instructions.

If the cable is a copper or cupro-nickel tape shielded construction see Section 36.2.30 and 36.2.60 for splicing, Section 36.7 for splice grounding and bonding and Section 37.1.60 for termination instructions.

Other applications which require an aerial cable shall be referred to Standards Engineering for cable selection and design.

Table 9

Voltage (kV)	Conductor	Messenger	Std. Item
15	4/0 CU	7/16”	A60E
15	500 AL	7/16”	A61GA
23	350 AL	7/16”	A61FA
23	500 CU	7/16”	A61G
35	2/0 CU	7/16”	A62D
35	350 CU	7/16”	A62F
35	500 CU	1/2”	A62G

35.8 SUBMARINE CABLE

There are two standard submarine cables available (Std. Items UC12BL and UC12BR). Both of these cables are single phase, #2 aluminum, 15 kV, with a concentric neutral.

Std. Item UC12BL is intended for crossing lakes, ponds or other bodies of water which have no flowing water. This cable has 22 #12 BWG aluminum armor wires applied over the insulation semi-conducting layer. These armor wires are used as the neutral conductor.

Std. Item UC12BR is intended for crossing streams, rivers or other waterways which have flowing water. This cable has (10) # 14 copper wires over the insulation semi-conducting layer. These #14 copper wires are the concentric neutral. There is an additional semi-conducting jacket over the concentric neutrals, and then a layer of #12 BWG galvanized steel armor wires. The armor wires shall be bonded to the ground grid / system neutral at riser locations. However, make sure to connect the copper concentric neutrals to the system neutral at all risers since the steel armor wires are not an effective neutral conductor.

Other applications which require a submarine cable shall be referred to Standards Engineering for cable selection and design.

Supersedes 7/09 Issue – Modified Table 9. Added 15kV 500 AL

35.9 CABLE STORAGE AND HANDLING

Standard reels are of wood construction and most are non-returnable. Steel reels are available at an additional charge. Steel reels should only be ordered on specialty types of cable or any assurance cables that are to be in storage for a long period of time. All reels should be stored on the flanges, never laid on the side. Lifting with forklift trucks shall be with a lifting rod, instead of the forks, through the center hole in the flanges, or, if necessary, from the side of the reel, with the forks bearing on the flanges. Never lift the reels from one flange or place the forks against the cable. Store cable reels on solid ground, preferably on concrete pads or pressure treated planks. Use chocks to secure the reels from rolling. Lifting reels with an overhead crane or boom truck may be accomplished by placing an arbor through the reel holes and attaching the sling to the arbor. Utilize a spreader or make the sling sufficiently long to prevent damage to the flanges of the reel.

All cable ends shall be sealed up from the elements at all times. Four sizes of cold shrink end caps (Std. Item UC90) are available. These caps will fit on all Company cables. Immediately after cutting a cable, install a cold shrink end cap on each end. Water intrusion into the strands of the conductor or between the shield and the jacket causes cable damage and will lead to future cable failures. Moisture in the air, humidity, can be driven into the open ends of cable as the air pressure constantly changes. Storage of cables inside does not keep water out of the cable, unless cold shrink end caps are installed. Wrapping the cut ends of cables with electrical tape is not adequate. See Section 35.12.

35.10 CABLE INSTALLATION

Shielded power cable must be installed in properly sized and installed ducts to avoid damage during installation. Larger is not necessarily better. The work methods, including pulling tensions, are also critical to allow for proper, damage free cable installation and for future operation.

The ultimate pulling tension / sidewall pressure of the cable, or tension on the grip used, must not be exceeded. Perform all the following calculations found in Sections 35.10.10 to 35.10.30 on each run of cable. Work methods which can be employed to reduce these values are: Clean ducts before pulling cable, properly and adequately lubricate the cable, properly size the ducts to avoid the jam ratio, locate the cable reel close to the bends, pull cable down riser pipes, and pull downhill if possible.

Supersedes 1/07 Issue –Change number of caps in first line of second paragraph of 35.9; text shift

35.10.10 Bending Radius

Insulated power cable, especially shielded cable, can be damaged by bending too sharply. Sharp bends also increase pulling tension, increasing the likelihood of inflicting cable damage. The minimum bending radius is a multiple of the outer diameter of the cable. Refer to Table 10 for the minimum bending radius for different types of cables.

Table 10

Type of Cable	Minimum Bending Radius
Secondary, non network	4 X OD
Secondary, network	5 X OD
Medium Voltage, tape shielded	12 X OD
Medium Voltage, concentric neutral	8 X OD

35.10.20 Duct Sizing / Jam Ratio

For new construction, first determine the cable to be installed and then size the conduit to accommodate that cable. It is possible to oversize the conduit to allow for future replacement with larger cable. However, care must be used to avoid the jam ratio when over-sizing the conduit. Cables may jam in the conduit during installation if the ratio of the duct ID to the cable OD (D/d) is between 2.8 and 3.2. For instance, 6 inch conduit would seem to be the best conduit to use since it appears to accommodate all cable sizes and voltages. But 15 kV, 1000 kcmil cable is within the jam ratio range for 6 inch conduit (D/d is 6.25/1.98 = 3.15). Six inch conduit should only be installed for circuits requiring 1000 kcmil 23 kV or 1000 kcmil 35 kV cable. The normal clearance between the duct and cable is a minimum of ¾ inch, but this can be reduced to ½ inch if needed. The approximate size of parallel cable assemblies is given by the following formula, where OD is the individual cable outer diameter:

Total diameter of 3 parallel cables = OD X 2.16

If the exact OD of 3 parallel cables is needed, the following formula can be used:

Where:

1. c is the clearance
2. D is the inside diameter of the duct
3. d is the outside diameter of an individual cable

$$c = \frac{D}{2} - 1.366 * d + \frac{D-d}{2} * \sqrt{1 - (\frac{d}{D-d})^2}$$

If the calculated clearance is less than ¾ inch, a mandrel the same size as the ID of the conduit must be pulled through the conduit prior to cable installation.

Refer to Section 32 – Conduit for more information.

Supersedes 1/07 Issue – Change Table number to 10, update last line of 35.10.10; Text Shift

35.10.30 Pulling Tension

Allowable pulling tensions shall never be exceeded, to prevent inflicting damage on the cables during installation. The tensions in this Standard are in accordance with AEIC publication G5-90 Underground Extruded Power Cable Pulling Guide. Three single-phase cables with a separate, bare neutral can generally be considered as three cables.

Cables may be pulled using pulling eyes or basket grips. When using basket grips, the safe working limit of the grip must not be exceeded.

Pulling eyes may be installed by either the factory or the field. Compression type eyes are used for aluminum conductors. Compression or solder type eyes are used for copper conductors. When using pulling eyes, the strength of the eye and the tensile strength of the conductor must be considered. When three cables are pulled with three eyes, the total load is assumed to be carried by two of the cables.

When using basket grips the cable should be cleaned and two half-lapped layers of friction tape wrapped over the cable before the grip is installed. The back end of the grip should be secured with a steel band or equivalent device. Upon completion of the pull, the cable should be cut off a minimum of 2 feet beyond the end of the basket to eliminate any potentially damaged cable.

Pulling lubricant (compound), (Std. Item UC75), shall be used for all pulls regardless of length, or the number or severity of bends.

The information needed to calculate the pulling tension, along with examples, follows. For more assistance, contact Distribution Engineering Services. Table 16, with notes, contains some typical permissible pulling lengths for URD/UCD cables.

A. Calculated Pulling Tension

Pulling tensions anticipated for an installation are determined by cable size, weight, length of run, and number and angle of bends. Usually only approximations can be made, based on the following simple assumptions, giving safe guideline limits. The pulling tension must be calculated in sections, from the reel to the pulling point.
Calculation for different sections:

1. Pulling Straight Horizontal Run:

$$T = W \times L \times N \times CF$$

Where:
T = tension in pounds
W = cable weight in pounds / foot
L = length of run in feet
N = number of cables
CF = coefficient of friction

The coefficient of friction will vary between 0.3 (well lubricated cables / new, smooth wall ducts) to 0.5 (well lubricated cables / rough or dirty ducts).

Supersedes 1/07 Issue –Modify first & fifth paragraph and add paragraph 6 to 35.10.30; text shift

2. Pulling Bends:

The multiplying factors, shown below, must be used to estimate the increase in tension due to pulling around bends. The tension at the point just ahead of the bend is multiplied by the appropriate factor from the table with the result being the tension that exists immediately past the bend. This factor must be applied in the calculation of the estimated pulling tension at each point where the cable encounters a bend as it is pulled. The multiplying factor for the bend is determined from Table 11. It is a function of the coefficient of friction and the angle of the bend. The tension at the exit of the bend is equal to the tension at the entrance of the bend multiplied by the factor from Table 11.

$$T_{\text{EXIT OF BEND}} = T_{\text{ENTRANCE OF BEND}} \times F$$

Table 11

Coefficient of Friction	Angle of Bend (degrees)					
	15°	**30°**	**45°**	**60°**	**75°**	**90°**
0.3	1.08	1.17	1.27	1.37	1.48	1.60
0.4	1.11	1.23	1.37	1.52	1.69	1.87
0.5	1.14	1.30	1.48	1.69	1.92	2.19

Multiplying Factor (F) for Bends

The highest tension will be at the pulling eye or grip. To determine the ultimate tension on a pulling section, calculate the tension in each section. The tension at the beginning end of the duct will be zero (assuming that the cable is manually pulled off the reel or a powered reel is used). The tension at the end of each section is the tension for the beginning of the next section. The tension at the end of the last section must then be compared to Tables 12 through 15 to determine if the pulling eye, pulling grip and cable can withstand that tension without damage.

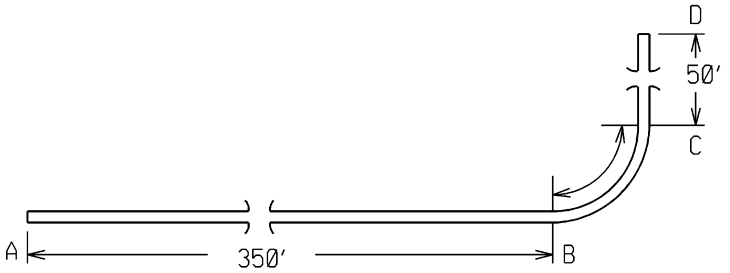


Figure 3

B. Pulling Tension Example Calculation:

Install 3 – 1/C #2 aluminum, 15 kV Concentric Neutral cable in horizontal duct shown in Figure 3. Cable weight is 500 lbs/1000 ft. (W = 0.5 lbs/ft; CF = 0.4; F = 1.87, cable hand pulled off reel so $T_{POINT\ A} = 0$)

With the reel at Point A, Pulling winch at Point D

$T_{POINT\ B}$ = $T_{POINT\ A}$ + W x L x N x CF
= 0 lbs + 0.5 lbs/ft x 350 ft x 3 cables x 0.4
= 210 lbs.

$T_{POINT\ C}$ = $T_{POINT\ B}$ x F
= 210 lbs x 1.87
= 392.7 lbs

$T_{POINT\ D}$ = $T_{POINT\ C}$ + W x L x N x CF
= 392.7 lbs + 0.5 lbs/ft x 50 ft x 3 cables x 0.4
= 392.7 lbs + 30 lbs
= 422.7 lbs.

Therefore, the tension on the winch and ultimate tension on the cable is 422.7 lbs.

If we move the reel to the other end, point D and the winch to point A we get (all other conditions equal):

Now $T_{POINT\ D}$ = zero

$T_{POINT\ C}$ = $T_{POINT\ D}$ + W x L x N x CF
= 0 + 0.5 lbs/ft x 50 ft x 3 cables x 0.4
= 30 lbs

$T_{POINT\ B}$ = $T_{POINT\ C}$ x F
= 30 lbs x 1.87
= 56.1 lbs

$T_{POINT\ A}$ = $T_{POINT\ B}$ + W x L x N x CF
= 56.1 lbs + 0.5 lbs/ft x 350 ft x 3 cables x 0.4
= 56.1 lbs + 210 lbs
= 266.1 lbs

The second scenario shows that positioning the cable reel close to the bends reduces the total pulling tension.
Now check the total calculated pulling tension to the eye / grip / cable limits in Tables 12 through 15 to be sure that the equipment is capable of the pull and that the cable will not be damaged.

Supersedes 1/07 Issue –Increase Table reference number by 1; text shift

Table 12
Single Cable Pulled With A Single Eye Or Grip
Maximum Allowable Tension (Pounds)

With Pulling Eye (All Cables)

SIZE	COPPER		ALUMINUM
	SOLDER EYE	COMPRESSION EYE	COMPRESSION EYE
#2	863	730	531
1/0	1372	1161	844
4/0	2751	2328	1693
250	3250	2750	2000
350	4550	3850	2800
500	6500	5500	4000
750	9750	8250	6000
1000	13000	11000	8000

With Pulling Grip - Max Tension Varies By Cable Type*

Conductor Size	COPPER		ALUMINUM	
	Secondary	Primary	Secondary	Primary
#2	863	863	730	730
1/0	1372	1372	1161	1161
4/0	2000	2751	2000	2328
250	2000	3250	2000	2750
350	2000	4550	2000	3850
500	2000	6500	2000	5500
750	2000	9750	2000	8250
1000	2000	10000	2000	10000

Supersedes 7/07 Issue – Increase Table reference by 1; Text Shift

Table 13
Three Cables Pulled With Three Eyes Or Grips
Maximum Allowable Tension (Pounds)

With Pulling Eye (All Cables)*

SIZE	CU CONDUCTOR		AL CONDUCTOR
	SOLDER EYE	COMPRESSION EYE	COMPRESSION EYE
#2	1726	1460	1062
1/0	2743	2321	1688
4/0	5502	4655	3386
250	6500	5500	4000
350	9100	7700	5600
500	13000	11000	8000
750	19500	16500	12000
1000	26000	22000	16000

With Pulling Grip (All Cables)*

SIZE	CU CONDUCTOR	AL CONDUCTOR
#2	1726	1460
1/0	2743	2321
4/0	5502	4655
250	650	5500
350	9100	7700
500	13000	11000
750	19500	16500
1000	20000	20000

* Do Not Exceed the Maximum Safe Working Load of the Grip

Supersedes 7/07 Issue –Increase Table reference number by 1; text shift

Table 14
Three Cables Pulled With A Single Grip
Maximum Allowable Tension (Pounds)

With Pulling Grip (All Cables)*

SIZE	CU CONDUCTOR	AL CONDUCTOR
#2	1726	1460
1/0	2743	2321
4/0	5502	4655
250	6500	5500
350	9100	7700
500	10000	10000
750	10000	10000
1000	10000	10000

* Do Not Exceed The Maximum Safe Working Load Of The Grip. The maximum allowable sidewall bearing pressure varies by cable construction type. These sidewall bearing pressures by cable type are listed in Table 14.

Table 15
Maximum Sidewall Bearing Pressure by Cable Type

Construction	(Lbs/Ft)
Network Secondary, EPR/CSP, 600 V	1,000
All other Secondary, XLPE, 600 V	1,200
Primary Cable, EPR, Concentric Neutral	2,000
Primary Cable, EPR, Flat Strap Neutral	2,000

Supersedes 7/07 Issue – Increase Table Index by 1; Text Shift

Table 16
URD/UCD Cable Installation Maximum Pull Chart

Straight cable pull chart typical maximum pulls						
	15kV Class			35kV Class		
Wire Size	Riser to Pad	Riser to Pull Box	Pull box to Pull Box	Riser to Pad	Riser to Pull Box	Pull box to Pull Box
#2 AL	530	605	750	n.a.	n.a.	n.a.
1/0 AL	n.a.	n.a.	n.a.	320	360	750
2/0 CU	n.a.	n.a.	n.a.	615	695	750
4/0 CU	695	720	750	n.a.	n.a.	n.a.

Notes to Table 16:
1) All Calculations are based on straight pulls
2) All conduits are 4”
3) Assume 50Lb reel drag
4) Assume .5 for coefficient of friction
5) Pulls are in feet
6) Pulls distances are shown from worst case pulling end.

35.11 NEUTRAL PRACTICE

The preferred primary cables are constructed with concentric neutrals, either #14 round wires or equivalent flat straps. Separate neutrals are not required for circuits utilizing these cables.

Circuits with cables which have other metallic shielding types (drain wire - any wire smaller than #14 - or copper tape) require a separate neutral. The separate neutral shall be 4/0 copper, 600 volt insulated cable (Std Item UC5E). The number of separate neutrals required in a ductbank is listed in Table 17 below.

Table 17

Number of Circuits with Drain Wire or Copper Tape Shields	Number of 4/0 Neutrals
1	1
2-4	2
5 or more	3

All neutrals shall be connected together in each manhole. Each neutral shall be separately connected to the substation ground grid for substation feeder get away cables.

The neutral of all cables spliced in a manhole shall be bonded to ground in that manhole. The neutrals shall be connected to the manhole ground bus. Refer to Section 33.2.40 for details. If there is no ground bus in the manhole, one shall be installed.

Supersedes 7/09 Issue – Updated reference in 35.11 to 33.2.40

35.12 END CAPS

All cables shall have cold shrink end caps installed when the cable is cut. Four end cap sizes are available which will fit all Company cables (Std. Item UC90_). Left over cable on reels shall also have end caps installed. Water intrusion into the conductor or neutral strands promotes future cable failure. Clean the jacket on the end of the cable prior to installing the end cap. Hold the cap firmly against the end of the cable while removing the core to achieve the best seal. See Section 35.9.

35.13 ARC & FIRE PROOFING CABLES

The installation of arc and fireproofing materials on cables and splices located in manholes and vaults will limit cable damage from faults within the manhole or vault. Arc and fireproofing shall be installed per the following:

- NETWORK MANHOLES (any manhole with primary or secondary for a network system) – all cables and splices above 600 V.
- MANHOLES CONTAINING CIRCUITS ABOVE 10 kV – all cables and splices above 10 kV when another circuit above 1000 V is present in the same manhole.
- OTHER MANHOLES AND AREAS – When deemed necessary by the Operating Department due to field conditions.

Wipe the cables off with rags to remove most dirt and dust. Wipe with cable cleaner and degreaser (Std. Item UC80F) to remove remaining dirt, grease and oil. Allow to air dry.

Cover the entire length of the cable with ½ lapped layer of arc and fireproofing tape (Std. Item T1F) as shown in Figure 4. To form a continuous wrap, the cable will have to be lifted off of racks or supports. When starting a new roll of tape, overlap the previously applied tape by at least six inches. Tape is available in two widths. Choose the width which best conforms to the cable.

Table 17 gives the approximate number of rolls of tape needed for different cable configurations. Each roll of tape is 20 feet long.

Apply a random wrap of glass cloth tape (Std. Item T1G5) as shown in Figure 4 to hold the arc and fireproofing tape in place.

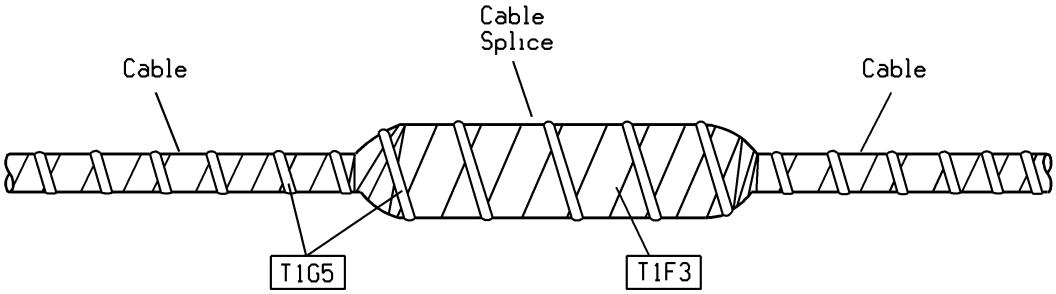


Figure 4

Table 18
Fireproofing Tape – Quantities Required

Cable Diameter * (Inches)	Tape Width (Inches)	No. Rolls Per 100' Of Cable
1	1½	21
1½	1½	32
2	3	21
3	3	32
4	3	42
5	3	53

Supersedes 7/07 Issue – Change Table to 18; Text Shift

35.14 CABLE AMPACITY

Cable ampacity is determined by a combination of conductor size, conductor material and the ability of the cables to dissipate heat. The dissipation of heat is affected by other sources of heat, including other cables. The allowable cable ampacity therefore varies widely due to different cable arrangements, duct bank configuration, cable loadings, adjacent duct banks, burial depth, ambient temperature, season of the year, etc.

Some examples of cable ampacity for 3 common sizes of main line cables are shown below. Keep in mind that the actual configuration of the particular duct bank as well as the loading of all circuits in the subject duct bank and any other heat source (including other electrical duct banks) within 10 feet in any direction will affect the allowable loading.

Contact Distribution Engineering Services for detailed ampacity ratings of any configuration if needed.

35.14.10 Ampacity Examples

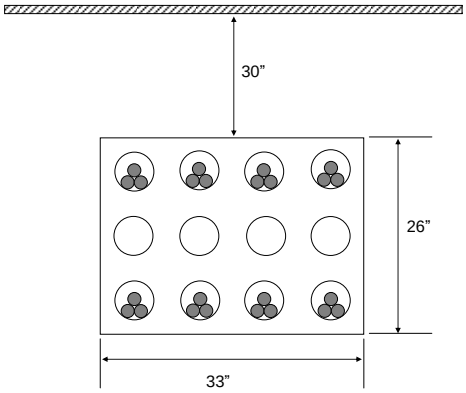
For each example the duct banks are constructed with 5-inch PVC conduits encased in concrete. These calculations presented are for estimating purposes only since actual field conditions are likely to be different. It has been assumed that there are no other heat sources within 10 feet of the ductbank(s) (steam pipes, other electric utility ducts, etc.). If cables are arranged differently (more cables, less cables, different arrangement, etc.), the cable ratings will change.

The emergency ratings are calculated for one circuit carrying the emergency ampacity with the other circuits carrying normal ampacity. Burial depth is assumed to be a minimum of 30".

Standard cables used in the examples are:

Cable	Standard Item
750 Al	UC12HG
1000 Al	UC12TA
1000 Cu	UC12TC

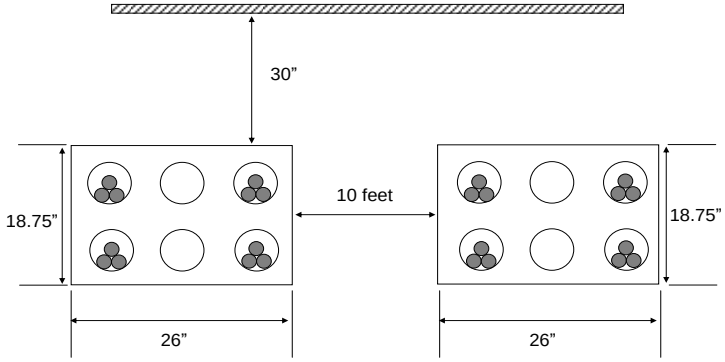
EXAMPLE 1: 12-way ductbank with 8 circuits:



Duct Bank Configuration	Conductor	Ampacity			
		Winter		Summer	
		Normal	Emerg. (24 hrs)	Normal	Emerg. (24 hrs)
12 Way	750 Al	306	490	272	472
	1000 Al	360	576	323	556
	1000 Cu	433	716	389	668

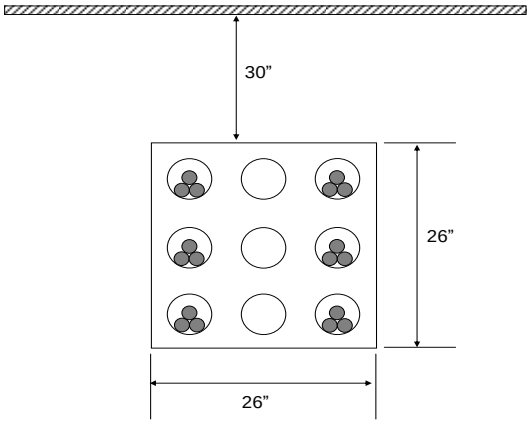
Supersedes 7/07 Issue – Text Shift

EXAMPLE 2: Two 6-way duct banks, each with 4 circuits – these duct banks are separated by 10' and go to different manholes:



Duct Bank Configuration	Conductor	Ampacity			
		Winter		Summer	
		Normal	Emerg. (24 hrs)	Normal	Emerg. (24 hrs)
2-6 Way	750 Al	403	549	361	523
	1000 Al	471	644	424	614
	1000 Cu	568	774	511	738

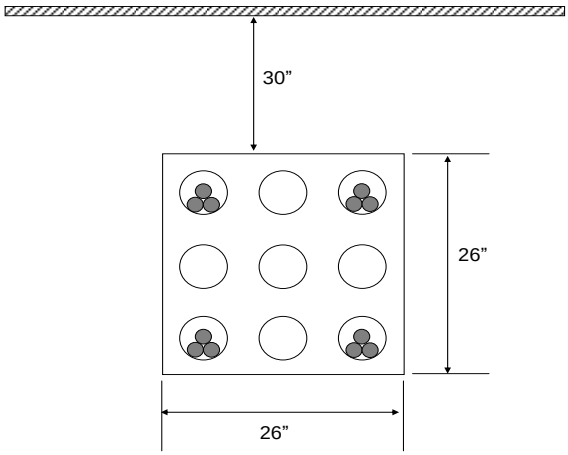
EXAMPLE 3: 9-way duct bank with 6 circuits:



Duct Bank Configuration	Conductor	Ampacity			
		Winter		Summer	
		Normal	Emerg. (24 hrs)	Normal	Emerg. (24 hrs)
9 Way	750 Al	350	516	313	494
	1000 Al	410	605	369	581
	1000 Cu	494	727	444	698

Supersedes 7/07 Issue – Text Shift

EXAMPLE 4: 9-way duct bank with 4 circuits:



Duct Bank Configuration	Conductor	Ampacity			
		Winter		Summer	
		Normal	Emerg. (24 hrs)	Normal	Emerg. (24 hrs)
9 Way	750 Al	418	559	375	531
	1000 Al	490	655	441	624
	1000 Cu	590	788	531	750

Supersedes 7/15 Issue – Updated text in 35.15

35.15 CABLE RACKING

The preferred arrangement in a manhole with a splice is to loop the manhole or vault with cable and put the splice on the long wall opposite the duct entrances. This arrangement will allow some extra cable for future repairs. Cables in manholes or vaults shall be neatly arranged and secured on cable racks designed for the purpose. Cables shall be arranged to prevent stress on the cable at the duct mouth. Cables will attempt to move due to load cycling and fault currents therefore they must be adequately restrained to prevent movement which will cause mechanical stress on the cable and eventual cable failure. See Section 36 for splices and Section 37 for terminations.

New polymer cable saddles have been set up in stock (Std. Item UM17S-SAP # 9392529 and Std. Item UM18S-SAP # 9392545) that can be attached to stanchion and unistrut cable support arms and allow a zip tie to be installed through. Cable ties (Std. Item P27TA) used with porcelain arm supports (Std. Items UM17L, UM17M, UM18A and UM18B) may be utilized to restrain cables with other style support arm.

Figure 4A

35.16 CABLE IDENTIFICATION TAGS

35.16.10 Primary Cables

All primary cables shall be identified at each access point (such as handhole, manhole, vault or pullbox) and at every termination. Individual tags are available with a variety of phrases (e.g.: “To Riser”, “B Phase”, “To MH”, “XMFR”), See Std. Item UP21P. The circuit number may be omitted from radial URD / UCD cables. The circuit number can be omitted in looped URDs when both or all risers that feed the system are supplied from the same circuit.

A. Manhole, Vault, Handhole, Pullbox:

The required identification shall include the circuit number and the next location where the cable can be accessed. The next location shall be placed adjacent to each entrance and / or exit. It is recommended to place the circuit number in a location where it can be viewed from above the hole. Other locations may be used according to local practice, as long as the circuit identifier is somewhere on the cable(s). Phase tags should be installed where the phase is known. On cables with two or three phases, all labels shall be installed on each phase unless the cable is fireproofed or the cables are otherwise bundled to indicate that they go together.

Where a cable circuit bifurcates or trifurcates, each section of cable shall have a unique identifier – such as 2391X & 2391Y or 13L1X and 13L1Y.

B. Terminations (Including Elbows):

The required identification shall include the circuit number, the next location where the cable can be accessed and the phase. The tags shall be located immediately below the termination, but not on the termination itself. For 3 phase loop feed transformers, the bushing (H1A, H2A, etc) shall be included in the tag. Where the three phases of a circuit are bundled together, only one label with the circuit number and the next location is required.

C. Switchgear:

For switchgear installations the circuit number, the next location where the cable can be accessed and the phase shall be placed immediately below the termination. It is acceptable to place the circuit number and the next location on the inside of the door for the compartment and not place them on the cables. The phase label is still required on each cable. For switchgear installed on a switchgear manhole, the circuit and the next location where the cable can be accessed shall also be placed on the cables in the manhole, as required in ‘A’ above. In this case, the next location label below the termination may be eliminated.

A complete selection of numbers and letters, 3 sizes of tag holders, various phrase tags and cable ties can be found in Section 50 – Materials Catalog (Std. Item UP21_).

Supersedes 7/15 Issue – Updated text in 35.16.10 First paragraph

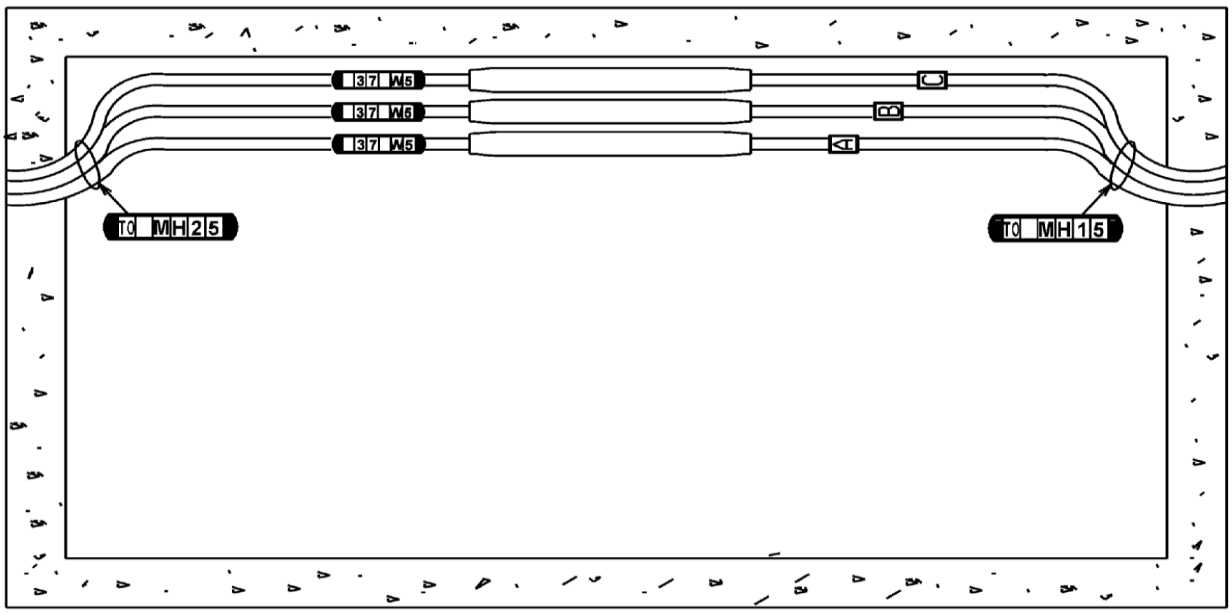


Figure 5

35.16.20 Secondary Cables

A. Company Owned Cable:

The labelidentifies Company owned 600 V secondary cable. The dash followed by a number, e.g. 15, identifies the transformer / manhole / handhole that the cable goes to.

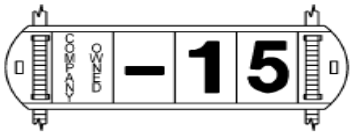


Figure 6
Identification Tags

B. Customer Owned Service Cable:

The label identifies the customer owned 600 V service cable. The number, e.g. 155, identifies the customer's building or apartment number.

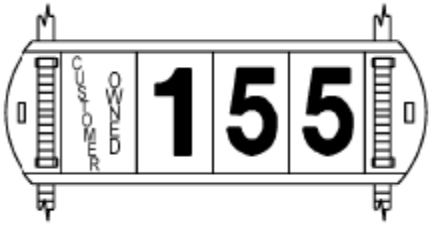


Figure 7
Identification Tags

C. For Parallel Secondary Services:

Install a parallel service tag in the tag holder along with the building or apartment number.

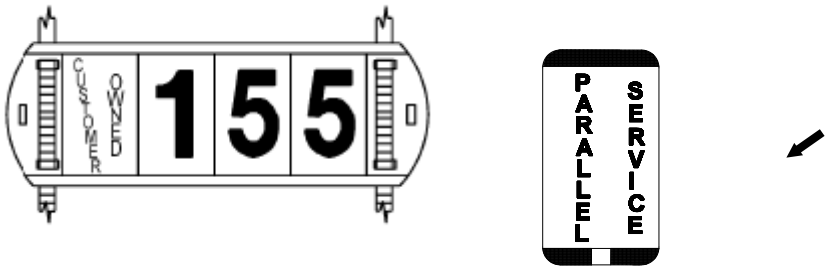


Figure 8
Identification Tags

35.17 CABLE LOCATION MARKERS

A cable marker (Std. Item P22R1) is available for permanent marking of Company owned underground facilities (See Figure 8). The marker is red fiberglass / plastic composite. It comes complete with a pre-applied label which denotes the company name and contact numbers as well as Dig Safe / Dig Safely contact information. The marker is installed with a drive tool (Std Item P21R2).

Figure 9
Location Marker **Close up of Label**

New Page – Revise paragraph 35.17; Insert New Figure 9, Text Shift

35.18 SUBMARINE CABLE SIGNS

The installation of Submarine Cable signs shall be limited to those applications deemed necessary, for public awareness of the submarine cable location, by the Operating Department. These locations are generally where the cable crosses navigable waters that may be subject to anchoring or dredging.

The signs shall be installed on a field fabricated structure and located an adequate distance from the water for protection from tides and ice. The sign shall face the water. The exact design of the support structure may vary due to field conditions. Suggested mounting structure designs are included in Figure 11.

Two sizes of standard signs for marking submarine cable locations are available. The large sign (see Figure 10) is 12 feet wide X 8 feet high (Std. Item UP22W1) and the small sign (see Figure 12) is 24 inches wide X 15 inches high (Std. Item UP22W2). These signs are not maintained in stock,but can be special ordered. When placing a request for a sign, include the appropriate local telephone number to be on the sign.

New Page – Increase Figure Numbers by 1, Text Shift

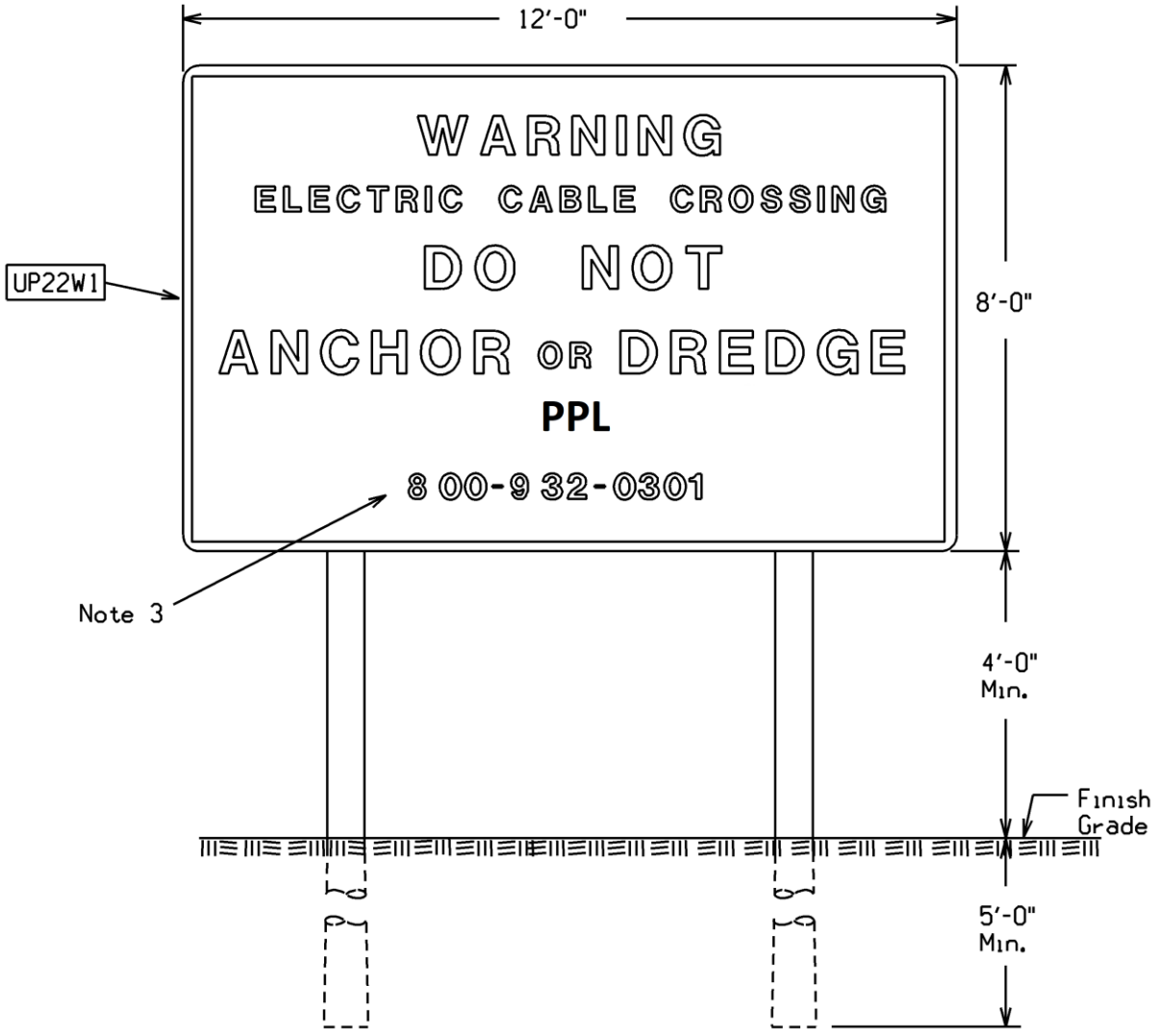


Figure 10
Signs for Submarine Locations

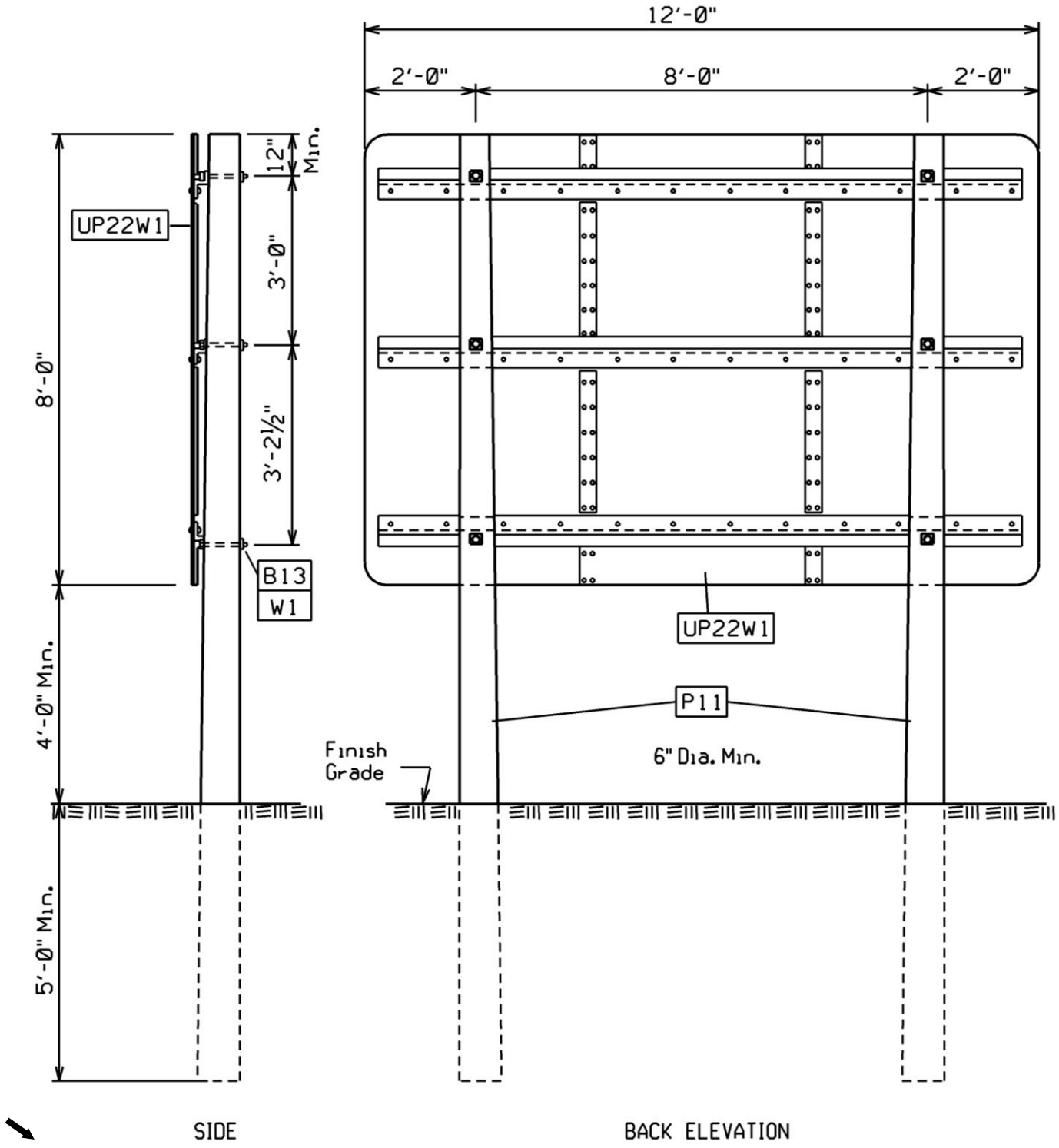


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Figure 11
Signs for Submarine Locations

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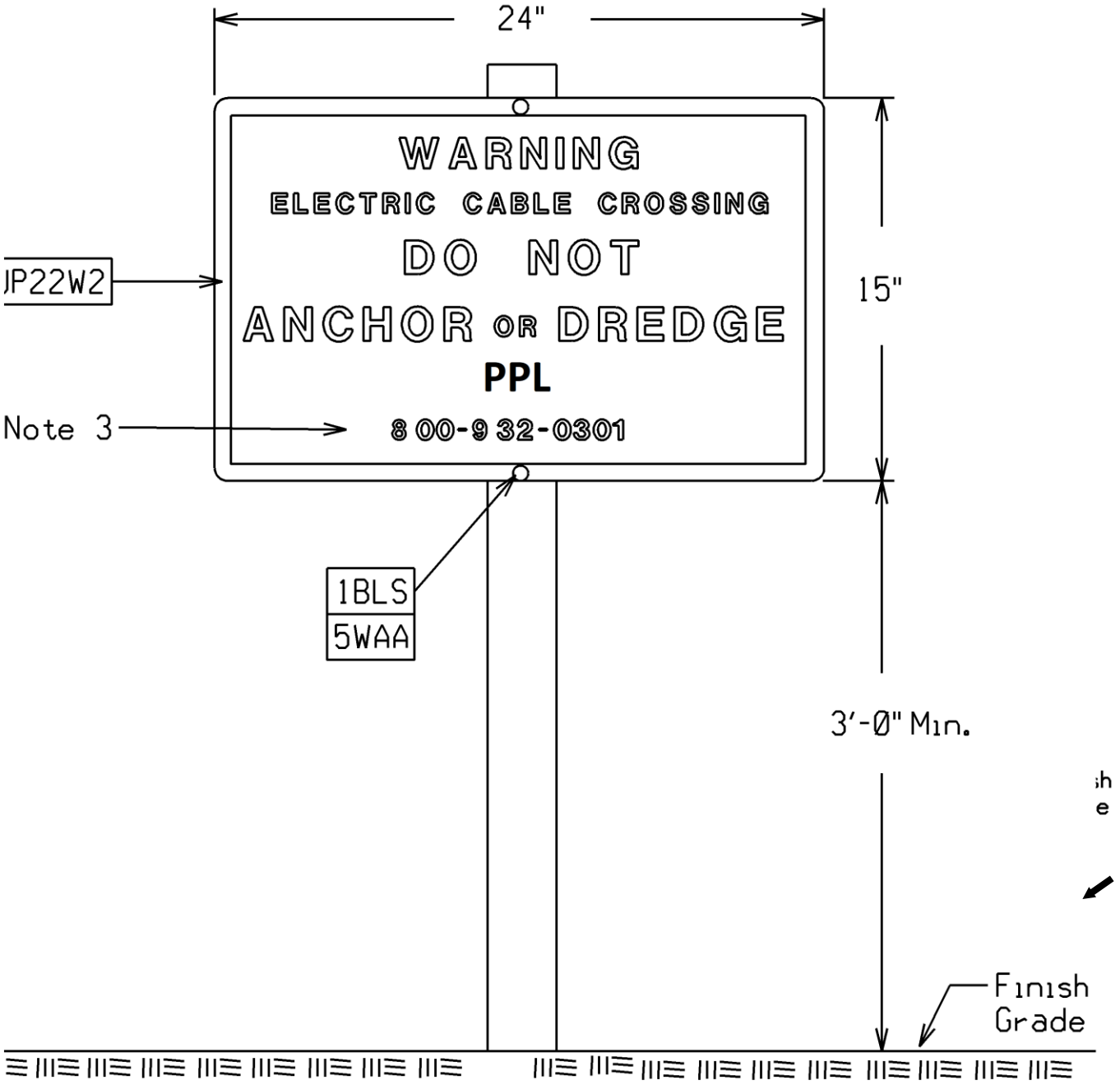

Figure 12
Signs for Submarine Locations

Version	Date	Modification	Author(s)	Approval by (Name/Title)
4	07/19	• Updated 35.3 - Reduced Diameter Cables • Updated 35.4 - Removed Section • Updated 35.5 - 10 Removed Section • Updated 35.5.20 - Removed Section • Updated reference in 35.11 • Revised paragraph of 35.15 • Revised paragraph of 35.16.10		
3	07/16	• Updated 35-23 and 35-24 Figures 6, 7 and 8		
2	07/15	• Revised paragraph of 35.2.10 • Revised paragraph of 35.2.30 • Revised paragraph and table 9 of 35.7 • Updated text in 35.15 and 35.16.10 (A)		
1	07/09	• Revise last paragraph of 35.0 • Correct packaging on Tables 2, 3 & 4 • Add two items to Table 2 • Revise Sections 35.1.20, 35.3, 35.4, 35.,7, 35.11, 35.13, 35.16.10 & 35.17 • Add Minimum Conduit Column and 2 cables to Table 5 • Change the title of 35.4 • Correct conductor description in Table 8 • Add cable description to 35.6.10 • Add Tables 9 & 16, change subsequent table numbers and references accordingly • Change cable caps to 4 in 35.9 • Add new end paragraph to 35.10.30 • Add Figures 5 & 9, increase subsequent figures accordingly		

Supersedes 7/18 Issue – Update Page Numbers due to Revisions

36.0 GENERAL

36.0.10 Splices

Cable Splices used throughout the Company are pre-engineered kits of either the cold shrink or heat shrink type. These splice kits have superior electrical stress relieving capabilities for long life. Types of splice kits to be used, in order of preference, are:

1. Cold Shrink – solid dielectric.
2. Pre-molded Quick splice - #2 Aluminum in URD / UCD applications installed in a pullbox or direct buried only
3. Heat Shrink – solid dielectric, where manhole space precludes use of cold shrink.
4. Heat Shrink – PILC to solid dielectric transition, PILC to PILC.
5. Heat Shrink – For Y splices where re-entry or disconnection not required.
6. Pre-molded Y or H splice – solid dielectric Y and H splices where re-entry or disconnection required.
7. Hand Tape Splice – special applications only.
8. Dead Break Tee – Maintenance / Restricted Space applications only.

36.0.20 General Splice Installation / Cable Handling

Follow the installation instructions packaged with each kit, except as detailed in this document for non-standard cables, such as drain wire and copper tape shielded cables. See Sections 36.0.40 and 36.7 for bonding / grounding of the neutral / shield.

The proper preparation of the cable is the most critical portion of the splice installation. Perform all steps carefully, taking care to use the proper dimensions. Keep the cable clean and dry. Use the standard cable preparation tools as they reduce the chance of damage to the cable insulation and shielding system. Almost every splice failure is the result of improper cable preparation, improper cutback dimensions, lack of cleanliness or incorrect splice assembly.

DO NOT make any substitutions for materials supplied in the splice kit, except as detailed in this Section.

See Section 36.1 for additional information.

36.0.30 Connectors

Standard splice connectors are the compression type with an oil stop. Connectors may be crimped with indent type or die type tools. Connectors for copper-to-copper cables are tinned copper. Connectors for aluminum-to-aluminum or aluminum-to-copper cables are tinned aluminum. Various reducing connectors are available. These reducers have uniform outside diameters so the same die can be used on both sides of the connector. Do NOT use inserts in place of reducing connectors.

Shear bolt connectors were piloted and have been approved for use with cold shrink splices Std. Item UR51_. Shear bolt connectors accept different size cables so they are range taking and have inserts or guide adapters for smaller size cables. They are made of copper and aluminum and have an internal oil stop in the middle of the connector. There are six connectors available with Std. Items UR58_ for copper and UR59_ for aluminum.

Supersedes 7/09 Issue – Updated 36.0.30 to include shear bolt connectors

36.0.40 Grounding & Bonding

For proper circuit protective device operation and protection of the cable system, the concentric neutrals / shields shall be bonded to ground at all splices. In general, the bonding shall consist of one #2 stranded tinned copper conductor crimped to the cold shrink splice #2 copper ground braid exiting the splice and connected to the manhole ground grid or a locally driven ground rod. The method of connection between the concentric neutrals / shields differs depending on specific cable construction. These methods are detailed in Section 36.7.

The only splices where the neutral is not grounded are those in 15 kV, #2 aluminum cable in URD / UCD applications, installed either direct buried or in a pullbox.

36.0.50 Arc & Fire Proofing

See Section 35.13 for Arc and Fireproofing Requirements.

36.1 GENERAL SPLICE INSTALLATION INSTRUCTIONS

Always read, understand and follow the manufacturer's installation instructions that are packaged with the splice kit, unless exceptions are indicated within this Section.

Select the proper connector from Section 36.10 for the cables being joined. All connectors are tinned, with oil stop barriers in the center of the barrel. Use tinned copper connectors to join two copper cables, tinned aluminum connectors to join two aluminum cables and tinned aluminum connectors to join aluminum cable with copper cable. Be sure the connector selected is within the diameter and length required by the splice kit to be used.

Follow the cable end preparation instruction in the specific splice kit being used. Cables should be racked into their final position prior to cutting for splicing. Make sure that there is sufficient space to park the splice tube over the cable. All conductor cuts should be made square. Insulation cutbacks are also made square, without tapering, penciling or stepping, unless otherwise indicated by the installation instructions.

Keep the cable and splice free of moisture, dirt, metal particles etc. during the entire preparation and splice installation process. If work must be stopped prior to completion, protect the exposed portions of the cable insulation and conductor with a half lapped layer of vinyl tape (Std. Item T2W1 or T2W2), a half lapped layer of silicon rubber tape (Std. Item T5S1) and another layer of vinyl tape. When work resumes, clean all adhesive residue off of the insulation and conductor with cable cleaner (Std. Item UC80__).

Clean the cable jackets back from the ends of the cable to provide a space for parking the splicing tubes. Maintain the splice tubes and the cable clean and dry during the entire splicing operation.

Until such time as the cable is ready to be terminated, the cable ends shall remain sealed to prevent moisture from entering the conductor strands. Use cold shrink end caps (Std. Item UC90__) to protect the cable until splicing is performed. DO NOT splice cable that shows evidence of moisture in the conductor strands.

Paper lead cable shall be checked for moisture prior to splice installation. Remove 2-3 layers of paper from the end of the cable (where the splice barrel will be located) and test by placing a short piece of paper in a pot of hot oil. If *any* foaming occurs, moisture is present in the papers and this cable is not suitable for splicing. Do not attempt to 'boil out' the end of the cable. This technique, while employed for many years, does not remove all the moisture. Some of the moisture is merely driven further into the cable. The presence of any moisture in a paper insulated cable will cause a future cable failure. Refer to EOP UG005 for more information on PILC cable repairs & splicing.

Supersedes 7/15 Issue – Revise Paragraph 1 of 36.0.40

Be sure to remove any semi-conducting layer, either extruded or tape type, from the insulation during the preparation process. If there is any question about whether a material is semi-conducting or not, consult Standards Engineering.

Older types of cable have a fabric tape type of semi-conducting insulation shield material. When this type of semi-conducting material is found, cut this material back ¼ - ½ inch more than needed. Then wrap the entire exposed portion of the semi-con fabric tape with new semi-com tape (Std. Item T1S) applied half lapped, until the semi-con cutback dimension needed is reached. Trim this tape square to the cable at the required cutback.

Thoroughly clean the surface of the insulation after removal of the semi-conducting material. Sand the insulation to remove all visible traces of the material, then clean the insulation with cable cleaner (Std. Item UC80__). Always wipe the cleaner from the conductor end toward the semi-conductor cutback. The solvent will pick up the carbon black in the semi-conducting material and spread it on the insulation if the wiping direction is the opposite. This will contaminate the insulation and cause a future splice failure.

36.2 COLD SHRINK SPLICES

Supersedes 7/15 Issue – Revise paragraph 4 of 36.2

Cold Shrink Rubber Splices are the preferred splicing system to be used throughout the Company. These materials have been found to be superior to all other splicing methods, within their ratings. They are rated from 5 kV through 35 kV, cover a wide range of sizes and can be used on cable size transitions and remain flexible after shrinking. They can be used in manholes, handholes, pullboxes and direct buried applications. They can be used outdoors on aerial cable applications. They can be used on all types of solid dielectric cable (EPR or XLPE) with any type of shielding system (concentric neutral, drain wire, copper tape). They are not for use on oil impregnated cables. For oil impregnated cables, use a heat shrink transition splice. See Section 36.3 for details.

Cold shrink splices are available for cables from #4/0 5 kV to 1000 kcmil 35 kV. The determining factor for splice kit selection is the insulation OD (under the semi-con). Each kit lists the minimum and maximum cable insulation OD that it covers. These splices can also be used for size transitions, provided the insulation OD on both cables is within the range of the splice kit being used. These splice kits are listed in Section 50 – Materials Catalog (Std. Item UR51__).

The instructions included with the kit detail the dimensions required for splicing jacketed concentric neutral, drain wire shield and flat strap cables. See Sections 36.2.10 to 36.2.40 for dimension changes required to splice cables with other types of neutral / shielding. Contact Electric Design and Material Standards Engineering for assistance if needed.

The kits do not include connectors. All conductor connectors are tinned copper or tinned aluminum, with an oil/water stop in the center of the connector. Use copper connectors to join two copper cables, aluminum connectors to join copper to aluminum and aluminum to aluminum cables. Select the proper connector from Section 50 – Materials Catalog (Std. Items UC58__ to UC63__). See Section 36.10 for additional information. If indent type compression tools are used, the indents do not have to be filled when using a cold shrink splice kit. Remove all sharp flashing from the connector after crimping.

All splices (except #2 aluminum 15 kV used in URD / UCD in pullboxes or direct buried) are to have their neutral / shield connected together and bonded to ground. The Company has specific instructions for making these connections. See Section 36.7 for the details on grounding / bonding.

36.2.10 Standard Concentric Neutral Cable Applications

The instructions packed with the kit are for jacketed concentric neutral (JCN) cable. Follow the instructions packed with the splice kit for cable preparation, cutbacks and splice installation.

See Section 36.7 for details on the grounding and bonding. Choose the correct section depending on the cable shield / neutral type on each side of the splice.

36.2.20 Drain Wire Shield Cable Applications

The instructions packed with the kit are for jacketed concentric neutral (JCN) cable. These same directions shall be used for drain wire shielded cables. Follow the instructions packed with the splice kit for cable preparation, cutbacks and splice installation.

See Section 36.7 for details on the grounding and bonding. Choose the correct section depending on the cable shield / neutral type on each side of the splice.

36.2.30 Copper Tape Shielded Cable Applications

The instructions packed with the kit are for jacketed concentric neutral (JCN) cable. Use the kit instructions with the following modifications for copper tape shielded cable:

A. Make the copper tape cutback with the same dimensions shown in the kit for jacketed concentric neutral and flat strap cables. Apply copper tape strip over end of shield. Apply four layers of copper mesh over copper tape and tie back.

   1. For unjacketed cable, place a tape marker on the copper tape shield at the dimension given in the instructions for the Jacket Cutback. Then make all other measurements from this tape marker.

See Section 36.7 for details on the grounding and bonding. Choose the correct section depending on the cable shield / neutral type on each side of the splice.

36.2.40 Flat Strap Neutral Cable Applications

The instructions packed with the kit are for jacketed concentric neutral (JCN) cable and flat strap. Follow the instructions packed with the splice kit for cable preparation, cutbacks and splice installation.

See Section 36.7 for details on the grounding and bonding. Choose the correct section depending on the cable shield / neutral type on each side of the splice.

Supersedes 7/09 Issue – Revise 36.2.30 & 36.2.40

36.2.50 URD / UCD Applications

For #2, Aluminum 15 kV URD / UCD applications in pullboxes, direct buried and riser poles, pre-molded quick splices (Std. Item UR50) are an acceptable splice. These come packaged with a crimp connector for aluminum-to-aluminum or aluminum-to-copper connections. Do not use on copper-to-copper connections. These splices are for use in pullboxes, direct buried and in a riser pole under the U guard only. They are not to be installed in any enclosure which a person can physically enter.

For repair of direct buried #2 URD cables, a special repair splice is available (Std. Item UR50R). The splice includes a long connector to replace up to 6 inches of damaged cable without having to add a piece of cable and a second splice. For jacketed cable, also use the cold shrink re-jacketing kit (Std. Item UR75A).

Connect the concentric neutrals across the splice with a #2 connector. The neutral on these cables does not have to be grounded.

When both cables are jacketed, also use the cold shrink re-jacketing kit (Std. Item UR75A).

36.2.60 Aerial Cable

New design aerial cables are jacketed, concentric neutral with a covered lashing tape. Older aerial cables have a copper tape metallic shield and can be jacketed or unjacketed. For unjacketed cable, place a tape marker on the copper tape at the distance given in the instructions for the jacket cutback. Then make all other measurements from this tape marker.

Splices are to be cold shrink. Each splice is to be externally bonded. New cold shrink splice integrated jackets (Std. Item UR51_) are made with UV resistant material therefore installation of a separate silicon UV resistant jacket is not required. For installation on concentric neutral cable and copper tape shielded cable follow the instructions included in the kit using the same cable cutbacks and grounding and bonding details in section36.7.10. Older cold shrink splices (Std. Item UR49_) require silicon outer jackets (Std. Item UR49D) since the outer jacket of the splice is not UV resistant. Follow grounding and bonding details in section 36.7.

Terminations are to be cold shrink. For installation on concentric neutral cable follow the instructions in 37.1.50. For installation on copper tape shielded cable follow the instructions in 37.1.60.

Similar information for splicing and terminating aerial cables can be found in Overhead Standards Section 16.

Supersedes 7/15 Issue – Revise 1st paragraph of 36.2.50

36.3 HEAT SHRINK SPLICES

Heat shrink splices are utilized for a variety of specialty applications. They should not be used in lieu of a cold shrink splice unless adequate installation space is not available. The most common application throughout the Company is for making a transition from PILC cable to solid dielectric cable. However, other approved uses include splices between two PILC cables, splices in manholes with limited working room and Y tap splices.

The various heat shrink splices are listed in Section 50 – Materials Catalog (Std. Items UR81__ for 5 kV, UR82__ for 15 kV, UR83__ for 23 kV and UR84__ for 35 kV). The different styles of splice kit are:

A. Transition splices are for single conductor PILC cable to single conductor solid dielectric jacketed cables.

B. Trifurcating splices are for 3 conductor solid dielectric cables with a single overall jacket to 3 single solid dielectric jacketed conductors.

C. Trifurcating transition splices are for 3 conductor PILC cable to 3 single solid dielectric jacketed conductors.

D. Straight joints for PILC to PILC cables, both single conductor and 3 conductors.

E. Y splices are for tapping a main line single conductor cable, any combination of solid dielectric and PILC cables.

36.3.10 Heat Shrink Splices – General Instructions

The kits do not include connectors. Select the proper connector from Section 50 – Materials Catalog (Std. Items UC60__ to UC63__). If indent crimping is used, the indents have to be filled prior to installation of the splice. Use small pieces of Raychem Stress Relief Mastic (SRM or Yellow Mastic) to fill the indents. Remove all flashing or sharp edges from the connector prior to installing the splice. Be sure that the surface of the cable / connector is uniform with no extreme discontinuities. The first heat shrink tube must be able to shrink down smoothly with no voids underneath it. Any voids under this tube will lead to splice failure.

Choose the correct kit for the application. Follow instructions packed with the kit for cable preparation and splice installation. The cable shield / neutral are to be connected across the splice and bonded to ground at each splice. See Section 36.7 for details on this grounding / bonding.

Supersedes 7/07 Issue – Revise 1st Paragraph of 36.3.10, Text Shift

36.4 DISCONNECTABLE H & Y SPLICES

Disconnectable H and Y splices can be used to join and to branch out various types and sizes of medium voltage solid dielectric cables. They are not suitable for PILC cables. They are not to be used on any cable with #2 aluminum conductor. These splices are the preferred method for making an H or Y joint in solid dielectric cables. Dead break elbows are permitted to be used as a splice in a few limited cases. See 36.11 for details.

Disconnectable H and Y are rated 600 amps and voltages of 5 kV to 35 kV. They are made of EPDM rubber through a pre-molding process and PPL has begun using silicone rubber cold shrink disconnectable joints in 5 kV to 25 kV systems.

One joint is used for all voltages up to 25 kV; a different joint is needed for 35 kV applications. The connector lugs are the same for all voltages. The 25 kV class cable adapters used with pre-molded splices are to be used for all voltages including 35 kV. Cold shrink joints do not require cable adapters or retaining rings since they can accept different cable ranges. The insulating caps that cover spare positions are different for the different voltage ranges.

Supersedes 7/17 Issue – Revised 36.4 entire section

36.4.10 Pre-molded H&Y Splices

The basic joint is made up of an insulated aluminum bus with three or four ports that can accommodate the same amount of cables and a terminated cable end. Each cable end is prepared to connect to one of the ports by installing a joint housing (boot), retaining ring, cable adapter and connector lug.

The materials available are listed in Section 50 – Materials Catalog (Std. Item UR71__). The accessories are cable adapter (Std. Item UR64_), lug, (Std. Item UR63__), retaining rings (Std Item UR72) and insulating cap (Std. Item UR73__). Be sure to select the correct parts for the applied voltage.

Follow the instructions packed with the kit for assembly. Use approved tools to assemble and disassemble the joint. **Torque** the connecting bolts to the proper value using a torque wrench. Be sure that the boots are completely installed. Tools for installation of the boots are listed in the Tool Catalog.

The concentric neutrals must be connected across the joint and bonded to ground. Cable jackets shall be sealed to avoid water intrusion that may corrode the neutrals. Use cable jacket sealing cold shrink kit (Std. Item UR23B1) for each cable joint. When the cold shrink jacket seal kits are not available use the following method: For jacketed concentric neutral cables, clean and sand the jacket. Apply 2–3 layers of sealing compound (Std. Item T5M) lay the concentric neutrals into the sealing compound, and then apply 2–3 additional turns of sealer. Apply two layers of splicing tape (Std. Item T5B) half lapped, from the end of the cable housing to the outside of the sealing compound. The splicing tape should lap 1 inch onto the cable housing. Complete the seal with two half lapped layers of vinyl tape (Std. Item T2W).

Connect a #14 copper wire from the grounding eyelet of the splice body and each cable housing to the concentric neutral / bond connection. Connect the concentric neutrals to the manhole ground bus with a #2 tinned copper ground braid connected with a constant force spring clamp. Due to the weight of pre-molded “H” and “Y” splices additional support is needed. This can be accomplished by installing additional stanchions, unistruts or splice boards. Arms should be placed on each side of the splice as close as possible to each housing and an additional arm at the middle of the splice for better support.

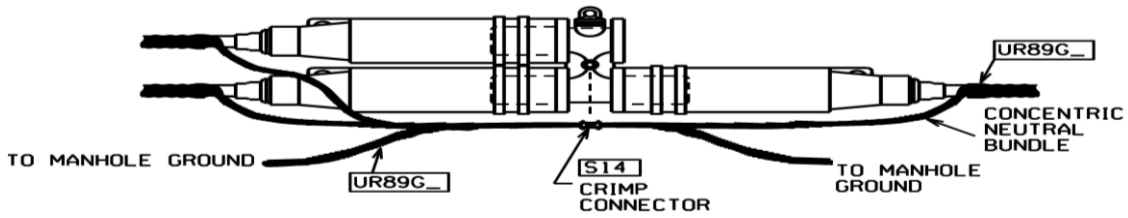

Figure 1 - Typical Pre-molded Y Joint

36.4.20 Cold Shrink H&Y Splices

Cold shrink disconnectable splices are range taking so one splice body fits several cable sizes eliminating the use of cable adapters and retaining rings. The basic joint is made up of an insulated aluminum bus with three or four ports that can accommodate the same amount of cables and a terminated cable end. Each cable end is prepared to connect to one of the ports by installing a silicone rubber joint housing (boot) and connector lug.

Cold shrink disconnectable splices have a pre-expanded EPDM rubber rejacketing sleeve and an integrated neutral sock into a single unit therefore a separate jacket seal is not required. The design of the joint allows the removal of the spiral hold-out over the cable, roll out the ground sock and connection to the ground braid and roll out of the rejacketing sleeve over the soldered block braid.

New Page

The materials available are listed in Section 50 – Materials Catalog (Std. Item UR74__). The splice comes as a kit that includes the cold shrink silicon rubber splice body, a shear bolt connector lug, a double-head shear bolt bus bolt, a 24” solder blocked ground braid, spring clamp and related accessories. Follow the instructions packed with the kit for assembly. Use approved tools to assemble and disassemble the joint.

The concentric neutrals must be connected across the joint and bonded to ground. Connect a #14 copper wire from the grounding eyelet of the splice body and each cable housing to the concentric neutral / bond connection. Connect the concentric neutrals to the manhole ground bus with a #2 tinned copper ground braid connected with a constant force spring clamp. Due to the weight of pre-molded “H” and “Y” splices additional support is needed. This can be accomplished by installing additional stanchions, unistruts or splice boards. Arms should be placed on each side of the splice as close as possible to each housing and an additional arm at the middle of the splice for better support.

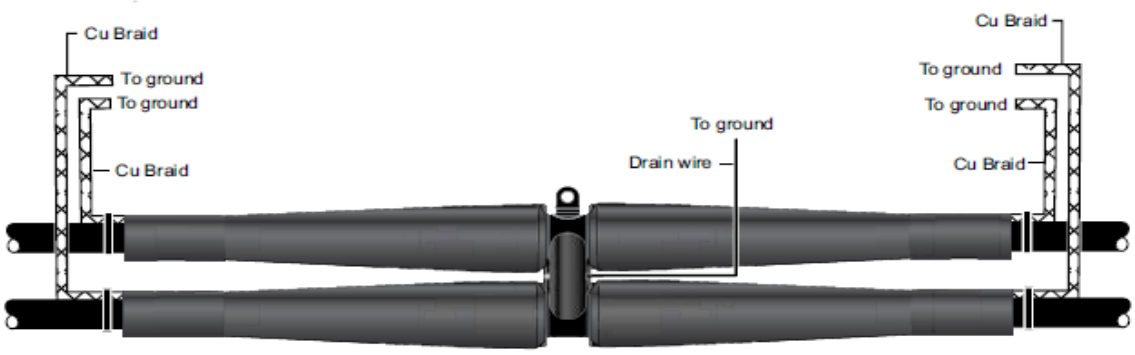

Figure 1A - Typical Cold Shrink H Joint

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36.5 HAND TAPED SPLICES

Hand taped splices should be limited to special conditions such as:

A. Small size cables which are outside of the range of the cold shrink or heat shrink splices.

B. Space limitations prevent using either cold shrink or heat shrink splices due to lack of room to park the tubes on the cable.

Hand taped splices shall always be the last choice due to lower reliability and installation time.

Refer to Table 1 for all letter designated dimensions.

Table 1

Cable Size AWG-kcmil	Voltage (kV)	A	B	C	D	G- Adder*		P	L
						Al	Cu		
2	5	7-¾	3-½	½	4-0	½	½	½	2-½
1/0	5	7-¾	3-½	½	4-0	½	½	½	2-½
4/0	5	7-¾	3-½	½	4-0	½	½	½	2-½
350	5	7-¾	3-½	½	4-0	½	½	½	2-½
500	5	7-¾	3-½	½	4-0	½	½	½	2-½
750	5	8-0	3-½	¾	4-¼	½	½	½	2-½
1000	5	8-0	3-½	¾	4-¼	½	½	½	2-½
2	15	11-¼	7-0	½	7-½	13/16	13/16	1-0	5-½
1/0	15	11-¼	7-0	½	7-½	13/16	13/16	1-0	5-½
4/0	15	11-¼	7-0	½	7-½	11/16	11/16	1-0	5-½
350	15	11-¼	7-0	½	7-½	11/16	11/16	1-0	5-½
500	15	11-½	7-0	¾	7-¾	⅝	⅝	1-0	5-½
750	15	11-¾	7-0	1-0	8-0	⅝	⅝	1-0	5-½
1000	15	11-¾	7-0	1-0	8-0	⅝	⅝	1-0	5-½
1/0	25	14-½	9-¼	1-½	10-¾	1-¼	1-⅜	2-¼	6-½
4/0	25	14-½	9-¼	1-½	10-¾	1-0	1-⅜	2-¼	6-½
350	25	14-½	9-¼	1-½	10-¾	1-0	1-0	2-¼	6-½
500	25	14-½	9-¼	1-½	10-¾	1-0	1-0	2-¼	6-½
750	25	14-½	9-¼	1-½	10-¾	1-0	1-0	2-¼	6-½
1000	25	14-½	9-¼	1-½	10-¾	1-0	1-0	2-¼	6-½
750	35	16-½	10-½	2-¼	12-¾	1-½	1-½	3-½	6-½
1000	35	16-½	10-½	2-¼	12-¾	1-½	1-½	3-½	6-½

Supersedes 1/07 Issue – Re-numbered page

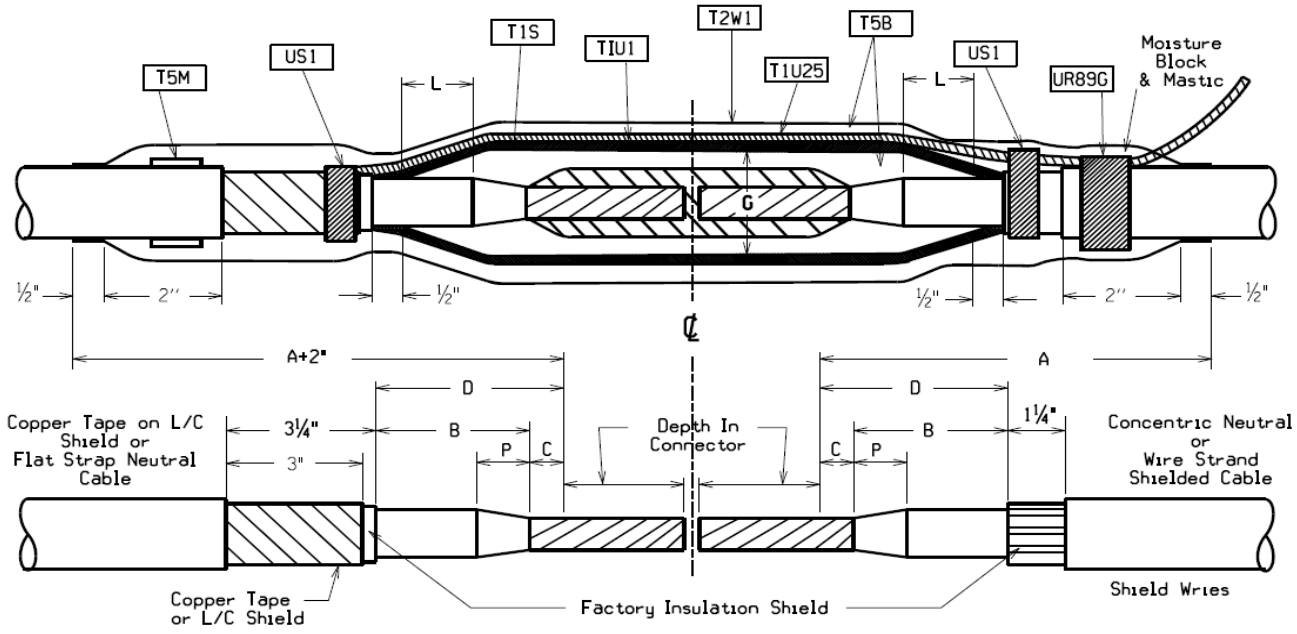

Figure 2

36.5.10 Cable Preparation

Train and rack cables into position. Cables must be straight for a distance equal to the entire length of the completed joint. Cut ends square, with the ends at the centerline of the splicing space.

Wipe jackets clean for a minimum distance of A plus 8 inches. On cables with concentric neutrals or drain wire shields, mark the jacket at a distance D plus 1¼ inches. On cables with copper tape shield, L/C shield or flat strap neutrals, mark the jacket at a distance of D plus 3¼ inches. Abrade the jackets from the mark outward for an additional 3 inches with abrasive cloth (Std. Item T5U1). Remove the jacket to the mark with approved jacket removal tool.

A. L/C or Copper Tape Shield Cables – mark the metallic shield 1 inch from the jacket cutback. Remove the shield, using scissors to make a square cut

B. Concentric Neutral, Flat Strap Neutral, Drain Wire Shield Cables – Remove mylar tape if present and cut the conductors to indicated length over semi-con layer. Cut the flat straps to the indicated length over the semi-con layer.

Remove the insulation semi-con a distance of D plus the 'depth in connector'. Use approved removal tools, using care not to cut or nick the cable insulation.

Remove the cable insulation and conductor shield a distance of C plus the 'depth in connector'.

Supersedes 7/17 Issue – Re-numbered page

36.5.20 Pencil The Insulation

Hand taped joints require penciling of the cable insulation. Use an approved penciling tool. Check that the penciling tool will form the correct pencil length and is equipped with a bushing sized to fit snugly over the cable insulation. Be sure the blade is sharp. Adjust the blade so that the tool will not leave a step at the conductor. On the last few turns of the tool, apply only light pressure, assuring that the blade will not gouge the insulation.

If a penciling tool is not available, carefully form the pencil using a sharp knife. Smooth the cuts with a file.

Sand the entire surface of the factory insulation with abrasive cloth (Std. Item T5U1). There must be a narrow band of conductor shield material exposed at the end of the penciling.

36.5.30 Install The Connector

Clean the conductor with a wire brush, being sure to remove all oxidation and any foreign material. Use copper connectors to join two copper cables, aluminum connectors to join copper-to-aluminum and aluminum-to-aluminum cables. Select the proper connector from Section 50 – Materials Catalog (Std. Items UC60__ to UC63__). See Section 36.10 for additional information.

Crimp with approved crimper and, if needed, correct dies. File off and sand any sharp edges and wipe off excessive anti-oxide compound.

36.5.40 Final Cable Check & Cleaning

Check to see that the factory insulation has been sanded thoroughly along its entire length. All traces of semi-con material must be removed. Check to see that all surfaces are smooth with no nicks, gouges, dents, cuts or other blemishes. Clean the entire area, from jacket to jacket with a cable prep kit (Std. Item UC80F). Wipe from the insulation toward the cable jacket to prevent dragging any carbon from the semi-con onto the insulation. Thoroughly clean the connector to remove oil & grease.

36.5.50 Connector / Conductor Shielding Tape

A. For 25 And 35 kV Cable Only – apply one layer, half lapped, of Teflon tape (Std. Item T2T) over the exposed bare conductor. Start taping ⅛ inch from the connector and end ⅛ inch from the end of the pencil. Do not put tape onto the connector or the cable semi-con.

Fill any indents in the connector with small pieces of semi-con tape (Std. Item T1S). The outer surface of the connector must be as smooth and uniform as possible, with no voids, to prevent partial discharge stress points. Build up a smooth layer of semi-con tape from the end of the connector to the end of the penciling, just covering the exposed cable semi-con at the end of the penciling. Do not allow the semi-con tape to touch the cable insulation at the end of the penciling. The final surface of the semi-con tape will be at a slope, opposite to the penciling, from the end of the connector to the end of the penciling. Repeat for the second side.

Apply one half-lapped layer of semi-con tape over the connector, with a half lap turn on the semi-con build up at both ends of the connector.

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36.5.60 High Voltage Splicing Tape

Using calipers, determine the maximum diameter over the connector and shielding tape. Add 'G' dimension to this maximum diameter and set the calipers to this total. This will be the finished diameter over the high voltage splicing tape. Preserve this caliper setting for the final check of the tape diameter.

Calculate the difference between the caliper setting and the cable insulation OD, in sixteenths of an inch. This number of sixteenths is approximately the number of layers of tape required to build the reinforcement tapers. Divide 16 by this number, and then multiply by L from the table. The result is the "step distance", in eighths of an inch, needed to build the reinforcement tapers.

Apply high voltage splicing tape (Std. Item T5__) in the V shaped spaces between the pencil and the end of the connector. Use a level wind technique. The tape edges must butt against the pencil. Do not apply the high voltage tape such that it lays flat against the pencil. Once the tape diameter reaches the connector diameter on the first side, repeat the process on the other side of the connector.

Apply the tape with sufficient, uniform tension to reduce its width to 50%. Build up the tape evenly, using half lapped layers forming a smooth, even surface.

When the diameter of the hand applied tape equals the diameter of the cable insulation, start to form the reinforcement tapers. The first layer of tape should end ½ inch from the cable insulation shield cutback. Form the tape so that its edge is perpendicular to the cable axis and parallel to the edge of the insulation shield.

Reverse direction of taping and immediately form the tape so that its edge is displaced toward the center of the joint by the "step distance" calculated above.

Continue to tape to the other end of the joint or to the connector if the tape diameter has not yet reached the connector diameter. Continue taping end to end, each time stopping a "step distance" less than the last layer, or one "step distance" closer to the center of the joint. Stop taping when the stepped distance equals dimension 'L'. Check the diameter over the connector. It should be slightly more than the caliper setting made previously.

36.5.70 Insulation Semi-Con Tape

Starting at the center of the joint, apply a tightly stretched, half-lapped layer of semi-conducting tape (Std. Item T1S) over the high voltage tape. Butt this semi-con tape snugly against the edge of the insulation shield. Apply as many turns at the insulation shield interface as needed to reach the insulation shield diameter. Then apply one final turn, overlapping the insulation shield by ¼ inch. Repeat the semi-con tape application from the center of the joint to the other end. Overlap the tape ½ inch at the center of the joint. Be sure not to leave a gap or void at the cable insulation shield interface or at the center of the joint.

36.5.80 Shielding, Neutral, Bonding & Grounding

Refer to the appropriate portion of Section 36.7, depending upon the cable combinations being spliced, for installation of splice shielding, neutral connection across splice, bonding and grounding the shield.

After these connections are made, return to Section 36.5.90 for splice completion instructions.

36.5.90 Sealing & Jacket Tape

Wrap a 1-2 inch wide strip, 2-3 laps thick, of sealing compound (Std. Item T5M) around each jacket where it was previously cleaned and abraded. Where the #2 copper braid exits the splice, firmly press the braid into the sealing compound, and then apply 2-3 layers over the bond wires. Apply two tightly wrapped, half-lapped layers of high voltage splicing tape over the entire joint, covering the sealing mastic on each end. Apply two half-lapped layers of vinyl tape (Std. Item T2W__) extending ½ inch beyond the high voltage splicing tape. Wrap tightly at both ends. Apply 2-3 final turns of tape without stretching to prevent flagging of the end.

36.6 SHRINKING TUBES

36.6.10 Cold Shrink Splices

Locate the tube over the splice as directed and begin to remove the core. Note that during the initial stages (before any part of the tube has shrunk down to the cable) the entire tube may be rotated to facilitate core removal. When the splice begins to contact the cable, recheck the location of the tube per the installation instructions. When the tube is properly located, continue removing the core. The core *must* be unwound around the cable to prevent jamming the core against the cable. Do not pull the core hard as breakage may result. Give a slight pull on the core, then unwind it one turn around the cable and then give another slight pull. The amount of pulling is actually small and the amount of unwinding is large. If the effort to pull the core increases, first relax the tension and attempt to unwind one or two turns, then attempt to pull again. Remember, unwinding is more important than pulling.

36.6.20 Heat Shrink Splices

Locate the tube over the splice as directed in the installation instructions. Use the approved propane torch, adjusted for a bushy flame. Contact the tube with only the outer 1-2 inches of the flame. Keep the flame moving to prevent scorching or burning the tube. Start heating at the center of the tube and move toward one end, heating evenly all around the circumference. Once one end is complete, return to the center and work the heat shrink process toward the opposite end. Avoid applying heat to the semi-con material. When multiple tubes are required, make sure that the surface of the last tube installed is still warm. If it has cooled, re-heat the entire previous tube before continuing. When shrinking of a tube is complete, check for uniform wall thickness, conformance to underlying shape, flat spots and that adhesive sealant flows evenly from both ends if that tube was coated. Some outer jackets have a green speckled surface. These green spots are heat indicators and they will turn black when the tube has been sufficiently heated. Check these tubes for any green spots that need additional heating. Be especially observant of the back side of the cable.

36.6.30 Oil Barrier Tubes

Shrinking the oil barrier tubes on PILC transition splices requires careful use of the propane torch. These tubes are very sensitive to heat and will split longitudinally if too much heat is applied. However, too little heat will result in an improper shrinking of the tube, which will result in splice failure. This is especially critical when working with 3 conductor PILC cable. It is suggested that all three ends be prepared for the oil barrier tubes and that the three tubes be shrunk together. An alternate is to use a heat shield to protect the other phases while shrinking one phase. If an oil barrier tube splits, it must be removed and replaced. Attempting to use the Raychem Stress Relief Mastic (yellow mastic) to repair the split tube is **NOT** acceptable.
Be sure that the oil barrier tubes are properly shrunk down onto the paper insulation. Inadequate shrinking will result in splice failure. The outer surface of the oil barrier tube after shrinking shall be smooth with no wrinkles. There shall be no air bubbles under the tube.

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36.7 GROUNDING AND BONDING

All splices will have the cable metallic shields / concentric neutrals bonded across the splice and connected to the system neutral and/or a driven ground rod. The connection to the neutral / driven ground rod provides a path for any fault current to exit the cable at the first splice. This will reduce the possibility of additional cable damage at a site away from the initial failure. For direct buried URD cable (#2 15 kV) refer to Section 36.2.50.

36.7.10 General

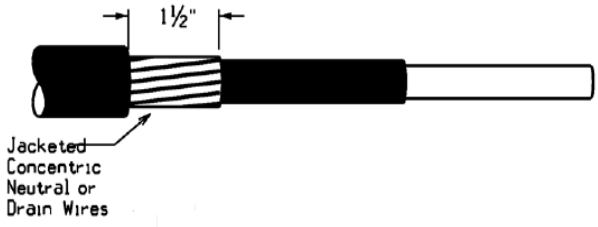
General requirements for splices are that the bond connection to the system neutral / driven ground will be with one #2 tinned copper braid (Std. Item T1U25) connected to the cable metallic shields with constant force spring clamps (Std. Item US1_). The tin coating reduces the chances of corrosion and the tinned copper braid has a moisture block (solder block) to avoid moisture ingress to the splice. The method of connecting the braid to the concentric neutrals, copper tape, lead sheath or flat strap neutrals using constant force springs is critical and has to be performed correctly. See Section 36.8 for the acceptable method of making the braid / spring connection.

Cold shrink splices (Std. Item UR51_) come with a tinned copper ground sock that runs the length of the splice and overlaps the cable on both sides. Connections to cable neutrals are made with constant force springs laid over the sock and neutrals at each side with a single #2 copper tinned ground braid on one side that exits the splice. This ground braid is connected to the system neutral / driven ground with a single #2 stranded tinned copper conductor (Std. Item W13F) and C crimps (Std. Item S14_). Instructions are included in the kits.

36.7.20 Cable / Metallic Shield Preparation

Cables to be spliced need to be prepared and cutbacks performed according to the splice manufacturer's instructions. Connection of the metallic shield across the splice and to the ground grid is important to maintain ground continuity. Preparation of the cable metallic shield for each side of the splice is as follows:

1. Jacketed Concentric Neutrals or Drain Wire

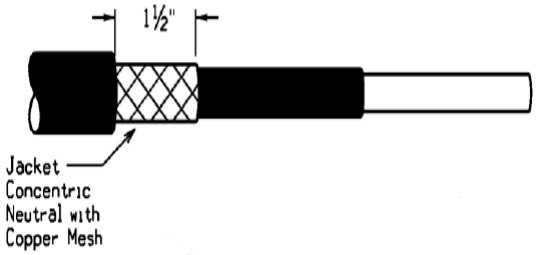


Cut concentric neutrals or drain wires to 1 ½" beyond the cable jacket. Be careful not to knick the semicon layer. Refer to Figure 3.

Figure 3

Lift concentric neutrals or drain wires. Wrap 4 layers of copper mesh onto the semicon. Lay the neutrals back down. Refer to Figure 4.

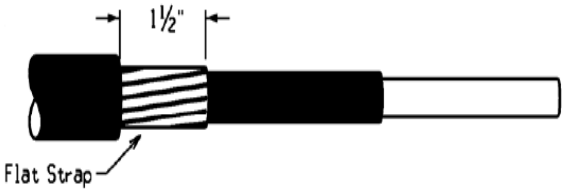
Figure 4



Cover with 4 additional layers of copper mesh and tie off. Refer to Figure 5.

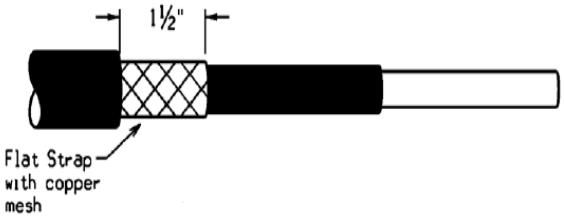
Figure 5

b) <u>Flat Strap</u>



Cut flat straps to 1 ½" beyond the cable jacket. Be careful not to nick the semicon layer**.** Refer to Figure 6.

Figure 6



Cover with 4 additional layers of copper mesh and tie off. Refer to Figure 7.

Figure 7

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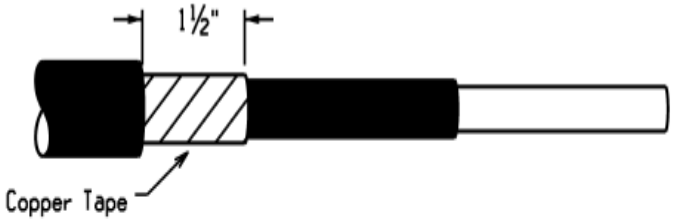
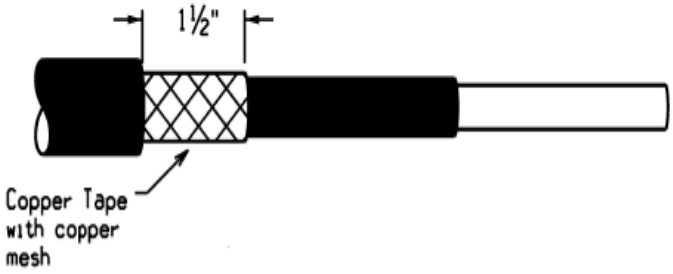
c) Copper Tape Shield



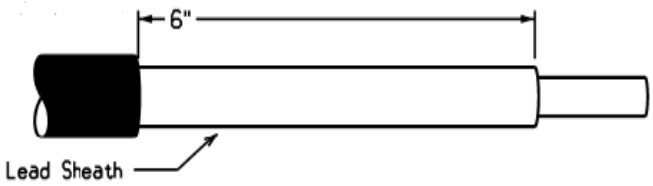
Cut flat straps to 1 ½" beyond the cable jacket. Be careful not to knick the semicon layer**.** Refer to Figure 8



Cover with 4 additional layers of copper mesh and tie off. Refer to Figure 9.

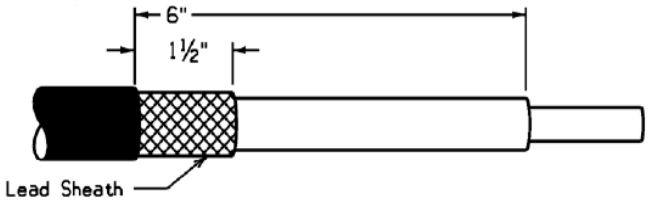
Figures 8 & 9

d) Lead Sheath



Remove cable jacket 6" from the paper insulation layer. Abrade and clean the lead oxide off the lead sheath with oil free solvent. Refer to Figure 10.

Figure 10



Cover with 4 additional layers of copper mesh for 1 ½" from the cable jacket and tie off. Refer to Figure 11.

Figure 11

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36.7.30 Cable Splicing / Metallic Shield Bonding (HEAT SHRINK/PRE-MOLDED/TAPE SPLICES)

1. Cut the concentric neutrals / drain wires and apply copper mesh on both sides of the splice to a convenient length as shown on section 36.7.20.

2. Connect the ends of each cable with the proper connector sized to the conductors. Compression connectors are to be used with heat shrink, pre-molded and hand taped splices. Shear bolt connectors are approved for use with cold shrink splices only. Refer to Figure 12.

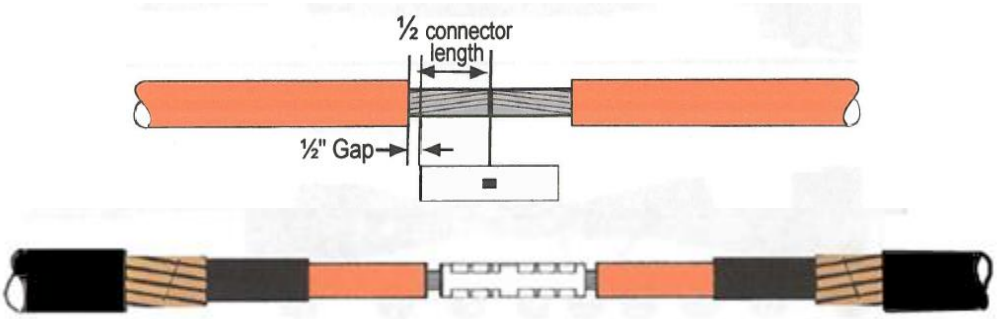

Figure 12

3. Build the splice body (heat shrink, pre-molded and tape) across the connector and cables according to the manufacturer and/or company instructions. Refer to Figure 13.

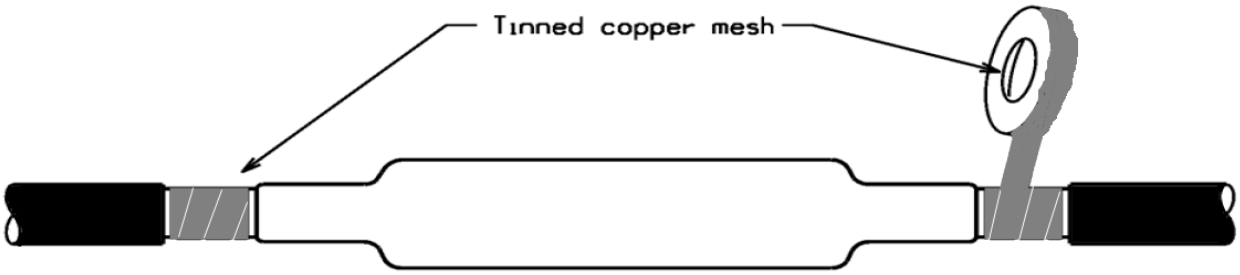

Figure 13

4. Lay one #2 tinned copper braid, provided with the splice or in grounding kit Std. Item UR89G_, along the splice and connect it to the cable metallic shield on both sides of the cable with spring clamps (Std. Item US1_). Start on the side of the cable where the braid exits the splice and where it will be connected to the system ground. Make sure braid contacts the copper mesh and secure with spring clamp afterwards. The solder/moisture block should be placed on this side. Make sure to locate the solder block on the jacket area beyond the jacket's edge. Vinyl tape (Std. Item T2W1) may be used to secure the braid to the splice to aid handling. See section 36.8 for proper installation of braid and spring clamp. Refer to Figure 14

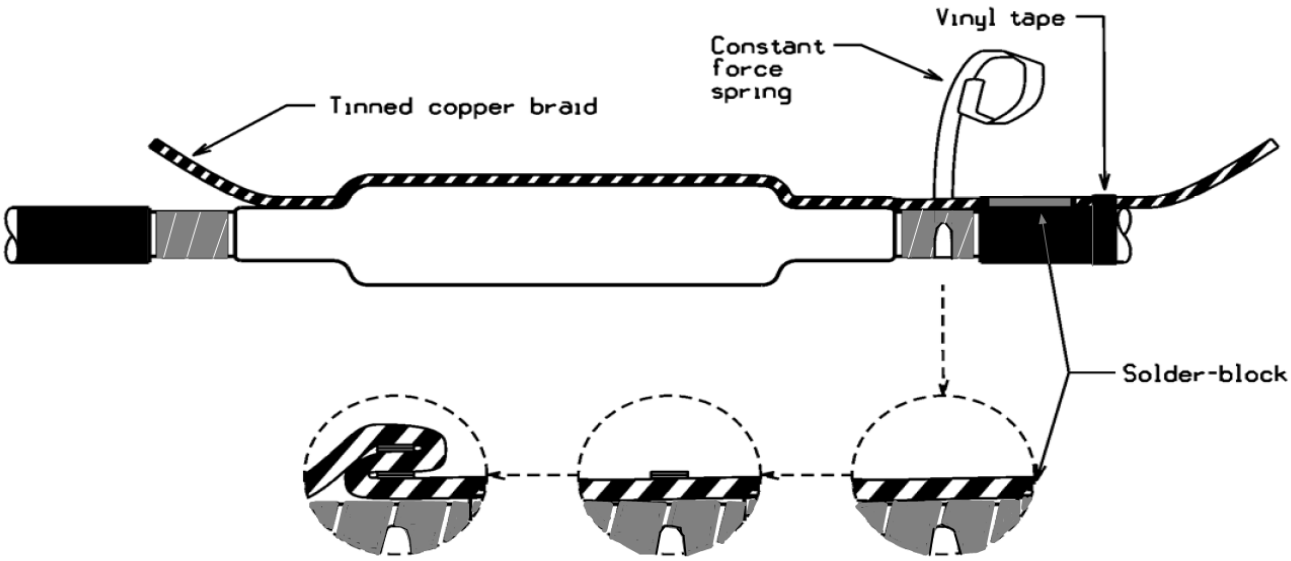

Figure 14

5. Lay over tinned braid across the splice and connect to metallic shield of the other cable with a spring clamp. Vinyl tape (Std. Item T2W1) may be used to secure the braid to the splice to aid handling. Wrap a couple of layers of vinyl tape over the spring clamp to smooth out sharp edges. Refer to Figure 15

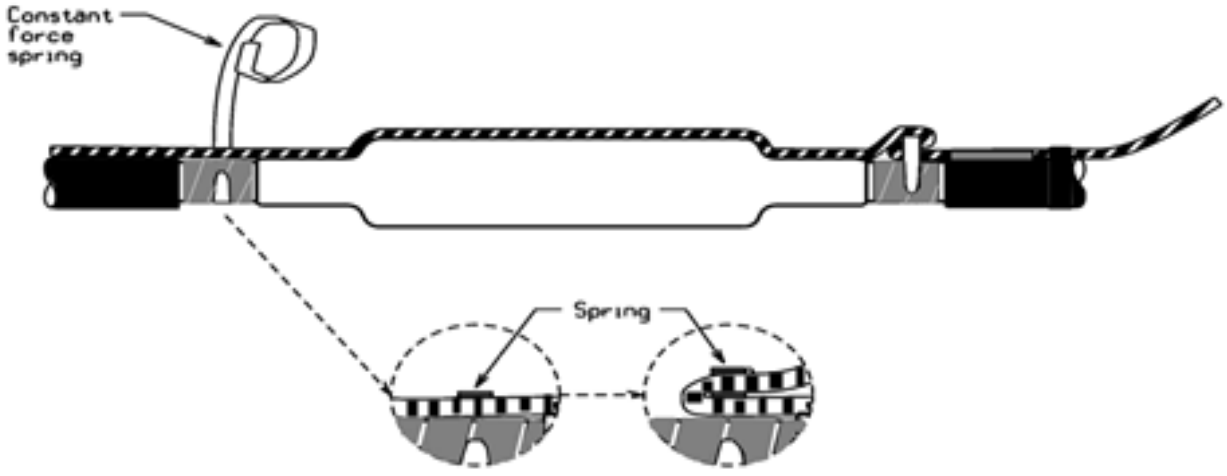

Figure 15

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Business Use

6. Apply 2 half-lapped layers of tinned copper mesh to provide mechanical protection and a smooth surface for the outer jacket of the splice. Tie off on the opposite side, clean the cable jackets for 3" from the jacket cutbacks. Refer to Figure 16.

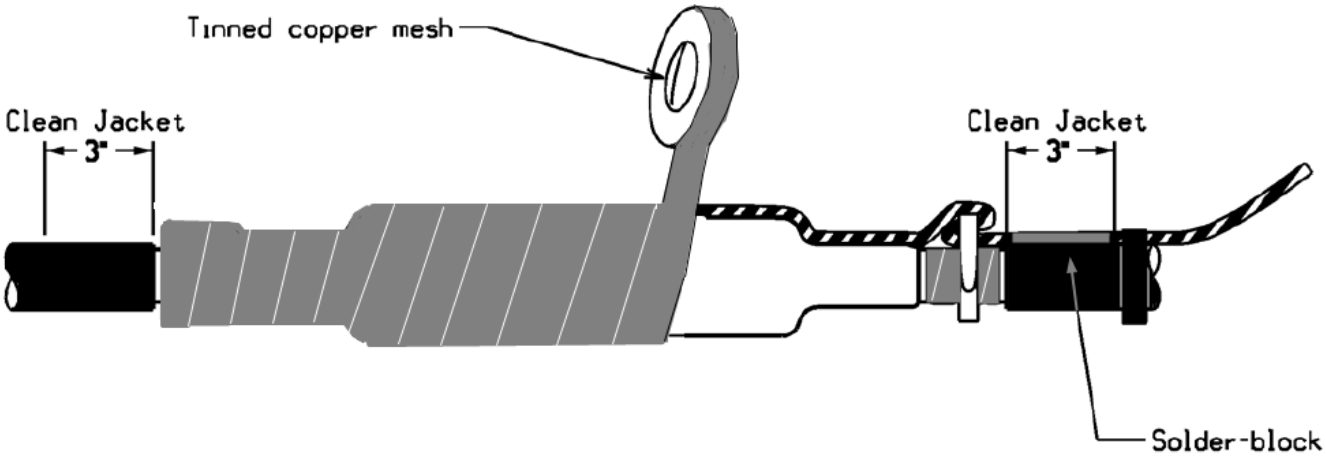

Figure 16

7. Make 1 wrap of the mastic sealant around each side of the cable. On the side with the external ground, press the solder block into the black sealant and make one more wrap over the solder block and previously applied sealant. Refer to Figure 17.

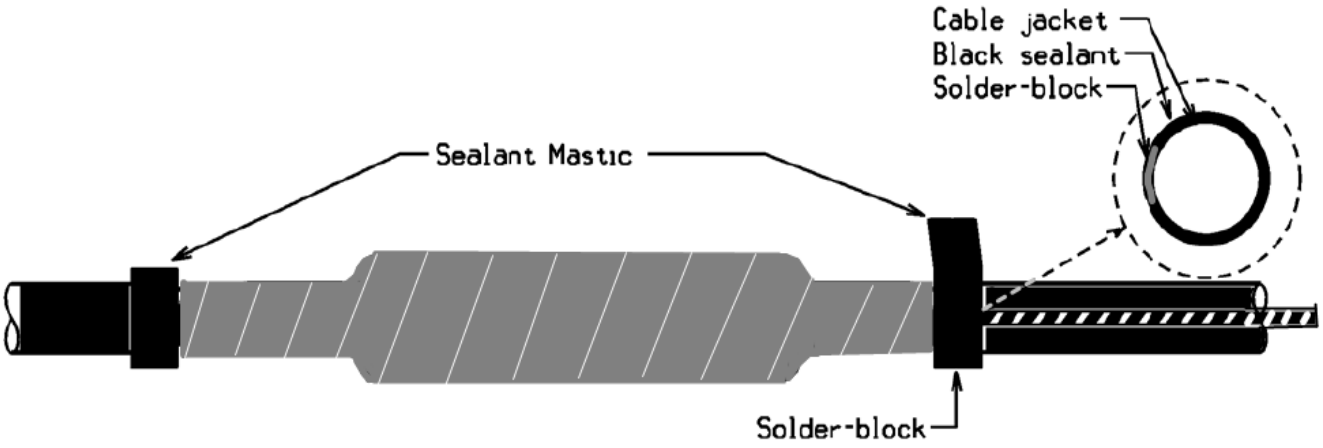

Figure 17

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8. Install cable jacket. Connect braid to the system ground. If braid is not long enough to reach ground, connect #2 tinned copper stranded conductor (Std. Item W13F) with a “C” crimp connector (Std. Item S14_) between braid and system ground. Refer to Figure 18.

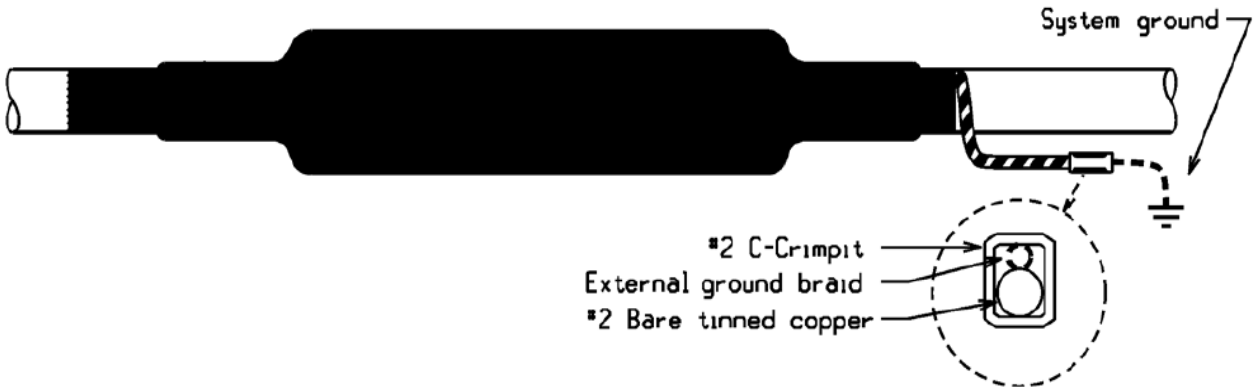

Figure 18

36.7.40 **Cable Splicing / Metallic Shield Bonding (COLD SHRINK SPLICES)**

1. Cut the concentric neutrals / drain wires and apply copper mesh on both sides of the splice to a convenient length as shown on section 36.7.20.

2. Connect the ends of each cable with the proper connector sized to the conductors. Compression connectors are to be used with heat shrink, pre-molded and hand taped splices. Shear bolt connectors are approved for use with cold shrink splices only. For compression connectors make sure to allow an expansion gap from the edge of connector and half the length of the connector for each side as indicated in the instructions. Shear bolt connectors are installed butting the insulation, no expansion gap required. Refer to Figure 19

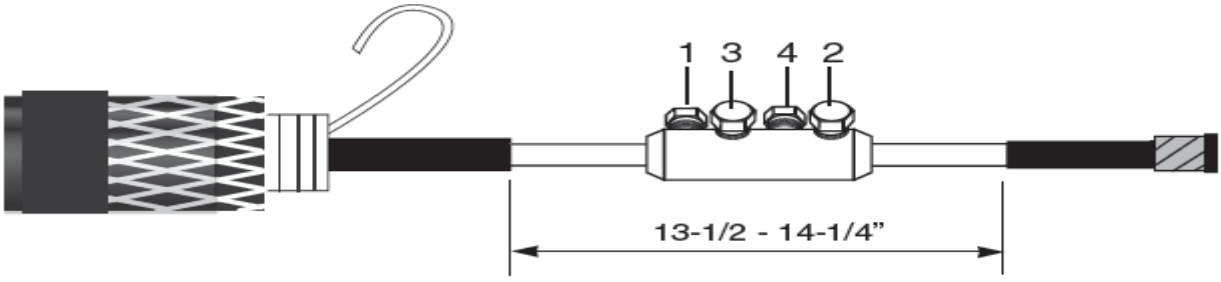

Figure 19

3. Place marking tape on one side of the cable as indicated in the instructions. Position the splice body so that the silicon's edge is lined up with the marking tape Refer to Figure 20.

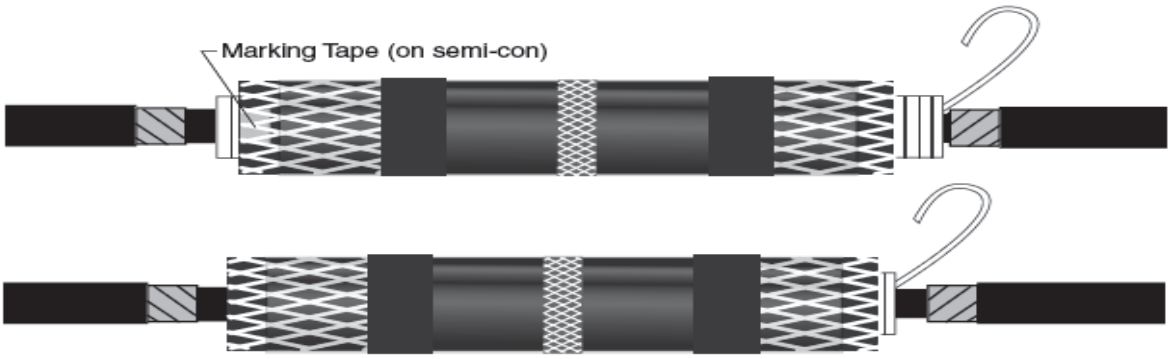

Figure 20

4. Pull the cord counterclockwise while holding the splice body in place. Do not pull the spiral holdout all at once. Slowly pull the spiral holdout on top of the cable then around and underneath until the cord has been completely removed. Refer to Figure 21.

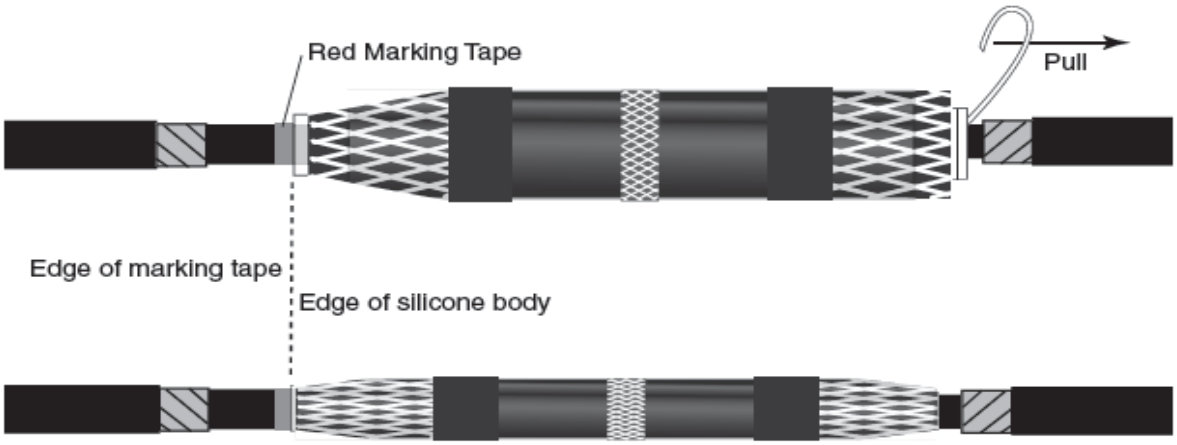

Figure 21

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5. Roll out the ground sock on each side of the splice. Lay the ground sock over the metallic shield end of the cables and connect with spring clamps included in the splice kit. Connect copper braid to system ground. Refer to Figure 22.

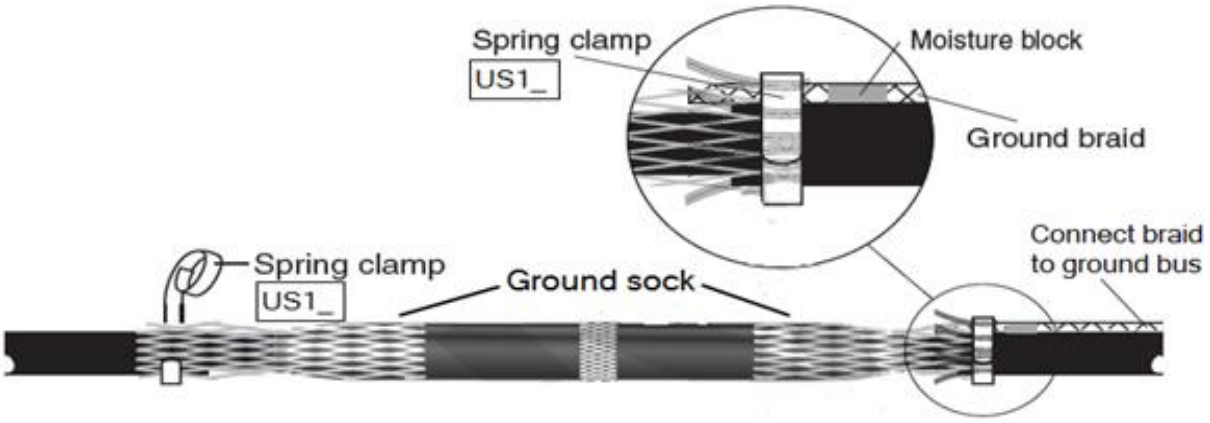

Figure 22

36.7.50 Cable Splicing / Metallic Shield Bonding (TRIFURCATING HEAT SHRINK SPLICES)

1. Cut the concentric neutrals / drain wires and apply copper mesh on the solid dielectric cable side of the splices to a convenient length as shown on section 36.7.20.

2. Place three tinned copper braids across the heat shrink transition splices. Use vinyl tape to temporarily secure the braids. Make sure to place the braid's solder block on the lead cable side. Clean and abrade the cable jacket beyond the lead where the solder block will be located. Clean and abrade the lead cable between the shrunk tubes and the jacket. Wrap four layers of copper mesh around the lead sheath. Connect the three copper braids to the copper mesh with a heavy duty spring clamp provided in the kit. Refer to Figure 23.

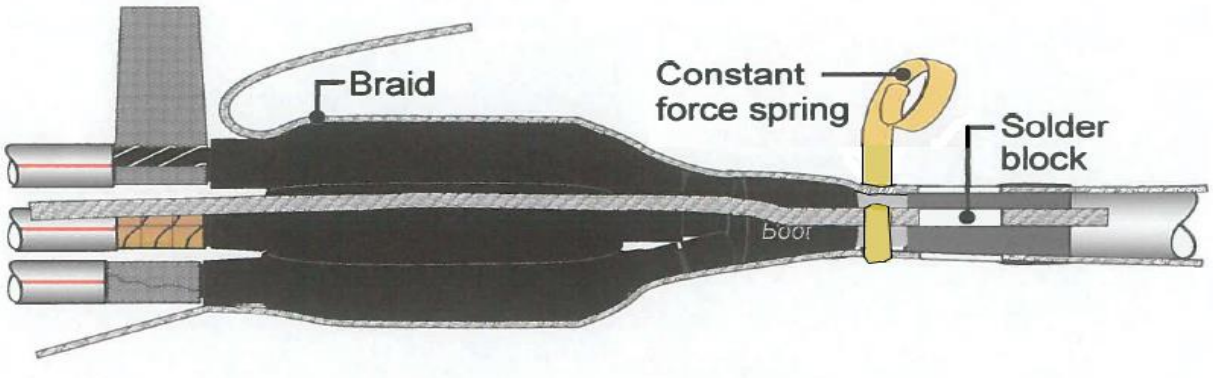

Figure 23

3. Connect copper braids to the solid dielectric cables over the copper mesh with spring clamps. Fold the excess braids back over the splices and wrap the remaining layers. Trim excess braid and secure with vinyl tape. Refer to Figure 24.

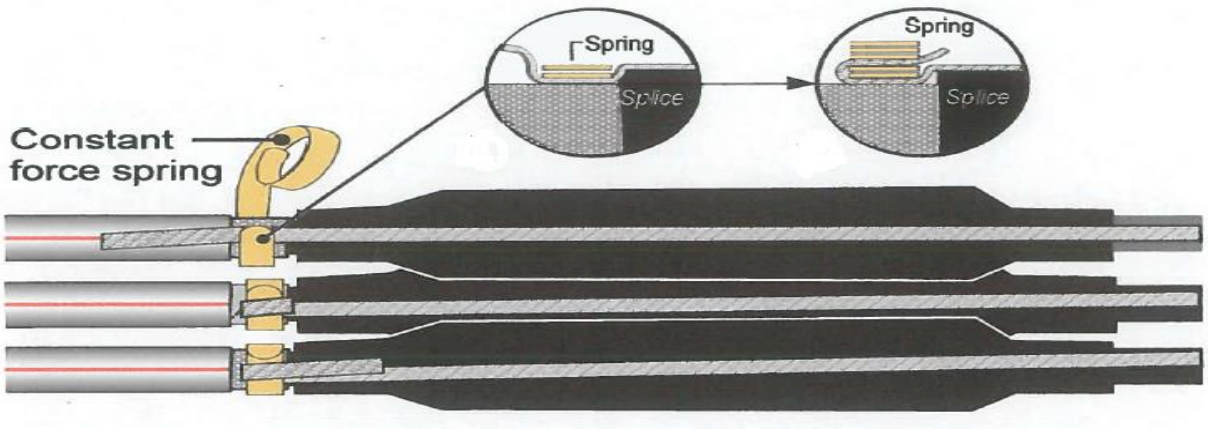

Figure 24

4. Wrap one half-lapped layer of tinned copper mesh around all three splices and tie off with a slip knot to secure. Install breakout boot and heat shrink according to manufacturer's instructions. Apply mastic sealant ant both ends of the splices. Make sure to wrap mastic sealant under and over the solder block braids to provide a complete moisture seal for the splice. Refer to Figure 25.

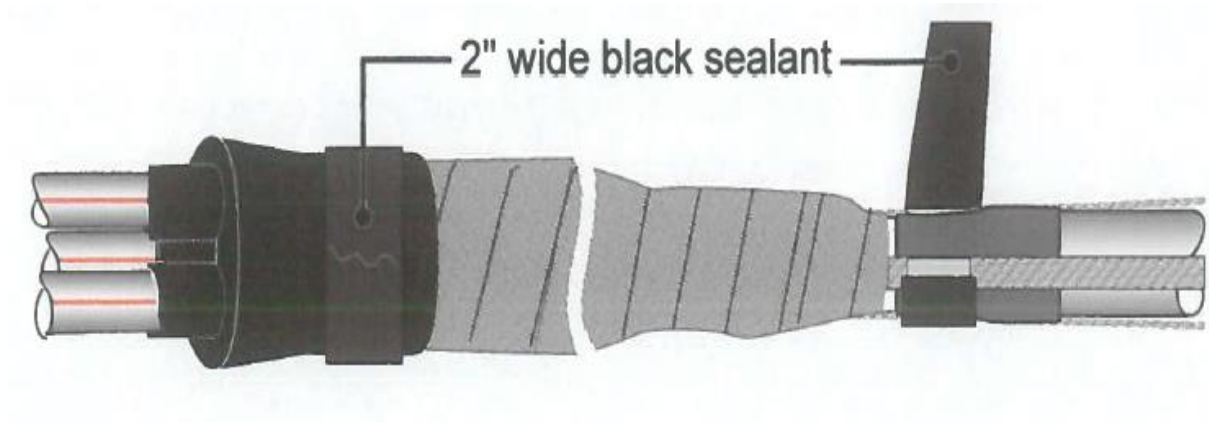

Figure 25

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5. Install the wrap around jacket sleeve and heat shrink according to manufacturer's instructions. Connect the external ground braids to a 4/0 bare copper neutral bonding it to the system ground bus in the manhole. Refer to Figure 26

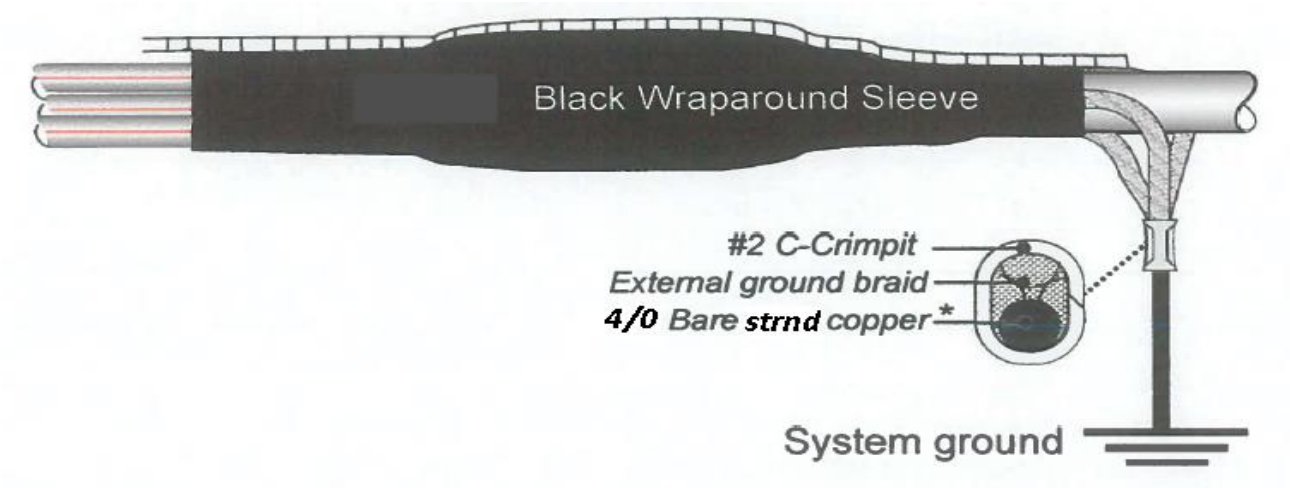


Figure 26

36.7.60 **Direct Buried Installations**

In direct buried installations of conductors larger than #2 (typically non-URD), drive a ground rod (Std. Item TG20) adjacent to the splice and connect #2 tinned copper braid to #2 tinned stranded copper bond wire (Std. Item W13F) and to the ground rod with a connector (Std. Item G4). See Figure 27 for details.

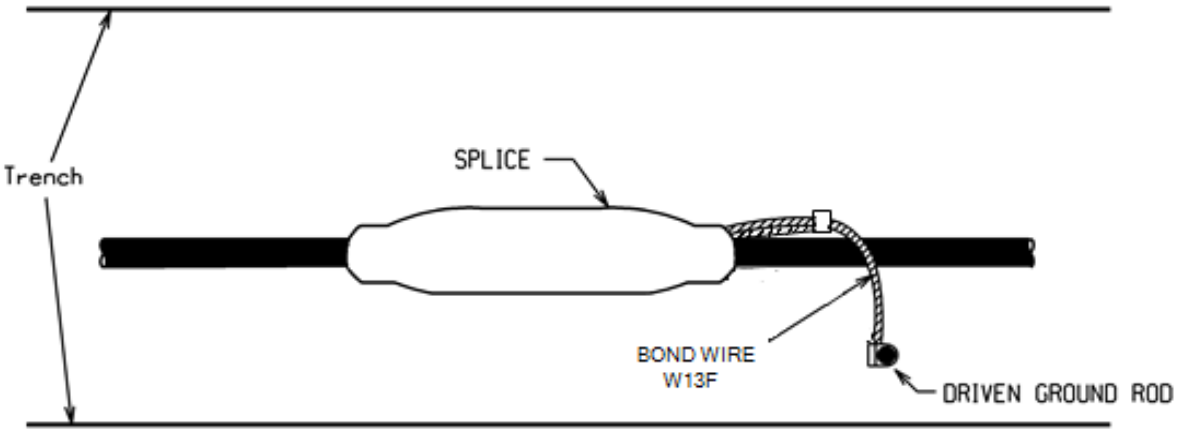


Figure 27

36.8 CONSTANT FORCE SPRING INSTALLATION (DOES NOT APPLY TO RAYCHEM / TE COLD SHRINK SPLICE STD ITEM UR51_)

The **only** acceptable method of braid to shield connection is the following:

1. Clean the surface of the metallic shield where the connection is to be made.

2. Stretch the width of the end of the braid for 4 – 5 “. Place the braid on the metallic shield, parallel to the cable. The goal is to maximize the contact area of the braid with the metallic shield. Wrap the constant force spring over the braid. Use up all of the spring. Caution: There must be some metal to metal contact between the braids and the spring – to prevent any partial discharge at this location. Refer to Figure 28.

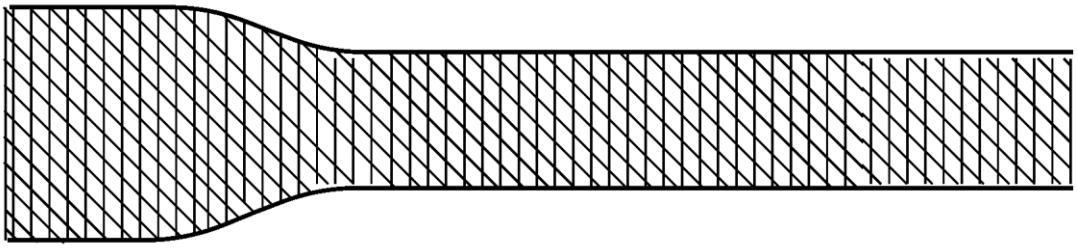


Figure 28

3. Extend the braid to the other side of the splice, parallel with the cable. Cut to an appropriate length, leaving a sufficient tail for connection to the tinned solder block braid. Refer to Figure 29.

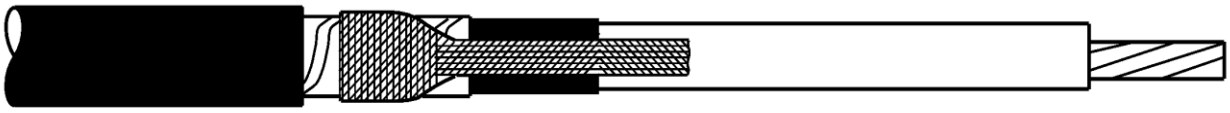


Figure 29

Supersedes 7/17 Issue – Re-numbered Page

4. Stretch the width of the braid at the location where the constant force springs will be installed. The goal is to maximize the contact area of the braid with the concentric neutrals / copper tape / lead sheath / flat straps. A couple laps of vinyl tape may be placed on the braids to temporarily hold them while the springs are installed. Wrap the constant force spring over the braid. Use up all of the spring. Caution: There must be some metal to metal contact between the braids and the springs – to prevent any partial discharge at this location. Refer to Figure 30.

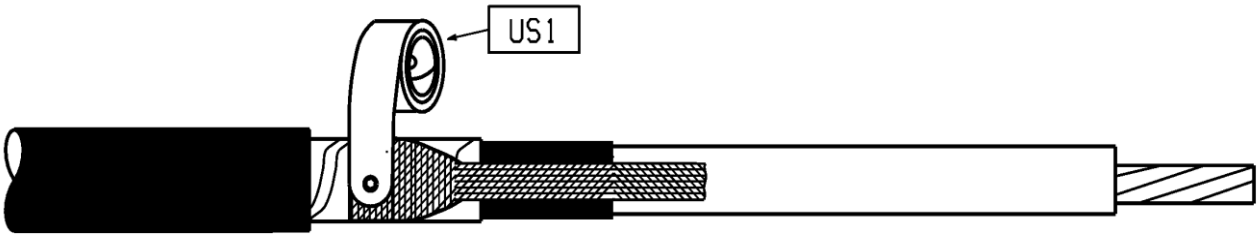


Figure 30

5. If necessary, one to two laps of vinyl tape (Std. Item T2W1) may be placed over the spring to hold it in place.

This connection method provides sufficient contact area of the braid to the cable shield and keeps the high resistance spring out of the electrical circuit. The spring is used solely as the mechanical force for the connection.

The traditional method of connecting the braid to the copper tape or lead has been to place one wrap of the constant force spring around the cable, then lay the braid over the spring parallel to the run of cable and then continue wrapping the spring around the cable until all the spring is used up. This connection depends on the spring to carry current from the cable shield to the braid, since the spring is the only material in contact with the shield. **This practice is no longer acceptable as** the spring steel has a relatively high resistance.

36.9 AERIAL INSTALLATIONS

3M Splices (Std. Item UR49_):
In aerial installations (or any installation where the joint will be exposed to direct sunlight), an overall silicone jacket (Std. Item UR49D) shall be used in place of the EDPM (black rubber) jacket supplied in the joint kit. The silicone tube is 24" long; therefore a splice will require two silicone jackets, overlapped in the middle. No mastic sealer is needed at the overlap of the jackets as they shrink down tightly enough over each other to prevent water intrusion. New aerial cables are jacketed concentric neutral construction. Older aerial cables have a copper tape shield. See 36.2.60 for splicing instructions. Connect the bond wires exiting the splice to the messenger wire and/or other grounded conductor.

Raychem TE Splices (Std. Item UR51_):
The splice bodies have carbon black therefore they are UV resistant and do not require a separate outer jacket. Bonding and grounding according to 36.7.10

Supersedes 7/17 Issue – Re-numbered Page

36.10 CONNECTORS

Approved connectors are the compression type and shear bolt connectors for cold shrink splices. Connectors are available in tinned copper and tinned aluminum. Connector dimensions (OD and length) must fall into the allowable range for the cold shrink and heat shrink splice kits. Use tinned copper connectors for copper-to-copper cables. Use tinned aluminum connectors for aluminum-to-aluminum and aluminum-to-copper cables. Choose the correct connector from Section 50 – Materials Catalog (Std. Items UC60__ to UC63__).

Compression reducing connectors are one piece, without inserts. These connectors have been designed to have a uniform outside diameter which allows the same tooling to be used on both sides of the connector. Some shear bolt connectors have inserts to work the correct conductor range. Read the instructions included in the packaging indicating when to use the inserts.

All connectors have a stop disk in the center of the barrel. This disk is sealed to prevent the migration of oil or water from one cable to the other. The stop disk also aids in correct splice assembly.

Connectors have little or no taper in order that the joint length remain in the range of the cold shrink and heat shrink kits.

Crimping can be with circumferential dies or indent style tools. If indent tools are used, the indents must be filled in when using heat shrink splice kits or hand taping. See Section 36.3 for heat shrink and Section 36.5 for hand tape instructions. The indents do not have to be filled in when using a cold shrink splice kit. Compress the connector with the correct tools / dies and using the proper number of compressions. See Section 34 – Tools / Dies for complete information.

Always compress the connector from the center to each end. Compress the connector only between the marks on the barrel. Rack the cables prior to compressing the connector. Straighten the cable for 3-4 feet on both sides of the connector prior to compressing. Rotate the tool 90 degrees between successive compressions. Shear bolt connectors can be installed with a ratchet wrench or an impact drill. Follow the instructions for the correct sequence of shearing the bolts.

36.11 DEAD BREAK 600A TEE SPLICE

Dead Break Elbows 600A (also known as T-Body or Hammerhead) shall not routinely be used to form a splice. The preferred method is to use a disconnectable Y or H joint – see Section 36.4. Dead Break Elbows 600A are routinely used as terminations – see Section 37.5.

However, there are many locations where these dead break elbows exist to make a joint. Installation of a dead break tee to make a joint is limited to the following:

1. Maintenance of existing units - replacement of an existing elbow
2. Addition of an elbow to an existing splice
3. Installation in a location which does not have space for a disconnectable Y or H
4. Installation on #2 aluminum conductor

In these locations, caution MUST be exercised to ensure a reliable installation. The lug must have a smooth hole. Lugs with a threaded hole are incorrect and will lead to joint failure. Any lugs found in service with a threaded hole shall be replaced the correct lug. The cables and joint must be secured to the cable racks to prevent movement from loading and fault currents. Each segment of the joint must be tightened separately, one joint at a time. Attempting to tighten a complete assembly (end to end) will result in improper torquing of the joint. The connectors must be torqued to 60 foot pounds and must not be moved after final tightening. The torque setting is reduced to 45 foot pounds when the spanner wrench is used. This is due to the increased length of the wrench with the spanner wrench added. Keep the spanner wrench and the torque wrench aligned in a straight line.

Supersedes 7/17 Issue – Re-numbered Page. Revised 36.11

Version	Date	Modification	Author(s)	Approval by (Name/Title)
5	07/20	• Revise Section 36.2.50		
4	07/18	• Revise 36-Index • Revise Section 36.4 • Re-numbered pages 36-8 to 36-27 • Revised Section 36.11		
3	07/17	• Revised entire Sections 36.7, re-numbered pages		
2	07/15	• Revised 36.0.40 General, Grounding and Bonding • Revised 36.2, 36.2.30 & 36.2.40 Cold Shrink Splices • Revised 36.2.69 Aerial Cable • Revised 36.4 Pre-molded H&Y Splices • Revised 36.6.10 Shrinking Tubes • Revised 36.7.10 General, Grounding and Bonding • Revised 36.7.120 Figure 6 • Revised 36.9 Constant Force Spring • Revised 36.9 Aerial Cables		
1	07/09	• Revise 36.0,10 paragraph 2 & 6 • Revise 36.0.40 paragraph 2 • Revise 36.1 paragraph 7 • Revise 36.2 paragraphs 1, 3 & 5 • Revise 36.2.40 A & B • Revise 36.2.50 paragraph 2 • Revise 36.2.60 last paragraph • Revise 36.3.10 paragraph 1 • Revise 36.4 paragraphs 4 & 5 • Revise 36.5.50 paragraph 2 • Revise 36.6.30 paragraph 1, add paragraph 2 • Revise #8 of 36.7.20 and 36.7.30 • Revise #5, 6 & 8 of 36.7.40, 36.7.50 & 36.7.60 • Revise #3, 4 & 7 of 36.7.70, 36.7.80, 36.7.90, 36.7.100 & 36.7.110 • Revise 36.8 paragraphs 1 thru 4 • Revise 36.9 • Revise 36.11 paragraph 3 • Revise Figures 2, 4, 5, 7, 8, 9 & 10		

SUMMARY OF RECENT CHANGES

ISSUE	PAGE NUMBER		
7/18	36-NOTES	UNDERGROUND CONSTRUCTION STANDARD	ppl

Supersedes 7/10 Issue – Added section 37.8

37.0 GENERAL

For cables with conductor size of 1000 kcmil and smaller, cable terminations shall be cold shrink type, packaged in a kit with appropriate installation instructions. With the exception of the kit for 15kV, #2 aluminum cable the kits do not include a connector lug or a mounting bracket. Both of these items are available separately. These terminators have superior electrical stress relieving capabilities to ensure long cable life. The installation instructions packed with each kit shall be followed, except as detailed below for non-standard cables, such as drain wire and copper tape shielded cables.

The preparation of the cable has been proven to be the most critical portion of the installation process. Perform all steps carefully, taking care to use the proper dimensions.

The use of standard cable preparation tools is required, as it limits the chance of damage to the cable insulation and shielding system. Company approved tools are listed in the Tool Catalog which can be found on the Distribution Engineering Services web site.

DO NOT make any substitutions for materials supplied in the appropriate kit, except as detailed in this Standard for drain wire or tape shielded cables.

Older types of cable may have a fabric tape semi-conducting insulation shield material. When cable with this type of semi-conducting material needs to be terminated, this material shall be cut back ¼ - ½ inch more than specified here-in for extruded semi-con layers. The exposed portion of the fabric tape semi-con shall then be wrapped with semi-con tape (Std. Item T1S), applied half lapped, until the specified semi-con cutback is reached. This tape shall then be trimmed square to the cable at the required cutback.

Until such time as the cable is ready to be terminated, the cable ends shall remain sealed. This prevents moisture from ground water or the atmosphere entering the conductor strands. DO NOT terminate cable that shows evidence of moisture in the conductor strands. Cold shrink end caps are available and shall be used on all open ends of cable. See Section 35.12 for additional details.

Keep the cable and termination free of moisture, dirt, and metal particles during the entire preparation and installation process. Once started, terminations shall be completed during one work session. If work must be stopped prior to completion of the termination, the exposed portions of the cable insulation and conductor shall be protected with a half lapped layer of vinyl tape (Std. Item T2W1 or T2W2) a half lapped layer of silicon rubber tape (Std. Item T5S1) and another half lapped layer of vinyl tape.

Be sure to remove any semi-conducting layer, either extruded or tape type, from the insulation during the preparation process. If there is any question about whether a material is semi-conducting or not, consult either Standards Engineering or Work Methods.

The surface of the insulation shall be thoroughly cleaned after removal of the semi-conducting material. Sand the insulation only to remove all visible traces of the semi-conducting material then clean the insulation with cleaning kit (Std. Item UC80F) or bottle and wipes (UC80D & UC80B). Always wipe the cleaner from the conductor end toward the semi-conductor cutback. The solvent will pick up the carbon black in the semi-conductor and spread it onto the insulation if the wiping direction is the opposite. This will contaminate the insulation and cause a future termination failure. CAUTION: Do not attempt to sand the 'grooves' out of EPR insulated cables. These grooves occur due to the manufacturing process where the concentric neutral wires are in contact with the insulation. These grooves will disappear when the cable is heated up. If it is necessary to remove the grooves to properly clean the insulation, gently heat the cable to remove the grooves.

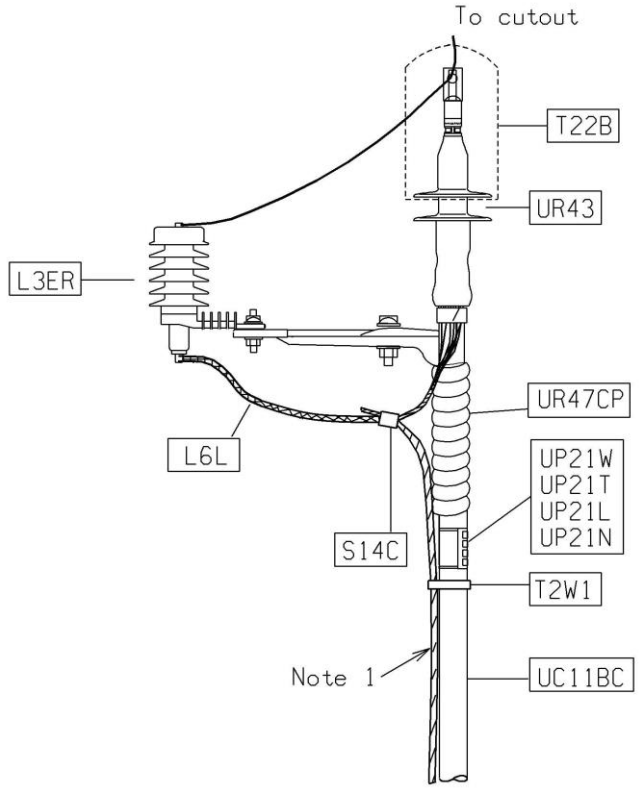
On concentric neutral cable, cut the cable and prepare the end such that the bundled concentric neutral wires form a tail a minimum of 18 inches in length outside of the terminator. Alternatively a piece of bare wire can be spiced to the concentric neutrals per Table 2. On drain wire, tape shielded and LC shielded cables the braid will be the neutral.

Supersedes 1/07 Issue – Revise Paragraphs 1, 3, 4, 5, 6, 7, 8, 9 & 10 of Section 37.0

For #2, 15 kV, URD cables, use the mounting bracket packaged with the terminator (Std. Item UR42). For all other cables, use a cable positioning device (Std. Item UR47CP) to mount the terminator. On wooden riser poles utilize a 3 position bracket (Std. Item C35A for single phase, Std. Item E12M for three phase). In stations or on steel structures, mount the cable positioning device to an appropriately located structural member. A surge arrester shall be installed in an adjacent hole of the three position bracket. See Figure 1 below for terminator mounting details.

37.0.10 Grounding And Bonding

For proper cable protection from lightning and other surges, a riser type surge arrester (Std. Items L3DR – L3JR) shall be installed immediately adjacent to the termination. Riser type arresters are identified by a yellow band on the dis-connector unit on the bottom of the arrester. Utilize an adjacent mounting hole in the bracket to mount the arrester. Install the flexible ground lead (Std. Item L6 or L6L) on the arrester. Extend the flexible ground lead to the system neutral with a tap lead sized according to the Table 2. Connect the flexible ground lead, the neutral from the cable and a neutral tap lead with an appropriately sized C crimp connector (Std. Item S14_) as shown. The tap lead shall be sized according to Table 2 below. Keep all lead lengths as short as possible for the best cable system protection from lightning and surges. Route the neutral tap along the primary cable or allow it to float in air. Tape (Std. Item T2W1) may be used as needed for a neat installation. DO NOT tape or route the neutral along the fiberglass terminator mounting bracket. On risers with more than one phase, connect the neutrals together when they reach the pole then run a single conductor of equivalent size, connecting it to system neutral. A #4 solid, covered ground conductor shall be connected to the system neutral and driven ground per standard grounding procedures.



Note 1: Continue to system neutral and driven ground rod.

Caution: *This is a current carrying portion of the cable; make all connections prior to energizing.*

Note 2: Some items will vary depending on cable size.

Figure 1

Supersedes 2/06 Issue – Revise 37.0.10; Revise Figure 1 & add note 2; Text Shift

37.1 COLD SHRINK TERMINATIONS

Cold shrink silicone rubber terminations shall be used for terminating shielded, high voltage power cables, 5 kV through 35 kV. These terminators have a wide cable range, can be used indoor or outdoor and are suitable for any solid dielectric insulation and any type of shielding.

A. Cold Shrink for Concentric Neutral / Jacketed Concentric Neutral, 5 – 35 kV
B. Cold Shrink for Copper Tape / Drain Wire Shield, 5 – 25 kV
C. Cold Shrink for Copper Tape / LC Shield, 35 kV

37.1.10 Application

Termination kits are supplied based on voltage and diameter of the insulation under the semi-con layer. Conductor size can be used as a guide, however, the diameter of the insulation shall be the final determining factor. The same kit is suitable for copper or aluminum conductors, indoor or outdoor application.

37.1.20 Type Of Cable

These kits can be installed on any type of solid dielectric cables.

The basic kit contains all parts for the concentric neutral cable & jacketed concentric neutral cable (See Section 37.1.50).

Ground braid, constant force springs and additional mastic are required for cables with copper tape, drain wire or LC shielding. For details refer to the following Sections of this Standard:

Application	Section
Concentric Neutral 5 kV thru 35 kV	Section 37.1.50
Copper Tape Shield or Flat Strap Neutral – 5 kV thru 25 kV	Section 37.1.60
Drain Wire Shield – 5 kV thru 25 kV	Section 37.1.70
Copper Tape / LC Shield – 35 kV	Section 37.1.80

37.1.30 Terminal Lugs

Pin type terminals (Std. Item S27F) shall be used for #2 conductor terminations on riser poles only. These terminals are included with (Std. Item UR42). Additional pin type terminal sizes are available for live front padmounted transformers. All other terminals shall be 2-hole pad style lugs (Std. Item UL15 / UL16) and are separate from the termination kit. The terminal lug material shall match the conductor material – aluminum lug for aluminum conductor, copper lug for copper conductor. Install the connector as directed in the instructions packaged with the terminator. Do not substitute lugs – approved lugs are sealed to prevent water intrusion and subsequent cable failure.

37.1.40 Termination Kit Selection

Select the proper kit from Table 1 below. Insulation OD will always be the final determining factor as to kit choice. If an overlap exists, choose the kit where the cable insulation OD falls closest to the middle of the range of the termination.

Table 1
Termination Kit Selection

Std. Item	Insulation OD	Conductor Size Range			
		5 kV	15 kV	25 kV	35 kV
UR42 [1]	0.64" – 1.08"	-	#2	-	-
UR43 [2]	0.64" – 1.08"	4/0 – 400	#2	-	-
UR44B	0.64" – 1.08"	4/0 – 400	#2		
UR44C	0.83" – 1.53"	500 – 1500	4/0 – 500	1/0 – 350	-
UR44D	1.05" – 1.80"	-	750 – 1000	500	-
UR44E	1.53" – 2.32"	-	-	1000	-
UR45B1	0.72" – 1.29"	-	-	-	1/0 – 2/0
UR45C3	1.05" – 1.80"	-	-	-	300 – 500
UR45H	1.53" – 2.32"	-	-	-	750 – 1000

Notes:

1. This kit is for #2 URD applications only. It comes packaged with a pin terminal connector and mounting bracket
2. This is a 2 skirt terminator, with no connector or mounting bracket in the kit. This item is being phased out – remaining stock can be used on URD / UCD riser poles. It is not recommended for switchgear. Use UR44B (4 skirt) for switchgear applications.

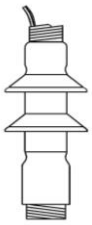


Figure 2
Typ. 5 – 15 kV

Figure 3
Typ. 15 – 25 kV

Figure 4
Typ. 35 kV

Table 2
Neutral Tap Wire

Conductor	# of Neutrals	Neutral Tap	Std. Item
#2 – #1/0	10 – 16	#2 stranded bare	W13G
#2/0 – 1000 kcmil	18 – 30	#2/0 stranded, bare	W17G

37.1.50 **Terminations For Concentric Neutral & Jacketed Concentric Neutral Cable**

The termination kit contains all materials needed for installation on these cables. Follow the manufacturer's instructions packed with the kit.

Supersedes 7/10 Issue – Revised dimension for UR44E

37.1.60 Terminations for Copper Tape Shield or Flat Strap – 5 kV Thru 25 kV (Includes Aerial Cable)

In order to adapt the termination kit for use on cables rated for 5 kV through 25 kV with copper tape shield, an accessory kit will be necessary. This kit contains a solder blocked ground braid and constant force spring. Follow the instructions below for preparation of the cable and installation of the ground braid. The instructions packed with the accessory kit are for a different type of cable.

Select the accessory kit based upon the OD over the shield of the cable, as listed in the following table.

Table 3

Shield OD	Accessory Kit
0.82” – 1.63”	UR47T4
1.15” – 2.42”	UR47T5

If the cable has fabric or tape semi-con, this material shall be cut back ¼ - ½ inch more than specified here-in for extruded semi-con layers. The exposed portion of the fabric tape semi-con shall then be wrapped with semi-con tape (Std. Item T1S) applied half lapped, until the specified semi-con cutback is reached. This tape shall then be trimmed square to the cable at the required cutback.

A. Prepare Cable:

1. Check to be sure cable size fits within kit range as shown in Table 1 (cover page) of the termination instructions packaged with the kit.

2. Prepare cable using dimensions shown in Figure 5. Be sure to allow for the depth of the terminal lug and growth of Aluminum Lug (if used – see chart below). If necessary to prevent tape shield from unraveling, TEMPORARILY hold down the edge with a single wrap of vinyl electrical tape.

Table 4

Aluminum Cable Size	#2 – 350 kcMil	400 – 650 kcMil	750 – 1000 kcMil
Growth Allowance	0.25”	0.50”	0.75”

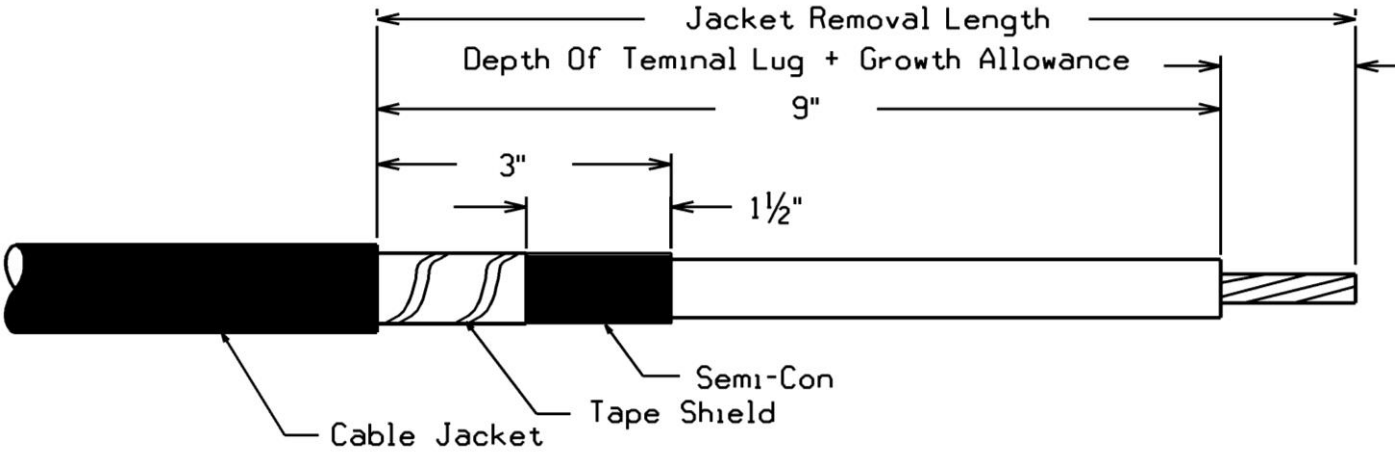


Figure 5

B. Install Ground Braid:

1. Select one of the mastic strips from the termination kit and remove the white release liners. Using light tension, apply a single wrap of mastic around the cable jacket ¼ inch from the cut edge. Cut off excess mastic. See Figure 6.

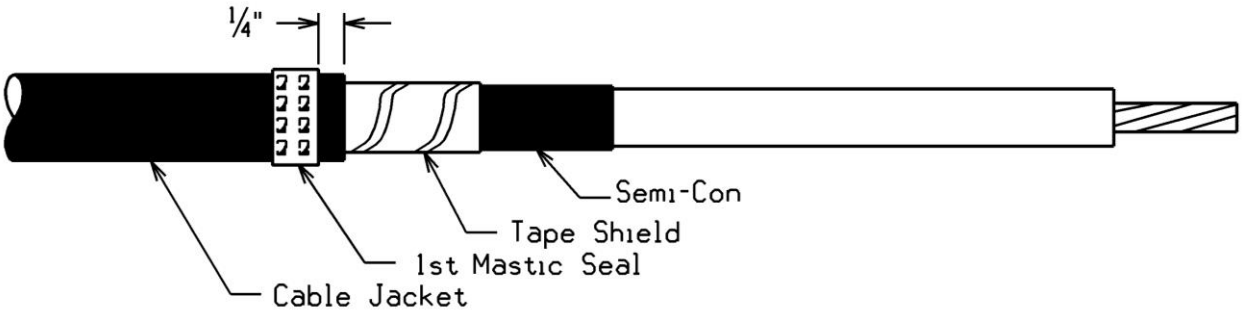


Figure 6

2. Position pre-formed "U" shaped ground braid over tape shield directly adjacent to the cable jacket cut edge. The long tails should extend over the cable jacket, with the solder block of one tail positioned over the mastic. Secure this tail to the cable jacket with a vinyl tape marker, located 4½ inches from the edge of the cable semi-con. See Figure 7.

Note: Position this vinyl tape with care as it will serve as the marker for final termination location on the cable.

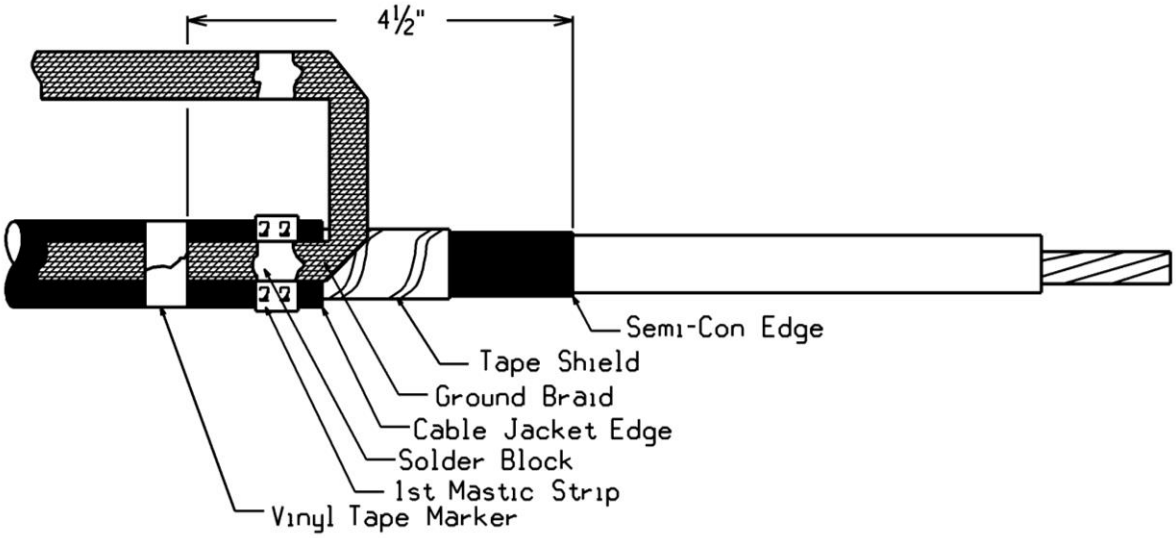


Figure 7

3. Wrap the ground braid around the tape shield, placing the solder block on the second tail on the mastic applied in Step 1. Secure with a constant force spring. Using the second mastic strip from the termination kit, remove the liners and wrap mastic over the solder blocks and the first mastic strip. If the solder blocks overlap each other, mastic must be applied between the solder blocks as well as over them. See Figure 8.

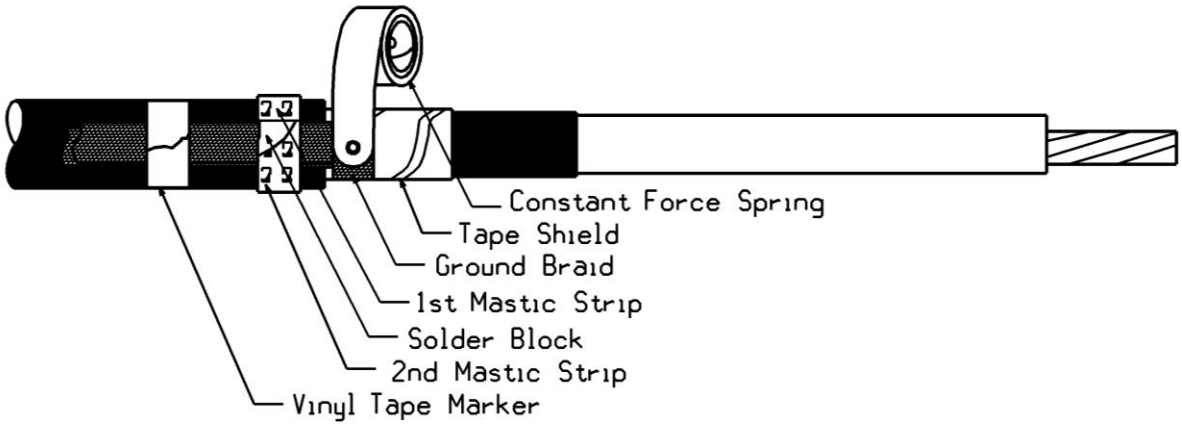


Figure 8

4. Wrap two half-lapped layers of vinyl tape around the mastic seal, constant force spring and exposed metallic shield. Do not allow the vinyl tape to lap onto the cable semi-con. Do not apply more than 2 half-lapped layers. **Note:** If vinyl tape was used to hold the copper tape in place in Step 2, remove it just prior to applying this tape. See Figure 9.

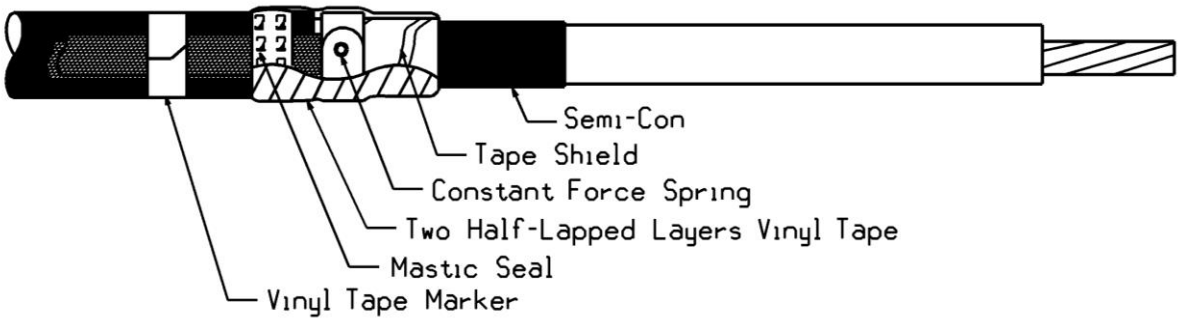


Figure 9

Continue with termination installation instructions, starting with the “Install Lug or Connector” section to complete the termination installation.

37.1.70 Terminations For Drain Wire Shield – 5 kV Thru 25 kV

In order to adapt the termination kit for use on cables rated for 5 kV through 25 kV with drain wire shield, an accessory kit will be necessary. This kit contains a solder blocked ground braid and constant force spring. Follow the instructions below for preparation of the cable and installation of the ground braid. The instructions packed with the accessory kit are for a different type of cable.

Select the accessory kit based upon the OD over the shield of the cable as listed in the following table.

Table 5

Shield OD	Accessory Kit
0.82”-1.63”	UR47T4
1.15”-2.42”	UR47T5

If the cable has fabric or tape semi-con, this material shall be cut back ¼ - ½ inch more than specified here-in for extruded semi-con layers. The exposed portion of the fabric tape semi-con shall then be wrapped with semi-con tape (Std. Item T1S) applied half lapped, until the specified semi-con cutback is reached. This tape shall then be trimmed square to the cable at the required cutback.

A. Prepare Cable:

1. Check to be sure cable size fits within the kit range, as shown in Table 1 (cover page) of the termination instructions packaged with the kit.

2. Prepare cable using dimensions shown in Figure 10. Be sure to allow for depth of terminal lug and growth of the aluminum lug (if used – see chart below).

Table 6

Aluminum Cable Size	#2 – 350 kcmil	400 – 650 kcmil	750 – 1000 kcmil
Growth Allowance	0.25”	0.50”	0.75”

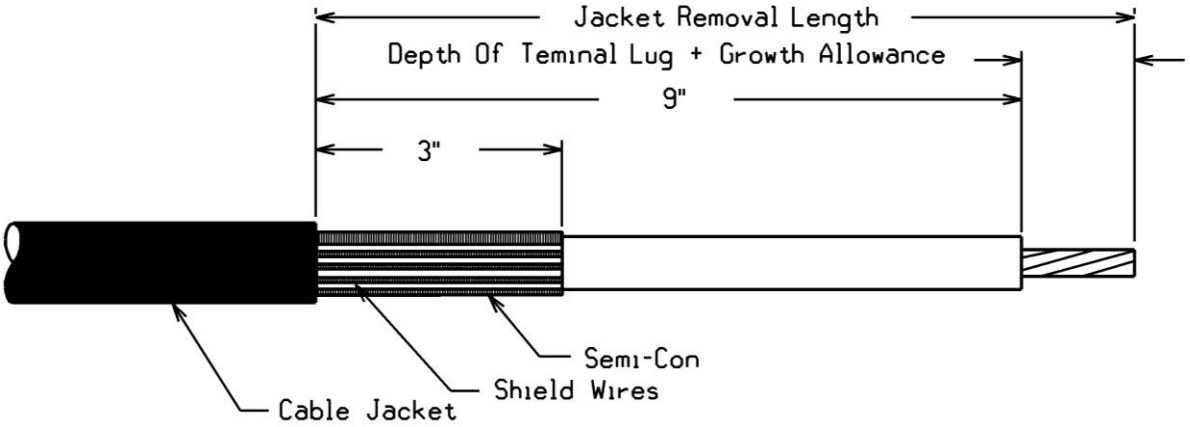


Figure 10

3. Bend the leading 1½ inches of exposed shield wires back upon themselves with the end of each wire close to the cut edge of the cable jacket. See Figure 11.

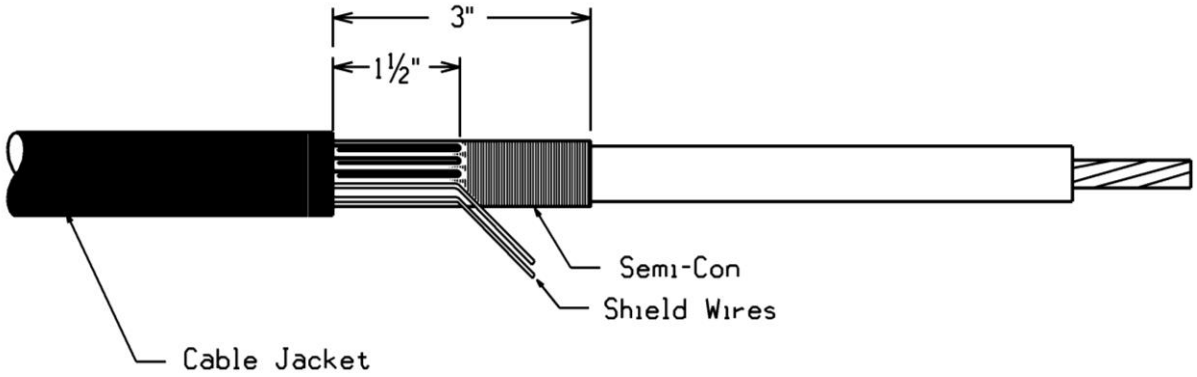


Figure 11

B. Install Ground Braid:

1. Select one of the mastic strips from termination kit and remove the white release liners. Using light tension apply a single wrap of mastic around the cable jacket ¼ inch from the cut edge. Cut off excess mastic. See Figure 12.

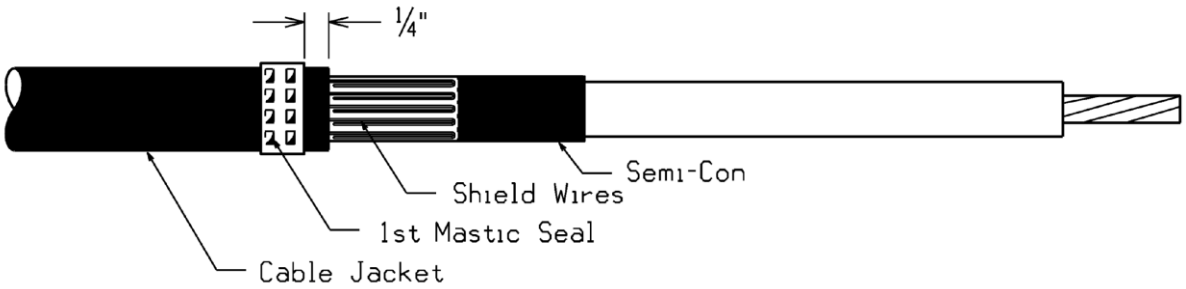


Figure 12

2. Position pre-formed “U” shaped ground braid over tape shield directly adjacent to cable jacket cut edge. The long tails should extend over the cable jacket with the solder block of one tail positioned over the mastic. Secure this tail to the cable jacket with a vinyl tape marker located 4½ inches from the edge of the cable semi-con. See Figure 13.

   Note: Position this vinyl tape with care as it will serve as the marker for final termination location on the cable.

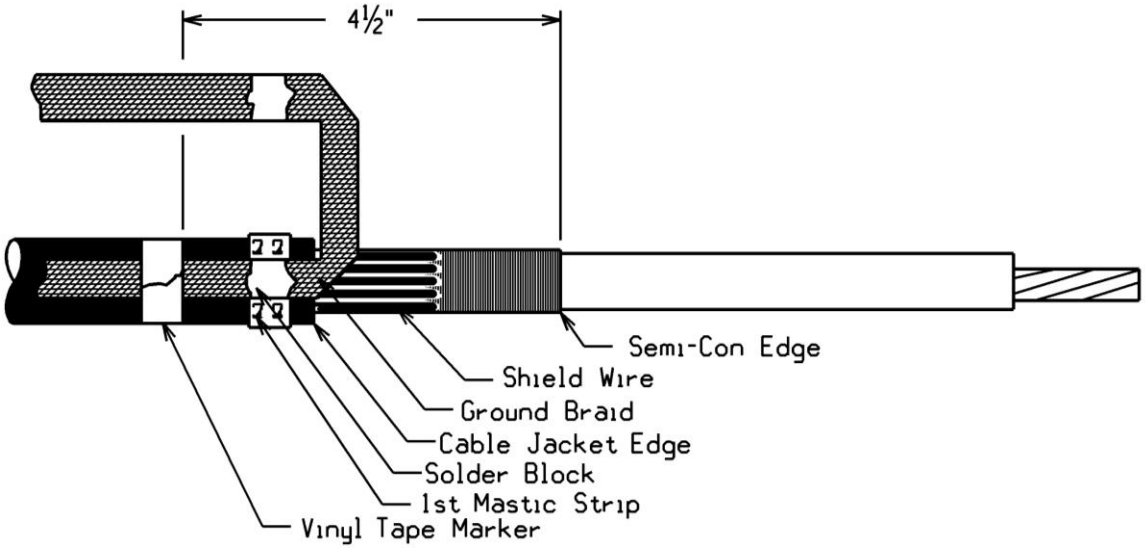


Figure 13

3. Wrap the ground braid around the metallic shield, placing the solder block on the second tail on the mastic applied in Step 1. Secure with a constant force spring. Using the second mastic strip from the termination kit, remove the liners and wrap mastic over the solder blocks and the first mastic strip. If the solder blocks overlap each other, mastic must be applied between the solder blocks as well as over them. See Figure 14.

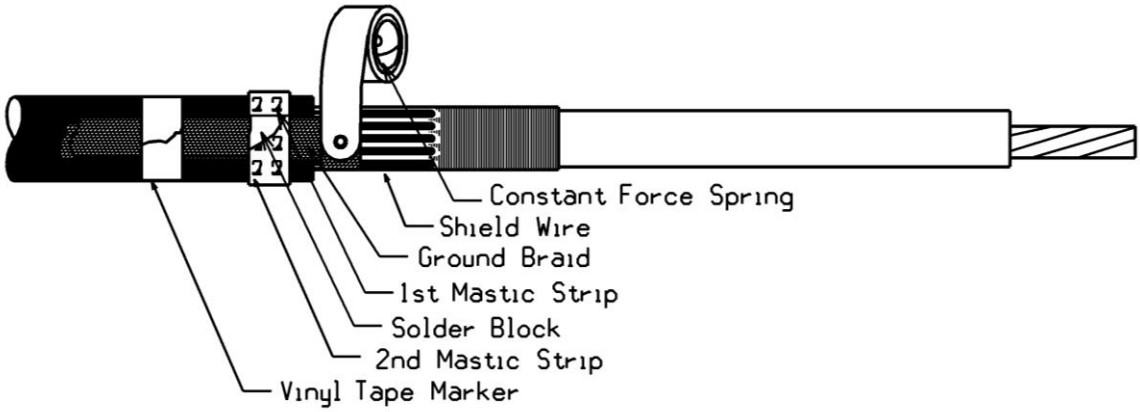


Figure 14

Supersedes 1/07 Issue – Revise 37.1.70 B3

4. Wrap two half-lapped layers of vinyl tape around the mastic seal, constant force spring and exposed metallic shield. Do not allow the vinyl tape to lap onto the cable semi-con. Do not apply more than 2 half lapped layers. See Figure 15.

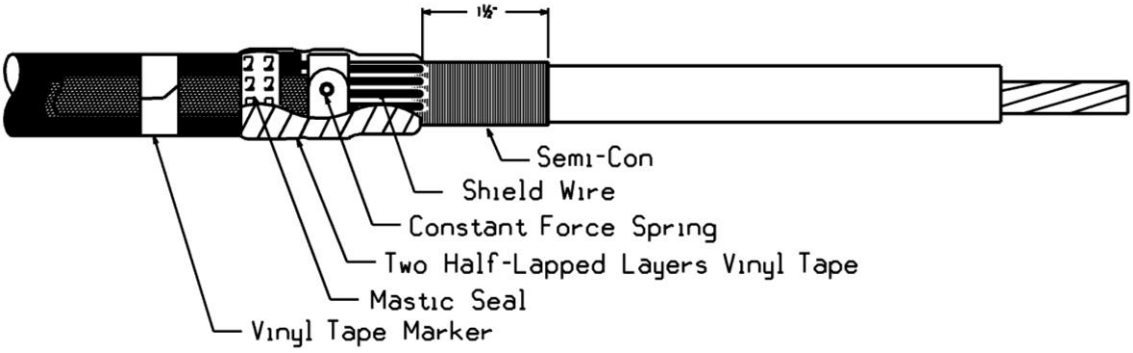


Figure 15

Continue with termination installation instructions, starting with the "Install Lug or Connector" section to complete the terminator installation.

37.1.80 Terminations For Copper Tape / LC Shield 35 kV

In order to adapt the termination kit for use on 35 kV cables with copper tape or LC shield, an accessory kit will be necessary. This kit contains a solder blocked ground braid and constant force spring. Follow the instructions below for preparation of the cable and installation of the ground braid. The instructions packed with the accessory kit are for a different type of cable.

Select the accessory kit based upon the OD of the cable shield, as listed in the following table.

Table 7

Shield OD	Accessory Kit
0.82"-1.63"	UR47T4
1.15"-2.42"	UR47T5

If the cable has fabric or tape semi-con, this material shall be cut back ¼ - ½ inch more than specified here-in for extruded semi-con layers. The exposed portion of the fabric tape semi-con shall then be wrapped with semi-con tape (Std. Item T1S) applied half lapped, until the specified semi-con cutback is reached. This tape shall then be trimmed square to the cable at the required cutback.

A. Prepare Cable:

1. Check to be sure cable size fits within the kit range as shown in Table 1 (cover page) of the termination instructions packaged with the kit.

2. Prepare cable using the dimensions shown in Figure 16 and the Semi-Con Cutback in Table 9 below. Be sure to allow for the depth of terminal lug and growth of the Aluminum Lug (if used – see Table 8 below). If necessary to prevent tape shield from unraveling, TEMPORARILY hold down the edge with a single wrap of vinyl electrical tape.

Table 8

Aluminum Cable Size	#2 – 350 kcmil	400 – 650 kcmil	750 – 1000 kcmil
Growth Allowance	0.25”	0.50”	0.75”

Table 9
35 kV Termination Semi-Con Cutback

Insulation O.D. (ins)	Splice Kit		
	UR45B1	UR45C3	UR45H
0.72 – 1.08	13.5”	N/A	N/A
0.88 – 1.29	13.0	N/A	N/A
0.83 – 1.21	N/A	13.5”	N/A
0.98 – 1.53	N/A	13.0”	N/A
1.53 – 1.85	N/A	N/A	13.5”
1.65 – 2.32	N/A	N/A	13.0”

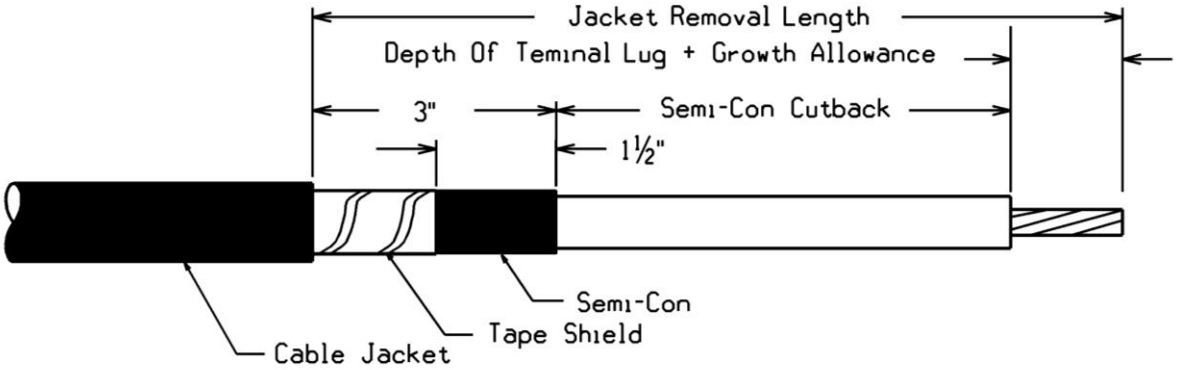


Figure 16

B. Install Ground Braid:

1. Select one of the mastic strips from the termination kit and remove the white release liners. Using light tension apply a single wrap of mastic around the cable jacket ¼ inch from the cut edge. Cut off excess mastic. See Figure 17.

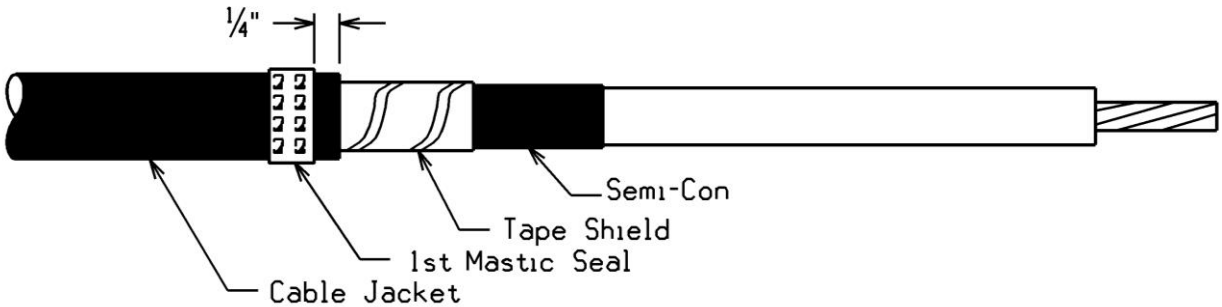


Figure 17

2. Position pre-formed “U” shaped ground braid over tape shield directly adjacent to cable jacket cut edge. The long tails should extend over the cable jacket with the solder block of one tail positioned over the mastic. Secure this tail to the cable jacket with a vinyl tape marker located 4½ inch from the edge of the cable semi-con. See Figure 18.

   Note: Position this vinyl tape with care as it will serve as the marker for final termination location on the cable.

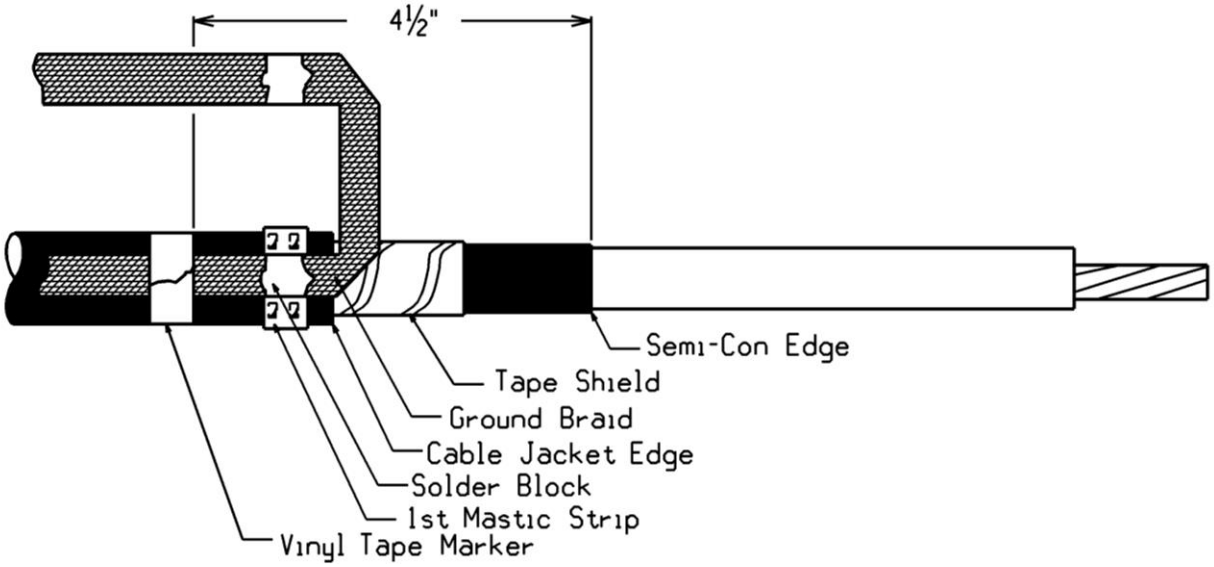


Figure 18

3. Wrap the ground braid around the metallic shield, placing the solder block on the second tail on the mastic applied in Step 1. Secure with a constant force spring. Using the second mastic strip from the termination kit, remove the liners and wrap mastic over the solder blocks and the first mastic strip. If the solder blocks overlap each other, mastic must be applied between the solder blocks as well as over them. See Figure 19.

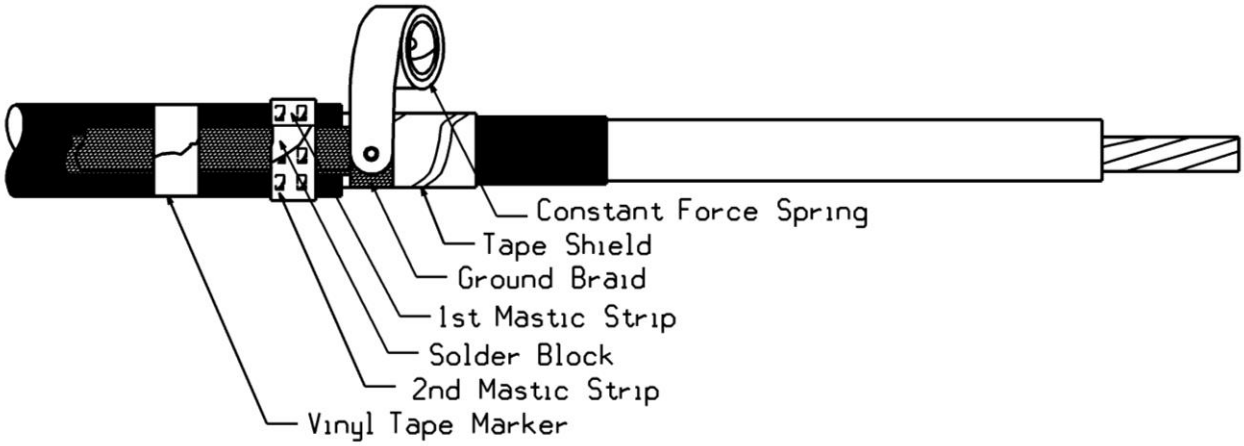


Figure 19

4. Wrap two half-lapped layers of vinyl tape around the mastic seal, constant force spring and exposed metallic shield. Do not allow the vinyl tape to lap onto the cable semi-con. Do not apply more than 2 half-lapped layers. **Note:** If vinyl tape was used to hold the copper tape in place in Step 2 of preparing the cable, remove it just prior to applying this tape. See Figure 20.

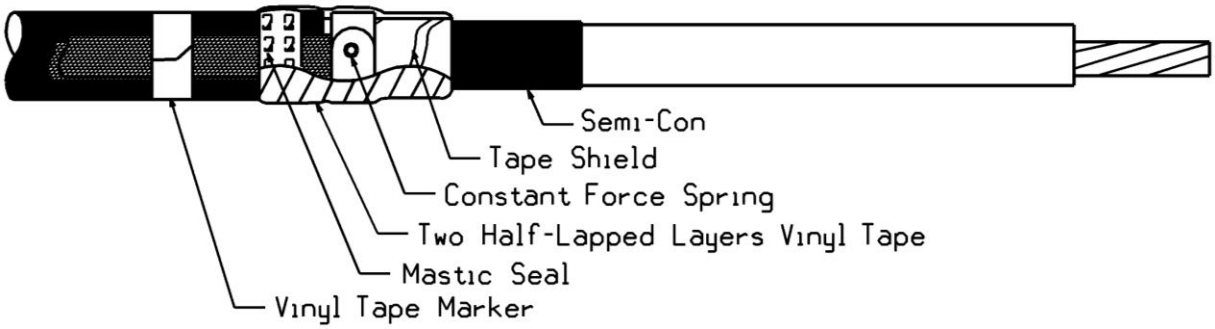


Figure 20

Continue with termination installation instructions, starting with the "Install Lug or Connector" section to complete the termination installation.

37.2 OBSOLETE TERMINATIONS

The following types of terminations are obsolete and shall not be installed on the Company system any longer:

A. Pre-molded slip on
B. Lead wiped pothead
C. Porcelain slip on (maintenance only, see section 37.4 below)
D. 200 Amp deadbreak elbows (replace with 200 Amp loadbreak equipment)

37.2.10 Pre-Molded Slip On

Pre-molded slip on type terminations are not to be installed. For any new terminations, use cold shrink terminations – See Section 37.1.

If an existing pre-molded termination is damaged, remove it and replace it with a cold shrink termination. Adjust the cutbacks of the insulation, semi-con and jacket as needed. When replacing an old slip on terminator, examine the conductor carefully to determine if there is any damage from corrosion due to water ingress – which happens frequently with this termination. The alternate repair would be to cut the cable further away from the terminator location and splice in a new piece of cable, using a cold shrink splice, as described in Section 36 – Connectors/Splices. Splices in #2 cables may be located on the pole, provided they are completely covered by U-duct. Other cable sizes will require splicing away from the pole – either direct buried or at the first pullbox / handhole / manhole.

37.2.20 Lead Wiped Pothead

Do not install any lead wiped potheads. If an existing pothead is damaged, it must be replaced with a cold shrink termination. Cut the cable back and install a piece of solid dielectric cable with a lead transition heat shrink splice as described in Section 36 – Connectors/Splices. Then install the new cold shrink termination. Check the PILC cable carefully for the presence of moisture. If moisture is present, the PILC cable must be cut back to eliminate the moisture.

Supersedes 1/07 Issue – Revise 37.1.80 B4; Paragraph 2 of Section 37.2.10; Revise Section 37.2.20

37.2.30 Porcelain Slip On

Pre-molded terminations with porcelain insulators (typical manufacturer was G&W) may remain in operation if the termination and cable are in good condition. This termination has been discontinued. Replace the entire termination with a cold shrink termination when necessary – See Section 37.1. Check carefully for moisture damage as noted in Section 37.2.10.

37.2.40 200 Amp Deadbreak Elbows

200 Amp deadbreak elbows are not standard on the Company system, although some do still exist in service. If repair or replacement of a deadbreak elbow is needed for any reason, it should be replaced with a standard 200 Amp loadbreak elbow (Std. Item UR23). The corresponding accessories will also have to be replaced. The bushing wells are compatible on the transformer side, so after replacing a deadbreak elbow with a loadbreak elbow at a transformer or other piece of equipment, replace the bushing well insert with a loadbreak type (Std. Item UR36B).

37.3 SPECIALTY APPLICATIONS

The following types of terminations may be used in special applications only:

A. Heat shrink (only where cold shrink terminations do not fit the cable size)
B. Hand tape (only for cables smaller than #2) consult Standards Engineering for approval.

There are some applications in the Company system which will require the use of a non-standard termination. For instance, there are some cables in use having dimensions which are outside the range of the cold shrink splices. One of these cables is used for substation bus tie and / or transformer secondary main applications. Where this cable is used, heat shrink terminations will be required to meet the cable dimensions. Since this cable is never used without consultation with Underground Cable Engineering, the termination will be specified as part of the design by the Underground Cable Engineering group.

Other special applications include small size (less than #2 conductor) and low voltage (less than 5 kV), non-standard cables for some customer service installations. These will require a hand taped termination due to small dimensions of the cables. Consult Standards Engineering for hand taped termination designs as needed.

37.4 MAINTENANCE ONLY ITEMS

G&W porcelain slip on terminators may be maintained for main line cables. The housing is being retained in stock (Std. Item UR47). If the terminator fails and causes cable damage, replace the entire terminator with a cold shrink termination.

G&W porcelain slip on terminations were widely used over the past 25 years. These terminators are now non-standard and shall not be used for new construction or replacement where the cable has been damaged and will be pieced out. For these applications, use cold shrink splices as described in Section 37.1.

However, the porcelain bodies of the terminators, filled with the gel at the factory, are being retained in stock. If the porcelain body is damaged, but the cable is intact and does not require any repairs, the housing only may be replaced. Also, the air side connectors are also being retained at this time to allow replacement of the connector only if needed. If the air side connector is replaced, thoroughly clean the top stud of the terminator and apply oxide inhibitor prior to installing the new air side connector. If a particular termination has been repeatedly replaced due to leaks of the gel, replace the entire termination with a cold shrink termination. If the location of the termination must remain unchanged, cut the cable further back and splice in a new piece using a cold shrink splice as described in Section 36 - Connectors/Splices.

37.5 DEADBREAK ELBOWS 600AMP (T-BODY)

Deadbreak Elbows 600A (Std. Item UR60) shall be routinely used only as a termination. These terminations are generally needed for connection to vacuum switches, SF6 insulated switchgear, network transformers, pad-mount transformers and similar equipment. They shall not be normally used as a splice. There are a few exceptions to the use as a splice, see Section 36.11 for details. For straight splices, use a standard cold shrink splice as described in Section 36.2 – Connectors/Splices. For T splices, use a disconnectable 'Y' splice as described in Section 36.4 – Connectors/Splices.

The elbows are available in two voltage classes, 25 kV and 35 kV. The 25 kV elbow may be used for all voltages from 5 kV through 25 kV. Follow the installation instructions in the elbow package. Be sure that the correct cable adapter (Std. Item UR64) and connector (Std. Item UR63) are used. The connectors are not voltage sensitive, only conductor size sensitive. The cable adapters are voltage sensitive – the lower voltage adapters are good for 5 – 25 kV applications, while the higher voltage ones are good for 35 kV only. The cable adapter is selected according to the OD of the cable insulation, under the semi-con layer. Pick the cable adapter where the cable insulation OD is as close as possible to the middle of the adapter range.

Some existing 35 kV elbows are 'stick-op' style for use on the 35 kV distribution feeders. These elbows utilize a different lug, connecting plug and dead end plug. The appropriate fittings are available to convert these to the normal deadbreak style elbows. Contact Standards Engineering for more information.

Orient the connector with the equipment prior to crimping on the connector. This will prevent excessive twisting of the cable to install the elbow after installation. All bolted connections shall be made using a torque wrench. The dead end plugs shall be tightened to 55 foot-pounds +/- 5 foot-pounds. Minimize cable movement after final tightening to prevent loosening the connection.

Any time these dead break elbows are installed as connections to equipment – transformers, switchgear, etc – the preferred method of installation is to install a reducing tap well (Std Item UR68_) on the outside of the elbow and use an insulating cap (UR24 for 15kv and UR 91 for 35 kV) to complete the installation. This allows for a location to perform a direct voltage test and install personal protective grounds as needed for maintenance work. New style elbow with integrated reducing tap well is available (Std. Item UR60R).

When a multi way submersible switch is installed, elbows with grounding provisions and short cables with live end caps shall be installed on any unused ways. Installation of these cables will prevent any nuisance voltages from developing on the unused ways. Also, grounding elbows can be installed on the unused way while the live end caps are removed and straight splices installed to make use of the way on the switch. See Figure 21.

Elbows installed on jacketed concentric neutral cable must have a jacket sealing kit (Std. Item UR23B1) installed. This will prevent the ingress of moisture under the jacket which could cause corrosion of the concentric neutral wires. After making the required jacket cutback, install one of the mastic strips on the cable jacket as described in the sealing kit instructions. Then bend the neutrals back and bed them in the mastic. Slide the cold shrink sealing tube over the cable and the neutrals. Continue with the installation of the elbow and then complete the jacket sealing kit. When installing elbows make sure they are fully seated on bushing. Bond the cable by connecting the concentric neutrals to the ground grid. Be sure to bond the elbow housing by inserting a #14 strand through the ground eye.

A stainless steel clamp (Std. Item UR71HC – SAP 9387549) shall be used on all 35 kV joints over the boot assembly. The boot is required to maintain required BIL. The clamp shall be used on 15/25 kV joints when assembling of boot becomes easy. The clamp will ensure a water tight seal.

Supersedes 7/15 Issue – Revised Section 37.5

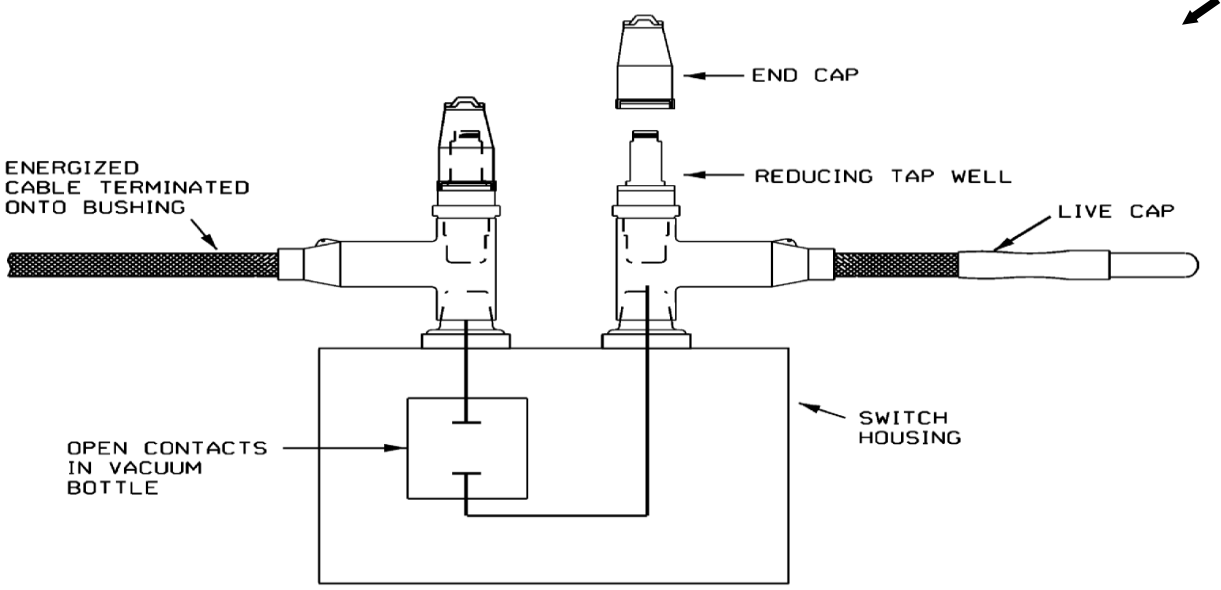


Figure 21

Supersedes 7/15 Issue – Text shift and added Section 37.5.10

37.5.10 Cold Shrink Deadbreak Elbows 600A

Cold Shrink Deadbreak Elbows 600A are being trialed at PPL underground systems. These elbows do not require installation of cable adapters, they are range taking and can be used with different size cable insulations. Installation of the elbows will become easier and time saving.

Standard elbow (Std. Item UR60CS__ - Figure 21A) rated 5-25 kV and elbows with a 200A reducing tap well (STD. Item UR60R_ - Figure 21B) rated 15 kV have been set up as stock items. The elbows are made of EPDM rubber and the housing of these elbows have a test point and an integrated rejacketing sleeve. Elbow kits come with a threaded stud, silicone grease and mastic to seal the elbow to prevent moisture ingress. Bond the cable by connecting the concentric neutrals to the ground grid. Be sure to bond the elbow housing by inserting a #14 strand through the ground eye. Make sure to follow the manufacturer's instructions included with the kit.

Figure 21A

Figure 21B

37.6 200 AMP LOADBREAK ELBOWS

200 Amp loadbreak elbows (Std. Item UR23 for 15 kV or UR90 for 35 kV), are the primary termination used for all pad-mount transformers, except those used on 23 kV, delta connected (ungrounded or resistance grounded) systems. They are not used on these systems since the phase to ground voltage can exceed the rating of the elbow during phase to ground fault events. They are used for all subway and subsurface transformer primary connections, and connections to various types of equipment, such as vacuum switches.

Follow the installation instructions included with the elbow. The kit is size sensitive due to the connector to be crimped on the end of the conductor and the cable insulation OD range. Consult Standards Engineering for applications where the cable dimensions do not meet the requirements of the in stock elbow kits.

Elbows installed on jacketed concentric neutral cable must have a jacket sealing kit (Std. Item UR23B) installed. This will prevent the ingress of moisture under the jacket which could cause corrosion of the concentric neutral wires. After making the required jacket cutback, install one of the mastic strips on the cable jacket as described in the sealing kit instructions. Then bend the neutrals back and bed them in the mastic. Slide the cold shrink sealing tube over the cable and the neutrals. Continue with the installation of the elbow and then complete the jacket sealing kit. Use caution when threading the loadbreak probe into the connector to prevent cross threading – which is a common failure mode. Tighten the probe with the one time tool included with the elbow or use the torque limited tool designed for the purpose. Be sure to bond the elbow housing by inserting a #14 strand through the ground eye. When installing elbows make sure they are fully seated on bushings.

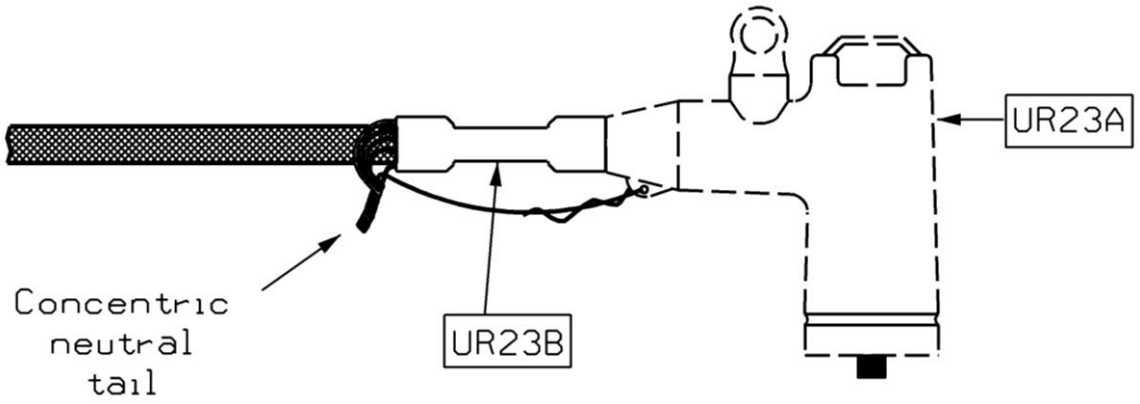


Figure 22

37.7 LIVE END SEAL, HEAT SHRINK

Live end seals (Std. Item UR77) are available for systems from 5 kV through 25 kV. They can be installed on paper lead and solid dielectric cables. Choose the correct seal kit based on the OD of the cable insulation. Follow the instruction in the kit for installation, being sure to heat the outer cap sufficiently to ensure a tight seal to the lead sheath or the cable jacket.

Live end seals on solid dielectric 35 kV cable consist of a 600 Amp deadbreak elbow with two insulating plugs. This method is also an alternate to the live end seal kits on solid dielectric 5 kV through 25kV cables. See Section 37.5.

Be sure to bond the concentric neutral / drain wires / lead sheath to ground when installing a live end seal.

Supersedes 7/10 Issue – Text shift and text edit for 37.6 3rd paragraph.

37.8 900 AMP DEADBREAK ELBOWS (T-BODY)

900 Amp deadbreak elbows (Std. Item UR62_) shall be used only as a termination for network transformers manufactured from June of 2015 and forward. The transformers being supplied will have a nameplate that indicates 900 Amps above the bushings, see figure 23. With the limited cable sizes and system voltages the terminations have been set up as kits. The kit includes the elbow, connector, cable adaptor and end cap. Based on the operating area and cable the appropriate kits have been set up, see table 10 below.

			OPERATING AREA	
STANDARD ITEM	CABLE SIZE	VOLTAGE CLASS	Rhode Island	Maintenance Only
UR62A	#2	15		x
UR62A2	#2	15	x	
UR62C	4/0	15		x
UR62C2	4/0	15	x	
UR62E2*	1/0	25		x
UR62G**	2/0	35		x
UR62G2**	2/0	35		x

** The 35kV class elbows are rated for 200kV BIL.

Table 10

New Standard

Notes:

1) Some of the 15kV class elbow kits might contain an extra cable adaptor depending on the manufacturer's specifications to meet our cable size requirements for both the 4 and 15kV cables in our operating system.
2) Depending on procurement, some of the elbow kits might also come with the reducing tap well build in.
3) The standard items listed ending with 2 come with a 200 amp reducing tap well and cap, depending on the room in the vault will determine if this kit is suitable.

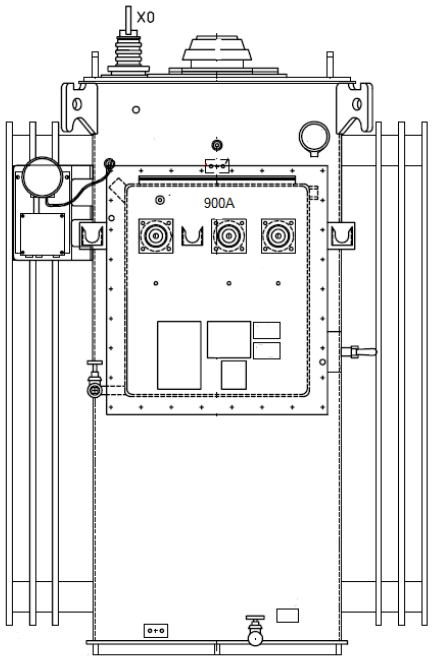


Figure 23

38.7.10 **Installation**

Orient the connector with the equipment prior to crimping on the connector. This will prevent excessive twisting of the cable to install the elbow after installation. All bolted connections shall be made using a torque wrench. The dead end plugs shall be tightened to 55 foot-pounds +/- 5 foot-pounds. Minimize cable movement after final tightening to prevent loosening the connection. Kits with the reducing tap well elbow come supplied with a disposable torque wrench. When the wrench starts to cantilever the proper torque has been applied and the wrench can be disposed of.

New Standard

Version	Date	Modification	Author(s)	Approval by (Name/Title)
5	7/20	• Text edit to 37.1.60 title block		
4	07/18	• Updated Section 37 Index • Revised Section 37.5		
3	07/15	• Text Edit 37.2.30 • Added paragraph 7 to 37.5 • Text edit to 37.5 and 37.6 • Text Edit for Table 1 (UR44E) • Added new section 37.8		
2	07/14	• Text Edit for 37.1.30		
1	07/10	• Revise Paragraphs 1, 3, 4, 5, 6, 7 8, 9, &10 of Section 37.0 • Revise Section 37.0.10 • Revise Figure 1 and add Note 2 • Revise Note 2 to Table 1 of Section 37.1.40 • Revise Section 37.1.40 • Revise Paragraph 2 of Section 37.2.10 • Revise Section 37.1.60 B3 & B4 • Revise Section 37.1.70 B3 & B4 • Revise Section 37.1.80 B3 & B4 • Revise Section 37.2.20 • Revise Section 37.2.30 • Revise Section 37.2.40 • Add new Paragraphs 5 & 6 and Figure 21 to Section 37.5 • Renumber Figure 21 to 22 on page 37-18 • Revise Section 37.7 Paragraph 2		

Supersedes 7/21 Issue – Updates to various sections see notes page for details.

Supersedes 7/21 Issue –Drawing additions / updates.

38.0 GENERAL

The following Standard is the practice to be followed when designing the application of and installing underground (UG) distribution system switches and their related equipment. This Standard is not intended to apply to secondary networks.

Switches designed for use with underground systems provide operational control and worker protection for the UG distribution system. UG switches and switchgear can be used as isolation points to remove a section of underground cable from the energized system. Switchgear and vacuum switches provide fused or electronic interrupting protection for the underground distribution system.

38.1 CUSTOMER REQUIREMENTS

In general, the Company's customer service policies require that customers "having the potential to exceed 75 kVA of transformer capacity are required to supply space for electrical equipment on private property" (See the *SPECIFICATIONS FOR ELECTRICAL INSTALLATIONS* or *ELECTRICAL SERVICE, INFORMATION AND REQUIREMENTS* for specific information related to different operating areas.). This generally requires the customers whose loads may reasonably be expected to exceed 75 kVA at some point in the future to provide a location for a pad-mounted transformer and pad-mounted switchgear. This could reasonably be expected to include any three-phase customer.

38.2 SWITCHING EQUIPMENT INSTALLATIONS

Listed below are guidelines for the installation of switching equipment and transformation in urban UG areas. These guidelines are listed in order of preference. Every effort should be made to install equipment serving new customers in accordance with the first choice below. The responsible engineer, the engineering manager, and the operations manager must review exceptions to these guidelines.

A. The first choice in expanding or developing new UG systems is to install a completely pad-mounted system. All switchgear and transformers should be pad-mounted and easily accessible to operating personnel using standard tools.

B. The second choice is to build a system where switchgear and transformers are installed below grade but are completely accessible from grade using standard tools for operation and grounding. Generally, equipment should be installed in vaults that are not intended to be accessed by personnel on a regular basis, so-called half vaults, hand holes, etc. Building vaults on customer property would also fit into this category.

C. The third choice is to install switchgear and transformers in manholes intended for personnel access. This equipment shall be accessible remotely and not require personnel to be in the manhole during switching operations. This remote operation can be accomplished through use of standard tools or by rigging, remote operators, or other means.

Switches and transformers with load break elbows, or other separable connections, may be installed in locations that require personnel to be in a manhole when operating elbows PROVIDED adequate means have been designed to allow the elbows or other connectors to be removed de-energized following all applicable safety rules and policies.

38.3 SWITCHING EQUIPMENT

38.3.10 Standard Underground Switching Equipment

A. Three Phase Pad-Mounted Switchgear – Available in several configurations (See Sections 38.4, 38.5, 38.6, 38.12, 38.13 and 38.14).
B. Submersible Switches – Available in several configurations (See Section 38.7, 38.14, 38.15 and 38.16).
C. 15 kV Switching Junction Enclosure (See Section 38.8).
D. Oil Fuse Cutouts – "Information provided for maintenance only" (See Sections 38.9, 38.10 and 38.11).
E. 15 kV Primary metering (See section 38.17)
F. Network switches (See section 38.18)
G. Padmount reclosers (See section 38.19)

38.4 THREE PHASE PAD-MOUNTED SWITCHGEAR – 15 kV CLASS

This Section covers the design, installation, and construction of three phase, pad-mounted switchgear. Elbow style (dead front) switchgear (STD Item US45_) is required for any new installations. Livefront style switchgear (Std. Item US36_) may be still used for maintenance purposes. This Section shall apply in conjunction with the Section 44 – UCD (Underground Commercial Distribution) and Section 45 – URD (Underground Residential Distribution).

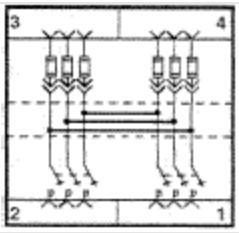


Figure 1

2 switch / 2 fuse US45, US45SS & US45CL
(SS is Stainless Steel and CL is Current Limiting)

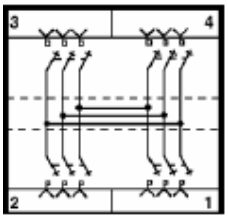


Figure 2

4 switch US45A & US45ASS
(SS is Stainless Steel)

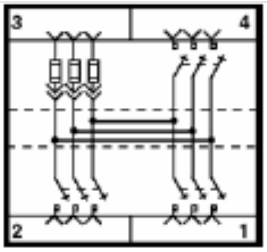


Figure 3

1 fuse / 3 switch US45B

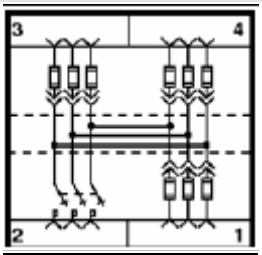


Figure 4

1 switch / 3 fuse US45C

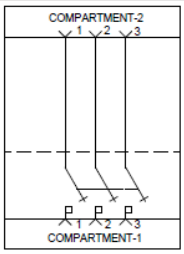


Figure 5

1 switch US45D2 (200A) & US45D6 (600A)

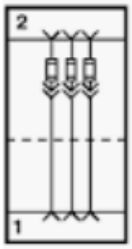


Figure 6

1 fuse US45E (200A)

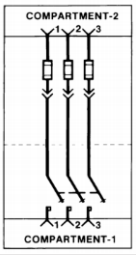


Figure 7

1 fuse/1switch US45F (200A)

38.4.10 Locations and Clearances

Three phase pad-mounted switchgear shall be located in an easement area, exact size of this area to be determined by Distribution Design. A minimum of 10 feet on the door sides of the switchgear and 5 feet on the non-door sides must be clear for switching and maintenance. Refer to Section 44 – UCD for additional clearance information and for bollard location.

Supersedes 7/18 Issue – Re labeled figure 4a to 5 and added figure 6, 7 and SS to Figure 2.

38.4.20 Foundation

Either the fiberglass reinforced plastic vault pad (Std. Item UF3) or the pre-cast switchgear manhole (Std. Item UM20A shall be used as the foundation for Elbow style switchgear (Std. Items US45, US45SS, US45CL, US45A, US45B or US45C). For cable sizes of 500 and greater terminating onto the switchgear, the switchgear manhole is preferred. For STD Item US45D_ UM20D shall be used. For STD Item US45E use UF4 and STD item US45F can use either fiberglass pad US50R or switchgear manhole Std Item UM20D.

a. Fiberglass Reinforced Plastic Vault Pad – (Std. Item UF3, UF4 and US50R) Excavation for the vault pad shall be to the proper grade so that the foundation rests on well tamped and/or undisturbed earth.

b. Pre-Cast Switchgear Manhole (Std. Item UM20A - manhole and collar for all US45_ except US45B which requires the larger collar UM20B and US45D which used UM20D – Fill the bottom of the excavated hole with 1 foot of well compacted, crushed, bank gravel.

c. New elbow switchgear installations can be installed on existing older smaller style fiberglass boxpads. The elbow gear will overhang a few inches on all sides of this installation.

d. For installations where the elbow style switchgear does not fit onto older smaller fiberglass boxpads, a base adaptor plate can be installed (STD Item UF3D).

38.4.30 Installation

A. Switchgear on a Fiberglass Reinforced Plastic Vault Pad – Prior to installation review drawing 38-104 and 38-106 for proper conduit entry way and install the conduits. Local operations and engineering shall determine the entry method to be used. Install the vault pad, ground rods and a ground grid as shown on drawing 38-100. For direct burial installation drawing 38-140 shows typical cable arrangement under the vault pad. Note: Primary cable shall not rest along the walls of the vault pad; the cables shall be brought into the vault pad allowing a minimum of four inches of soil between the cable and the vault pad vertical walls. Loop the cables around the inside of the vault pad and train the cable so that it can be extended two or three feet above the top of the vault pad. Backfill around the vault pad in 6-inch lifts to proper grade.

B. Pre-Cast Switchgear Manhole – Set precast manhole and collar. Install ground rods and ground grid shown on drawing 38-101.

Install the three phase, pad-mounted switchgear on the vault pad or manhole and remove the lifting provisions from the switchgear.

After the switchgear is secured to the vault pad, fill the space, if any, between the base of the switchgear and the top of the vault pad or switchgear manhole collar (Use Std. Item S2 or S3). Install all primary cable elbows in their respective compartment as required. Seal foundation collar openings as shown in section 33.5.

38.4.40 Cable Terminations

Terminate the primary cable in its respective compartment as required. All cables terminated shall have a reducing tap well and end cap installed off of the deadbreak 600-amp elbow. See section 37.5 for information on dead break elbow terminations and figures 19 and 20 in section 38.7.20. In areas of the company that terminate cable on unused switch positions, the appropriate amount of cable shall be brought out to properly terminate it in the manhole or trench for future use. Make the neutral and grounding connections. Neutral and ground connections shall be made before the switchgear is energized. Cables are to be trained

Supersedes 7/20 Issue – Revised Section 38.4.20.

straight downward as possible. Larger cables can be secured with cable supports to unistrut on the switchgear or switchgear collar. See drawings 38-140 and 38-150 for installation details. Note: US45D2 has all 200-amp bushings for load break elbow terminations.

38.4.50 Fusing

Elbow style switchgear shall use Standard SMU-20 style fuses (Std. Items F6E and F6K) as required with fuse end fittings (Std. Item C51E). In limited applications, Standard NX style current limiting fuses (Std. Item F12C_) as required with fuse end fittings (Std. Item C51ECL). Refer to EOP UG016 for installation and operation of fuses.

Livefront style switchgear shall use Standard SMU-20 style fuses (Std. Items F6E and F6K) as required with fuse end fittings (Std. Item C51). Note that older installations may have different style fuses (Std. Item F4E_) with corresponding fuse holder (Std. Item C49B).

38.4.60 Labeling

Switchgear are to have the appropriate identification information as shown in the drawings on pages 38-103, 38-103A and 38-103B. Labeling as applicable to includes address, switchgear number, switch number, fuse number warning label, feeder number, phase labeling on cables and to the next location.

38.4.70 Arresters

Elbow arresters (STD Item UR40A_) are required to be installed on a normal open point, end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. Installation of elbow arrestors shall be off of the reducing tap well at the cable termination point. Ensure elbow arrester housing is bonded to the ground grid of the switch gear. When installing the elbow arrestor, the elbow arrestor shall be fully seated onto the bushing.

38.4.80 Insulating Caps

Insulating caps (STD Item UR24) shall be used on all bushing wells. Ensure the cap is bonded to the ground grid of the switchgear. When installing the insulating cap, the cap shall be fully seated onto the bushing.

On fuse positions that will be operated, the insulating cap bond wire, shall be removed prior to operating. See EOP UG016 for details.

38.4.90 Grounding

Switchgears shall be tied into the ground grid of the switchgear at two points diagonally located in the switch cabinets. The ground wire shall be terminated with a 2-hole lug (STD Item UL14E) and attached to the mounting pad located near the grounding bus bar, an example is shown on page 38-140.

38.4.100 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the switchgear if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the switchgear if left installed permanently.

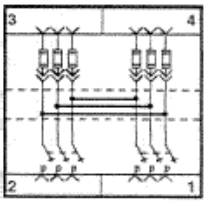
38.4.110 Switchgear Security

After the switchgear doors are securely closed, a pad lock shall be installed (Std. Item UL20_).

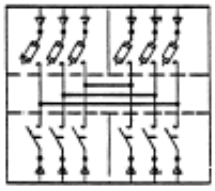
Supersedes 7/16 Issue – Update to text in section 38.4.40

38.5 THREE PHASE PAD-MOUNTED SWITCHGEAR – 23 kV

This Section covers the design, installation, and construction of three phase, pad-mounted switchgear for various systems. Elbow style (dead front) switchgear (Std Item US46_) is the preferred choice for installations. Livefront style (Std Item US37) switchgear may be still used. Higher fault duty applications (Std. Item US37I) is rated for 20ka. For ungrounded systems, see note below. This Section shall apply in conjunction with the Section 44 – UCD (Underground Commercial Distribution) and Section 45 – URD (Underground Residential.

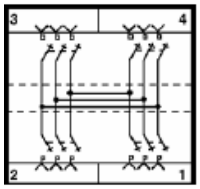


US46 / US46B



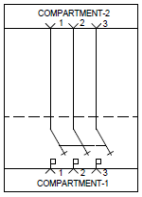
US37 / US37I

Figure 9
2 switch / 2 fuse



US46A

Figure 10
4 switch



US46D6

Figure 11
1 switch 600A

NOTE 23 kV pad-mounted switchgear may be elbow style design if the 23 kV system is effectively grounded - per Material Specification 2790. This switchgear is rated 200 A, available with 2 switched positions and either 1 or 2 fused positions. If the 23 kV system is delta, resistance grounded or a single point grounded design (not effectively grounded) or in the event that 600 A switchgear is needed contact Electric Standards for further assistance.

38.5.10 Locations and Clearances

Three phase pad-mounted switchgear shall be located in an easement area, exact size of this area to be determined by Distribution Design. A minimum of 10 feet on the door sides of the switchgear and 5 feet on the non-door sides must be clear for switching and maintenance. Refer to Section 44 – UCD for additional clearance information and for bollard locations.

38.5.20 Foundation

Live Front

The foundation for the livefront switchgear Std Item US37 shall be a precast switchgear manhole (Std. Item UM20B). For Std. Item US37I shall use a precast XL switchgear manhole (Std Item UM41K1). – Fill the bottom of the excavated hole with 1 foot of well compacted, crushed, bank gravel.

Elbow Front

The foundation for the elbow front style switchgears Std. Item US46, US46A and US46B shall be a pre-cast large switchgear manhole (Std. Item UM21). For Std. Item US46D6 shall be a precast switchgear manhole UM20F. – Fill the bottom of the excavated hole with 1 foot of well compacted, crushed, bank gravel.

Supersedes 7/21 Issue –text update 38.5.20.

38.5.30 Installation

A. Switchgear on a Fiberglass Reinforced Plastic Vault Pad – Prior to installation review drawing 38-105 and 38-106 for proper conduit entry way and install the conduits. Install the vault pad, ground rods and a ground grid as shown on Page 38-100. For direct burial installation drawing 38-141 shows typical cable arrangement for the elbow style cable under the vault pad. Note: Primary cable shall not rest along the walls of the vault pad; the cables shall be brought into the vault pad allowing a minimum of four inches of soil between the cable and the vault pad vertical walls. Loop the cables around the inside of the vault pad and train the cable so that it can be extended two or three feet above the top of the vault pad. Backfill around the vault pad in 6 inch lifts to proper grade. Note: The Elbow style switchgear will overhang the base which is acceptable.

B. Pre-Cast Switchgear Manhole – Set precast manhole and collar. Install ground rods and ground grid shown on Page 38-101. Install the three phase, pad-mounted switchgear on the vault pad or manhole and remove the lifting provisions from the switchgear. After the switchgear is secured to the vault pad, fill the space, if any, between the base of the switchgear and the top of the vault pad or switchgear manhole collar (Use Std. Item S2 or S3). Seal foundation collar openings as shown in section 33.5.

38.5.40 Cable Terminations

Live front installation; terminate the primary cable in its respective compartment as required; see drawing 38-102 for terminating pad assembly detail. Cable termination brackets shall be mounted in the horizontal position to maximize clearance between cable neutrals and live components. In areas of the company that terminate cable on unused switch positions, the appropriate amount of cable shall be brought out to properly terminate it in the manhole or trench for future use. Make the neutral and grounding connections.

Elbow front installation; terminate the primary cable in its respective compartment as required. All cables terminated shall have a reducing tap well and end cap installed off of the deadbreak 600-amp elbow. See section 37.5 for information on dead break elbow terminations and figure 19 in section 38.7.20. In areas of the company that terminate cable on unused switch positions, the appropriate amount of cable shall be brought out to properly terminate it in the manhole or trench for future use. Make the neutral and grounding connections. Neutral and ground connections shall be made before the switchgear is energized. Cables are to be trained straight downward as possible. Larger cables can be secured with cable supports to unistrut on the switchgear or switchgear collar. See drawings 38-140 and 38-150 for installation details.

38.5.50 Fusing

Standard fuses SM-4 (Std. Item F19) shall be used as required with fuse end fittings elbow style (Std. Item C51E25) and live front style (Std. Item C51L25). Standard Fuses SM-5 (STD. Item F23) shall be used as required with fuse and holder (Std. Item C50I). Standard fuses SM-20 (Std. Item F8) shall be used as required with fuse holder (Std. Item C51E).

38.5.60 Labeling

Switchgear are to have the appropriate identification information as shown in the drawings on pages 38-103, 38-103A and 38-103B. Labeling as applicable to includes address, switchgear number, switch number, fuse number warning label, feeder number, phase labeling on cables and to the next location.

38.5.70 Insulating Caps

Insulating caps (STD Item UR24C) shall be used on all bushing wells. Ensure the cap is bonded to the ground grid of the switchgear. When installing the insulating cap, the cap shall be fully seated onto the bushing.

On fuse positions that will be operated, the insulating cap bond shall be removed prior to operating. See EOP UG016 for details.

Supersedes 7/20 Issue – Updated to 38.5.50.

Supersedes 7/20 Issue –Updated in 38.6 new switch US38D1 and update to 38.6.20.

38.5.80 Grounding

Switchgears shall be tied into the ground grid of the switchgear at two points diagonally located in the switch cabinets. The ground wire shall be terminated with a 2 hole lug (STD Item UL14E) and attached to the mounting pad located near the grounding bus bar, an example is shown on page 38-141.

38.5.90 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the switchgear if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the switchgear if left installed permanently.

38.5.100 Switchgear Security

After the switchgear doors are securely closed, a pad lock shall be installed (Std. Item UL20_).

38.6 THREE PHASE PAD-MOUNTED SWITCHGEAR – 35 kV

This Section covers the design, installation, and construction of three phase, pad-mounted switchgear (Std. Items, US38D1, US38F, US38G and US38H_). This Section shall apply in conjunction with the Section 44 – UCD (Underground Commercial Distribution) and Section 45 – URD (Underground Residential Distribution).

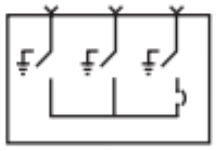
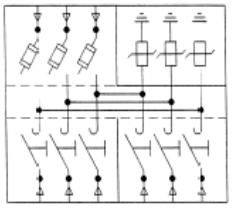
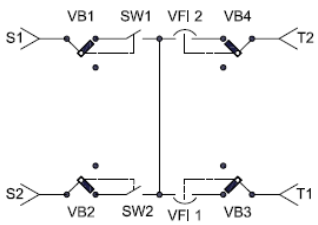
			

Figure 13 US38D1 3way 2 ways load interrupters, 1 way fault interrupter (Novec Gas Insulated)	**Figure 14 US38F 3 way 2 ways load interrupters, 1 way fuses, live front (1 way surge arrester compartment) Maintenance use only**	**Figure 15 US38G 1 way load interrupter**	**Figure 16 US38H (600 S / 200 L Amp bushings) or US38H6 (all 600 Amp bushings) 4 way 2 ways load interrupters and 2 ways fault interrupter**

38.6.10 Locations and Clearances

Three phase pad-mounted switchgear shall be located in an easement area, exact size of this area to be determined by Distribution Design. A minimum of 10 feet on the door sides of the switchgear and 5 feet on the non-door sides must be clear for switching and maintenance. Refer to Section 44 – UCD for additional clearance information and for bollard locations.

38.6.20 Foundation

Either the fiberglass reinforced plastic vault pad (Std. Item US38GA, US38HA or US38HT) or the pre-cast switchgear manhole (Std. Item UM21) shall be used as the foundation for Std. Items US38G or US38H. Std. item US38D1 shall use fiberglass base Std. Item US38DA.

A Fiberglass Reinforced Plastic Vault Pad – Excavation for the vault pad shall be to the proper grade so that the foundation rests on undisturbed earth.

B Pre-Cast Switchgear Manhole (Std. Item UM21/UM41 - manhole and collar) – Fill the bottom of the excavated hole with 1 foot of well compacted, crushed, bank gravel.

38.6.30 Installation

Install ground rods and a ground grid as shown on Page 38-100, for the fiberglass reinforced plastic vault pad. Refer to Page 38-101 for grounding instructions for the pre-cast switchgear manhole.

Install the vault pad or manhole before the ground grid is installed. If going direct buried into a vault pad, the primary cable shall be brought into the vault pad allowing a minimum of four inches of soil between the cable and the vault pad vertical walls. Loop the cables around the inside of the vault pad and train the cable so that it can be extended two or three feet above the top of the vault pad. Backfill around the vault pad in 6 inch lifts to proper grade.

Install the three phase, pad-mounted switchgear on the vault pad or manhole and remove the lifting provisions from the switchgear.

After the switchgear is secured to the vault pad, fill the space, if any, between the base of the switchgear and the top of the vault pad (Use Std. Item S2 or S3). Terminate the primary cable in its respective compartment as required; see section 37.5 for information on deadbreak elbow terminations. Make the neutral and grounding connections. Neutral and ground connections must be made before the switchgear is energized.

38.6.40 Cable Terminations

Terminate the primary cable in its respective compartment as required. All cables terminated shall have a reducing tap well and end cap installed off of the deadbreak 600 amp elbow. See section 37.5 for information on dead break elbow terminations and figure 21 in section 38.7.20. In areas of the company that terminate cable on unused switch positions, the appropriate amount of cable shall be brought out to properly terminate it in the manhole or trench for future use. Make the neutral and grounding connections. Neutral and ground connections shall be made before the switchgear is energized. Cables are to be trained straight downward as possible. Larger cables can be secured with cable supports to unistrut on the switchgear or switchgear collar. See drawings 38-142 and 38-150 for installation details.

38.6.50 Fusing

Standard item US38F standard fuses (Std. Items F7E_) shall be used as required with fuse holder (Std. Item F7H). Additional information is in Section 39 for fusing details, fuse sizing and coordination.
Standard items US38D1 and US38H and are supplied with programmable over current controls that can be programmed to most common current fuse curves for protection of the downstream device.

38.6.60 Labeling

Switchgear are to have the appropriate identification information as shown in the drawings on pages 38-103, 38-103A and 38-103B. Labeling as applicable to includes address, switchgear number, switch number, fuse number warning label, feeder number, phase labeling on cables and to the next location.

38.6.70 Arresters

For Std. Item US38D1, US38G and US38H and elbow arresters (STD Item UR40A6) are required on a normal open point, end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. Installation of elbow arrestors shall be off of the reducing tap well at the cable termination point. Ensure elbow arrester housing is bonded to the ground grid of the switch gear. When installing the elbow arrestor, the elbow arrestor shall be fully seated onto the bushing.

Supersedes 7/20 Issue – Updated to 38.6.50 and 38.6.70.

38.6.80 Insulating Caps

Insulating caps (STD Item UR91) shall be used on all bushing wells. Ensure the cap is bonded to the switchgear. When installing the insulating cap, the cap shall be fully seated onto the bushing.

38.6.90 Grounding

Switchgears shall be tied into the ground grid of the switchgear at two points diagonally located in the switch cabinets. The ground wire shall be terminated with a 2 hole lug (STD Item UL14E) and attached to the mounting pad located near the grounding bus bar, an example is shown on page 38-142.

38.6.100 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the switchgear if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the switchgear if left installed permanently.

38.6.110 Switchgear Security

After the switchgear doors are securely closed, a pad lock shall be installed (Std. Item UL20_).

38.7 SUBMERSIBLE SWITCHES

This Section covers the design, installation, and construction of single phase and three phase, submersible mounted switches (Std. Items US40_, US41_, US42_ and US43_). They are intended for use in UG distribution systems, 35 kV and below, where pad-mounted switches cannot be installed. Application on other systems requires engineering review.

38.7.10 Locations

Submersible switches may be installed below grade where the switch is completely accessible from above grade using standard tools

38.7.20 Installation

Submersible switches are available in several configurations. To install any one of the switches, a field inspection with local operations is needed prior to completing the engineering design to ensure the installation of the switch in the chosen manhole will meet all safety and work method requirements for operation and maintenance of the switch. A few typical illustrated switch installations are shown on pages 38-120 thru 38-122. Switches installed on the wall of the manhole can be secured directly to the wall with anchor bolts (Std Item B7_) or onto any other sound racking system. Switches installed on the floor should be mounted on a stand (see table 1) were feasible. The stand and switch shall be properly secured to the manhole floor with anchor bolts (Std Item B7_). All switches shall be grounded to the manhole and with new manhole installations an external ground loop shall be installed. Anodes shall be installed to keep corrosion to a minimum, see section 33.2 and page 38-101 for further details on grounding and bonding.

During the field inspection if installation, operation and maintenance of the proposed switch hinders egress, the structure shall be modified with two openings, one for entry way and the other for equipment installation operation and maintenance or redesign the job to meet these requirements.

Supersedes 7/19 Issue –Update to text in 38.7.20.

Table 1

Switch Std Item	Switch Stand Std Item	Switch Std Item	Switch Stand Std Item
US40H1	Typically wall mounted	US41B	US41BA
US40J1	Typically wall mounted	US41BV	Stand is part of switch
US40K	Stand is part of switch	US41BVM	US41BVMA
US40L	US40LS	US41C	US41CA
US40L1	Wall mount or US40LS	US41C1	Stand is part of switch
US40L2	Wall mount or US40LS	US42A	US42AA
US40L3	Wall mount or US40LS	US42B	US42BA
US41A	US41AA	US43A	US42AA
US41A1	Stand is part of switch	US43B	US42BA
US41A2	Stand is part of switch		

S
S
Submersible and pad mounted switches are to be built with 600 A separable connectors, with a 200 amp reducing tap plug that allows the installation of a standard grounding elbow, see figures 19, 20 and 21. Figure 19 shows a new one piece 600 A separable connector with a built-in reducing tap well, this is only available at the 15kV class.

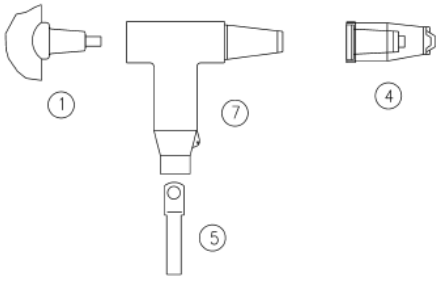


Figure 19 15kV class

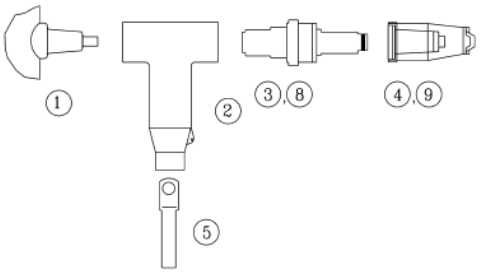


Figure 20 15/25kV

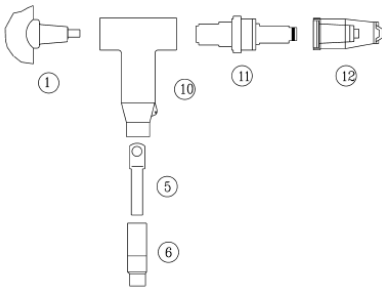


Figure 21 35kV class

Table 2

identifier	Material Description	Voltage kV	Std. Item	CU Code
1	600 A Apparatus Bushing			
2	600 A Elbow Connector	5, 15, 25	UR60CS_	CPCS_* K_** SNE
3	Reducing Tap Well	5, 15	UR68A1	CPCSRTW
4	Loadbreak Insulating Receptacle	5, 15	UR24	CLIC15K
5	Terminal Lug		UR63__	Part of elbow conn.
6	Cable Adapter		UR64__	Part of elbow conn.
7	600 A reducing tap well Elbow	5, 15	UR60R__	CDBE600AUR60R__**
8	Reducing Tap Well	25	UR68C	CPCSRTWUR68C25KV
9	Loadbreak Insulating Receptacle	25	UR24C	CLIC25K
10	600 A Elbow Connector	35	UR60B	CDBE600UR60B35KV_**
11	Reducing Tap Well	35	UR68D	CPCSRTW35KV
12	Loadbreak Insulating Receptacle	35	UR91	CLIC25K

* Voltage 5, 1or 25 kV
** Cable sizes #2, 1/O, 4/O, 350, 500, 750 and 1000

38.7.30 Fusing

Switches with Std. Items US40H1, US40J1, US40L1, US40L2, US40L3, US41A, US41A1, US41A2, US41C and US41C1 have an external programmable relay that comes with each switch. Software and assistance for programming is available, refer to Electric Materials Standards for assistance.

38.7.40 Ratings and Limitations

Submersible switches have 600 A separable connectors (Except Std. Item US40L1 which has 200 amp connectors); with a 200A reducing tap plug that allows the installation of a standard grounding elbow (Std. Item UR32 for 15kV and UR93 for 35kV).
The 200 A loadbreak elbow interface has a 10,000 A symmetric, 10 cycle momentary fault close rating. Therefore, submersible switches shall not be used in locations where the short circuit duty exceeds 10,000 a symmetric.

38.7.50 Cable Terminations

Terminate the primary cable in its respective bushing as required. All cables terminated shall have a reducing tap well and end cap installed off of the deadbreak 600 amp elbow. See section 37.5 for information on dead break elbow terminations and figures 19, 20 and 21 in section 38.7.20. For unused bushings install the appropriate amount of cable off of the bushing to properly terminate it in the manhole for future use. Make the neutral and grounding connections. Neutral and ground connections shall be made before the switch is energized. Cables are to be trained to the closest wall for support and racking. See drawing 38-150 for a typical installation.

38.7.60 Labeling

Install identification information on the all cables to the switch. Install labels to all switch positions on the switch. At a minimum, the Control Center will issue a six digit number for all mainline switch devices and require the property address or location number to be labeled. Drawing 38-150 shows an example of a typical labeled switchgear.

38.7.70 Arresters

Elbow arresters (STD Item UR40A_) are required to be installed on a normal open point, end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. Installation of elbow arrestors shall be off of the reducing tap well at the cable termination point. Ensure elbow arrester housing is bonded to the ground grid of the switch. When installing the elbow arrestor, the elbow arrestor shall be fully seated onto the bushing.

38.7.80 Insulating Caps

Insulating caps (STD Item UR24, UR24C or UR91) shall be used on all bushing wells. Ensure the cap is bonded to the ground grid of the switch. When installing the insulating cap, the cap shall be fully seated onto the bushing.

38.7.90 Locking

Switch operating handles shall have a lock installed on them at all times to ensure they stay in the correct operating position. Drawing 38-150 shows a typical switch with locks installed on the operating handles.

Supersedes 7/18 Issue –Update to text in 38.7.30 and 50.

38.7.100 Grounding

Switches shall be tied into the ground grid of the manhole at two points diagonally located in the switch where feasible. The ground wire shall be terminated through the switches ground terminal connections, a typical example is shown in figure 24.

Figure 24

38.7.110 Feed-thru Bushings and Parking Stands

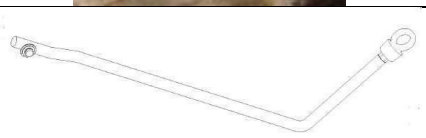
Feed-thru bushings and parking stands shall be bonded to the ground grid in the switch if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the switch if left installed permanently.

38.7.120 Switching Equipment

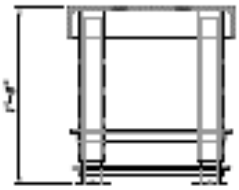
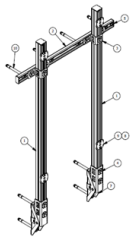
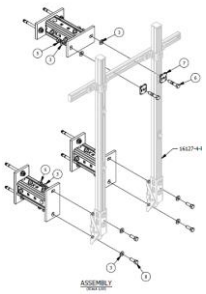
The following submersible switches are standard for underground application at voltage levels 15 kV and below. For three phase operation, gang operated switches shall be used.

Table 3

Submersible Switches – 15 Kv

Std. Item	Phases	Description	Illustration
US40EE		Interface cord for legacy Elastimold switch. Cord is 30’	
US40L1	1	Single phase 200 Amp switch with overcurrent protection	
US40L2	1	Single phase 600 Amp switch with overcurrent protection	
US40L3	3	Three phase 600 Amp switch with overcurrent protection	
US40L1C	1	Single phase control box	
US40L3C	3	Three phase control box	
US40LH		Straight handle	
US40LM		Motor for 3 phase switch	

Supersedes 7/15 Issue – Update to table 3

US40LMCC		Motor control cable (required to connect and operate motor remotely)	
US40LMC		Portable motor control for 3 phase switch	
US40LCC	1 or 3	Control cable interface	
US40LCE	1 or 3	Cord extension for control cable 20 ft.	
US40LS	1 or 3	Floor stand for switch, Adjustable height 1’ 6” to 2’ 3”	
US40GB	3	Wall stand for switch	
US40GBB	3	Wall stand extension bracket, offsets switch 8 inches from wall to allow installation where cables run through.	

Supersedes 7/15 Issue – Table shift.

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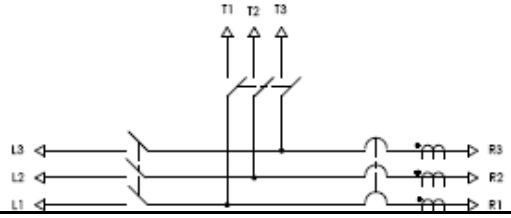
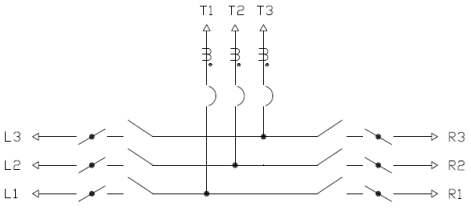
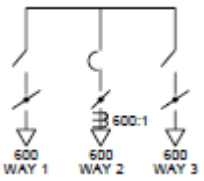
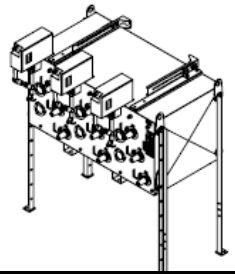
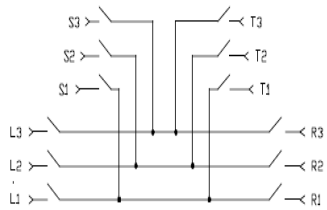
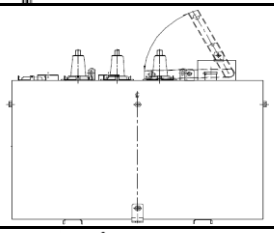
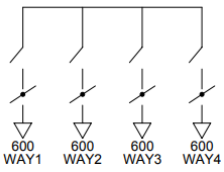
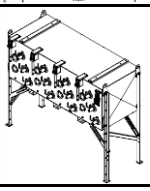
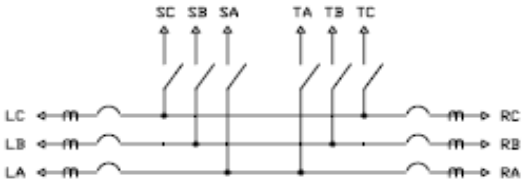
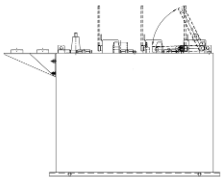
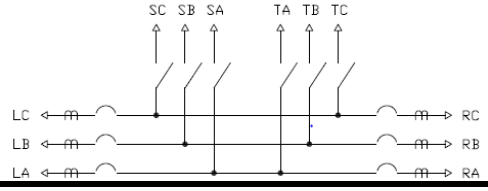
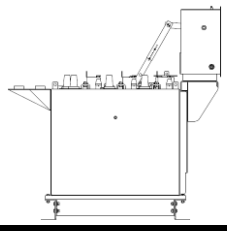
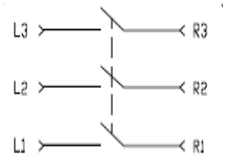
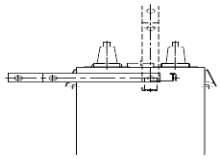
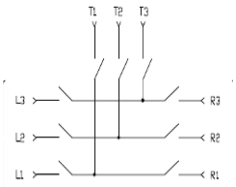
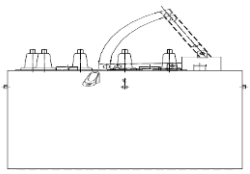
Std. Item	Wiring One Line Diagram / Description	Illustration / Picture
US41A		
US41AR	Programmable External Relay for US41A	
US41A1	 Note : switch has visible open.	
US41A2		
US41B		
US41BV		
US41C		
US41CR	Programmable External Relay for US41C	
US41C1		

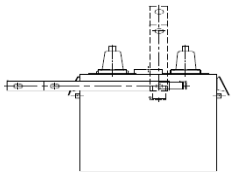
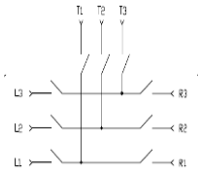
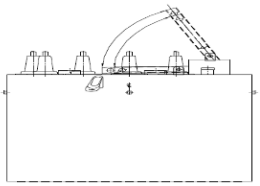
Supersedes 7/19 Issue – Added US41BV

Submersible Switches – 23 kV (for maintenance use)

Notes: 1) Can be used at the 15kV Class
2) For new installations use 35kV class (Std Item US43_).

Std. Item	Wiring One Line Diagram	Illustration
US42A		
US42B		

Submersible Switches – 35 kV

Std. Item	Wiring One Line Diagram	Illustration
US43A		
US43B		

38.8 SWITCHING JUNCTIONS

Single phase padmounted junctions 200 Amp

Single phase junctions (STD Item US33F1) are to be used for terminating cable points in URD's where there are radial sidetaps. The single phase junctions are to be mounted on a minipad boxpad. Single phase junction comes complete, fiberglass reinforced cabinet with a four position junction, parking stand and ground bus bar installed. See figure 26 for typical schematic detail.

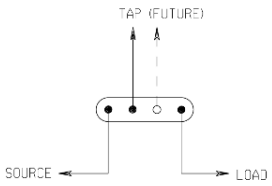


Figure 26

Three phase pad-mounted junctions 200 Amp

Three phase junctions are available in two styles.

1) Std. Item US33F is to be used for terminating cable points in URD's and UCD's where there are radial sidetaps. The three phase junctions US33F are to be mounted on a primary pull/splice box (Std Item UR6). This three phase junction comes complete, fiberglass reinforced cabinet with four position junctions, parking stands and ground bus bar installed. See figure 25 for schematic detail. Preferred installation method.

2) Std Item US33 is to be used for terminating cable points in URD's and UCD's where there are radial sidetaps. The three phase junction US33, is to be mounted on a URD minipad boxpad. This three phase junction comes with grounding attachment points. Junctions and mounting hardware applicable Std. Items UR28C, UR28D, UR28CH, UR28DH can be chosen for proper installation. See figure 26 for schematic detail. Alternate installation method.

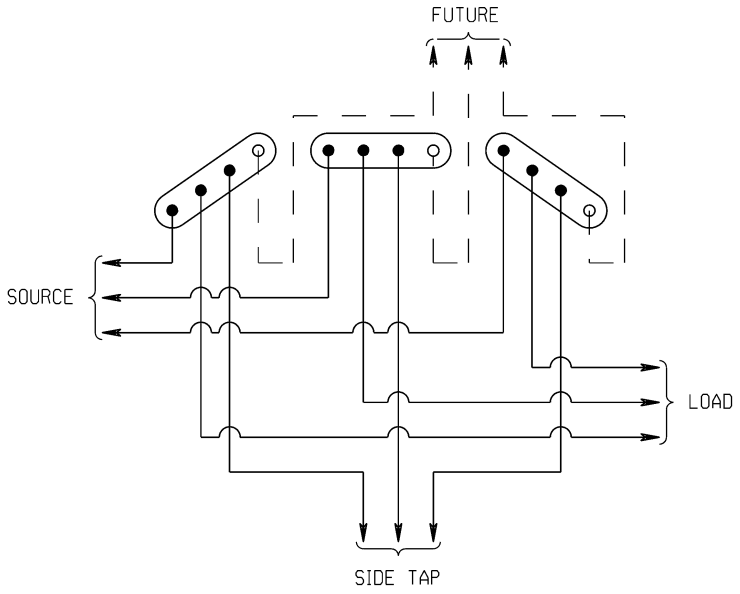


Figure 27

Supersedes 7/18 Issue – Figure numbering updates.

38.8.10 Clearance

The enclosure shall be located in an easement, the exact size of such shall be determined by local engineering. A minimum of 10 feet on the door side of the enclosure, and 5 feet on the non-door sides, shall be kept clear for switching and maintenance.

Supersedes 7/15 Issue – Text shift and new section 38.8.80.

38.8.20 Grounding

Copperclad ground rods (Std. Item TG20) and grid shall be installed as shown on Page 38-110 and 38-111.

38.8.30 Installation

In a direct buried application, the primary cable shall be brought into the vault pad allowing a minimum of four inches of earth between the cable and the base of the vault pad. Loop the cable around the bottom of the vault and train the cable so that it can be extended two or three feet above the top of the vault pad to permit operation of the loadbreak elbows and accessory devices. Backfill around the vault pad in well tamped layers not to exceed 6 inch lifts to the proper grade. Install the enclosure on the vault pad. Fill the space, if any, between the base of the enclosure and the top of the vault pad with sealing compound or duct seal (Std. Items S2 or S3). Train the primary cable and install loadbreak elbows (Std. Item UR23) so that the cable is located in the final assembled position, with enough slack to provide adequate clearance for removing the elbow and to prevent strain on the electrical connections. Neutrals shall be compression clamped to the ground grid as show on Page 38-112. These connections must be made before the elbows are energized. See Pages 38-112 and 38-113 for a typical three phase 3-way junction installed.

Install identification information on enclosure and cables as shown on Page 38-114 and as detailed in Section 35 – Cables.

38.8.40 Arresters

Elbow arresters (STD Item UR40A_) are required to be installed on a normal open point, end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. Installation of elbow arrestors shall be off of the reducing tap well at the cable termination point. Ensure elbow arrester housing is bonded to the ground grid of the switch junction. When installing the elbow arrestor, the elbow arrestor shall be fully seated onto the bushing.

38.8.50 Insulating Caps

Insulating caps (STD Item UR24) shall be used on all bushing wells. Ensure the cap is bonded to the ground grid of the switch junction. When installing the insulating cap, the cap shall be fully seated onto the bushing.

38.8.60 Grounding

Switch junctions shall be tied into the ground grid of the switchgear at two points diagonally located in the switch cabinets. The ground wire shall be terminated to the grounding connector on the switch junction.

38.8.70 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the switch junction if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the switch junction if left installed permanently.

38.8.80 Junction Box Security

After the junction box cover is securely closed, a pad lock shall be installed (Std. Item UL20_)

38.9 MAINTENANCE ON OIL FUSE CUTOUTS

38.9.10 Application

No new installations will be allowed. See Section 38.7 for other submersible switches.

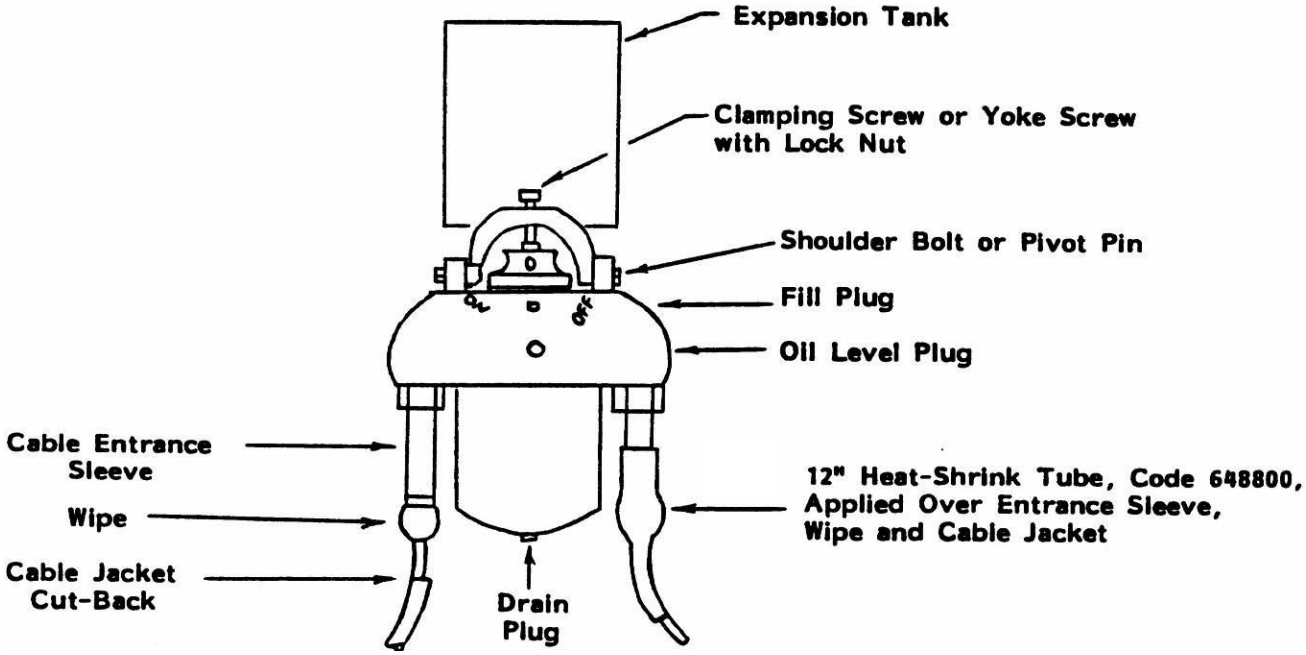


Figure 29

Supersedes 7/16 Issue – Figure Number Update.

38.9.20 Associated Equipment

Table 4

Std. Item	Description
F17A	Sleeve entrance for GE 200 A OFC for solid dielectric cable
F17B	Sleeve entrance for GE 100 A OFC for solid dielectric cable
F17C	Sleeve entrance for GE 200 A OFC for lead covered cable
F18	Expansion chamber for GE OFC

38.9.30 Fuse Links

Table 5
Fuse Links

Current Rating (Amps)	Std. Item		Current Rating (Amps)	Std. Item		Current Rating (Amps)	Std. Item	
	GE	G & W		GE	G & W		GE	G & W
10	F15A10	F16A10	65	F15A65	F16A65	150	F15015	F16015
15	F15A15	F16A15	75	F15A75	--	200	F15020	F16020
25	F15A25	F16A25	100	F15010	F16010	250	F15025	--
40	F15A40	--	125	F15012	--	300	F15030	--
50	F15A50	F16A50	140	--	F16014	Solid	F150S	--

Application Data pertaining to GE Oil Fused Cutouts:

A. Fuses 5 A through 100 A – For use in cutouts rated 100, 200 or 300 A.

B. Fuses 125 A through 200 A – For use in cutouts rated 200 A or 300 A.

C. Fuses 250 A through 300 A – For use in cutouts rated 300 A.

D. Solid Blade – For use in cutouts rated 200 A or 300 A.

38.9.40 Superseded Designs

The GE carrier with plastic body may be used in all OFCs. The older carrier with a wooden body does not fit newer OFCs - Cat. #9F32 series.

38.9.50 Transformer Fusing in Oil Fused Cutouts

Table 6
Single Phase, 2400 Volt Transformers
3Φ Wye, Open Delta & Open Wye Connected

Transformer kVA Per Phase	Fuse	Rating
	G & W Type FL	GE Type 9F57
10	10	10
15	15	15
25	25	25
37.5	40	40
50	50	50
75	65	75
100	100	100
150	140	150
167	140	150
200	140	150

Table 7
2400 Volt Transformers
3Φ Delta Connected

Transformer kVA Per Phase	Fuse	Rating
	G & W Type FL	GE Type 9F57
30	15	15
45	25	25
75	40	40
112.5	65	65
150	65	75
225	100	100
300	140	125
450	Check relay curves before using 200 A fuse.	
500		
600		

38.9.60 Coordination

Since characteristics of G&W, GE, K and N fuses are different, coordination problems involving different types should be referred to Distribution Design.

38.9.70 Installation Considerations

Lubricate shoulder bolts, clamping screw and all plugs with Never Seize sealing compound, (Std. Item UC77). Apply a 12 inch length of heat-shrinkable tubing (Std. Item UT7E) over wipe from cable to entrance sleeve for mechanical strength and corrosion protection.

Supersedes 7/15 Issue –Text shift

38.10 CABLE ENTRANCES GE OIL FUSED CUTOUTS

38.10.10 General

Cable entrance terminals are interchangeable between paper and solid dielectric insulated cables.

The sweat copper contact will accept up to 2/0 conductor on the 100 A cutout and 4/0 on the 200 A cutout.

Be sure that all parts are dry, clean, and in good mechanical condition. To check the interior, remove the fuse carrier. Temporarily mount the cutouts in their final location with the carrier end upward and check that it hangs vertically. Allow room for the expansion tank, removal of fuse carrier, and line up gang operating mechanism if used. Cutouts are to be removed later for filling with petrolatum.

All cutouts are to be properly grounded.

38.10.20 Connection to Lead-Sheathed Cable

A. Disassemble Terminal – Figure 29, removing the union nut (3), wiping sleeve (5), gasket (4), insulating sleeve (7), and plug contact (8) leaving the terminal as shown in Figure 16. To remove sleeve (7), pull with a steady twisting motion.

B. Slide Heat-Shrink Tube – (Std. Item UT7E) on cable for future installation.

C. Remove Lead Sheath and Cable Insulation – using gage furnished with cutout, Figure 18. Be sure that current (A) rating on gage is same as cutout.

D. Sweat Plug Contact – (8) onto cable, Figure 32. To prevent migration of petrolatum, apply two tightly half-lapped layers of dacron-glass tape, T3V, on the exposed conductor, insulation and ½ inch of lead sheath.

E. Cut End of Wiping Sleeve – (5) on taper so that sleeve will just pass over cable. Pass the nut (3) and the wiping sleeve (5) over the cable keeping the union nut (3) in the position shown in Figure 33.

F. Push Plug Contact – (8) into assembly fixture as far as possible, Figure 34, and turn union nut up tightly by hand. Be sure to omit gasket (4) at this time. Assembly fixture is a tool which allows the cable to be wiped to wiping sleeve, outside the cutout body. If an assembly fixture is not available, use the cutout, being sure to omit gasket. Mark the cable at the end of the wiping sleeve and lower sleeve on cable. Apply additional layer of dacron-glass tape on cable to make a snug fit into the wiping sleeve. This will center the cable and prevent lead from flowing into sleeve. Reassemble as in Figure 29, again omitting gasket.

G. Wipe Joint – between cable and sleeve (5), Figure 35.

H. Uncouple Union – Turn cutout upside down.

I. Melt Petrolatum – (Std. Item UC76) Approximate melting point is 135 degrees Fahrenheit; do not overheat. Fill the molded insulation members in the cover with melted petrolatum, Figure 36. The petrolatum should be poured up to the inside shoulder of the molded insulation members. Proceed immediately with Steps J and K while petrolatum in cutout

Supersedes 7/16 Issue – Figure numbering updates in 38.10.20

is cooling. Allow petrolatum to cool only sufficiently so that the cutout may be righted in its permanent position.

J. Heat Wiping Sleeve – (5), Figure 37, to about melting point of petrolatum and fill sleeve with melted petrolatum up to base of plug contact (8), Figure 30.

K. Push Insulating Sleeve – (7), Figure 38, slowly but promptly into the wiping sleeve (5) until the ring (9), (Figure 30) snaps into the groove on the end of the insulating sleeve (7). Do this while petrolatum is warm and with wood block closing the end of the insulating sleeve (7).

L. Place Gasket – (4) on top of wiping sleeve (5) flange, Figure 29, and push the assembled terminal back into position until the union nut (3) catches onto the threads of the cutout, allowing the excess petrolatum to squeeze out through the gasket joint. Tighten the union nut sufficiently to seal the joint.

M. Apply Heat-Shrink Tube – over cable terminal per Section 36 – Connectors/Splices. Install expansion tank and secure cutout in its permanent position.

N. Fill Cutout With 10c Oil – exactly to the level indicated by the nameplate and pipe plug on the front of the cutout, or to the oil-level mark on the fuse carrier.

Supersedes 7/16 Issue – Figure numbering updates.

Supersedes 7/16 Issue –Figure Numbering updates.

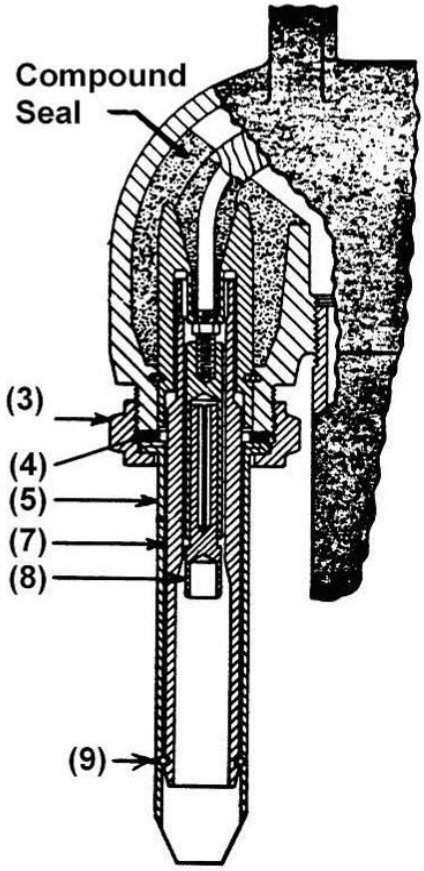


Figure 29
Assembled View of Terminal

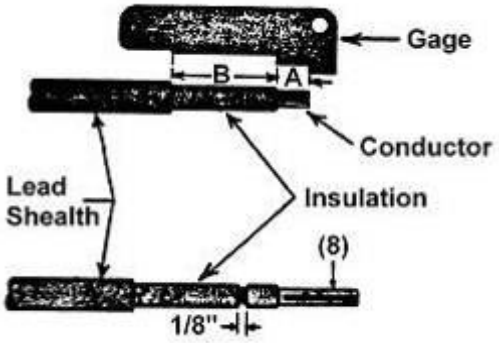


Figure 32

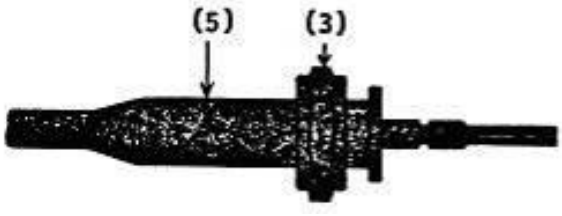


Figure 33

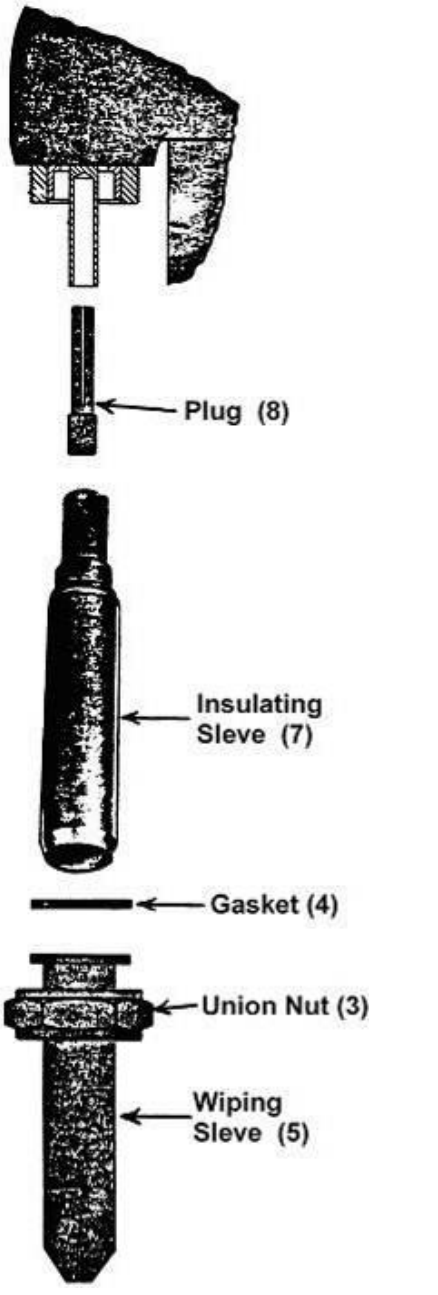


Figure 31
Disassembled View of Terminal

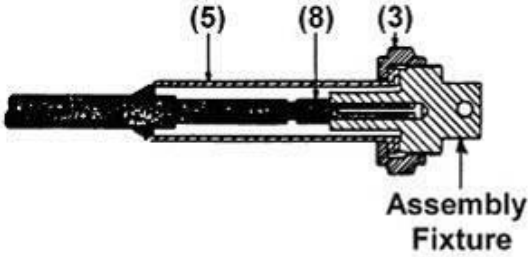


Figure 34

38.10.30 Connection to Solid Dielectric Cable

A. Entrance Terminal – for solid dielectric cable is listed in Section 39 – Fuses. Refer to Figure 40 for details. The bronze stud on the end is the equivalent of 1/0 stranded cable. Slip the union nut (3) on the entrance terminal before connecting terminal to cable.

B. Connect – solid dielectric cable to the stud at the end of the entrance terminal as if two cables were being spliced. Refer to Figure 40 and use standard splicing material and procedures. Select connector from Section 36 – Connectors/Splices. For shielded cable, extend shielding mesh over joint and solder to metal sleeve.

C. Fill the Cover – with petrolatum as described in Step I, Figure 36. Then fill wiping sleeve (5) with melted petrolatum up to base of plug (8), Figure 30.

D. Reassemble Terminal – as described in Step L, install expansion tank, and secure cutout in its permanent position.

E. Fill Cutout With 10C Oil – as described in Step N.

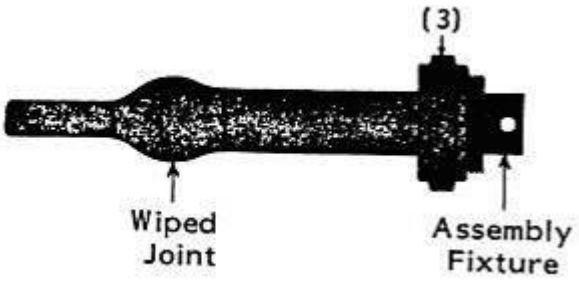


Figure 35

Figure 36

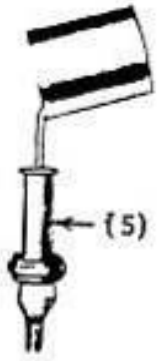


Figure 37

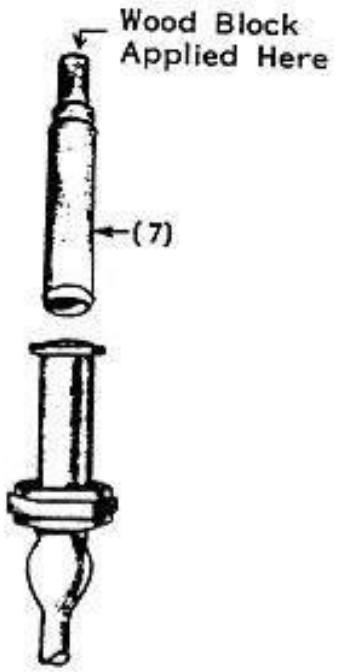


Figure 38

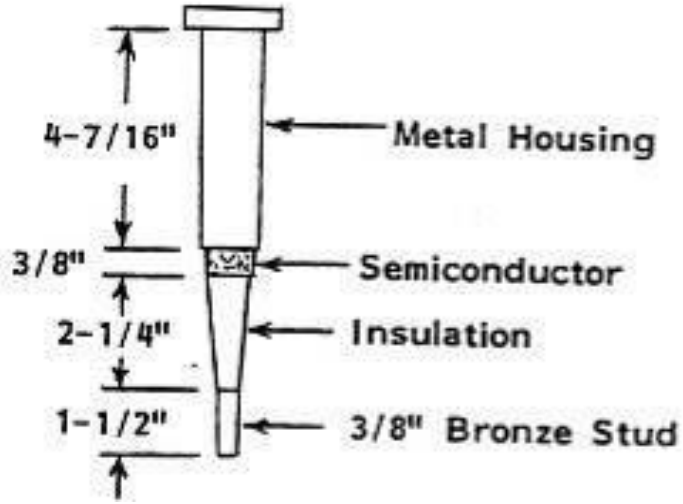


Figure 39

Supersedes 7/16 Issue –Figure Numbering Updates.

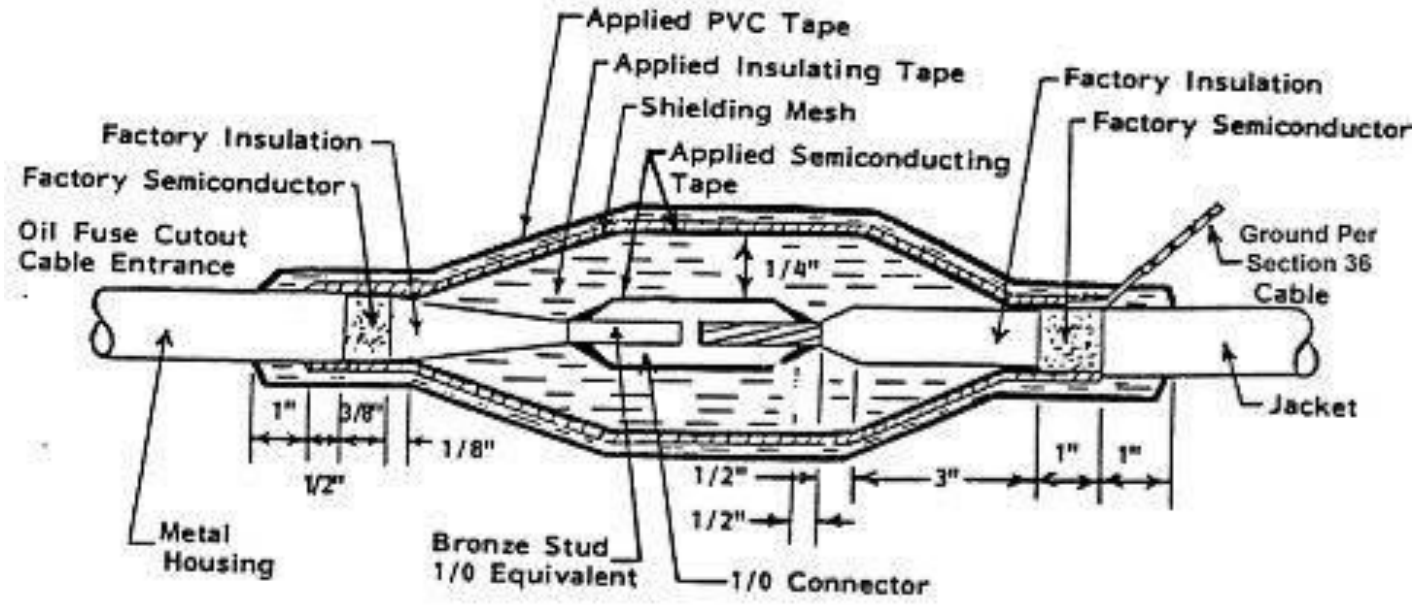


Figure 40

38.11 CABLE ENTRANCES – G&W OIL FUSED CUTOUTS

Cable entrance terminals to be used with paper and lead covered cable. Connector size must be specified when ordering. Maximum connector size is 4/0 copper.

Be sure that all parts are dry, clean and in good mechanical condition. If the humidity indicator packed inside the body shows excessive moisture, check the Bakelite fuse carrier with a 2500 Volt meggar. The resistance between clips should be a minimum of 5000 megohms. To dry the carrier, heat in an oven for 12 hours at 250 degrees Fahrenheit and recheck the resistance after the carrier has cooled.

Mount the cutouts in their final location with carrier end upward and check that it hangs vertically. Allow room for expansion chambers, removal of fuse carrier and gang operating mechanism, if used.

Ground cutouts and operating mechanism.

A. Temporarily Assemble the Complete Cable Terminal – to the cutout body. Train the cable alongside the cable terminal and mark the cable sheath at location “M”, bottom of wiping sleeve, Figure 30. Remove cable terminal from cutout body.

B. Measure – and record the length “X” between the bottom surface of the connector and the bottom surface, “M”, of the wiping sleeve.

C. Remove the Connector – from the porcelain, Figure 42, measure and record the depth “L” of the connector socket. Cut the cable at the measured distance “X” plus “L” inches above cable sheath mark, “M”, made in Step A.

D. Remove Lead Sheath – a distance “L” plus 4 inches from the cable end. Remove insulation down to bare conductor a distance “L” plus ½ inch.

E. Cut End of Wiping Sleeve – on taper so that sleeve will just fit over cable. Slide the wiping sleeve down over the cable.

Supersedes 7/16 Issue –Figure Numbering updates.

F. Sweat Connector – to cable conductor. Be sure that locking fins on connector will align with internal grooves in porcelain. Clean surface of insulation thoroughly. Apply additional half-lapped layers of dacron-glass tape over cable insulation to at least the outside diameter of the lead sheath.

G. Slide Cable Up into Terminal Porcelain – making sure that locking fins on connector align with grooves in porcelain. Slide hoodnut gasket over the exposed end of the connector and assemble hoodnut to connector. Hand tighten hoodnut, since hoodnut must be loosened for venting while compound is being poured.

H. Assemble Cable Terminal – parts to cutout body and wipe sleeve to cable

I. Secure Cable Terminal – assembly in a vertical position detached from the cutout body. Install a standpipe in filling plug hole. The top of the standpipe should be level with, or slightly higher than the top of the porcelain. Loosen hoodnut to vent cable terminal.

J. Heat Compound – to proper pouring temperature. Pour compound into the standpipe rapidly, but not so fast that it will gush from the top of the cable terminal. Be careful to have the compound fill to within ½ inch of the gasket surface and at the same time it must not flow onto the gasket surface. Any compound on the gasket surface must be removed since it will interfere with the seal. When the compound reaches the proper level, tighten hoodnut. Keep the standpipe hot and full of compound until the cable terminal cools to ambient temperature. In cold weather, it may be necessary to warm the cable terminal to room temperature before pouring in compound. Remove standpipe and replace filler plug.

K. Install Cable Terminal **–** assembly in cutout body.

L. Check Operation – Tighten all nuts and cap screws. Close cover and check operation for mechanical interference.

M. Fill with Oil – furnished with cutout. Fill cutout to 3 inches below the cover gasket with cover and fuse carrier assembly removed. Remove oil level plug to allow excess oil to flow out when cover and fuse carrier assembly are placed in position. Replace oil level plug. If supplemental oil is required, use 10C oil.

Supersedes 7/15 Issue – Text shift

Supersedes 7/16 Issue –Figure numbering updates.

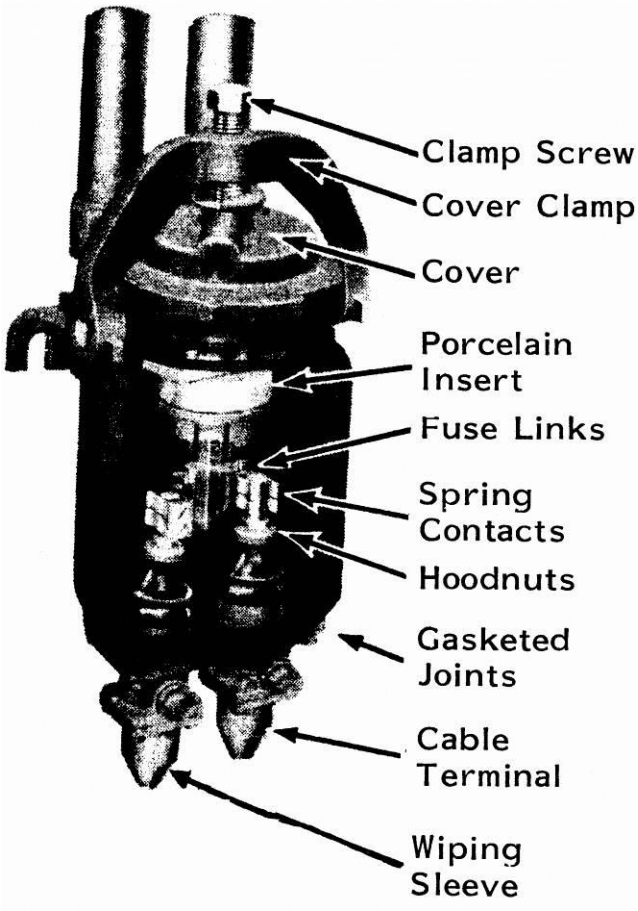


Figure 40

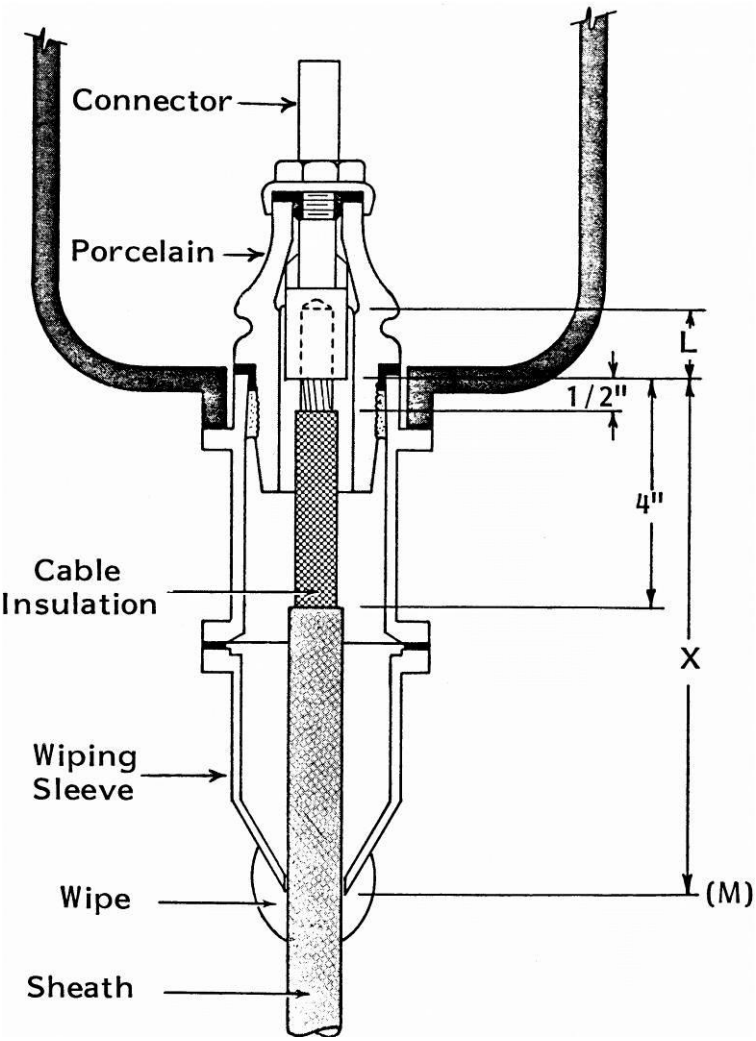


Figure 41

38.12 AUTO TRANSFER PADMOUNTED SWITCHGEAR

Auto transfer padmounted switchgear is an option for installations where there is a need for auto tranfer between two sources feeding load. This is currently only available in the 15kV class on four wire systems as a livefront style.

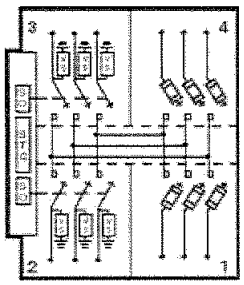


Figure 44
2 switch / 2 fuse US39H

38.12.10 Locations and Clearances

Three phase pad-mounted switchgear shall be located in an easement area, exact size of this area to be determined by Distribution Design. A minimum of 10 feet on the control side doors and switch door sides of the switchgear and 5 feet on the non-door side must be clear for switching and maintenance. Refer to Section 44 – UCD for additional clearance information and for bollard locations

38.12.20 Foundation

Either the fiberglass reinforced plastic vault pad (Std. Item UF3) or the pre-cast switchgear manhole (Std. Item UM20A). For cable sizes of 500 and greater for terminating onto the switchgear, the switchgear manhole is preferred. Note: when replacing and manual gear with the auto transfer gear the compartments of the source and fuse cable positions are in different compartments.

A. Fiberglass Reinforced Plastic Vault Pad – (Std. Item UF3) Excavation for the vault pad shall be to the proper grade so that the foundation rests on well tamped and/or undisturbed earth.

B. Pre-Cast Switchgear Manhole (Std. Item UM20A - manhole and collar) – Fill the bottom of the excavated hole with 1 foot of well compacted, crushed, bank gravel.

38.12.30 Installation

A. Switchgear on a Fiberglass Reinforced Plastic Vault Pad – Prior to installation review drawing 38-104 and 38-106 for proper conduit entry way and install the conduits. Install the vault pad, ground rods and a ground grid as shown on Page 38-100. For direct burial installation drawing 38-102 shows typical cable arrangement under the vault pad. Note: Primary cable shall not rest along the walls of the vault pad, the cables shall be brought into the vault pad allowing a minimum of four inches of soil between the cable and the vault pad vertical walls. Loop the cables around the inside of the vault pad and train the cable so that it can be extended two or three feet above the top of the vault pad. Backfill around the vault pad in 6 inch lifts to proper grade.

Supersedes 7/16 issue – Figure number update.

B. Pre-Cast Switchgear Manhole – Set precast manhole and collar. Install ground rods and ground grid shown on Page 38-101.

Install the three phase, pad-mounted switchgear on the vault pad or manhole and remove the lifting provisions from the switchgear.

After the switchgear is secured to the vault pad, fill the space, if any, between the base of the switchgear and the top of the vault pad or switchgear manhole collar (Use Std. Item S2 or S3). Install and terminate all primary cable in their respective compartment as required. Make the neutral and grounding connections. Neutral and ground connections must be made before the switchgear is energized. Seal foundation collar openings as shown in section 33.5.

Supersedes 7/18 Issue – Update to text in 38.12.60 and page reference in 38.12.80.

38.12.40 Fusing

Livefront style switchgear shall use Standard SML-20 style fuses (Std. Items F6E_ and F6K_) as required with fuse end fittings (Std. Item C51). Note that older installations may have different style fuses (Std. Item F4E_) with corresponding fuse holder (Std. Item C49B).

38.12.50 Auto Control

The control for the switchgear is set to a factory preset default setting. The local engineering group shall review and set the control appropriately for the system it will be installed for. The control has an overcurrent lockout feature to prevent automatic transfer that would close a source into a fault. The switchgear comes with current sensors that shall be mounted onto the source side of the attached cables feeding the switchgear. Sensors must be installed and connected in accordance with manufacturer's instructions (output connections, polarity, and cable concentric neutrals).

38.12.60 Labeling

Switchgear are to have the appropriate identification information as shown in the drawings on pages 38-103, 38-103A and 38-103B. Labeling as applicable to includes address, switchgear number, switch number, fuse number warning label, feeder number, phase labeling on cables and to the next location.

38.12.70 Cable Terminations

Terminate the primary cable in its respective compartment as required. In areas of the company that terminate cable on unused switch positions, the appropriate amount of cable shall be brought out to properly terminate it in the manhole or trench for future use. Make the neutral and grounding connections. Neutral and ground connections shall be made before the switchgear is energized. Cables are to be trained straight downward as possible. See drawings 38-102 for typical installation details

38.12.80 Grounding

Switchgears shall be tied into the ground grid of the switchgear at two points diagonally located in the switch cabinets. The ground wire shall be terminated with a 2 hole lug (STD Item UL14E) and attached to the mounting pad located near the grounding bus bar, an example is shown on page 38-102.

38.12.90 Switchgear Security

After the switchgear doors are securely closed, a pad lock shall be installed (Std. Item UL20_).

38.13 ADVANCED PAD-MOUNTED SWITCHGEAR 15kV CLASS

Advanced pad-mounted switchgear is a option for installation where there is a need for remote communications and control of the switchgear. The switchgear is elbow style equipped with motor contols and sensors to allow for switching between the two sources remotely. The load side of the switchgear is controlled with vacuum interrupters for protection of connected load. The control for the switchgear gear will give scada features to allow monitoring.

This Section covers the design, installation, and construction of elbow style advanced auto transfer pad-mounted switchgear (STD Item US39_). This Section shall apply in conjunction with the Section 44 – UCD (Underground Commercial Distribution) and Section 45 – URD (Underground Residential Distribution).

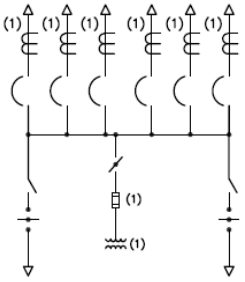


Figure 45
One line of US39I 15kV Class 2 switch / 2 VFI's SEL control

38.13.10 Locations and Clearances

Three phase pad-mounted switchgear shall be located in an easement area, exact size of this area to be determined by Distribution Design. A minimum of 10 feet on the control door side and switch door sides of the switchgear and 5 feet on the non-door sides must be clear for switching and maintenance. Refer to Section 44 – UCD for additional clearance information and for bollard location.

38.13.20 Foundation

This switch (Std. Item US39I) has the same footprint as the conventional elbow style switchgear. Either the fiberglass reinforced plastic vault pad (Std. Item UF3) or the pre-cast switchgear manhole (Std. Item UM20A) shall be used as the foundation. For cable sizes of 500 and greater terminating onto the switchgear, the switchgear manhole is preferred.

C. Fiberglass Reinforced Plastic Vault Pad – (Std. Item UF3) Excavation for the vault pad shall be to the proper grade so that the foundation rests on well tamped and/or undisturbed earth.

D. Pre-Cast Switchgear Manhole (Std. Item UM20A - manhole and collar) – Fill the bottom of the excavated hole with 1 foot of well compacted, crushed, bank gravel.

E. New advanced switchgear installations can be installed on existing older smaller style fiberglass boxpads. The gear will overhang a few inches on all sides of this installation.

F. Installations where the advanced switchgear does not fit onto older smaller fiberglass boxpads, a base adaptor plate can be installed (STD Item UF3D).

Supersedes 7/16 Issue – Update to figure number

Supersedes 7/16 Issue-Update to text in section 38.13.50.

38.13.30 Installation

Set precast manhole and collar. Install ground rods and ground grid shown on Page 38-101. Install the three phase, pad-mounted switchgear on the vault pad or manhole and remove the lifting provisions from the switchgear.

After the switchgear is secured, fill the space, if any, between the base of the switchgear and the top of the vault pad or switchgear manhole collar (Use Std. Item S2 or S3). After the cables are terminated, seal foundation collar openings as shown in 33.5.

38.13.40 Fusing

The advanced padmounted switches are equipped with vacuum circuit interrupters that can be programmed to most common current fuse curves for protection of the downstream device.

38.13.50 Labeling

Switchgear are to have the appropriate identification information as shown in the drawings on pages 38-103, 38-103A and 38-103B. Labeling as applicable to includes address, switchgear number, switch number, fuse number warning label, feeder number, phase labeling on cables and to the next location.

38.13.60 Arresters

Elbow arresters (STD Item UR40A_) are required on a normal open point; end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. Installation of elbow arrestors shall be off of the reducing tap well at the cable termination point. Ensure elbow arrester housing is bonded to the ground grid of the switch gear.

38.13.70 Insulating Caps

Insulating caps (STD Item UR24) shall be used on all bushing wells. Ensure the cap is bonded to the ground grid of the switchgear. When installing the insulating cap, the cap shall be fully seated onto the bushing.

38.13.80 Control Power

The advanced switchgear is powered by an internal PT for its control power. The switchgear also has battery backup external supply for use when control power is lost.

38.13.90 Communications

The advanced pad mounted switchgear shall use a cellular means to communicate its information back to various departments within the company. In the control provisions are made for a GE orbit radio system, includes a mounting location and prewired power wiring. Antenna mounting provisions, include antenna knockouts with pre-installed coax wiring from the control to the antenna exterior mount locations.

38.13.100 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the switchgear if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the switchgear if left installed permanently.

38.13.110 Grounding

Switchgears shall be tied into the ground grid of the switchgear at two points diagonally located in the switch cabinets. The ground wire shall be terminated with a 2 hole lug (STD Item UL14E) and attached to the mounting pad located near the grounding bus bar, an example is shown on page 38-122.

38.13.120 Cable Terminations

Terminate the primary cable in its respective compartment as required. All cables terminated shall have a reducing tap well and end cap installed off of the deadbreak 600 amp elbow. See section 37.5 for information on dead break elbow terminations and figures 19 and 20 in section 38.7.20. In areas of the company that terminate cable on unused switch positions, the appropriate amount of cable shall be brought out to properly terminate it in the manhole or trench for future use. Make the neutral and grounding connections. Neutral and ground connections shall be made before the switchgear is energized. Cables are to be trained straight downward as possible. Larger cables can be secured with cable supports to unistrut on the switchgear or switchgear collar. See drawings 38-140 and 38-150 for installation details.

38.13.130 Switchgear Security

After the switchgear doors are securely closed, a pad lock shall be installed (Std. Item UL20_).

Supersedes 7/20 Issue – Text Update 38.13.90.

38.14 AUTO TRANSFER ADVANCED PAD-MOUNTED SWITCHGEAR

Auto transfer advanced pad-mounted switchgear is a option for installation where there is a need for automation and remote control of the switchgear. The switchgear is elbow style equipped with motor contols and sensors that automate it to allow for switching between the two sources. The load side of the switchgear is controlled with vacuum interrupters for protection of connected load. The control for the switchgear gear will give scada features and allow monitoring of line voltage and current.

This Section covers the design, installation, and construction of elbow style advanced auto transfer pad-mounted switchgear (STD Items US38D1A and US39_). This Section shall apply in conjunction with the Section 44 – UCD (Underground Commercial Distribution) and Section 45 – URD (Underground Residential Distribution).

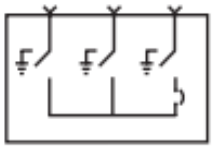


Figure 46
One line of US38D1A Hi duty 25ka 38kV Class 2 switch / 1 VFI SEL control

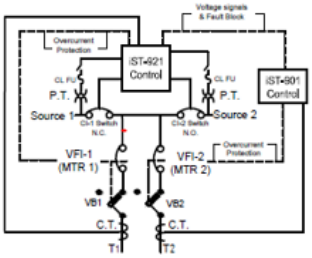


Figure 46A
One line of US39L/US39LD 15kV Class, US39J 27kV Class and US39K 38kV Class 2 switch / 2 VFI's PST Control

38.14.10 Locations and Clearances

Three phase pad-mounted switchgear shall be located in an easement area, exact size of this area to be determined by Distribution Design. A minimum of 10 feet on the control door side and switch door sides of the switchgear and 5 feet on the non-door sides must be clear for switching and maintenance. Refer to Section 44 – UCD for additional clearance information and for bollard location.

38.14.20 Foundation

Switchgear Std. Item US38D1A shall be in installed on foundation Std. Item US38DA. Switchgears Std Item US39_ has large footprint compared to the conventional elbow style switchgear. A large pre-cast switchgear manhole Std. Item UM35 shall be used as the foundation Fill the bottom of the excavated hole with 1 foot of well compacted, crushed, bank gravel.

Supersedes 7/21 Issue- New switchgear US38D1A added

38.14.30 Installation

Set switchgear onto appropriate base and tie into ground grid as shown on Page 38-100 or 38-101.Remove the lifting provisions from the switchgear.

After the switchgear is secured, fill the space, if any, between the base and the switchgear (Use Std. Item S2 or S3). After the cables are terminated, seal foundation collar openings as shown in 33.5.

38.14.40 Fusing

The advanced padmounted switches are equipped with vacuum circuit interrupters that can be programmed to most common current fuse curves for protection of the downstream device.

38.14.50 Labeling

Switchgear are to have the appropriate identification information as shown in the drawings on pages 38-103, 38-103A and 38-103B. Labeling as applicable to includes address, switchgear number, switch number, fuse number warning label, feeder number, phase labeling on cables and to the next location.

38.14.60 Arresters

Elbow arresters (STD Item UR40A_) are required on a normal open point; end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. Installation of elbow arrestors shall be off of the reducing tap well at the cable termination point. Ensure elbow arrester housing is bonded to the ground grid of the switch gear.

38.14.70 Insulating Caps

Insulating caps (STD Item UR24, UR24C or UR91) shall be used on all bushing wells. Ensure the cap is bonded to the ground grid of the switchgear. When installing the insulating cap, the cap shall be fully seated onto the bushing.

38.14.80 Control Power

The advanced switchgear is powered by an internal PT for its control power. The switchgear also has battery backup external supply for use when control power is lost.

Supersedes 7/19 Issue- Update to text in section 38.14.30.

Supersedes 7/21 Issue-Update to section 38.14.120.

38.14.90 Communications

The advanced auto transfer pad mounted switchgear shall use a cellular means to communicate its information back to various departments within the company. In the control provisions are made for a GE orbit radio system, includes a mounting location and prewired power wiring. Antenna mounting provisions, include antenna knockouts with pre-installed coax wiring from the control to the antenna exterior mount locations.

38.14.100 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the switchgear if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the switchgear if left installed permanently.

38.14.110 Grounding

Switchgears shall be tied into the ground grid of the switchgear at two points diagonally located in the switch cabinets. The ground wire shall be terminated with a 2 hole lug (STD Item UL14E) and attached to the mounting pad located near the grounding bus bar, an example is shown on page 38-120.

38.14.120 Cable Terminations

Terminate the primary cable in its respective compartment as required. All cables terminated shall have a reducing tap well and end cap installed off of the deadbreak 600 amp elbow. See section 37.5 for information on dead break elbow terminations and figures 19 and 20 in section 38.7.20. In areas of the company that terminate cable on unused switch positions, the appropriate amount of cable shall be brought out to properly terminate it in the manhole or trench for future use. Make the neutral and grounding connections. Neutral and ground connections shall be made before the switchgear is energized. Cables are to be trained straight downward as possible. Larger cables can be secured with cable supports to unistrut on the switchgear or switchgear collar. See drawings 38-140, 38-141, 38-142, 38-143, 38-144 and 38-150 for installation details.

38.14.130 Switchgear Security

After the switchgear doors are securely closed, a pad lock shall be installed (Std. Item UL20_)

38.15 Advanced Submersible Switchgear 15kV Class

Advanced submersible switchgear is a option for installation where there is a need for remote communications and control of the switchgear. The switchgear is elbow style equipped with motor contols and sensors that provides capabilities for remote switching between the two sources. The load side of the switchgear is controled with vacuum interupters for protection of connected load. The control for the switchgear gear will give scada features and allow monitoring of line voltage and current.

This Section covers the design, installation, and construction of elbow style advanced transfer submersible switchgear. (STD Item US41A1 or US41C1). This Section shall apply in conjunction with the Section 44 – UCD (Underground Commercial Distribution) and Section 45 – URD (Underground Residential Distribution).

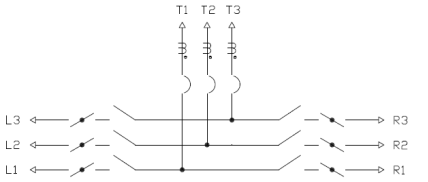


Figure 47
2 switch / 1 VFI US41A1

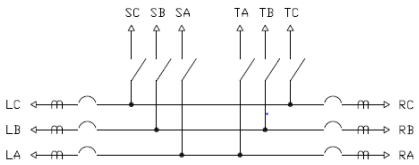


Figure 48
2 switch / 2 VFI US41C1

38.15.10 Locations and Clearances

Submersible switches shall be installed below grade where the switch is completely accessible from grade using standard tools. Generally, equipment should be installed in locations that are not intended to be commonly accessed by personnel on a regular basis (e.g. so-called half vaults, sidewalk vaults, etc.). Building vaults on customer property would also fit into this category.

Where conditions require that submersible switches be installed in spaces intended for personnel access, typical manholes for instance, the switch shall be operable remotely and not require personnel to be in the manhole during switching operations. This remote operation can be accomplished through use of standard tools or by rigging, remote operators, or other means

38.15.20 Installation

To install any one of the switches, a field inspection with local operations is needed prior to completing the engineering design to ensure the installation of the switch in the chosen manhol will meet all safety and work method requirements for operation and maintenance of the switch. During the field inspection if installation, operation and maintenance of the proposed switch hinders egress, the structure shall be modified with two openings, one for entry way and the other for equipment installation operation and maintenance or redesign the job to meet these requirements.

The advanced submersible switches come with a built-in rail to keep the switch off of the manhole floor. The switch shall be properly grounded and bolted to the manhole along with anodes to keep corrosion to a minimum, see 33.2 for further details on grounding and bonding.

Supersedes 7/18 Issue- Update to figure numbers.

Supersedes 7/19 Issue- Update to text in section 38.15.80.

38.15.30 Fusing

The advanced submersible switches are equipped with vacuum interrupters that can be programmed to most common current fuse curves for protection of the downstream device.

38.15.40 Labeling

Install identification information on the all cables to the switch. Install labels to all switch positions on the switch. At a minimum, the Control Center will issue a six-digit number for all mainline switch devices and require the property address or location number to be labeled. Drawing 38-150 shows an example of a typical labeled switchgear.

38.15.50 Arresters

Elbow arresters (STD Item UR40A_) are required to be installed on a normal open point, end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. Installation of elbow arrestors shall be off of the reducing tap well at the cable termination point. Ensure elbow arrester housing is bonded to the ground grid of the switch. When installing the elbow arrestor, the elbow arrestor shall be fully seated onto the bushing.

38.15.60 Insulating Caps

Insulating caps (STD Item UR24) shall be used on all bushing wells. Ensure the cap is bonded to the ground grid of the switchgear. When installing the insulating cap, the cap shall be fully seated onto the bushing.

38.15.70 Control Power

The advanced submersible switchgear requires 120 volt control power. If feasible use an alternate source than what the switchgear is on. The switchgear also has a battery backup external supply for use when control power is lost.

38.15.80 Communications

The advanced submersible switchgear shall use a cellular means to communicate its information back to various departments within the company. In the control provisions for a GE orbit radio system is integrated in along with means for antenna egress. External antennas to be mounted to the underside of the vault hatch.

38.15.90 Cable Terminations

Terminate the primary cable in its respective bushing as required. All cables terminated shall have a reducing tap well and end cap installed off of the deadbreak 600 amp elbow. See section 37.5 for information on dead break elbow terminations and figures 19 and 20 in section 38.7.20. For unused bushings install the appropriate amount of cable off of the bushing to properly terminate it in the manhole for future use. Make the neutral and grounding connections. Neutral and ground connections shall be made before the switchgear is energized. See drawing 38-150 for a typical installation. Cables are to be trained toward the closest wall for support and racking.

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38.15.100 Locking

Switch operating handles shall have a lock installed on them at all times to ensure they stay in the correct operating position. Drawing 38-150 shows a typical switch with locks installed on the operating handles.

38.15.110 Grounding

Switches shall be tied into the ground grid of the manhole at two points diagonally located in the switch where feasible. The ground wire shall be terminated through the switches ground terminal connections, a typical example is shown in figure 49.

Figure 49

38.15.120 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the switch if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the switch if left installed permanently.

Supersedes 7/16 Issue- Update to figure number.

Supersedes 7/18 Issue - Section 38.16 text and figure updates.

38.16 Auto Transfer Advanced Dry Vault Side Mount Switchgear 15kV Class

Auto transfer advanced dry vault side mount style switchgear is a option for installation where there is a need for automation and remote control of the switchgear. A fully submersible style is also available, contact electric standards for ordering. The switchgear is elbow style equipped with motor contols and sensors that automated it to allow for switching between the two sources. The load side of the switchgear is controled with a vacuum interupter for protection of connected load. The control for the switchgear gear will give scada features and allow monitoring of line voltage and current. Switch installation requires room for associated control box and external PT's and voltage sensors.

This Section covers the design, installation, and construction of elbow style advanced transfer submersible switchgear. (STD Item US41A2). This Section shall apply in conjunction with the Section 44 – UCD (Underground Commercial Distribution) and Section 45 – URD (Underground Residential Distribution).

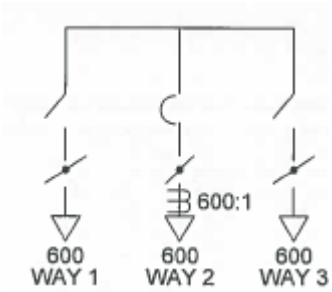


Figure 50
One 2 switch / 1 VFI US41A2

38.16.10 Locations and Clearances

The switch shall be installed below grade where the switch is completely accessible using standard tools.

Where conditions require that switches be installed in spaces intended for personnel access, typical manholes for instance, the switch shall be operable remotely and not require personnel to be in the manhole during switching operations. This remote operation can be accomplished through use of standard tools or by rigging, remote operators, or other means.

38.16.20 Installation

To install the switch, a field inspection with local operations is needed prior to completing the engineering design to ensure the installation of the switch in the chosen location will meet all safety and work method requirements for egress, installation, operation and maintenance of the switch.

The auto transfer switch comes with an adjustable height stand to keep the switch off of the ground. The switch shall be properly grounded and bolted to the floor along with anodes to keep corrosion to a minimum, see 33.2 for further details on grounding and bonding.

38.16.30 Fusing

The auto transfer advanced switches are equipped with vacuum interrupters that can be programmed to most common current fuse curves for protection of the downstream device.

38.16.40 Labeling

Install identification information on the all cables to the switch. Install labels to all switch positions on the switch. At a minimum, the Control Center will issue a six-digit number for all mainline switch devices and require the property address or location number to be labeled. Drawing 38-150 shows an example of a typical labeled switchgear.

38.16.50 Arresters

Elbow arresters (STD Item UR40A_) are required to be installed on a normal open point, end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. Installation of elbow arrestors shall be off of the reducing tap well at the cable termination point. Ensure elbow arrester housing is bonded to the ground grid of the switch. When installing the elbow arrestor, the elbow arrestor shall be fully seated onto the bushing.

38.16.60 Insulating Caps

Insulating caps (STD Item UR24) shall be used on all bushing wells. Ensure the cap is bonded to the ground grid of the switchgear. When installing the insulating cap, the cap shall be fully seated onto the bushing.

38.16.70 Control Power

The switch control power is by an external PT's. If both sources are lost the switchgear also has a battery backup external supply.

38.16.80 Communications

The auto transfer advanced vault mounted switchgear shall use a cellular means to communicate its information back to various departments within the company. In the control provisions are made for a GE orbit radio system, includes a mounting location and prewired power and antenna wiring to a coax connection point on the control box. Local comms study and installation to be performed for determining suitable antenna mount installation and location.

38.16.90 Cable Terminations

Terminate the primary cable in its respective bushing as required. All cables terminated shall have a reducing tap well and end cap installed off of the deadbreak 600 amp elbow. See section 37.5 for information on dead break elbow terminations and figures 19 and 20 in section 38.7.20. For unused bushings install the appropriate amount of cable off of the bushing to properly terminate it in the manhole for future use. Make the neutral and grounding connections. Neutral and ground connections shall be made before the switchgear is energized. See drawing 38-150 for a typical installation. Cables are to be trained toward the closest wall for support and racking

Supersedes 7/19 Issue- Updates to text in section 38.16.80.

38.16.100 Locking

Switch operating handles shall have a lock installed on them at all times to ensure they stay in the correct operating position. Drawing 38-150 shows a typical switch with locks installed on the operating handle.

38.16.110 Grounding

Switches shall be tied into the ground grid of the manhole at two points diagonally located in the switch where feasible. The ground wire shall be terminated through the switches ground terminal connections.

38.16.120 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the switch if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the switch if left installed permanently.

7/18 – New Standard- Primary Metering is now section 38.17

38.17 Pad-mounted Primary Metering

This section covers the design, installation, and construction of three phase, pad-mounted primary metering. Elbow style primary metering is available at the 15kV class in 200 Amp (STD Item US39M) and 600 amp (STD Item US39N) ratings.

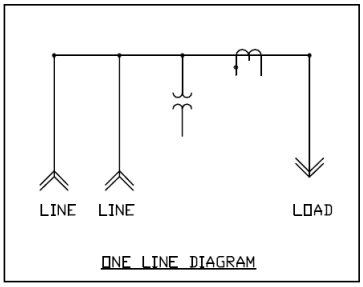


Figure 53

200 amp style US39M

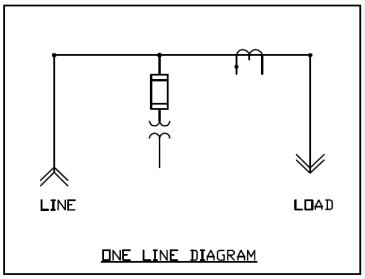


Figure 54

600 amp style US39N

38.17.10 Locations and Clearances

Pad-mounted primary metering shall be located in an easement area, exact size of this area to be determined by Distribution Design. A minimum of 10 feet on the door sides of the primary metering and 5 feet on the non-door sides must be clear for switching and maintenance. Refer to Section 44 – UCD for additional clearance information and for bollard locations.

38.17.20 Foundation

Either the fiberglass reinforced plastic vault pad (Std. Item US39P) or the pre-cast switchgear manhole (Std. Item UM20M) shall be used as the foundation for the pad mounted primary metering. For cable sizes of 500 and greater terminating onto the switchgear, the switchgear manhole is preferred.

A. Fiberglass Reinforced Plastic Vault Pad – (Std. Item US39P) Excavation for the vault pad shall be to the proper grade so that the foundation rests on well tamped and/or undisturbed earth.

B. Pre-Cast Switchgear Manhole (Std. Item UM20M - manhole and collar) – Fill the bottom of the excavated hole with 1 foot of well compacted, crushed, bank gravel.

38.17.30 Installation

A. Primary metering on a Fiberglass Reinforced Plastic Vault Pad – Prior to installation review drawing 38-104 and 38-106 for proper conduit entry way and install the conduits. Install the vault pad, ground rods and a ground grid as shown on drawing 38-100. For direct burial installation drawing 38-140 shows typical cable arrangement under the vault pad. Note: Primary cable shall not rest along the walls of the vault pad, the cables shall be brought into the vault pad allowing a minimum of four inches of soil between the cable and the vault pad vertical walls. Loop the cables around the inside of the vault pad and train the cable so that it can be extended two or three feet above the top of the vault pad. Backfill around the vault pad in 6 inch lifts to proper grade

B. Pre-Cast Switchgear Manhole – Set precast manhole and collar. Install ground rods and ground grid shown on drawing 38-101.
Install the pad-mounted primary metering on the vault pad or manhole and remove the lifting provisions from the switchgear.

Supersedes 7/18 Issue- Updates to figure numbers.

After the pad-mounted primary metering is secured to the vault pad, fill the space, if any, between the base of the switchgear and the top of the vault pad or switchgear manhole collar (Use Std. Item S2 or S3). Install all primary cable elbows in their respective compartment as required; see drawing 38-206 and 38-2-8. Seal foundation collar openings as shown in 33.5.

38.17.40 Labeling

Install applicable identification information as shown on the switchgear drawing 38-103.

38.17.50 Arresters

Elbow arresters (STD Item UR40A_) are required on a normal open point; end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. For 600 amp metering installation of elbow arrestors shall be off of the reducing tap well at the cable termination point. For 200 amp install elbow arrestors in spare line bushings. Ensure elbow arrester housing is bonded to the ground grid of the primary metering. When installing the elbow arrestor, the elbow arrestor shall be fully seated onto the bushing.

38.17.60 Insulating Caps

Insulating caps (STD Item UR24) shall be used on all bushing wells. Ensure the cap is bonded to the ground grid of the metering switch. When installing the insulating cap, the cap shall be fully seated onto the bushing.

38.17.70 Cable Terminations

Terminate the primary cable in its respective compartment as required. All cables terminated shall have a reducing tap well and end cap installed off of the deadbreak 600 amp elbow. See section 37.5 for information on dead break elbow terminations and figures 19, 20 and 21 in section 38.7.20. Make the neutral and grounding connections. Neutral and ground connections shall be made before the primary metering is energized. Cables are to be trained straight downward as possible. See drawings 38-206 and 38-208 for installation details.

38.17.80 Grounding

Primary metering cabinets shall be tied into the ground grid at two points diagonally located in the primary metering cabinets. The ground wire shall be terminated with a 2 hole lug (STD Item UL14E) and attached to the mounting pad located near the grounding bus bar.

38.17.90 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the primary metering cabinet if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the primary metering cabinet if left installed permanently.

38.17.100 Primary Metering Security

After the primary metering doors are securely closed, a pad lock shall be installed (Std. Item UL20_).

Supersedes 7/18 Issue-Update 38.17.70 figure numbers and to text in 38.17. 80..

38.18 NETWORK SWITCHES

This Section covers the design, installation, and construction of three phase switches used in the network system (Std. Items US40H, US40H1, US40I, U40J, US40J1, US40K and US40L). They are intended for use for isolation of the network transformer and are available at the 15, 27 and 38kV class. Further information is available in sections 42.10 and 50.US4__.

38.18.10 Locations

Network switches can be installed in indoor or outdoor vaults and are to be installed in locations where the switch is completely accessible using standard tools.
Note: Std Items US40H, US40I and US40J are currently rated for use in indoor vaults and are not submersible rated.

38.18.20 Installation

To install the switch, a field inspection with local operations is needed prior to completing the engineering design to ensure the installation of the switch in the chosen location will meet all safety and work method requirements for egress, installation, operations and maintenance of the switch.

Switches can be installed on the wall, or on a stand for floor mounting in the manhole or vault. To install, anchor bolts (Std Item B7_) can be used for direct mounting to a solid surface. For stand mounting, the stand and switch shall be properly bolted to the manhole floor with anchor bolts (Std. Item B7_). All switches shall be grounded to the manhole and with new manhole installations an external ground loop shall be installed. Anodes shall be installed to keep corrosion to a minimum, see section 33.2 and page 38-101 for further details on grounding and bonding.

38.18.30 Fusing

Network switches have an external programmable relay that comes with each switch. Auxiliary contacts are an added feature of the network switch for additional protection for operation of the switch. Software and assistance for programming is available, refer to Electric Materials Standards for assistance.

38.18.40 Cable Terminations

Terminate the primary cable in its respective bushing as required. See section 37.5 for information on dead break elbow terminations and figures 19, 20 and 21 in section 38.7.20. Make the neutral and grounding connections. Neutral and ground connections shall be made before the switch is energized. See figure 54 on page 38-44 for a typical installation of US40H. Cables are to be trained toward the closest wall for support and racking.

38.18.50 Labeling

Install identification information on the all cables to the switch. Install labels to all switch positions on the switch. At a minimum, the Control Center will issue a six digit number for all mainline switch devices and require the property address or location number to be labeled. Figure 57 on page 38-47 for an example of a typical labeled switch.

Supersedes 7/19 issue - Updates to text in 38.18.20

Supersedes 7/18 Issue- Update to figure number in section 38.18.90 and figures.

38.18.60 Arresters

Elbow arresters (STD Item UR40A_) are required to be installed on a normal open point, end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. Installation of elbow arrestors shall be off of the reducing tap well at the cable termination point. Ensure elbow arrester housing is bonded to the ground grid of the switch. When installing the elbow arrestor, the elbow arrestor shall be fully seated onto the bushing.

38.18.70 Insulating Caps

Insulating caps (STD Item UR24 or UR91) shall be used on all bushing wells. Ensure the cap is bonded to the ground grid of the switch. When installing the insulating cap, the cap shall be fully seated onto the bushing.

38.18.80 Locking

Switch operating handles shall have a lock installed on them at all times to ensure they stay in the correct operating position. Drawing 38-150 shows a typical switch with locks installed on the operating handles.

38.18.90 Grounding

Switches shall be tied into the ground grid of the switch at two points diagonally located in the switch where feasible. The ground wire shall be terminated through the switches ground terminal connections, a typical example is shown in figure 57 below.

38.18.100 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the switch if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the switch if left installed permanently.

Figure 57
US40H

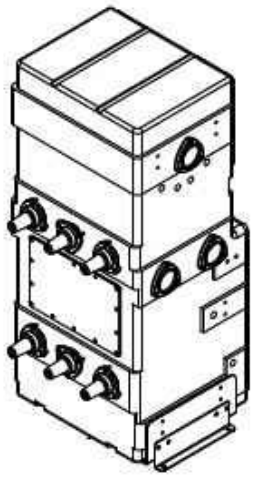


Figure 58
US40K

38.19 Pad-mounted Recloser

This section covers the design, installation, and construction of three phase, pad-mounted, elbow style reclosers. There are 4 variations available as described below.

Std. Item US50, legacy style pad mount recloser that was used on limited underground applications uses a Form 6 control style is for installations up to 22.9kV. It requires a 120-volt power supply.

Std. Item US51_ legacy style pad mounted recloser that was used on limited underground and DER applications uses a Form 6 control style with provisions for a radio and antennas for communication, automation and control. It is self-powered with battery backup and has a pendant for local remote operation. There are two choices: one for a 15kV class wye system and one for a 25kV class delta system.

Std. Item US52_ pad mounted recloser is used for underground and DER applications uses a SEL 651R control. It is self-powered with provisions for a radio and antennas for communication, automation and control. The recloser is rated at 12ka and there are two voltage class choices: 12.47/13.2/13.8 wye and 34.5 wye kV systems. **Note:** For 23kv delta application pad mounted use US54P25.

Std. Item US54P_ pad mounted recloser is used for underground and DER applications uses a SEL651R control. It is self-powered with provisions for a radio and antennas for communication, automation and control. The recloser is rated at 40 ka and can be used on wye, delta and ungrounded systems. There are for voltage class choices; 12.47/13.2/13.8, 22.9 and 34.5 kV systems. **Note**: The 34.5 kV pad mounted recloser have not been set up in inventory when an application for them is required, contact electric engineering standards for further assistance.

38.19.10 Locations and Clearances

Pad-mounted reclosers shall be located in an easement area, exact size of this area to be determined by Distribution Design. A minimum of 10 feet on the door side of the recloser and 5 feet on the non-door sides must be clear for switching and maintenance. Refer to Section 44 – UCD for additional clearance information and for bollard locations.

38.19.20 Foundation

For STD. Items US50 and US51_: Either the fiberglass reinforced plastic vault pad (Std. Item US50R) or the pre-cast switchgear manhole (Std. Item UM20C) shall be used. For cable sizes of 500 and greater terminating onto the switchgear, the switchgear manhole is preferred.

For STD. Items US52_ shall be installed on switchgear manhole STD. Item UM21J2.

For STD. Item US54P15 shall be installed on switchgear manhole STD. Item UM20M and for STD. Item US54P25 shall be installed on XL switchgear manhole STD. Item UM41K.

Supersedes 7/20 issue – Update to 38.19

38.19.30 Installation

Fiberglass Reinforced Plastic Vault Pad – Prior to installation review drawing 38-104 and 38-106 for proper conduit entry way and install the conduits. Install the vault pad, ground rods and a ground grid as shown on drawing 38-100. For direct burial installation drawing 38-140 shows typical cable arrangement under the vault pad. Note: Primary cable shall not rest along the walls of the vault pad; the cables shall be brought into the vault pad allowing a minimum of four inches of soil between the cable and the vault pad vertical walls. Loop the cables around the inside of the vault pad and train the cable so that it can be extended two or three feet above the top of the vault pad. Backfill around the vault pad 6 inches at a time and compact.

Pre-Cast Switchgear Manhole – Set precast manhole and collar. Install ground rods and ground grid shown on drawing 38-101.

Install the pad-mounted recloser on the vault pad or manhole and remove the lifting provisions from the recloser.

After the pad-mounted recloser is secured to the vault pad, fill the space, if any, between the base of the switchgear and the top of the vault pad or switchgear manhole collar (Use Std. Item S2 or S3). After cables are terminated, seal foundation collar openings as shown in section 33.5.

Supersedes 7/21 Issue- Update to text in 38.19.70,

38.19.40 Labeling

Install applicable identification information as shown on the switchgear drawing 38-103.

38.19.50 Arresters

Elbow arresters (STD Item UR40A_) are required on a normal open point; end of the circuit or in an underground area where there is a need for additional protection of potential voltage surges in the system. Elbow arrestors shall be off of the reducing tap well at the cable termination point. Ensure elbow arrester housing is bonded to the ground grid of the recloser. When installing the elbow arrestor, the elbow arrestor shall be fully seated onto the bushing.

38.19.60 Insulating Caps

Insulating caps (STD Item UR24, UR24C or UR91) shall be used on all bushing wells. Ensure the cap is bonded to the switchgear. When installing the insulating cap, the cap shall be fully seated onto the bushing.

38.19.70 Cable Terminations

Terminate the primary cable in its respective compartment as required. All cables terminated shall have a reducing tap well and end cap installed off of the deadbreak 600-amp elbow. See section 37.5 for information on dead break elbow terminations and figures 19, 20 and 21 in section 38.7.20. Neutral and ground connections shall be made before the switchgear is energized. Cables are to be trained straight downward as possible. For reference drawings 38-145, 38-146, 38-147_ and 38-148_ show typical cable terminations.

38.19.80 Grounding

Pad-mounted reclosers shall be tied into the ground grid at two points diagonally located in the primary cabinet. The ground wire shall be terminated with a 2 hole lug (STD Item UL14E) and attached to the mounting pad located near the grounding bus. If the recloser has a ground rod bar, terminate ground wire with ground rod connector (STD Item G4).

38.19.90 Feed-thru Bushings and Parking Stands

Feed-thru bushings and parking stands shall be bonded to the ground grid in the pad-mounted recloser if left installed permanently. Insulating caps shall be installed on any un-used bushings on feed-thru bushings and parking stands. The insulating caps shall be bonded to the ground grid in the pad-mounted recloser if left installed permanently.

38.19.100 Control Power

Recloser Std Item US50 requires 120-volt control power. Recloser Std. Item US51_ , US52_ and US54P_are self-powered and have a battery backup for when control power is lost.

38.19.110 Communications

The Std. Item US51_ , US52_ and US54P_ use a cellular means to communicate its information back to various departments within the company. In the control provisions are made for a GE orbit radio system, includes a mounting location and prewired power wiring. Antenna mounting provisions, include antenna knockouts with pre-installed coax wiring from the control to the antenna exterior mount locations.

38.19.120 Recloser Security

After the recloser doors are securely closed, a pad lock shall be installed (Std. Item UL20_).

38.19.130 Voltage Sensors

Voltage sensing is available for Std. Item US51A with the Cooper Control; the recloser is equipped with elbow style sensors, Std. Item UR96.
The US52_ and US54P_ style reclosers have internal voltage sensing.

Supersedes 7/20 issue – Update 38.19.100, 110 and 130, section 38.20 deleted.

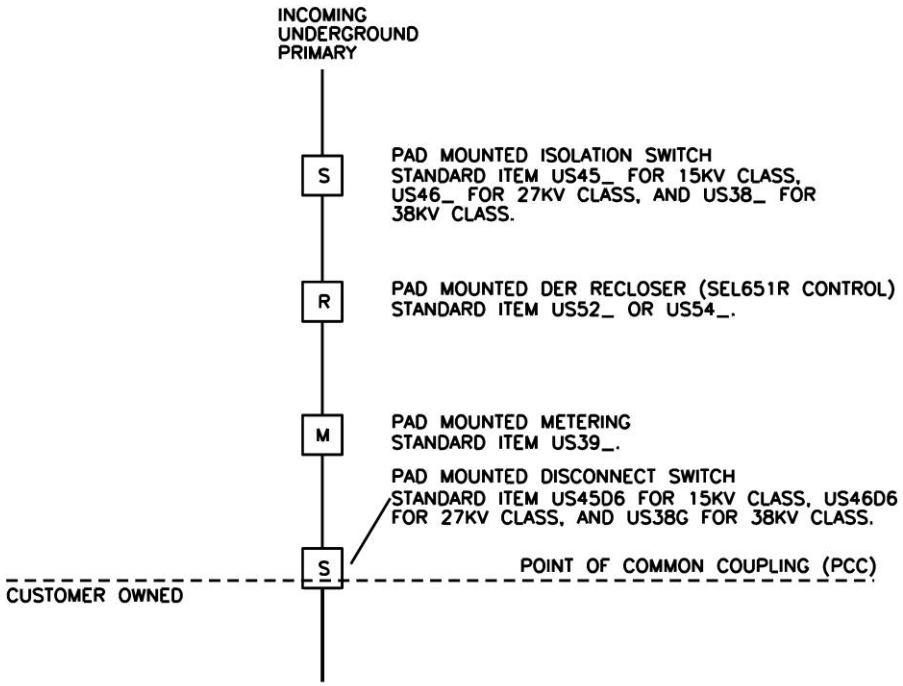
Supersedes 7/20 Issue- Text update i38.21 and note added to figure 61.

38.21 DER Interconnections

This section covers the required equipment for a DER (Distributed Energy Resource) interconnection. Figure 61 lists the required equipment for interconnection in Rhode Island.

Notes:
1) Some equipment at the higher voltage classes are in development and if the item in question is not in the materials section, reach out to electric standards.

DER INTERCONNECTION FOR UNDERGROUND



Designer	Drawing	Date
MPR	ug38-53	6/18/21

NOTE:
1. FOR 15KV CLASS AND BELOW WYE SYSTEMS WITH LESS THAN 170 AMPS OF CONTINUOUS CURRENT AT NOMINAL VOLTAGE AND UNITY POWER FACTOR, 200 AMP LOAD BREAK ELBOWS AT THE METERING EQUIPMENT CAN BE USED IN PLACE OF THE ISOLATION SWITCH AT THE PCC.
2. NON EFFECTIVELY GROUND SYSTEMS REQUIRE GANG OPERATED EQUIPMENT AND 600A ELBOWS

Figure 61

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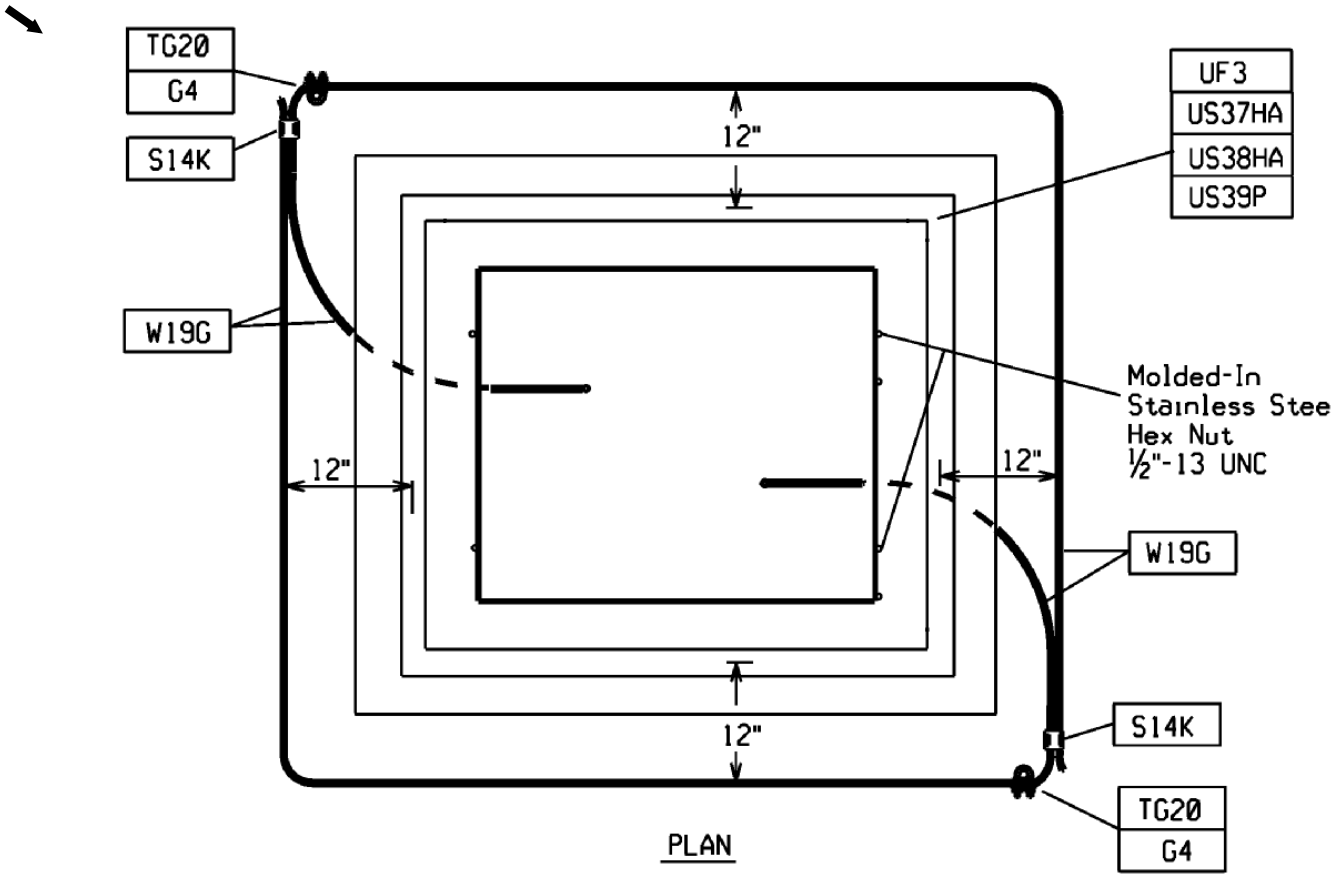
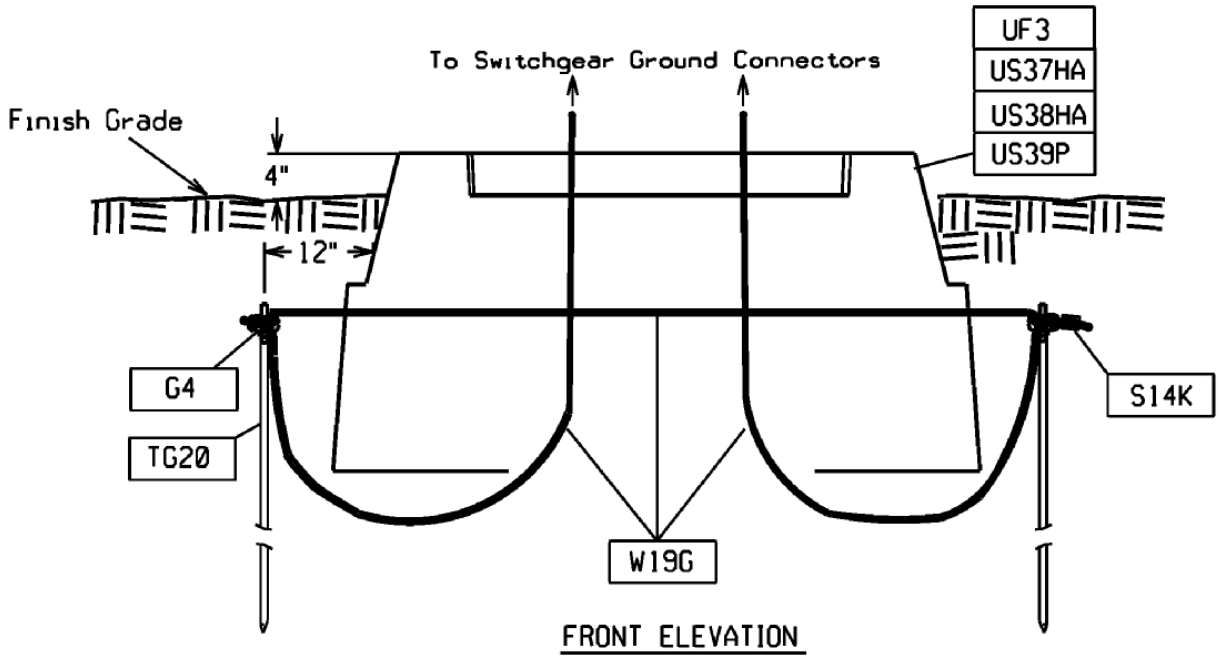


PLAN

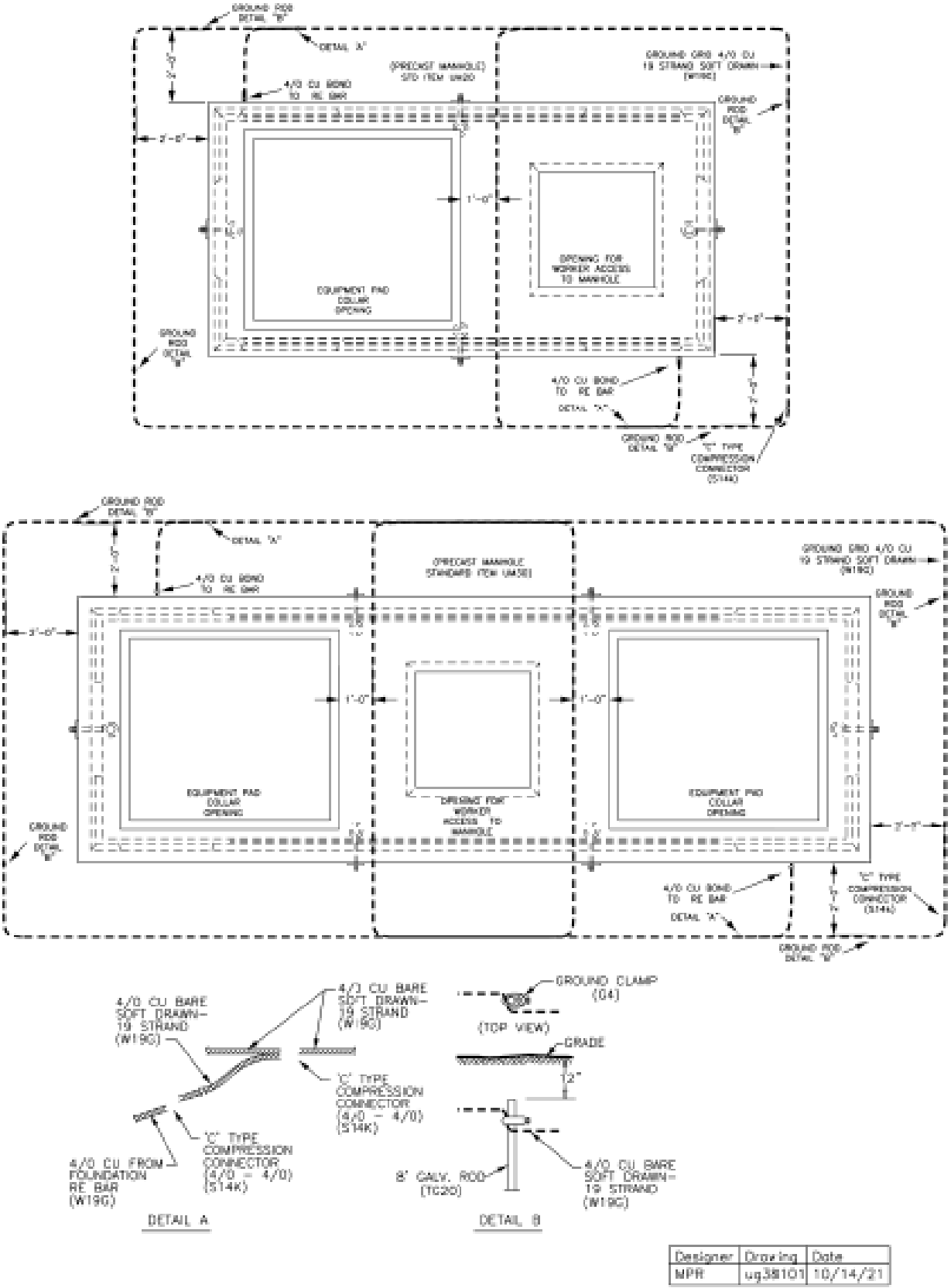


FRONT ELEVATION

Supersedes 2/06 Issue –Drawing Update

PADMOUNTED EQUIPMENT – MANHOLE INSTALLATION WITH GROUND GRID			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		38-101	7/22

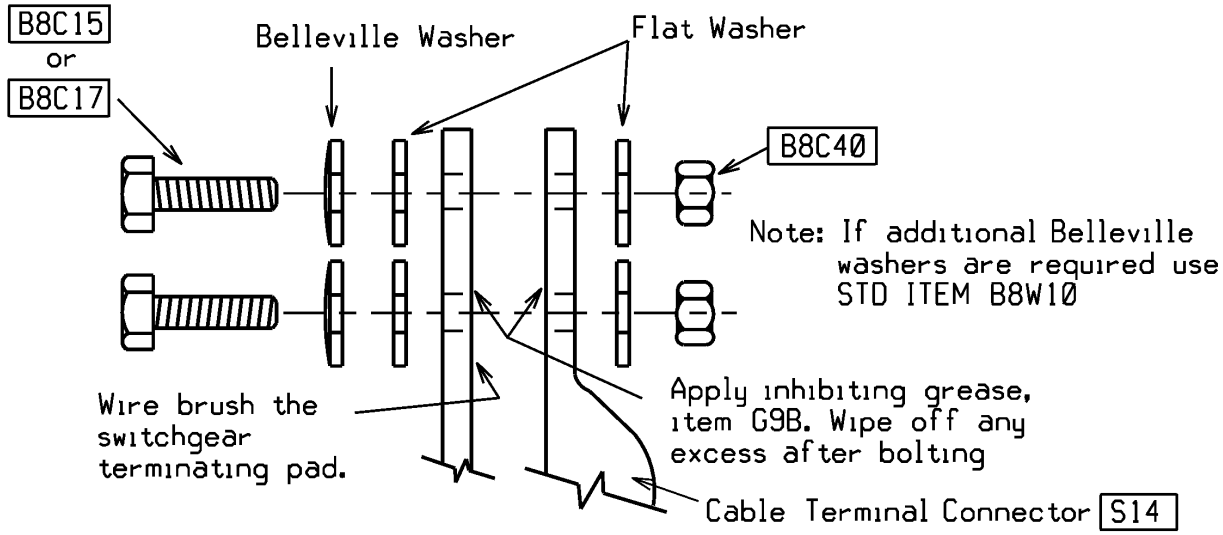
Supersedes 7/16 Issue – Drawing Update added double collar manhole.



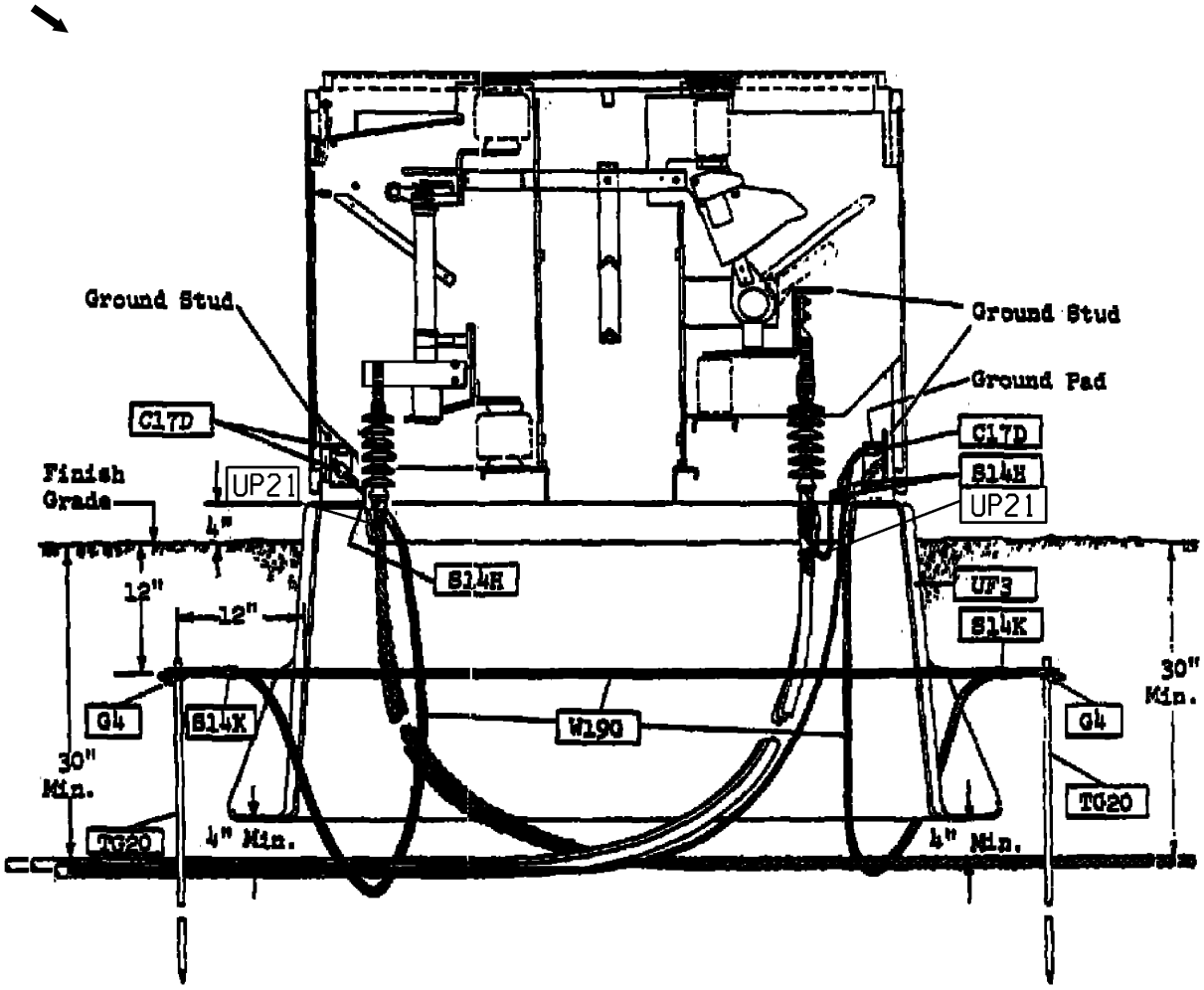
Designer	Drawing	Date
MPR	ug38101	10/14/21

PADMOUNTED EQUIPMENT FIBERGLASS BASE INSTALLATION WITH GROUND GRID

ISSUE	PAGE NUMBER		
7/14	38-100	UNDERGROUND CONSTRUCTION STANDARD	ppl

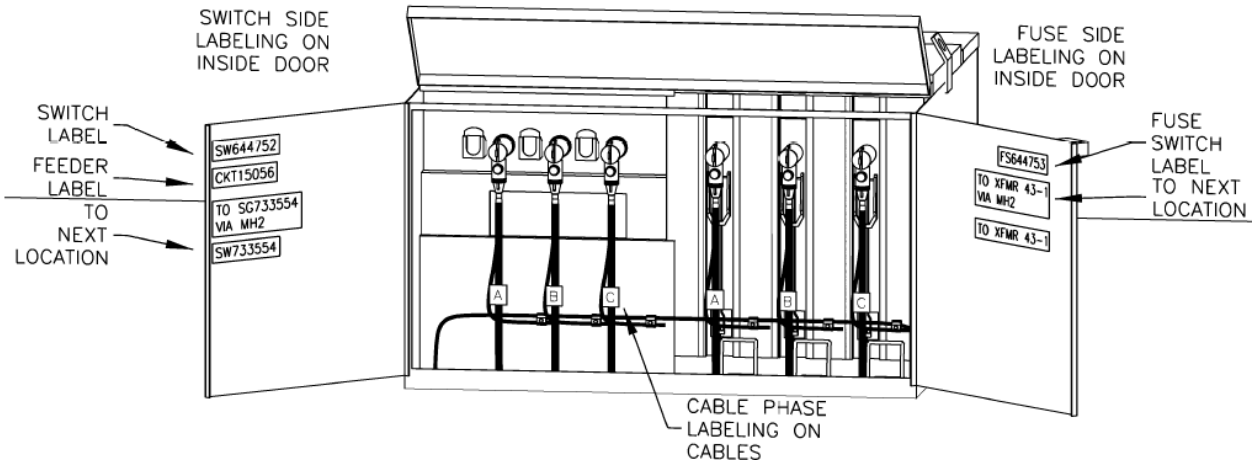


TERMINATING PAD ASSEMBLY DETAILS



Supersedes 2/06 Issue –Drawing Update

THREE PHASE PAD-MOUNTED SWITCHGEAR TYPICAL IDENTIFICATION AND LABELING			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		38-103	7/18



Labeling for the interior of a typical switchgear.

Note the following:

1) Phase designating labeling is required on primary cables.

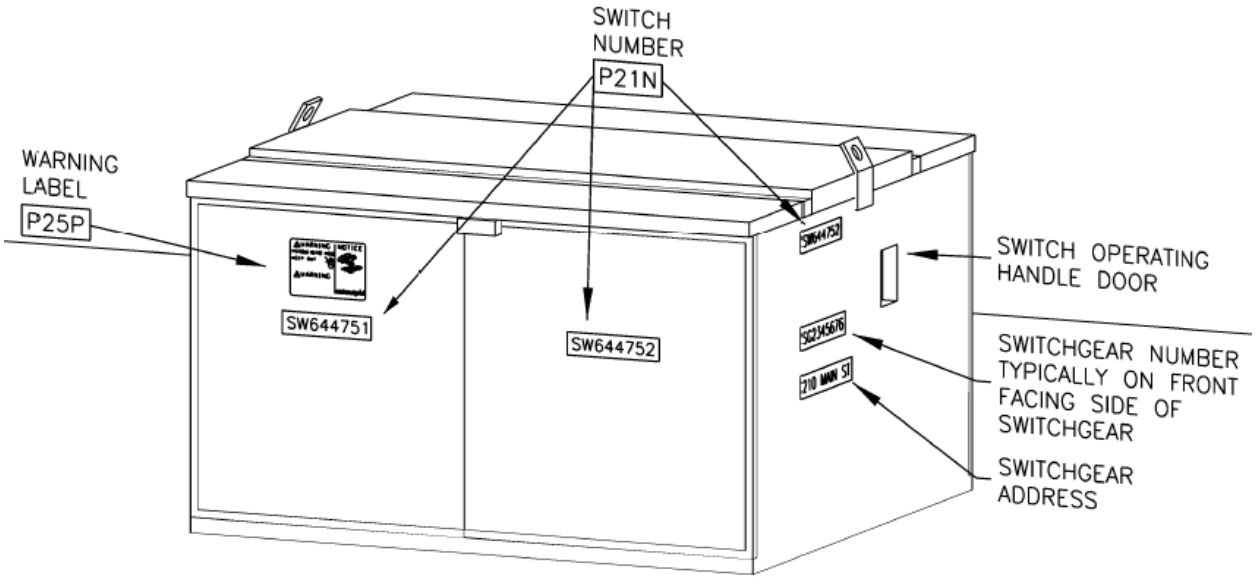
2) Switch labeling is required in the associated compartment door.

3) Feeder labeling is required in the associated compartment door.

4) Fuse labeling is required in the associated compartment door.

5) To the next location is required in all compartment doors. The next location can also include the manhole that the cable passes through by using the “via” tag.

Supersedes 7/14 Issue – Drawing Update



Labeling of exterior of a typical switchgear switch side.

Note the following:

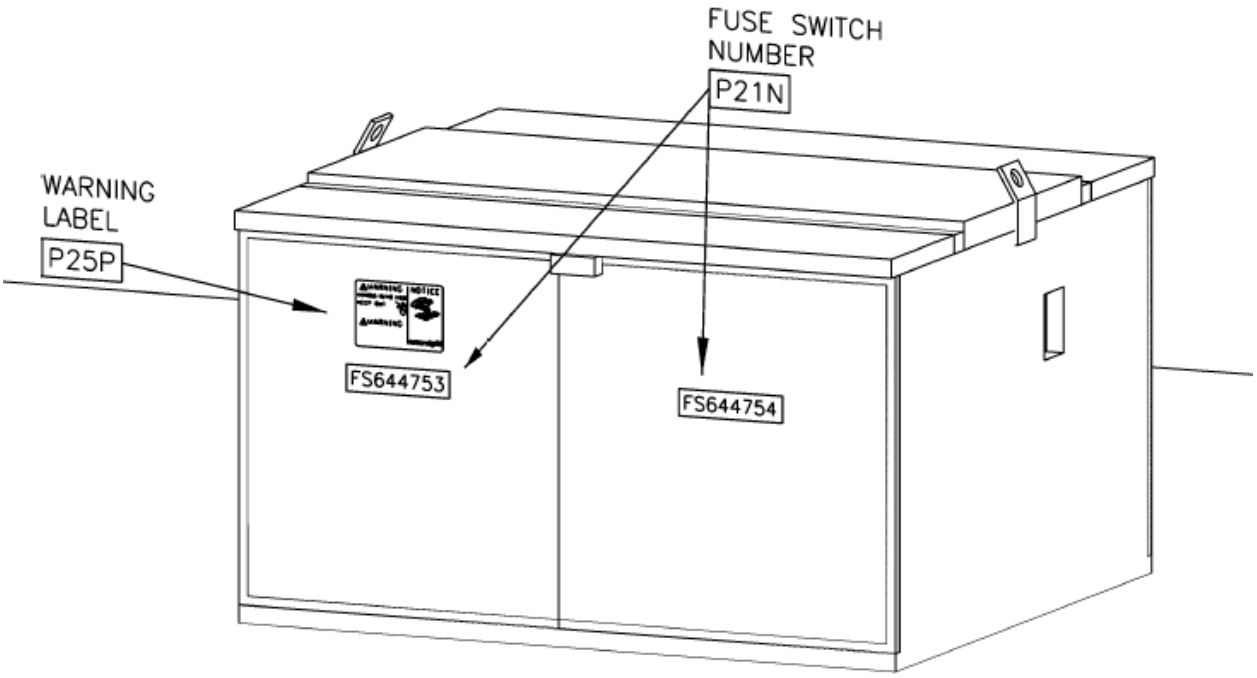
1) Address labeling of the switch will be on the side facing in front based on its location. The address labeling is optional based on the local operating areas practices.

2) Switchgear number labeling of the switch will be on the side facing in front based on its location.

3) Switch labeling is required in the associated compartment door and switch handle side.

4) Warning label is required on a front and back compartment door.

Supersedes 7/18 Issue-Note 1 update.



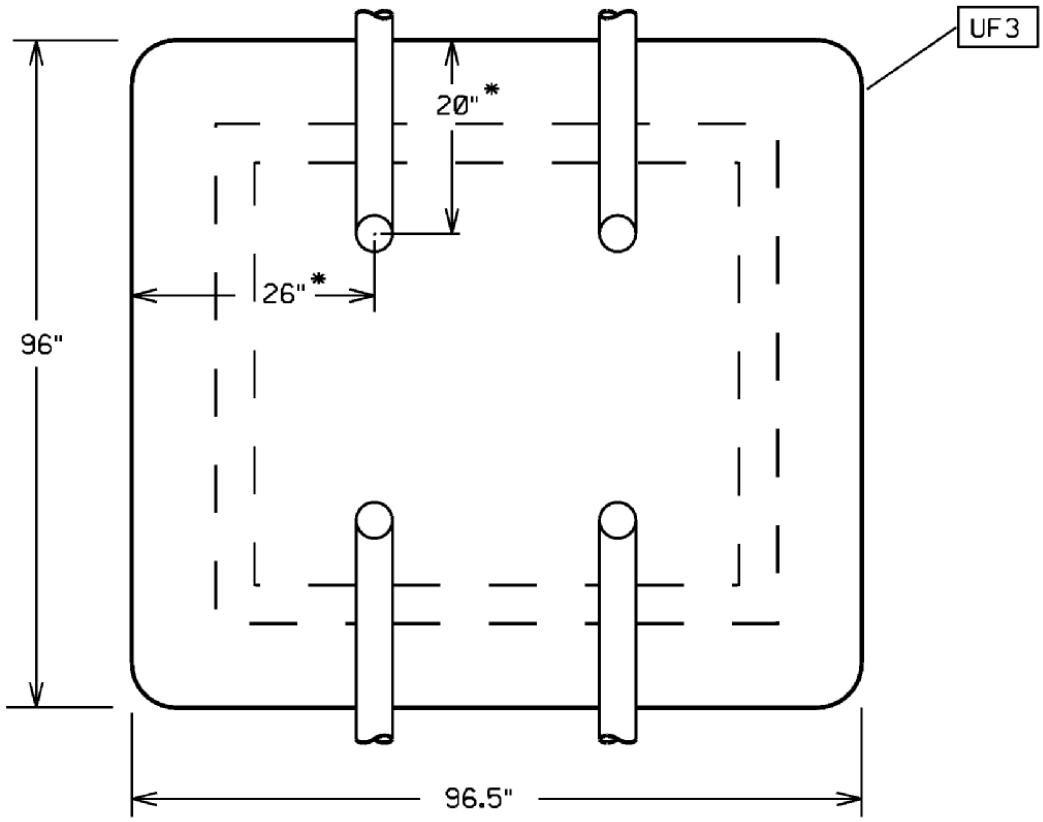
Labeling of exterior of a typical switchgear fuse side.

Note the following:

1) Fuse switch labeling is required in the associated compartment door.

2) Warning label is required on a front and back compartment door.

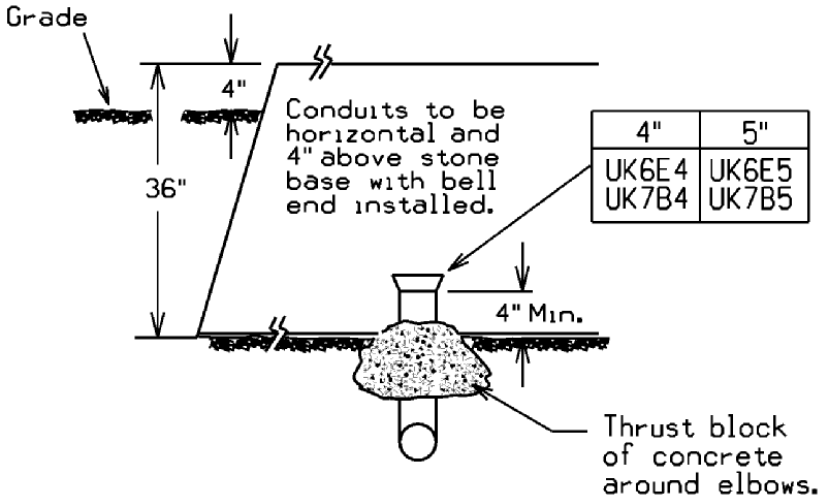
Supersedes 7/14 Issue – Drawing Update



* Typical Measurement For Each Quadrant

NOTE: 4" OR 5" CONDUIT - 1 OR 2 CONDUITS PER QUADRANT AS REQ.

PLAN VIEW



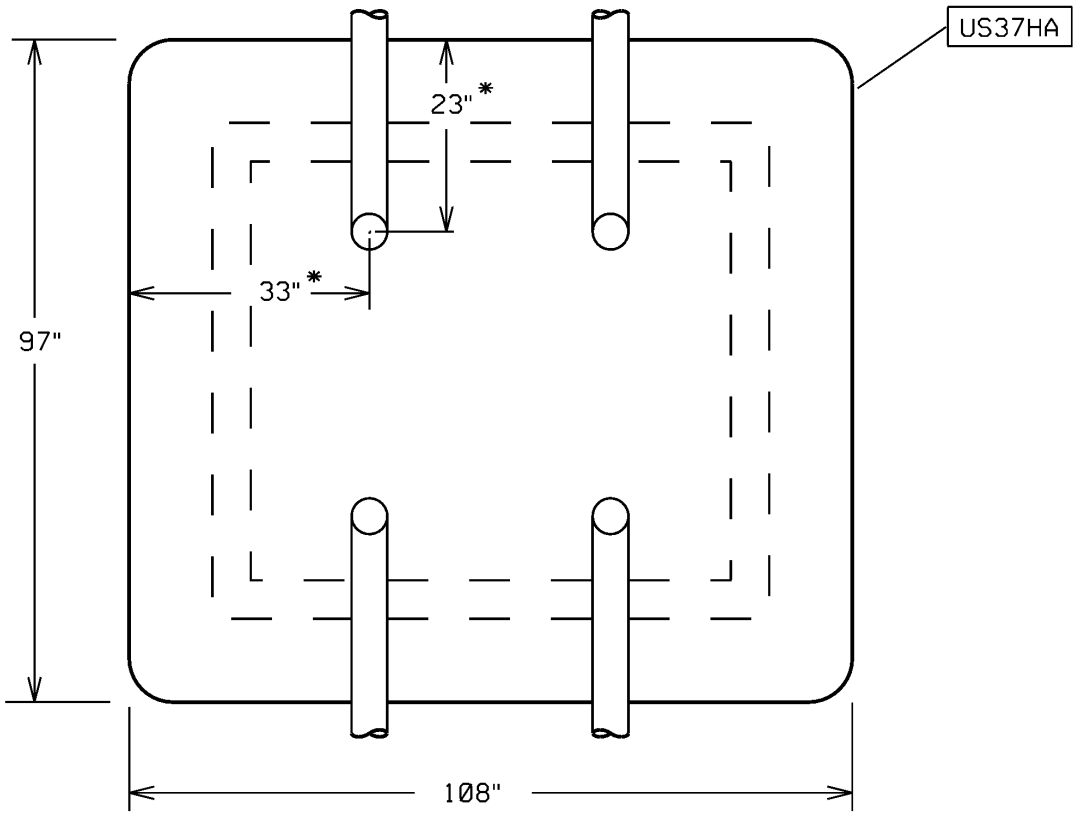
4"	5"
UK6E4 UK7B4	UK6E5 UK7B5

TYPICAL SIDE VIEW

Supersedes 7/08 Issue Drawing update

1

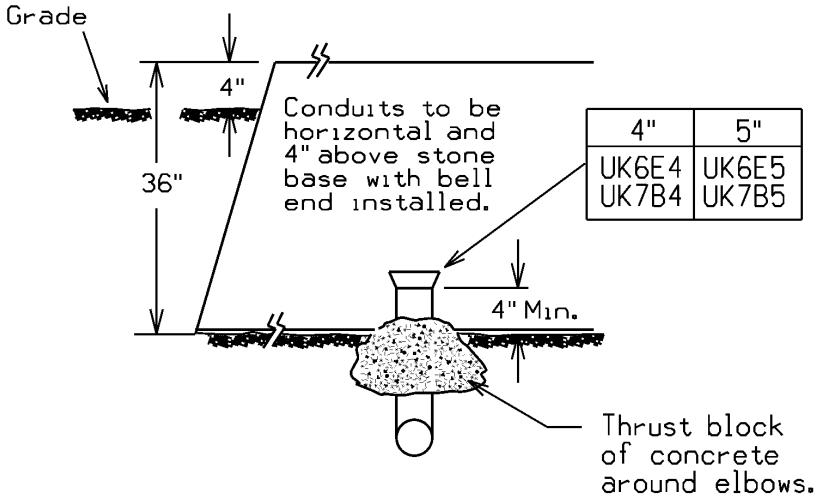
THREE PHASE PAD-MOUNTED SWITCHGEAR TYPICAL IDENTIFICATION AND LABELING			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		38-103D	7/14



* Typical Measurement For Each Quadrant

NOTE: 4" OR 5" CONDUIT - 1 OR 2 CONDUITS PER QUADRANT AS REQ.

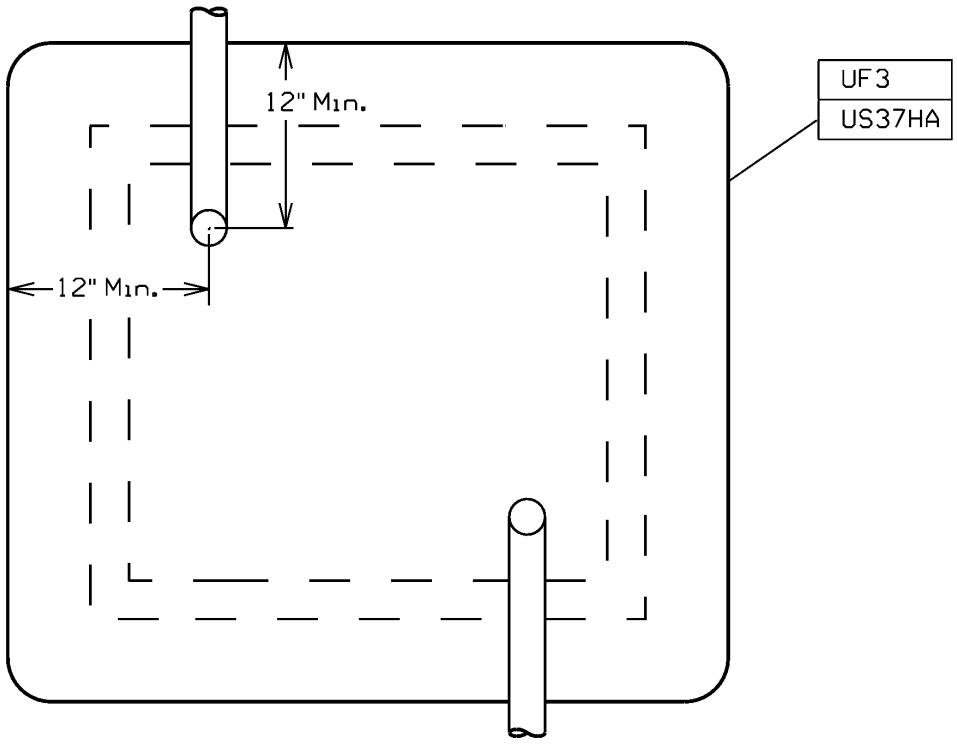
PLAN VIEW



4"	5"
UK6E4 UK7B4	UK6E5 UK7B5

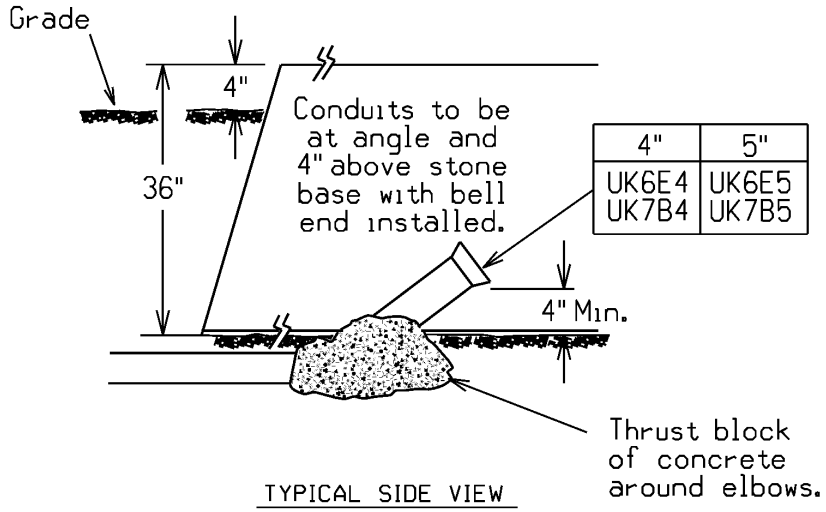
TYPICAL SIDE VIEW

THREE PHASE PAD-MOUNTED SWITCHGEAR – 15 kV FIBERGLASS BASE CONDUIT ENTRY VERTICAL			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/14	**38-104**		



NOTE: 4" OR 5" CONDUIT - 1 OR 2 CONDUITS PER QUADRANT AS REQ.

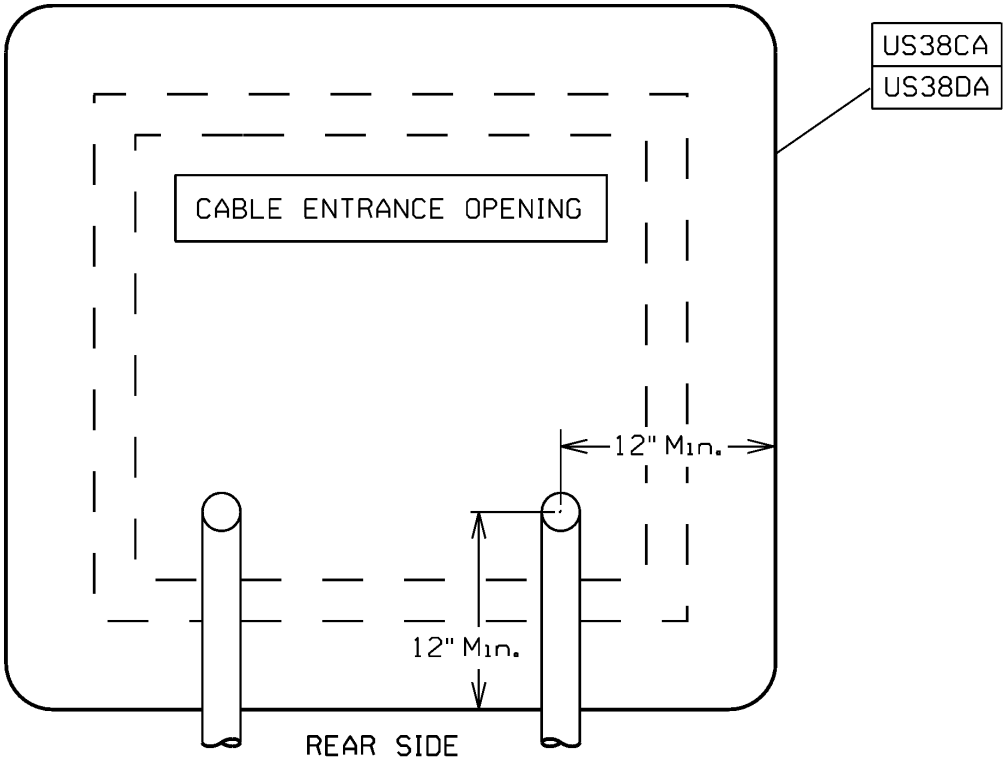
PLAN VIEW



TYPICAL SIDE VIEW

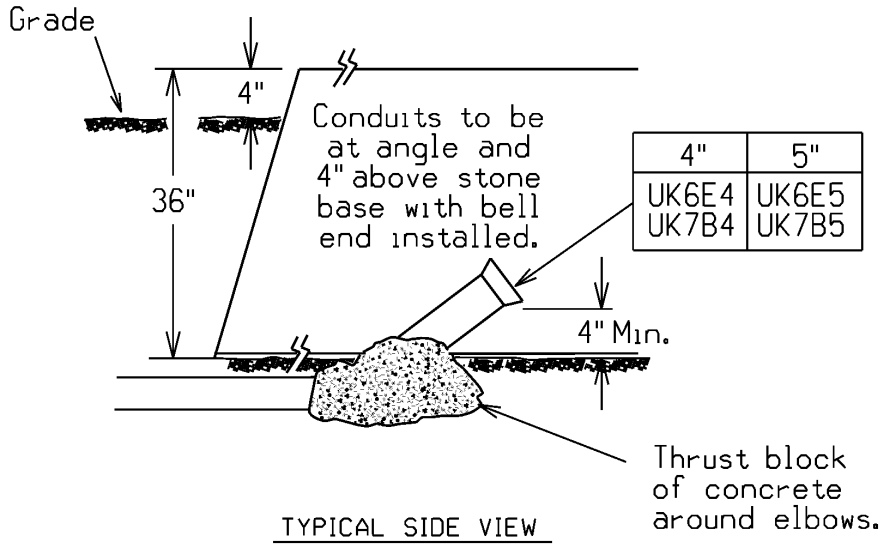
Supersedes 7/08 Issue - Updated Std Item Number

THREE PHASE PAD-MOUNTED SWITCHGEAR –35 kV FIBERGLASS BASE CONDUIT ENTRY HORIZONTAL			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		38-107	7/08



NOTE: 4" OR 5" CONDUITS TO ENTER FROM REAR OF BOXPAD.

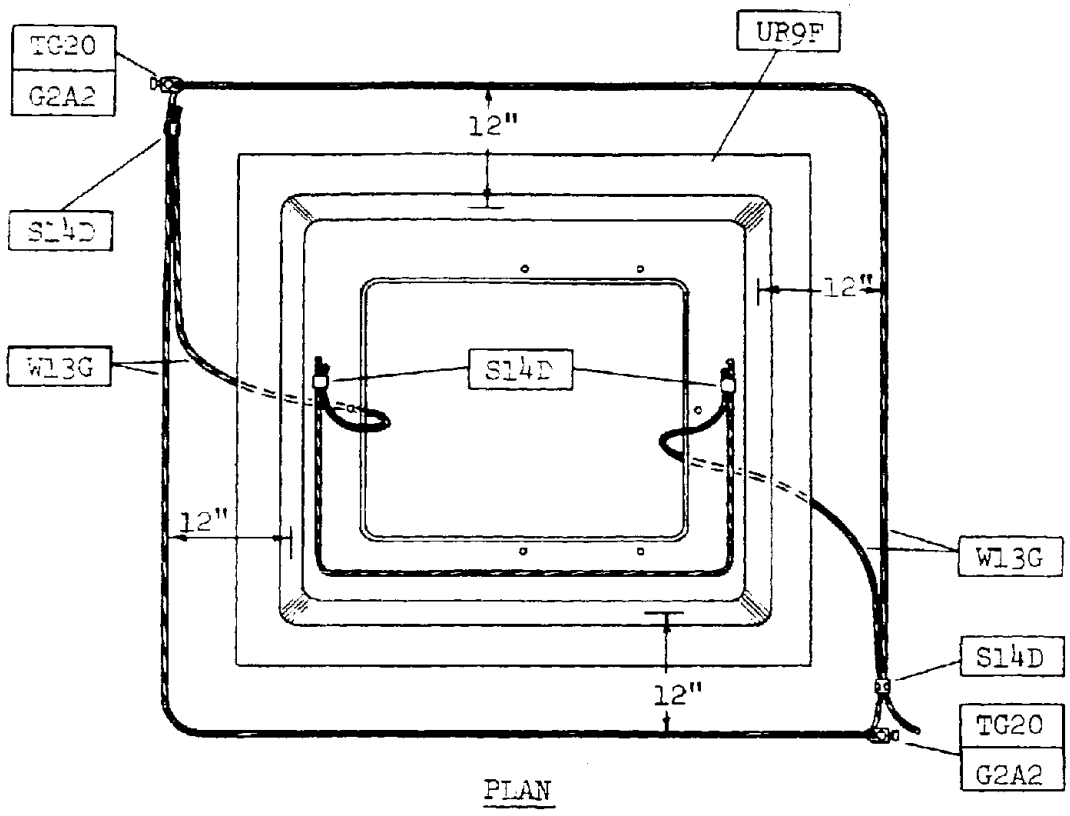
PLAN VIEW



4"	5"
UK6E4 UK7B4	UK6E5 UK7B5

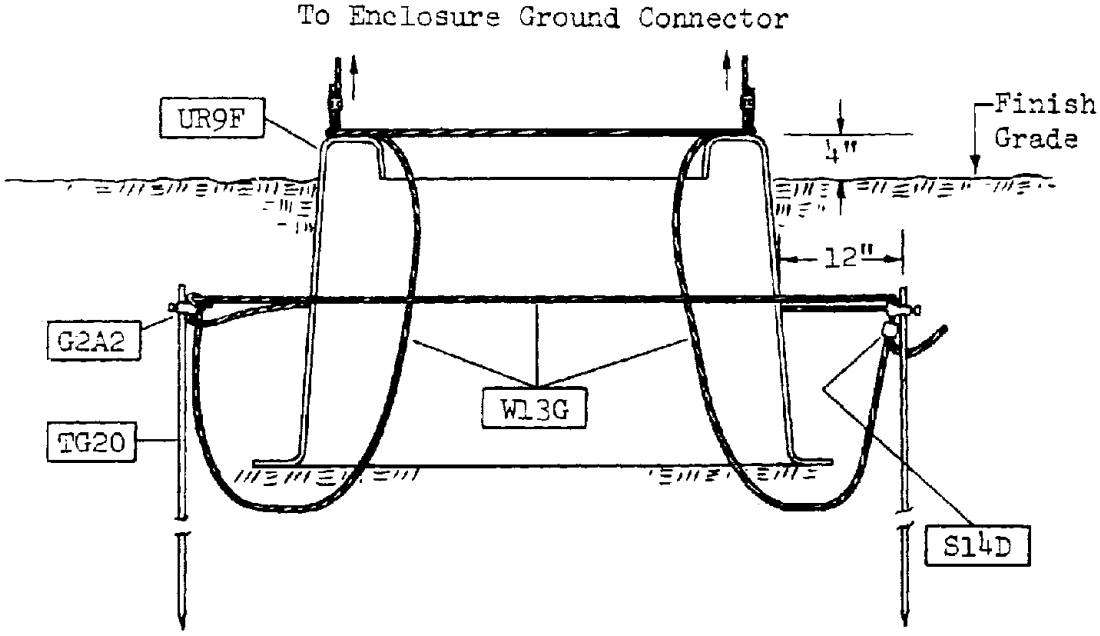
TYPICAL SIDE VIEW

PAD MOUNTED JUNCTION ENCLOSURE GROUND GRID FOR BASE UR8 AND UR9			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/08	**38-110**		



PLAN

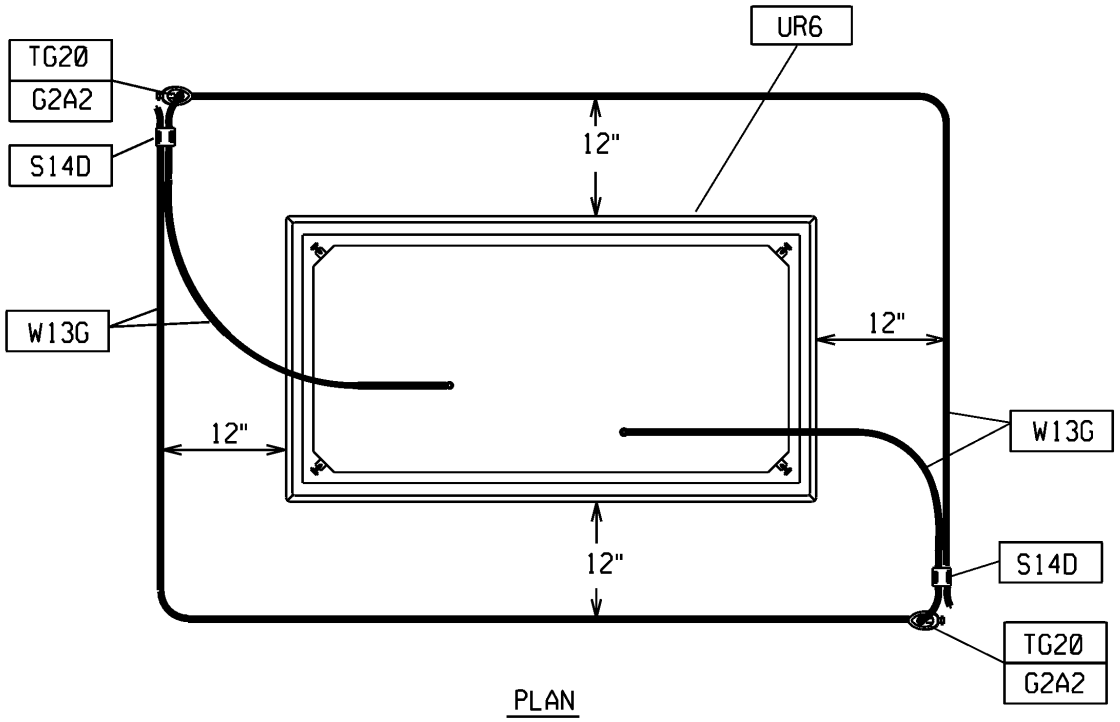
STREET SIDE AND POSITION OF FRONT
OF PAD MOUNTED ENCLOSURE



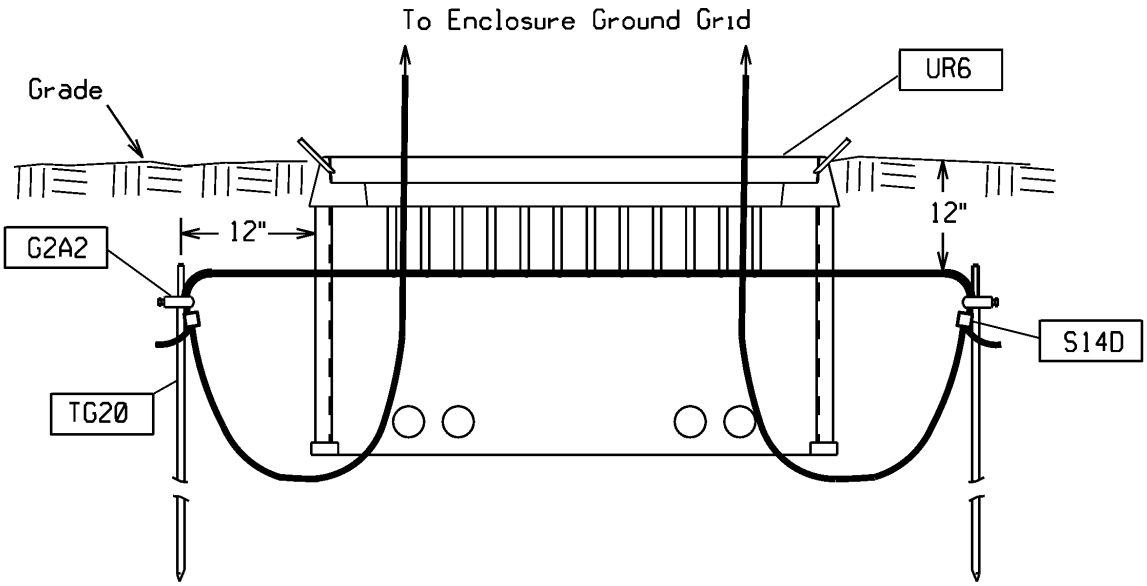
Supersedes 2/06 Issue –Drawing Update

THREE PHASE PAD-MOUNTED SWITCHGEAR - 35KV FIBERGLASS BASE CONDUIT ENTRY HORIZONTAL			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		38-107	7/09

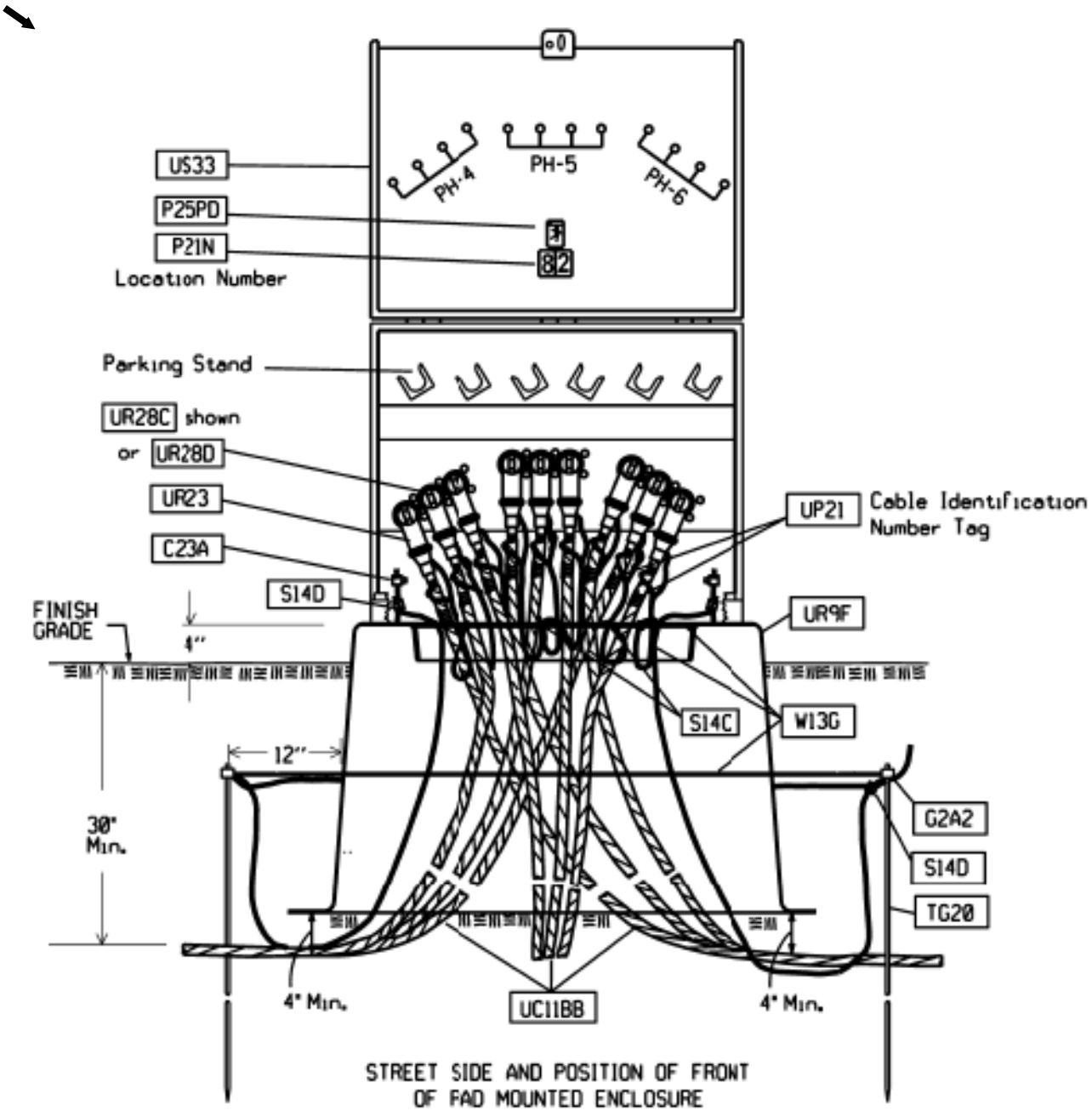
New Drawing



PLAN

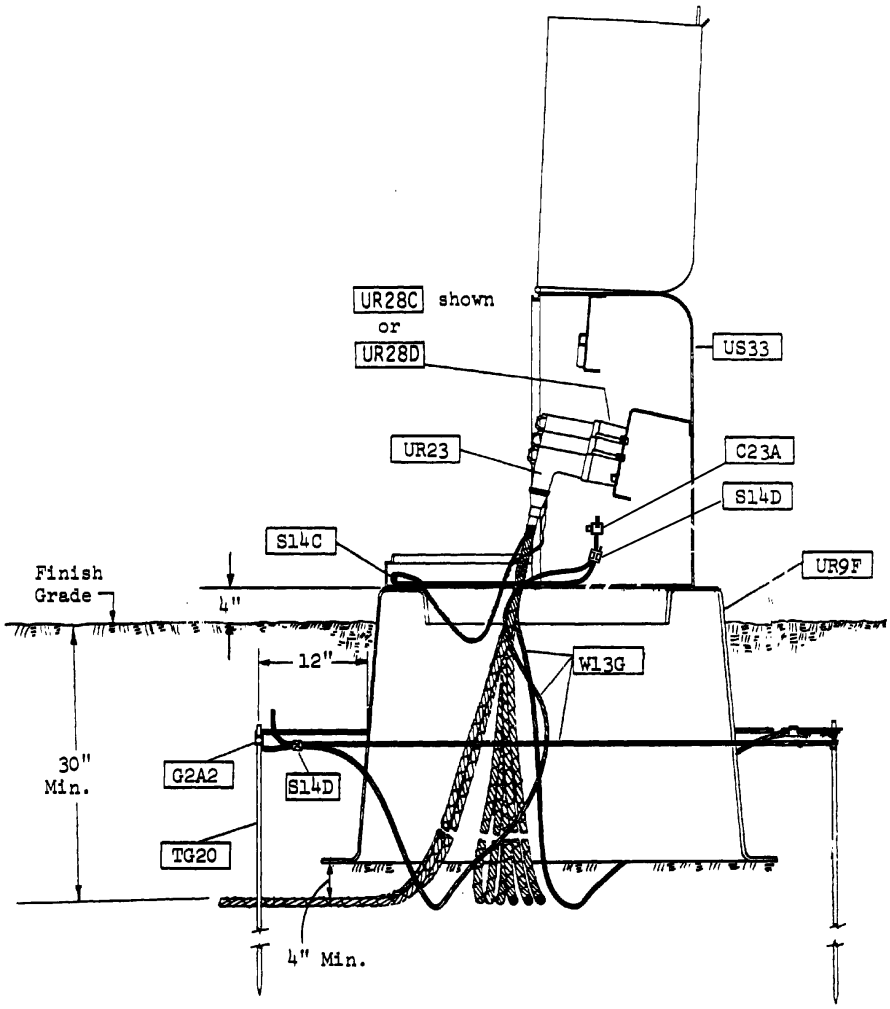


PAD MOUNTED JUNCTION ENCLOSURE GROUND GRID FOR BASE UR8 AND UR9			
ISSUE	**PAGE NUMBER**		
7/08	**38-110**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl



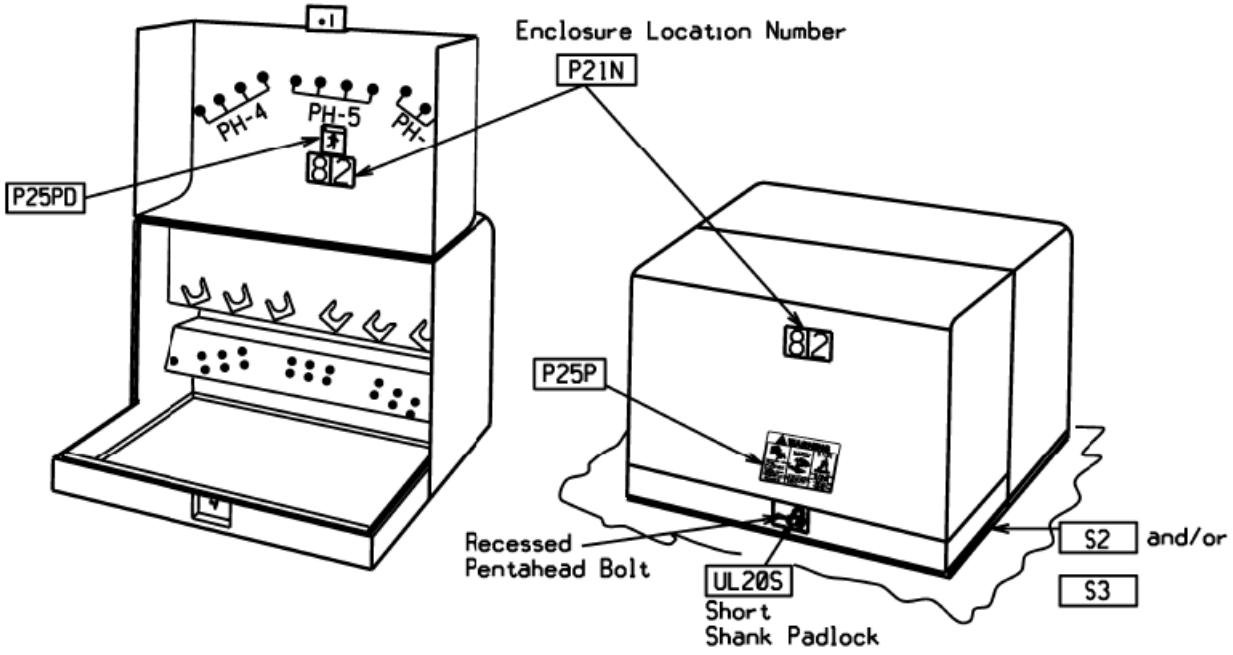
Supersedes7/08 Issue –Drawing Update

PAD MOUNTED JUNCTION ENCLOSURES DIRECT BURIAL SHOWN WITH US33			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		38-113	7/08



Supersedes 2/06 Issue– Drawing Update and was previously drawing 38-112

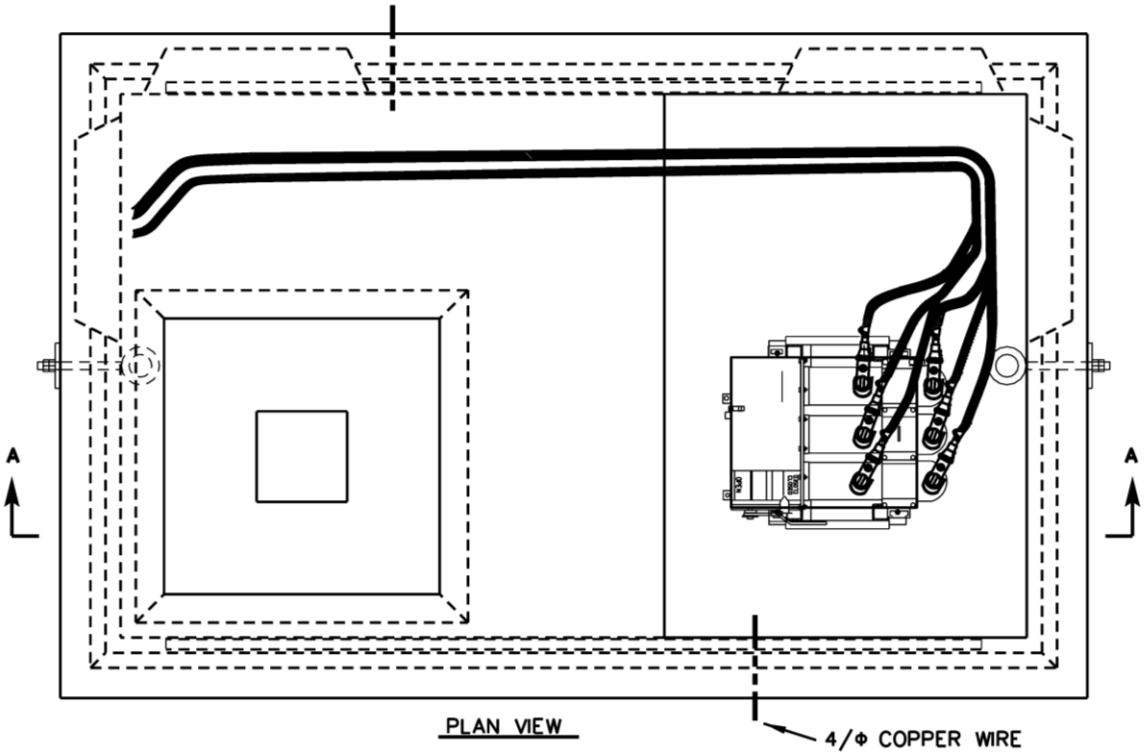
PAD MOUNTED JUNCTION ENCLOSURE TYPICAL INSTALLATION SHOWN WITH US33			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/15	**38-112**		

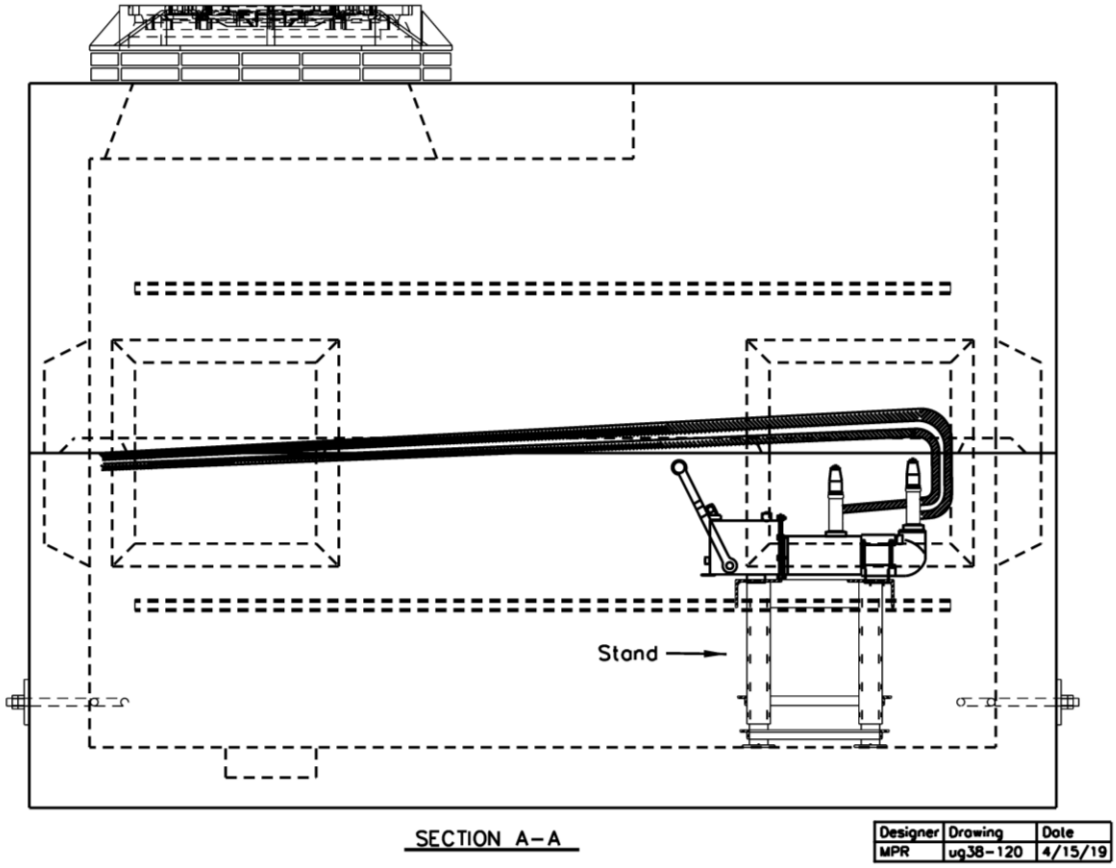


Supersedes 7/08 Issue – drawing update

THREE WAY SUBMERSIBLE SWITCH INSTALLED IN A 6'X10' SIDEWALK MANHOLE			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		38-122	708

Supersedes 7/08 Issue Drawing Update to 3D.

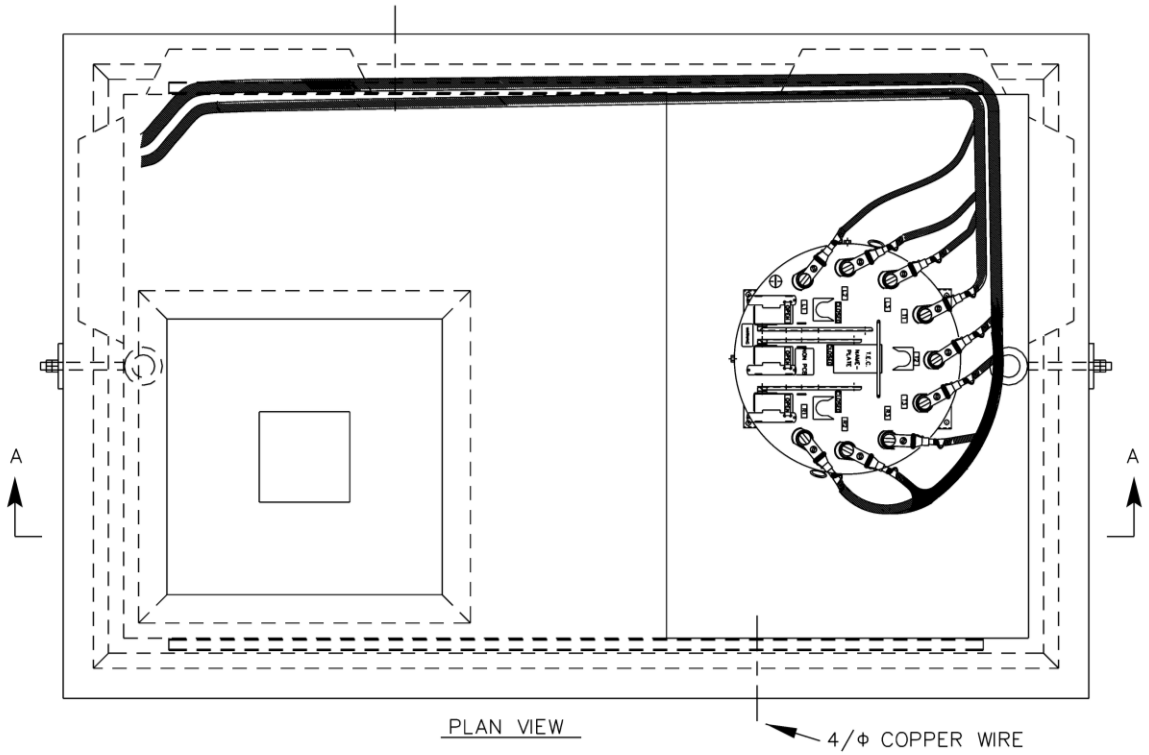




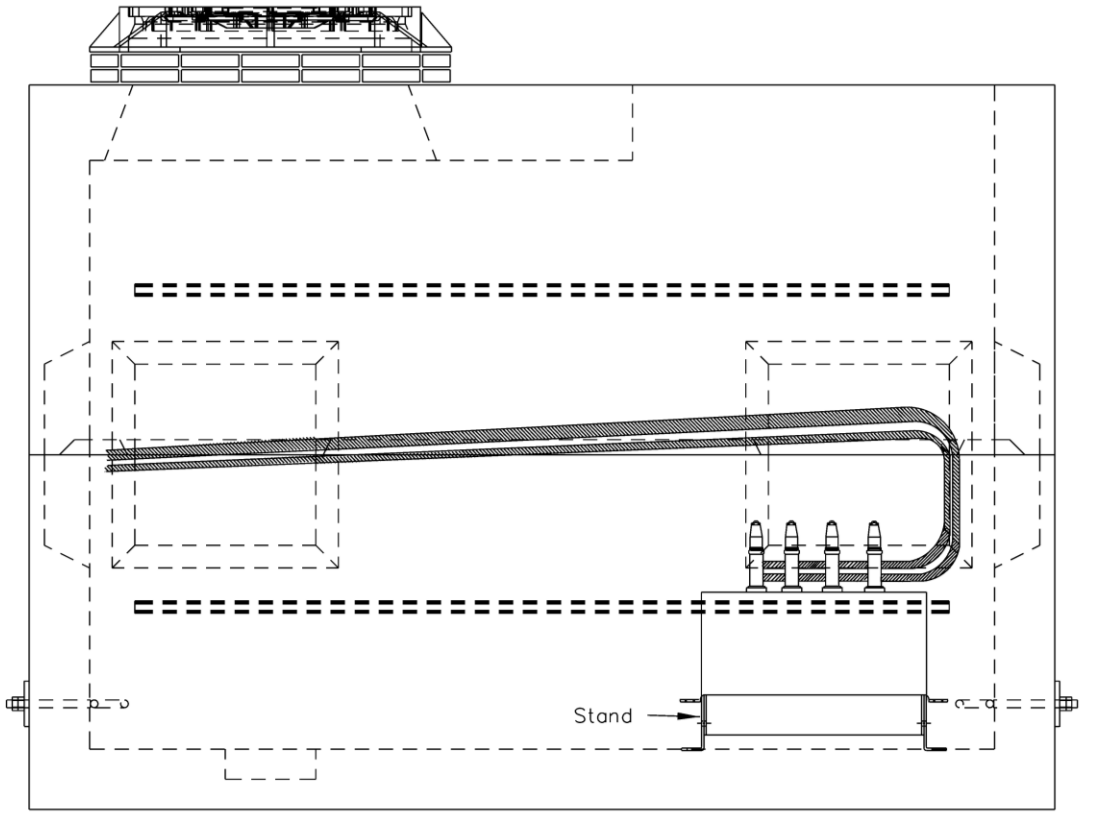
Designer	Drawing	Date
MPR	ug38-120	4/15/19

THREE WAY SUBMERSIBLE SWITCH INSTALLED IN A 6'X10' SIDEWALK MANHOLE (STD ITEM UM28)

ISSUE	PAGE NUMBER		
7/08	38-121	UNDERGROUND CONSTRUCTION STANDARD	ppl



PLAN VIEW

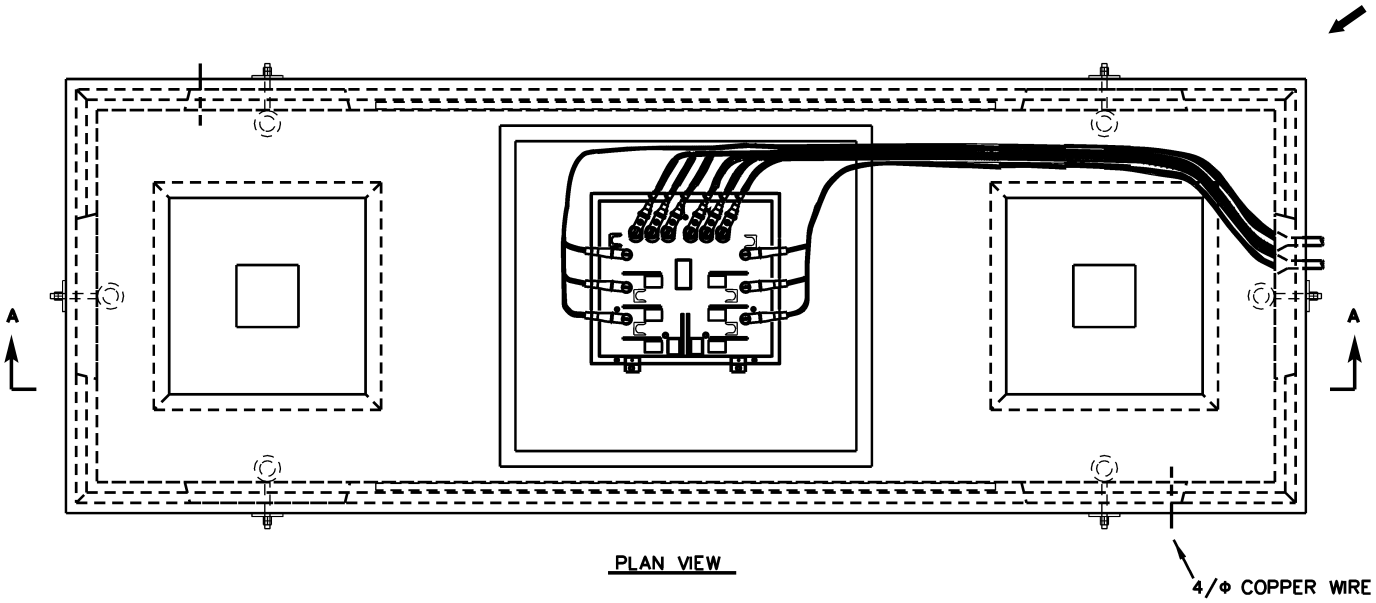


SECTION A–A

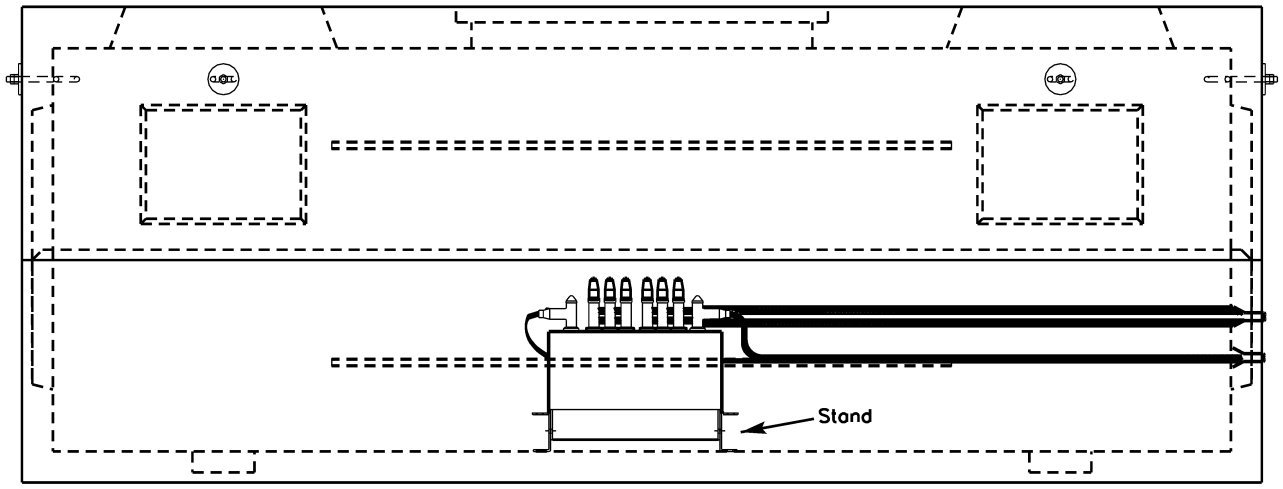
Designer	Drawing	Date
MPR	ug38–121	4/15/19

Supersedes 7/08 /Issue – Drawing update to 3D.

FOUR WAY SUBMERSIBLE SWITCH INSTALLED IN A DOUBLE ENTRY MANHOLE (STD ITEM UM31)



PLAN VIEW



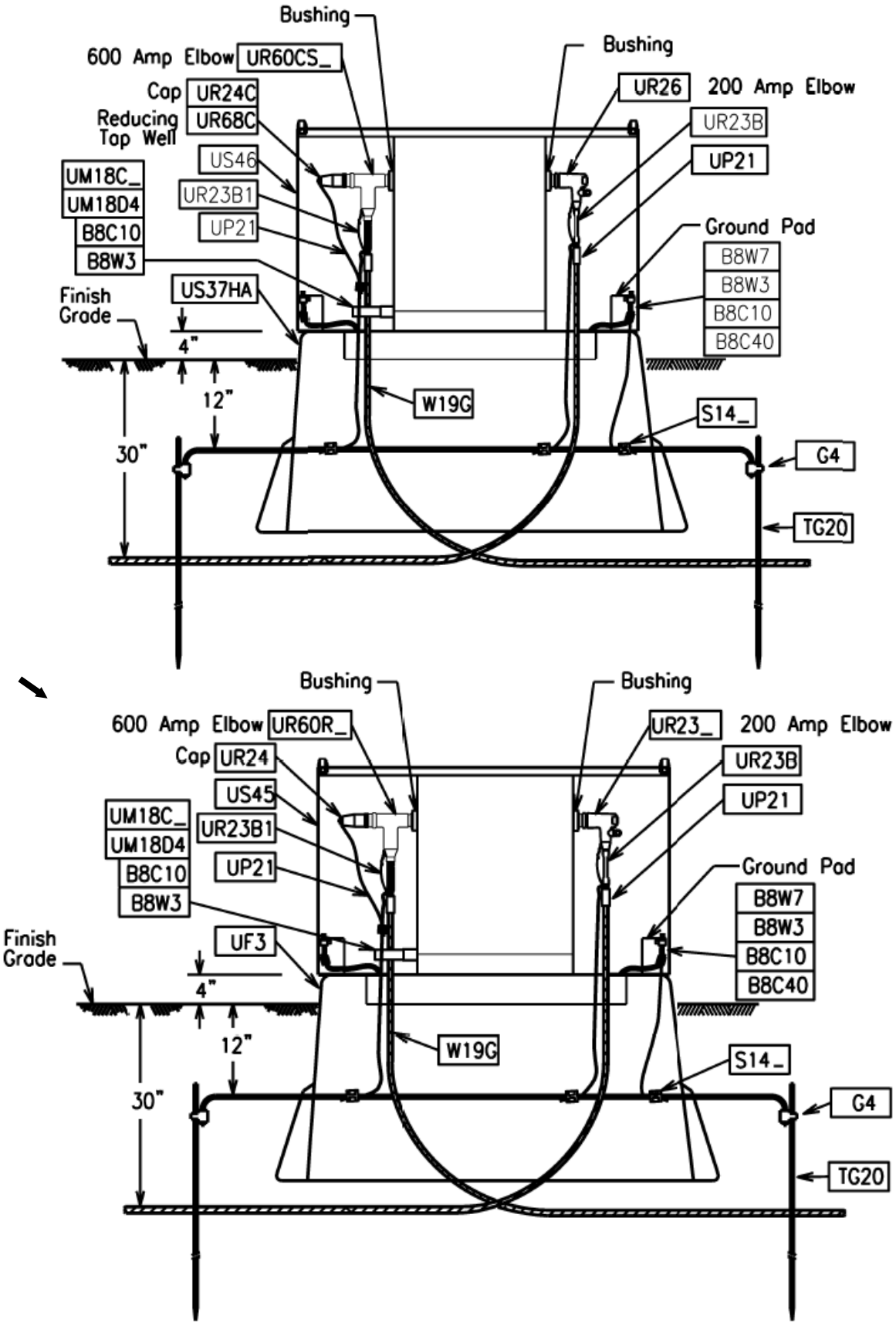
SECTION A–A

Designer	Drawing	Date
MPR	ug38-122	3/29/19

Supersedes 7/14 Issue - Drawing Updated to 3D.

THREE PHASE 1 WAY SUBMERSIBLE SWITCH INSTALLED IN A 6'X10' SIDEWALK MANHOLE

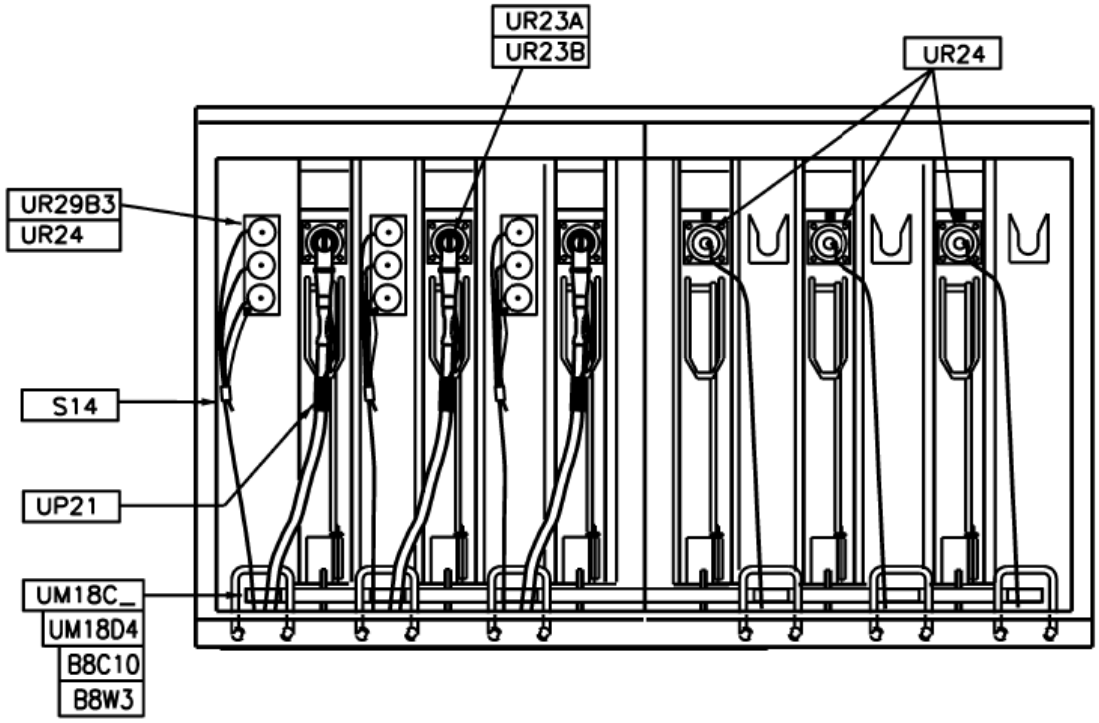
ISSUE	PAGE NUMBER		
7/19	38-121	UNDERGROUND CONSTRUCTION STANDARD	ppl



THREE PHASE PAD-MOUNTED ELBOW STYLE (DEAD FRONT) SWITCHGEAR INSTALLATION – 25 KV

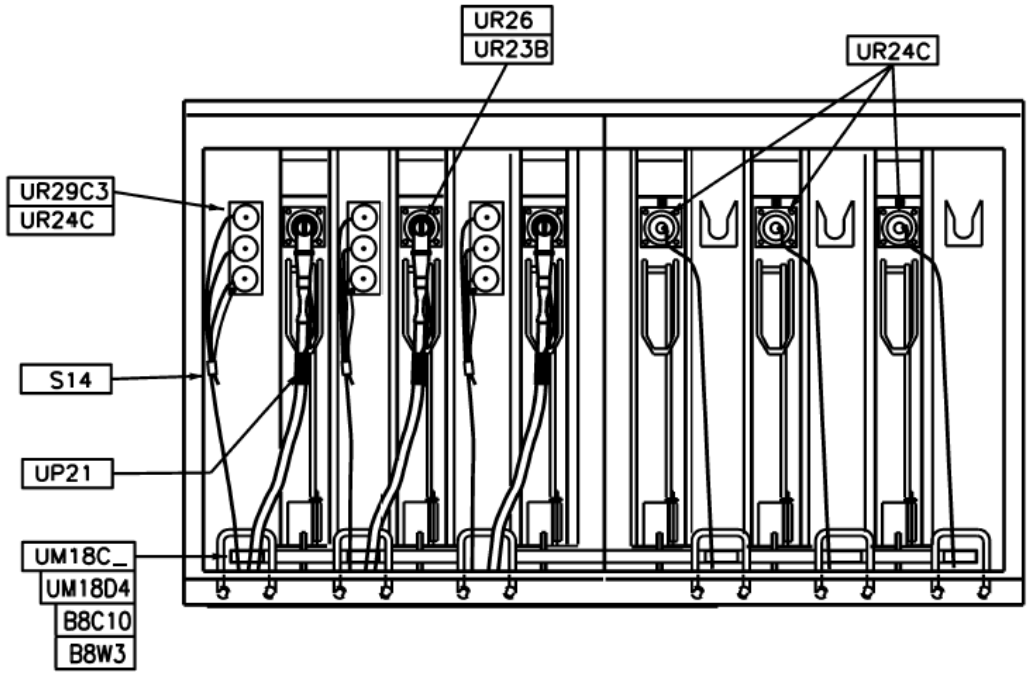
Supersedes 7/19 Issue Drawing Update

Side view of switchgear installed on a vault pad



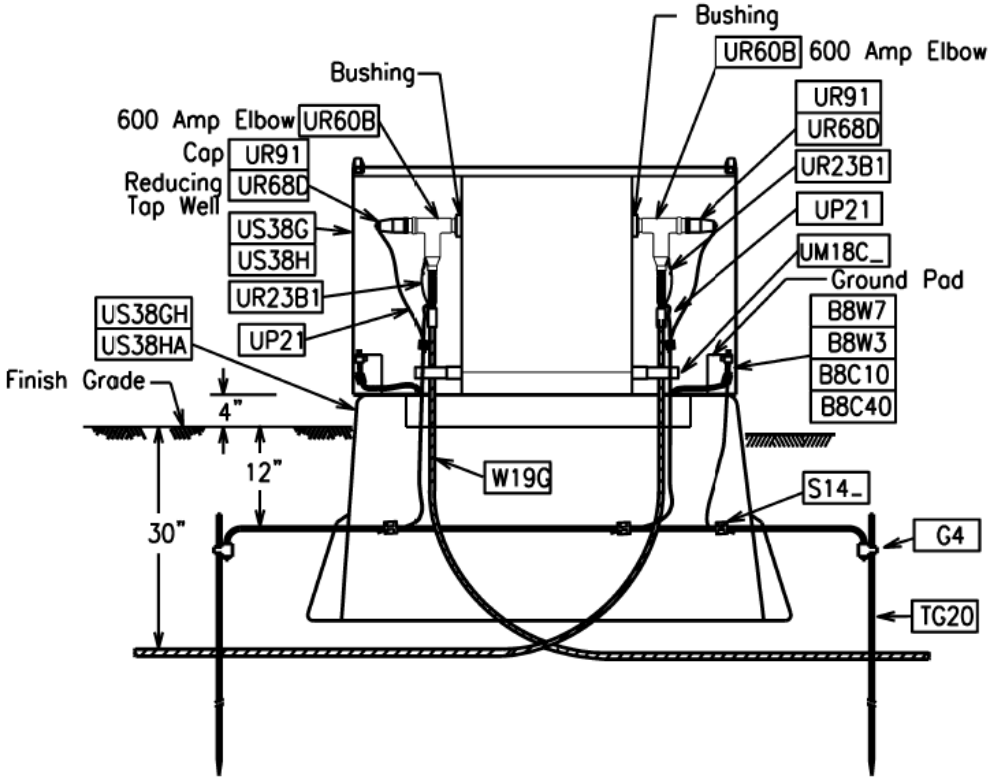
Layout side view of the fuse side with cables installed on one side

Side view of the switchgear installed on a vault pad

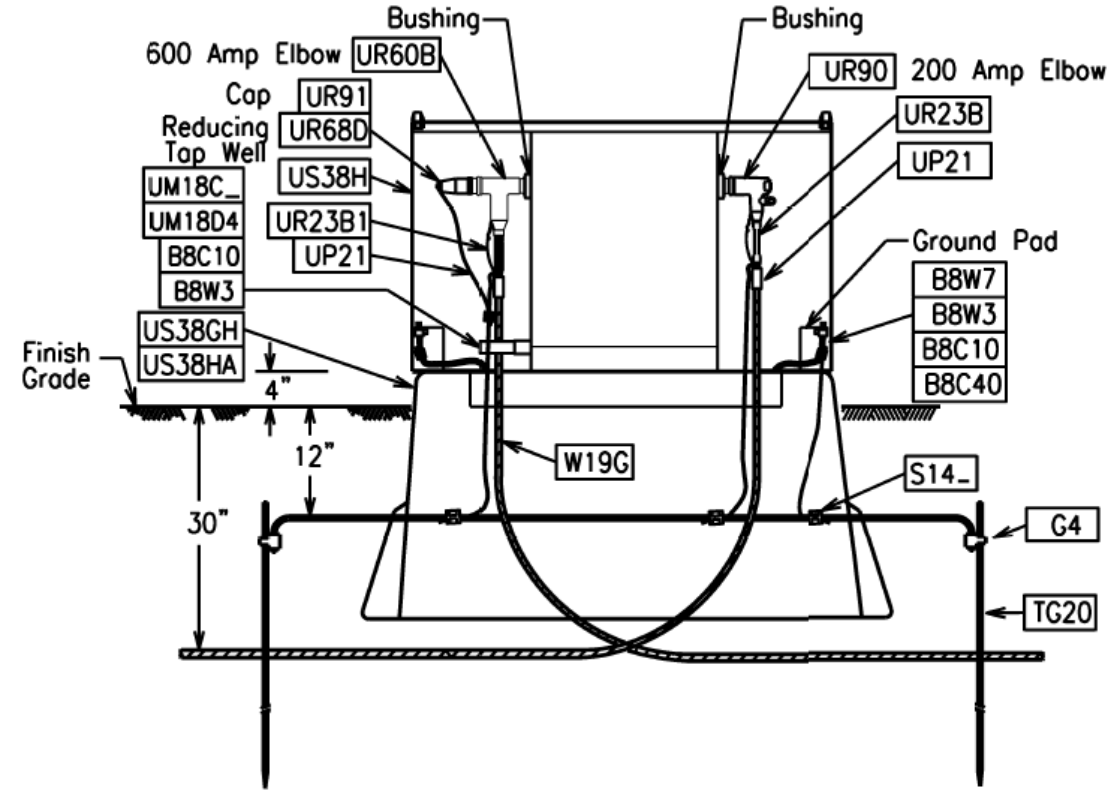


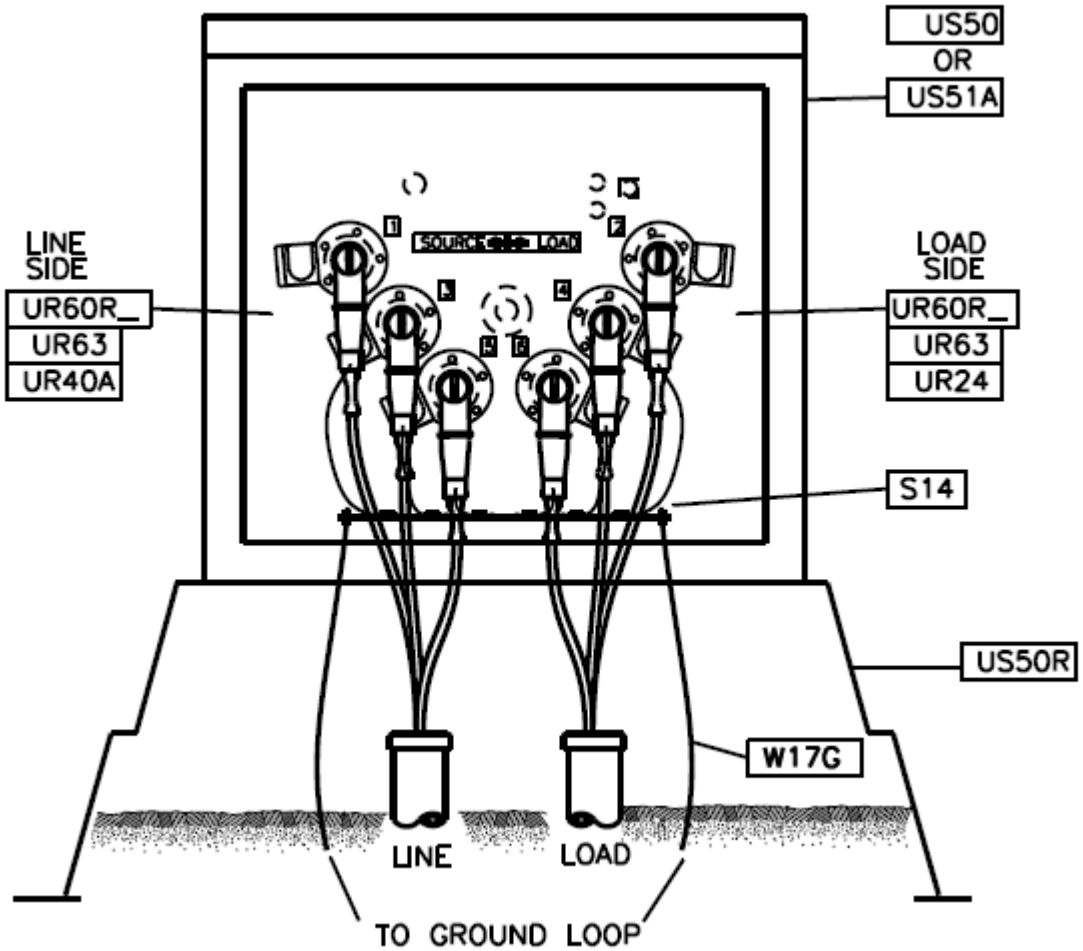
Layout side view of the fuse side with cables installed on one side

Side view of the switchgear installed on a vault pad with 600 amp elbows on the source side and 200 amp elbows on the load side.

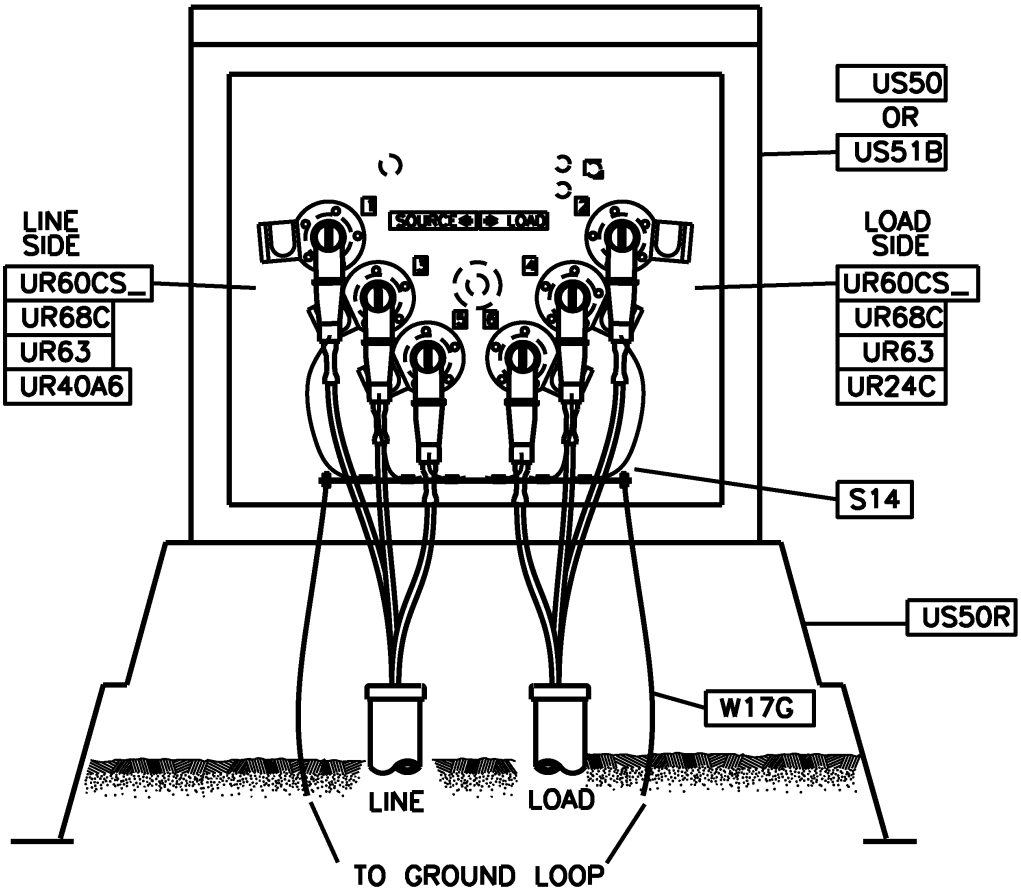


Side view of the switchgear installed on a vault pad with 600 amp elbows on the source side and load side.

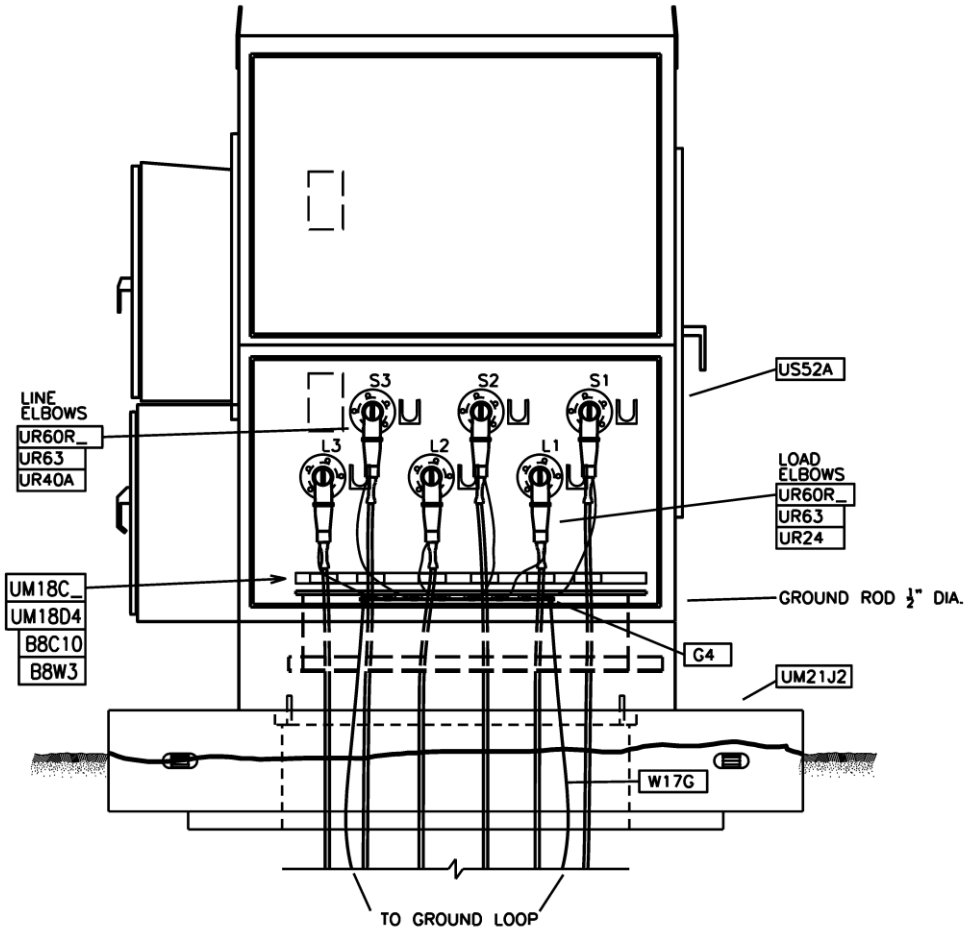




INSTALLATION – 35 KV



THREE PHASE PAD-MOUNTED 600 AMP ELBOW STYLE (DEAD FRONT) RECLOSER – INSTALLATION 15Kv CLASS

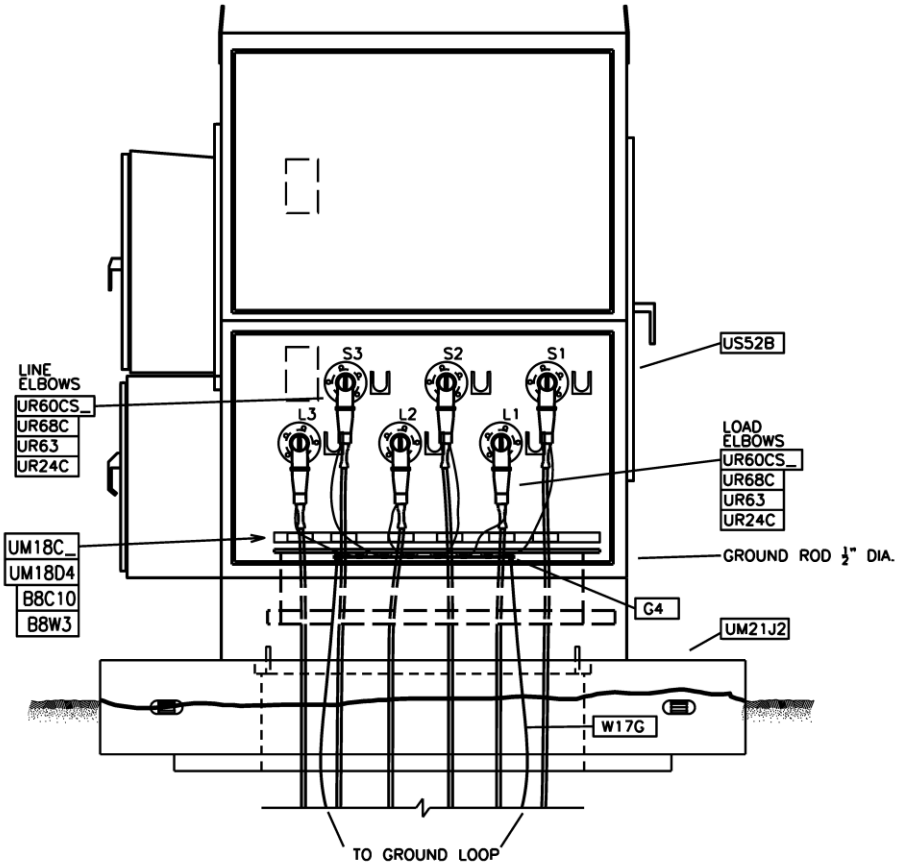


Designer	Drawing	Date
MPR	od38147A	11/30/21

Supersedes 7/19 Issue – drawing update.

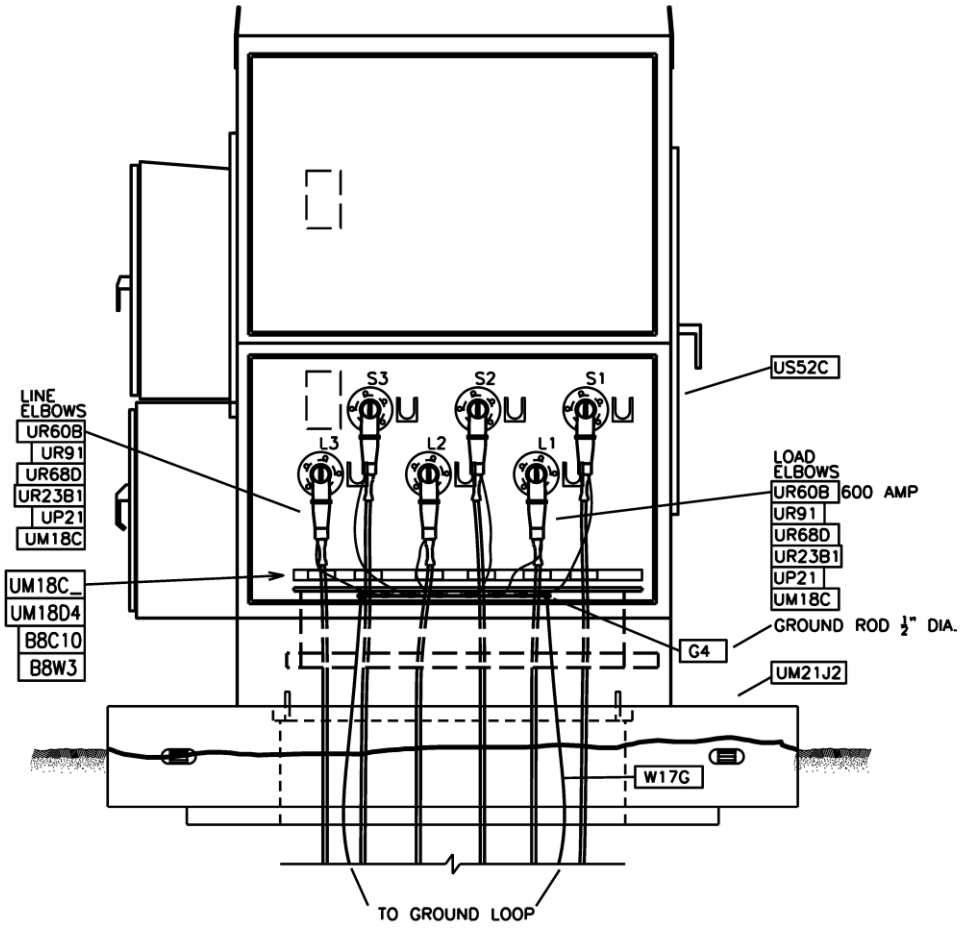
THREE PHASE PAD-MOUNTED 600 AMP ELBOW STYLE (DEAD FRONT) RECLOSER – INSTALLATION 27kV CLASS

MAINTANCE USE ONLY



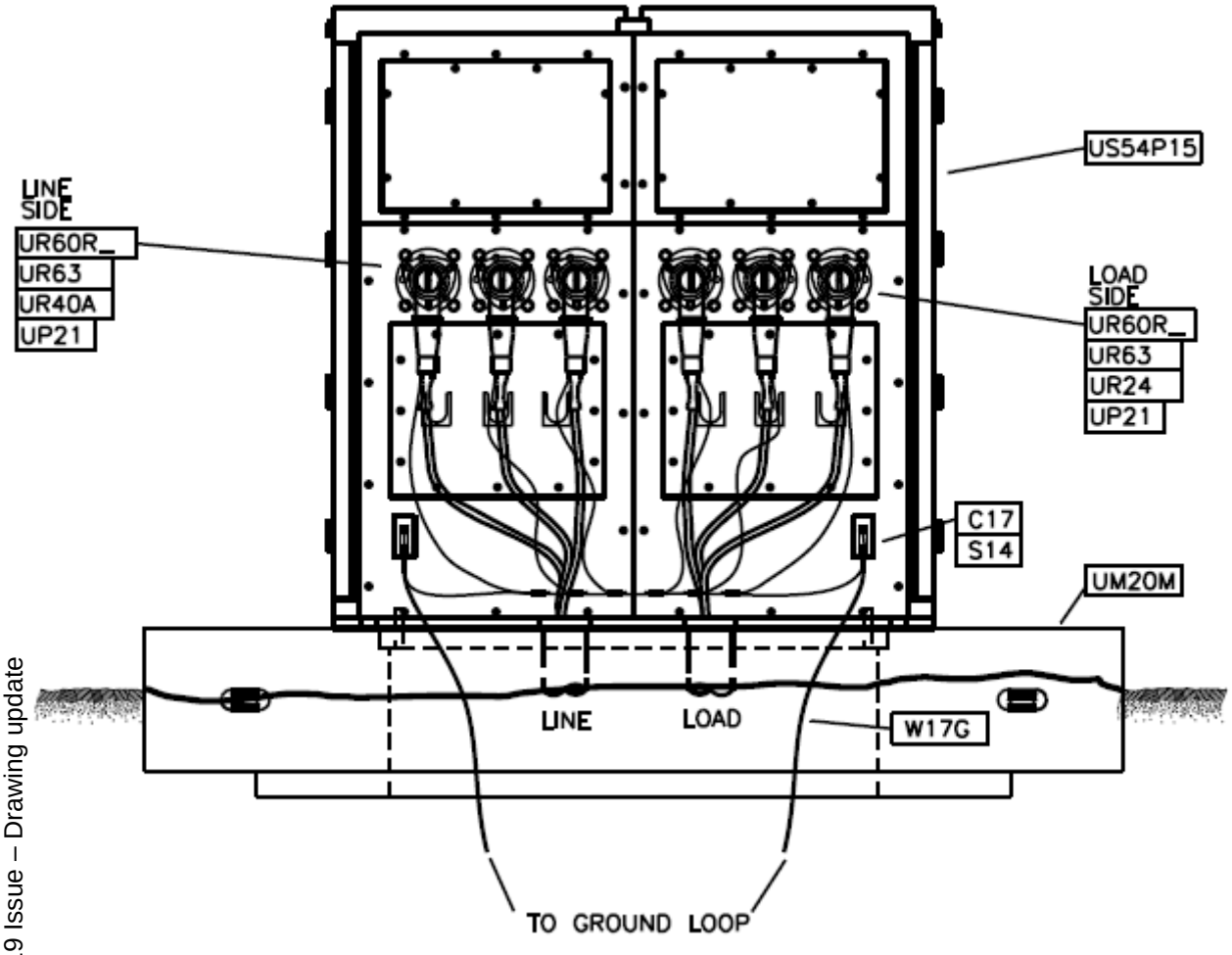
Designer	Drawing	Date
MPR	od38147B	11/30/21

THREE PHASE PAD-MOUNTED 600 AMP ELBOW STYLE (DEAD FRONT) RECLOSER SEL CONTROL– INSTALLATION 35KV CLASS

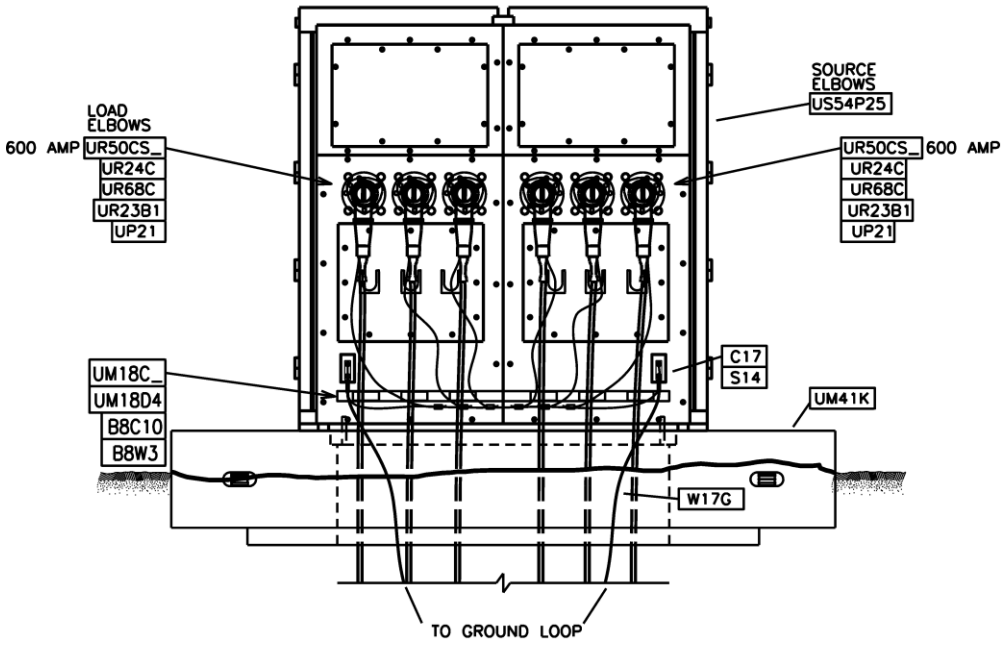


Designer	Drawing	Date
MPR	od38147C	11/24/21

THREE PHASE PAD-MOUNTED 600 AMP ELBOW STYLE (DEAD FRONT) RECLOSER SEL CONTROL – INSTALLATION 25kV CLASS



Supersedes 7/19 Issue – Drawing update

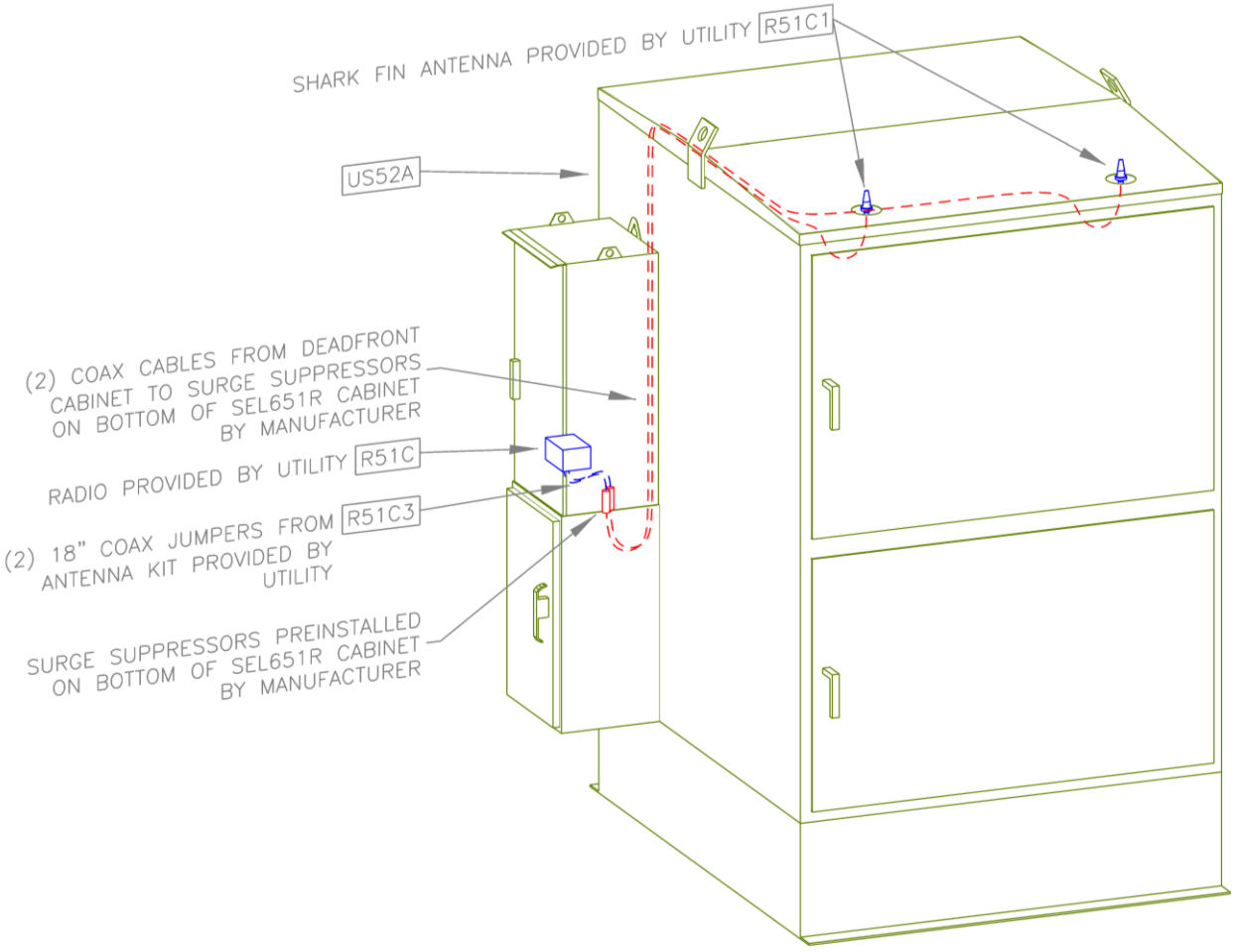


Designer	Drawing	Date
MPR	od381488	11/30/21

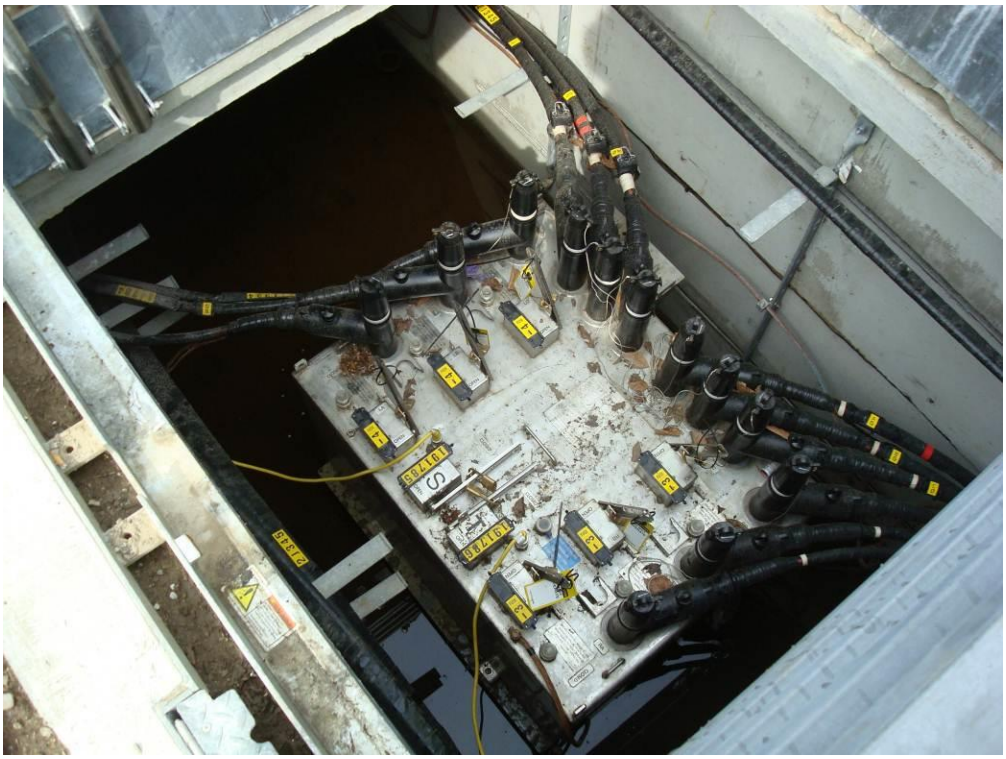
New Drawing

SWITCHGEAR COMMUNICATIONS (NOVA STYLE SHOWN)

ISSUE	PAGE NUMBER		
7/21	38-149	UNDERGROUND CONSTRUCTION STANDARD	ppl

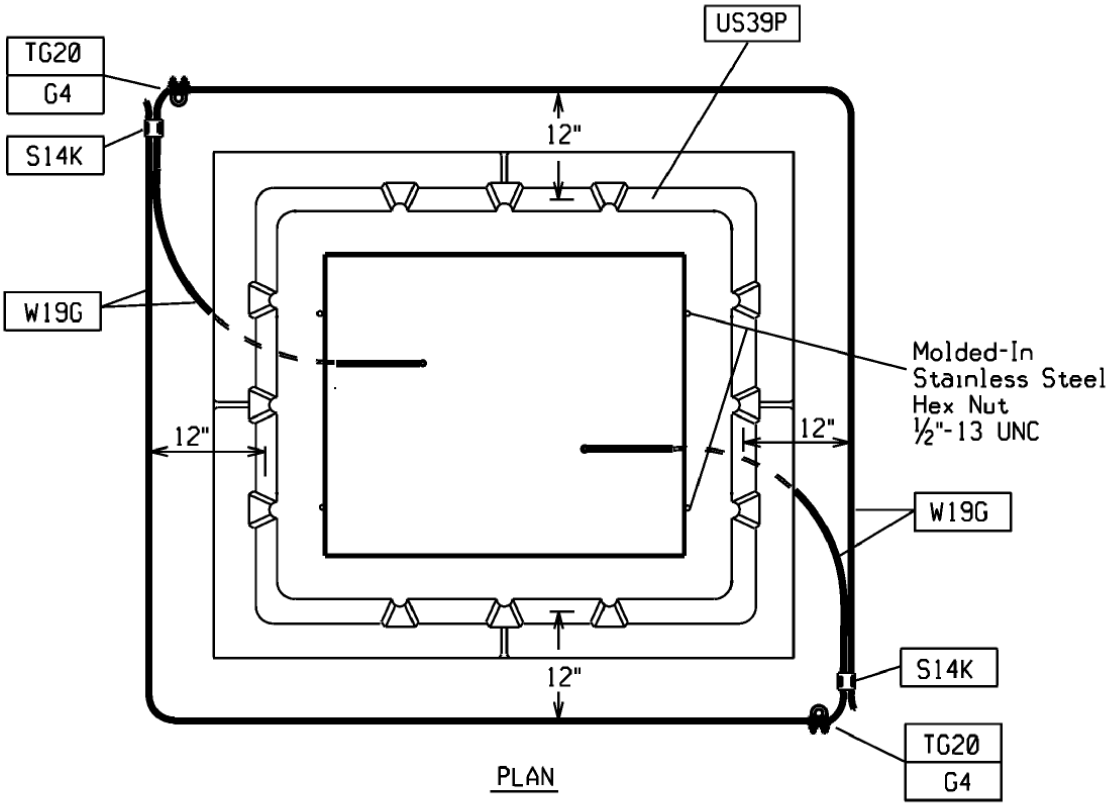


New Drawing

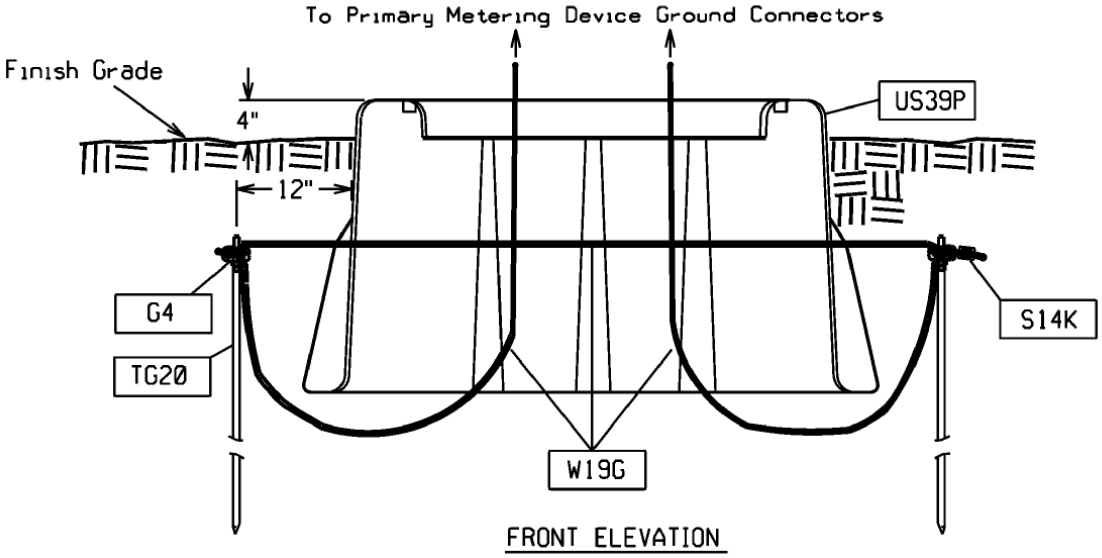


Drawing of a typical submersible switchgear with cables terminated.

Drawing of a typical pad mounted switchgear with cables terminated.



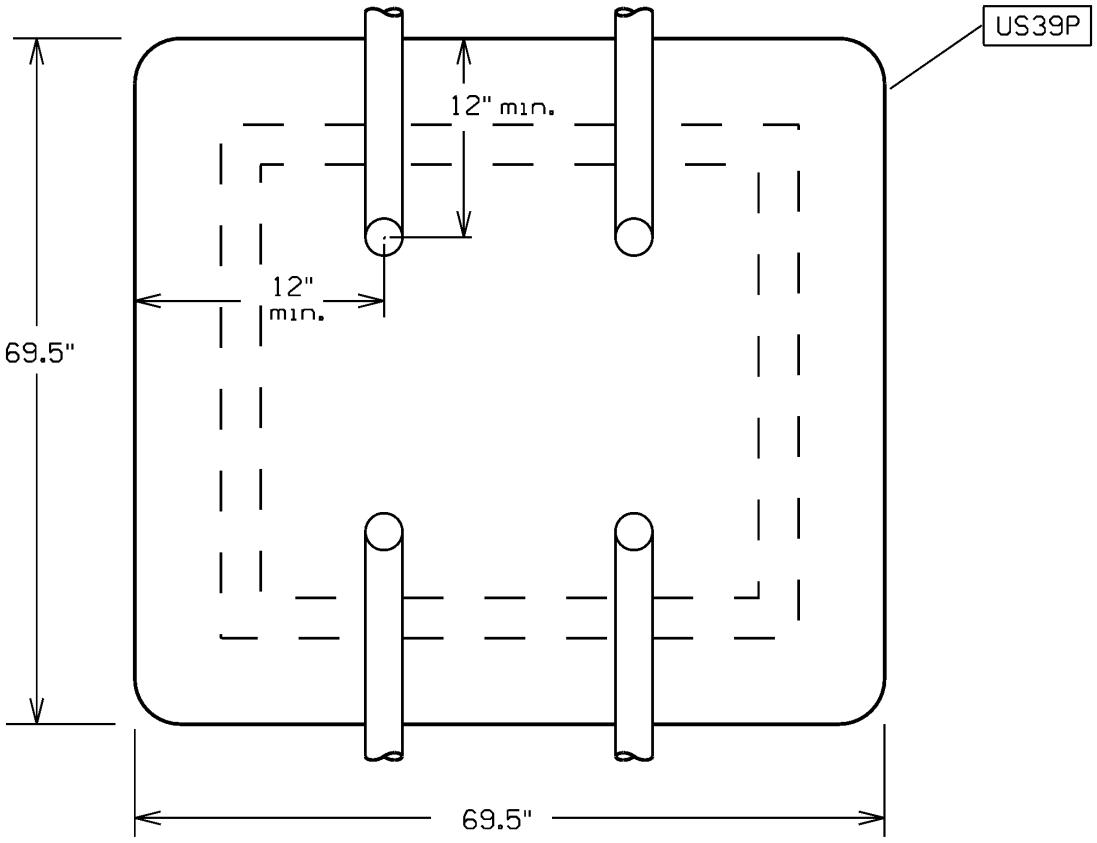
PLAN



FRONT ELEVATION

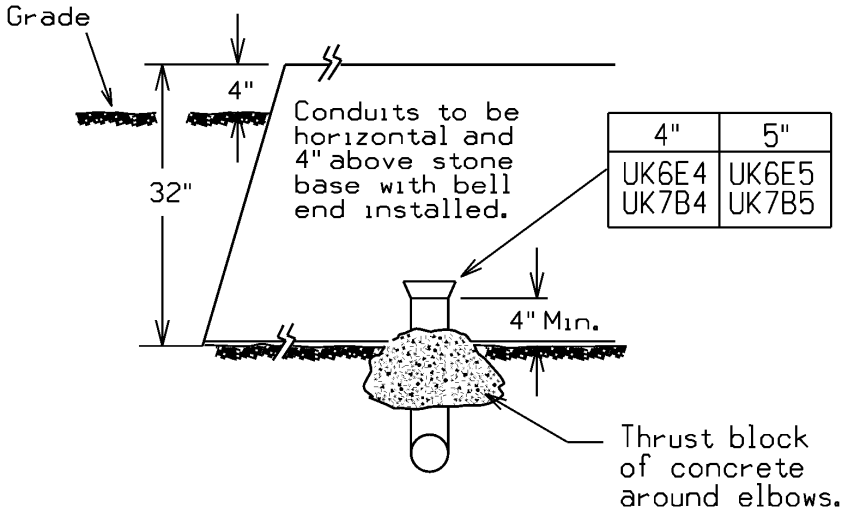
New drawing.

TYPICAL SWITCH INSTALLATION			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		38-150	7/15



NOTE: 4" OR 5" CONDUIT - 1 OR 2 CONDUITS PER QUADRANT AS REQ.

PLAN VIEW

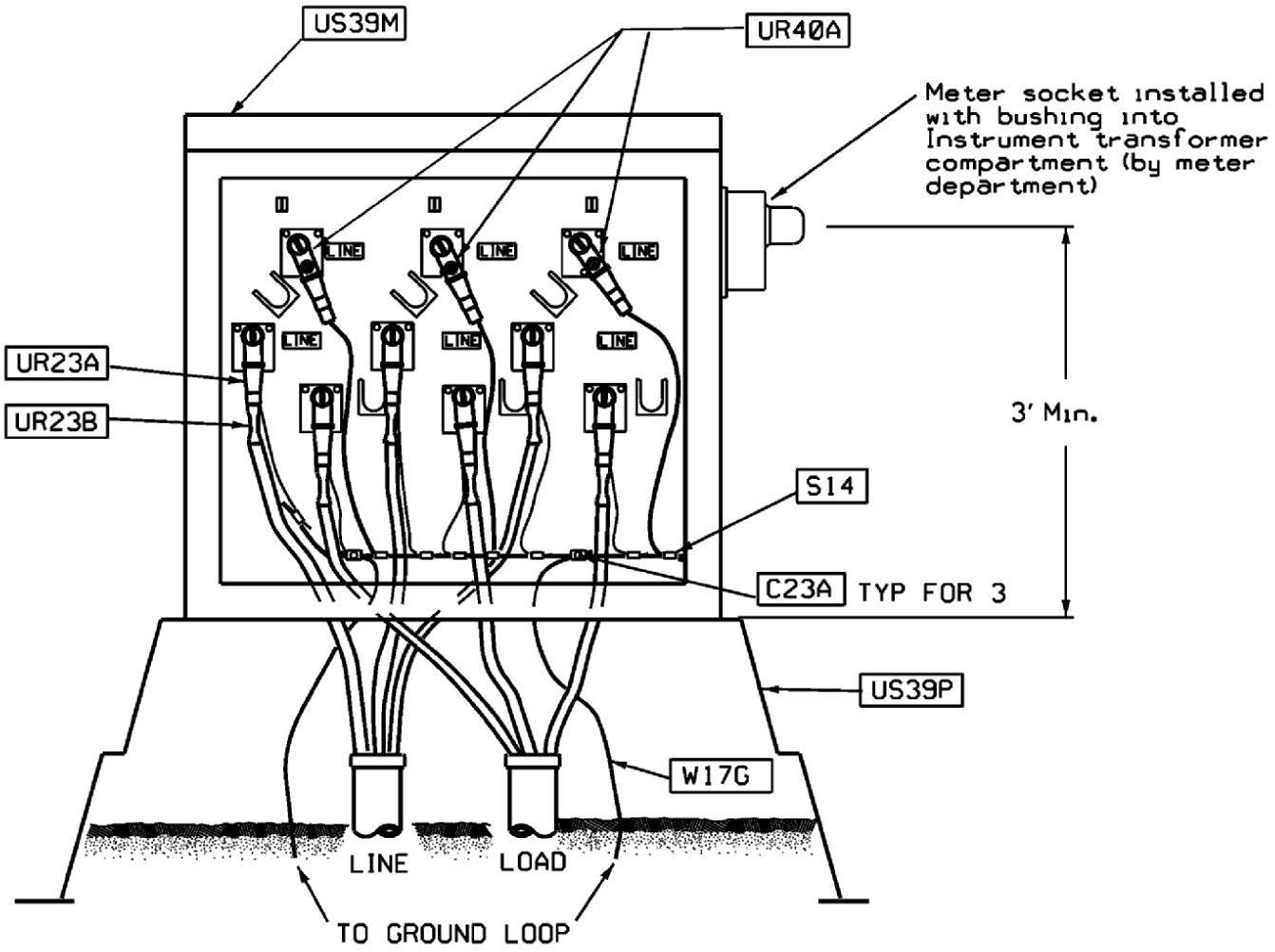


4"	5"
UK6E4 UK7B4	UK6E5 UK7B5

TYPICAL SIDE VIEW

Supersedes 7/09 issue - Updated title

THREE PHASE PAD-MOUNTED PRIMARY METERING FIBERGLASS BASE INSTALLATION WITH GROUND GRID			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/14	**38-200**		

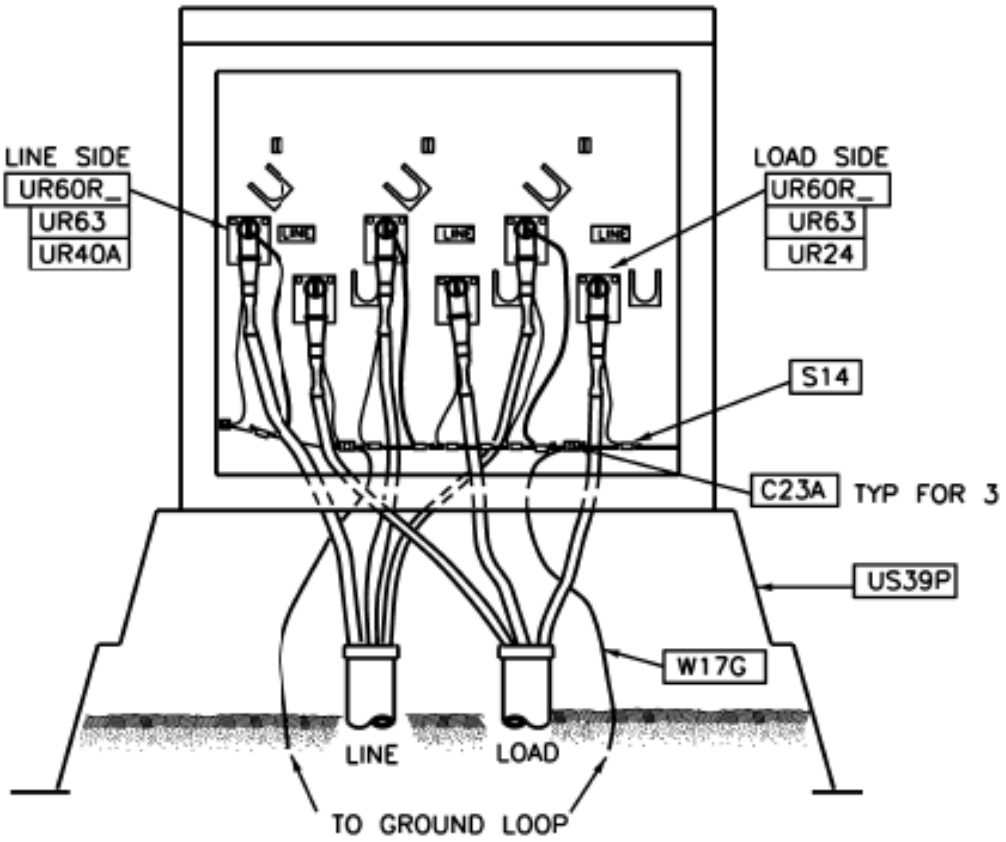


NOTES:

1. Arrestor eblows UR40A to be installed on line side.

New drawing.

THREE PHASE PAD-MOUNTED 600 AMP PRIMARY METERING CABLE INSTALLATION 15 KV			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		38-208	7/19



NOTES:

1. Must use 600A T–Body dead break elbows with reducing tap wells and arrestor elbows on line side, end caps on load side.

THREE PHASE PAD-MOUNTED 200 AMP PRIMARY METERING CABLE INSTALLATION 15 KV			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/14	**38-206**		

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Version	Date	Modification	Author(s)	Approval by (Name/Title)
5.6	7/22	• Drawing 38-101,147A, 147B and 148A update • New drawings 38-143, 38-144, 38-147C and 38-148B • Text updates in section 38.5, 38.14 and 38.19		
5.5	7/21	• Sections 38.4, 38.5, 38.6, 38.13, 38.14 38.15, 38.16, 38.19 and 38.21 • Update and merged section 38.20 into 38.19. • New drawing 38-149. • Removed drawing 38-300.		
5.4	7/20	• Update to sections 38.5, 38.6, 38-7.20, 38.18.20,38-19 and 38-20. • Figure 61 update in section 38.21. • Update to drawings 38-103A, 140, 141 and 142		
5.3	7/19	• Update to sections 38-3 to38-19 • New standard sections 38-20 and 38-21. • Drawing updates, 38-120, 38-121, 38-122, 38-140, 38-141, 38-145, 38-146 and 38-208. • New Drawings 38-147A, 38-147B and 38-148		
5.2	7/18	• Update to Sections 38.3, 38.4, 38.5, 38.6, 38.7, 38.8, 38.12, 38.14, 38.15, 38.17, 38.18 and 38.19. • New section 38.16. • Update to drawings 38-103		
5.1	7/16	• Update to 38.7.120 table 3. • Updates to section 13, now split in section 13 and 14. • Section 14 thru 16 has shifted to 15 thru 17. • New Section 38.18 • All pad-mount equipment sections have a new security section. • Update drawing 38-101 • New Drawings 38-145 and 38-146 • Figure numbering updates from figure 31		
5.0	7/15	• Updates to sections 38.4, 38.5, 38.6, 38.7, 38.13 and 38.14. • Updated drawings 38.112, 38.114, 38.140, 38.141 and 38.142. • New drawing 38-150 • New section 38.16		

SUMMARY OF RECENT CHANGES

ISSUE	PAGE NUMBER	UNDERGROUND CONSTRUCTION STANDARD	
7/18	**38-NOTES**		

4.0	7/14	• Updated sections 38.4, 38.5, 38.6, 38.7 and 38.8. • New Sections 38.12. 38.13 38.14 and 38.15 • Updated drawings 38-100 and 38-122 • New Drawings 38-103A, 38-103B, 38-103C, 38-140, 38-141, 38-206, 38-208 and 38-300		
2	7/09	• Updated Std. Item numbers on Drawings 38-100, 38-105, 38-106, and 38-107. • Added new drawings for Primary Metering fiberglass boxpad installation (Drawings 38-200 and 38-204).		
1	07/08	• Updated Std. Item numbers in section 38.4. • Updated section 38.5. • Updated section 38.6. • Updated section 38.7. • Update to US41A and Added US41AR, US41C and US41CR on page 38-10. • Updated section 38.8 and inserted Figure 12. • Renumbered Figures and Tables throughout text • Std. Item numbers updated on page 38-100. • Drawing updated on pages 38-101, 38-102, 38-103, 38-110. • New construction drawings on pages 38-104, 38-105, 38-106, 38-107, 38-111, 38-120, 38-121, 38-122. • Drawing updated on page 38-112 and previously was drawing 38-111 (renumbered). • Drawing updated on page 38-113 and was previously drawing 38-112 (renumbered). • Page 38-114 was previously drawing 38-113 (renumbered).		

Supersedes 7/18 Issue – Update to section 39.7.

39.0 GENERAL

The following Standard is to be followed when designing and installing fuses. This Section shall apply to primary and secondary systems.

Listed below is a general guide to power fuse nomenclature used by S&C Electric, the power fuse manufacturer. In the event that greater detail is necessary, the manufacturer should be contacted.

Table 1
S&C Power Fuse Nomenclature

SM - _	Basic designation for power fuses
SML - _	Refers to a mounting with “uni-rupter”, for single pole switching (Indoor use)
SMU - _	Fuse “unit”. No refills - replace entire “unit” when blown (e.g. SMU-20)
SM-4Z and SML-4Z	Refers to fuse holder. The “Z” denotes a silencer (indoor use**)**
SM-5S and SM-5SS	Refers to a fuse holder. Includes “snuffler” or “super snuffler” (indoor use)
SMD -20	Refers to an outdoor disconnect mounting.

SM-4 and SM-5 mountings generally do not include fuse holders or refills but do include silencers where appropriate. SM-20 mountings may not include end fittings.

39.1 APPLICATION

Fuses will be used where there is a need to protect line-side equipment from high currents caused by failures within the equipment on the load-side of the fuse. Fuses will also be installed to protect equipment from overload and fault currents, and will be used to minimize the potential catastrophic failure of transformers due to internal faults.

39.2 CURRENT LIMITING FUSES

In areas of high fault currents, an energy limiting device may be required to limit let-through short circuit current to a level which will minimize the potential of failures to transformers and other distribution equipment. A full range current limiting fuse is such a device and is designed to interrupt any current large enough to melt its fuse element up to its maximum interrupting rating. A type C fuse is a full range current limiting fuse which will melt the fuse element at 1000 seconds when carrying 170 – 240% of its continuous current rating. They can be applied at locations where the available fault current is as high as 50,000 A, RMS symmetrical.

Full range current limiting fuses are to be installed where recommended by Distribution Design (e.g. pad-mounted transformers, switchgear, etc.). Refer to Section 50 – Materials Catalog for clip style full range current limiting fuses (Std. Item F12C) and for current limiting fuses with an arc strangler switch (Std. Item F13C).

39.3 POWER FUSES

Power fuses are used on the distribution system when increased interrupting or current carrying capacity is required, or where expulsion fuses are otherwise not suitable. Power fuses are to be used only when specified by Distribution Design. Refer to appropriate power fuse located in Section 50 – Materials Catalog (Std. Items F4 – F8 and F19 – F24).

Supersedes 2/06 Issue – Spelling update in Table 1

39.4 INTERRUPTING CAPACITY

Table 2
SM-4 Fuses

Nominal System Voltage (kV)	Nominal Fuse Rating (kV)	Interrupting Rating (kA)	
		Asymmetric	Symmetric (X/R=15) *
2.4 – 4.8 kV Grounded or Ungrounded	7.2[1]	27.5	17.2
8.32 kV Grounded Wye	14.4[2]	25.0	15.6
11.5 – 13.8 kV Grounded or Ungrounded	14.4[2]	20.0	12.5
22.9 – 24.9 kV Grounded or Ungrounded	25.0	15.0	9.4
34.5 kV Grounded Wye	34.5	10.0	6.25

* For other X/R ratios refer to manufacturer's catalog
1. 7.2 kV refills and holders in 4.8 kV mountings
2. 14.4 kV refills and holders in 13.8 kV mountings

Table 3
SM-5 Fuses (SM-5, SM-5S, SM-5SS)

Nominal System Voltage (kV)	Nominal Fuse Rating (kV)	Interrupting Rating (kA)	
		Asymmetric	Symmetric (X/R=15) *
2.4 – 4.16 kV Grounded or Ungrounded	4.16[1]	60.0	37.5
2.4 – 4.16 kV Grounded or Ungrounded	7.2[2]	44.5	28.0
4.8 kV Delta	7.2[2]	43.5	27.0
8.32 – 13.8 kV Grounded or Ungrounded	14.4[3]	40.0 **	25.0 **
22.9 – 24.9 kV Grounded or Ungrounded	25.0	32.0	20.0
22.9 – 34.5 kV Grounded or Ungrounded	34.5	28.0	17.5

* For other X/R ratios refer to manufacturer's catalog
** SM-5SS Ratings greater
1. 4.16 kV refills in 7.2 kV holders in 4.8 kV mountings
2. 7.2 kV refills and holders in 4.8 kV mountings
3. 14.4 kV refills and holders in 13.8 kV mountings

Table 4
SM-20 Fuses (SM-20, SML-20, SMD-20)

Nominal System Voltage (kV)	Nominal Fuse Rating (kV)	Interrupting Rating (kA)	
		Asymmetric	Symmetric (X/R=15) *
8.32 – 13.8 kV Grounded or Ungrounded	14.4[1]	22.4	14.0
22.9 – 24.9 kV Grounded or Ungrounded	25.0	20.0	12.5
22.9 – 34.5 kV Grounded or Ungrounded	34.5	13.5	8.45

* For other X/R ratios refer to manufacturer's catalog
1. 14.4 kV fuse units in 13.8 kV mountings

Supersedes 7/15 Issue – Update to Table 6 and 7, added new table 7a

39.5 FUSE HOLDERS AND END FITTINGS

The following fuse holders are for outdoor use. Silencer/snuffler are available separately if needed.

Table 5
SM-4/SM-5

Nominal Voltage (kV)	SM-4		SM-5	
	Std. Item	S&C Catalog No.	Std. Item	S&C Catalog No.
7.2	C49A	86051	C50A	86151R2
14.4	C49B2	86052	C50B	86152R2
25.0	C49C	86053	C50C	86153R2
34.5	C49D	86054	F7H	86154R2

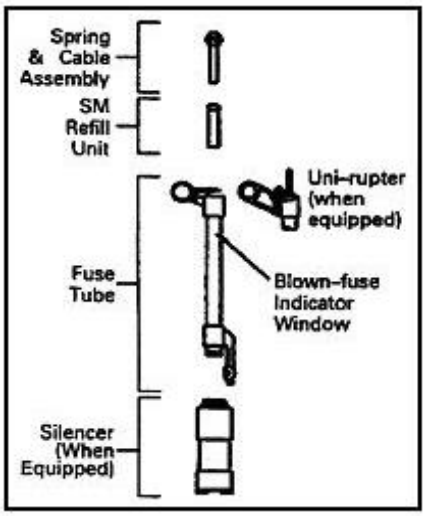


Figure 1
SM-4 (SM-5 Similar)

The following fuse holders are for indoor use with SM-4 fuse units, including pad-mounted switchgear, and incorporate silencer/snuffler.

Table 6

Nominal Voltage (kV)	End Fittings	Std. Item	S&C Catalog No.	Front
14.4	SML-4	C49B__	92352	Live
25.0	SML-4	C51L25	92353	Live
25.0	SME-4	C51E25	90363	Elbow

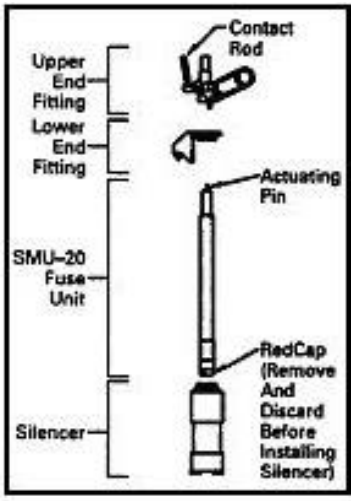


Figure 2
SMU-20

The following end fittings are for indoor use with SMU-20 fuse units, including pad-mounted switchgear. Silencer and uni-rupter fitting included.

Table 7

Nominal Voltage (kV)	End Fittings	Std. Item	S&C Catalog No.	Front
14.4	SML-20	C51	3097	Live
14.4	SME-20	C51E	3093	Elbow

The following end fittings are for indoor use with NX fuse units for 15kV class pad-mounted switchgear.

Table 7a

Nominal Voltage (kV)	Fault Fiter			
	End Fittings	Std. Item	S&C Catalog No.	Front
14.4	NX clip in	C51ECL	3122-A1	Elbow

39.6 TRANSFORMER FUSING

Pad-mounted transformers are equipped with different types of fusing depending on date of purchase and/or voltage class. The transformer nameplate should be consulted to determine the type of fusing for any given transformer. Current designs utilize a Bay-O-Net fuse under oil in series with an internal, non-replaceable current limiting fuse. Older designs had a Bay-O-Net fuse in a drywell canister, both with and without current limiting fuses

When a transformer must be re-fused, a fuse of the same type and rating as that originally supplied by the manufacturer must be used. When this information is not available, the following tables shall be used to determine the replacement fuse.

39.6.10 Single Phase Transformers

A. Bay-O-Net Fuse

A Bay-O-Net fuse may be used alone or in conjunction with a current limiting fuse. In general, the Bay-O-Net fuse is designed to protect the line-side system from damage caused by transformer faults, and the transformer from overload and secondary fault currents. The current limiting fuse is designed to minimize the potential of catastrophic failure of the transformer due to internal faults. The current limiting fuse is not accessible externally. When the current limiting fuse operates, the transformer must be replaced.

When a single-phase pad-mounted transformer is equipped with a Bay-O-Net fuse only, or with a Bay-O-Net fuse in series with current limiting fuse, the following table should be used to determine the replacement fuse.

Table 8

kVA		Primary Voltage				
		3740 GrdY/2160 4160 GrdY/2400	8320 GrdY/4800	12470 GrdY/7200	13200 Grd/7620 13800 GrdY/7920	34500 GrdY/19920
25	Rating (A)	25	10	10	6	3*
	Std. Item	F3B25	F3B10	F3B10	F3B6	F3A3
50	Rating (A)	40	25	15	15	3*
	Std. Item	F3B40	F3B25	F3B15	F3B15	F3A3
75	Rating (A)	65	25	25	15	8*
	Std. Item	F3B65	F3B25	F3B25	F3B15	F3A8
100	Rating (A)	65	40	25	25	10
	Std. Item	F3B65	F3B40	F3B25	F3B25	F3B10
167	Rating (A)	140	65	40	40	15*
	Std. Item	F3B140	F3B65	F3B40	F3B40	F3A15

* Dual (load) sensing fuse, all others are current (fault) sensing.

B. Full Range Current Limiting Fuse In Drywall Canister

Single phase transformers, 15 kV class and below, may be equipped with a full range current limiting fuse in a loadbreak drywell canister. In these cases, the following table should be used to determine the appropriate replacement fuse.

Supersedes 7/07 Issue – Corrected section numbering formatting and update in table 8.

Table 9

kVA		Primary Voltage		
		3740 GrdY/2160 4160 GrdY/2400	**8320 GrdY/4800**	**12470 GrdY/7200 13200 GrdY/7620 13800 GrdY/7970**
25	**Rating (A)**	18C	10C	8C
	Voltage (kV)	4.36	5.5	8.3
	Std. Item	F12C1	F12C6	F12C10
50	**Rating (A)**	35C	18C	12C
	Voltage (kV)	4.3	5.5	8.3
	Std. Item	F12C2	F12C7	F12C11
75	**Rating (A)**	50C	25C	18C
	Voltage (kV)	4.3	5.5	8.3
	Std. Item	F12C4	F12C8	F12C12
100	**Rating (A)**	65C	40C	25C
	Voltage (kV)	4.3	5.5	8.3
	Std. Item	F12C4	F12C9	F12C13
167	**Rating (A)**	100C	--	40C
	Voltage (kV)	4.3	--	8.3
	Std. Item	F12C5	--	F12C14

39.6.20 Three Phase Transformers

A. Bay-O-Net Fuse

Bay-O-Net fuses may be used alone or in conjunction with current limiting fuses. In general, the Bay-O-Net fuse is designed to protect the line-side system from damage caused by transformer faults and the transformer from overload and secondary fault currents. The current limiting fuse is designed to minimize the potential of catastrophic failure of the transformer due to internal faults. The current limiting fuse is not accessible externally. When the current limiting fuse operates, the transformer must be replaced.

When a three-phase pad-mounted transformer is equipped with Bay-O-Net fuses only, or with Bay-O-Net fuses in series with current limiting fuse, the following table should be used to determine the replacement fuse.

Table 10

kVA		Primary Voltage						
		2400	3740	4160 4800	8320	11500	12470 13200 13800	34500
75	Rating (A)	25	25	25	10	10	10	3*
	Std. Item	F3B25	F3B25	F3B25	F3B10	F3B10	F3B10	F3A3
150	Rating (A)	65	40	40	25	15	15	3*
	Std. Item	F3B65	F3B40	F3B40	F3B25	F3B15	F3B15	F3A3
300	Rating (A)	--	65	65	40	25	25	10
	Std. Item	--	F3B65	F3B65	F3B40	F3B25	F3B25	F3B10
500	Rating (A)	--	100	100	65	40	40	15
	Std. Item	--	F3B100	F3B100	F3B65	F3B40	F3B40	F3B15
750	Rating (A)	--	100	140	100	65	65	25*
	Std. Item	--	F3B100	F3B140	F3B100	F3B65	F3B65	F3A25
1000	Rating (A)	--	--	--	100	100	65	25*
	Std. Item	--	--	--	F3B100	F3B100	F3B65	F3A25
1500	Rating (A)	--	--	--	--	--	100	50*
	Std. Item	--	--	--	--	--	F3B100	F3A50

* Dual (load) sensing fuse, all others are current (fault) sensing.

B. Full Range Current Limiting Fuses In Type EL Bay-O-Net Holders

Some transformers rated 34.5 kV may be equipped with Cooper type ELS full range current limiting fuses in Bay-O-Net holders.

When a three phase pad-mounted transformer is equipped with type ELS current limiting fuses in Bay-O-Net holders, the following table should be used to determine the replacement fuse.

Table 11

Type ELS Current Limiting Fuse – 34.5 kV Application		
Transformer kVA	**Fuse Size**	**Std. Item**
750	20 A	F14A20
1000	20 A	F14A20
1500	25A	F14A25

Supersedes 7/07 Issue – Corrected numbering formatting.

39.6.30 MINIPAD TRANSFORMER FUSE COORDINATION

This section of the standards will assist in fuse coordination with underground transformers and riser pole fuses. The coordination is where two adjacent fuses operate in series, the “protected fuse” is on the supply side and the “protecting fuse” is on the load side. If a fault occurs beyond the protecting fuse, it should clear before the protected fuse has reached 75% of its melting time. In high fault duty areas, current limiting fuses may be required. More information on current limiting fuses is available in the overhead standards book in section 12.4.20.

Supersedes 2/06 Issue – Corrected numbering formatting and Standard Item ID F3B6 in tables 12 and 13.

39.6.40 Coordination with Bayonet Type Fuses for Single Phase Minipads

A. K Link Sectionalizing fuse

TABLE 12

Std. Item	Bayonet Type Amps	Minimum Sectionalizing Fuse Size K Link		Std Item	Bayonet Type Amps	Minimum Sectionalizing Fuse Size K Link
F3A3	3*	10		F3B25	25	65
F3A8	8*	25		F3B40	40	100
F3A15	15*	65		F3B65	65	**
F3B6	6	15		F3B100	100	**
F3B10	10	15		F3B140	165	**
F3B15	15	25				

* Dual (load) sensing fuse, all others are current (fault) sensing.
** Refer to Field Engineering for coordination.

B. T Link Sectionalizing fuse

TABLE 13

Std. Item	Bayonet Type Amps	Minimum Sectionalizing Fuse Size T Link		Std Item	Bayonet Type Amps	Minimum Sectionalizing Fuse Size T Link
F3B6	6	15		F3B40	40	65
F3B15	15	25		F3B65	65	100
FB325	25	40		F3B140	165	**

** Refer to Field Engineering for coordination.

39.6.50 Coordination with Full Range Current Limiting Type Fuses for Single Phase Minipads

TABLE 14

Full Range Current Limiting Fuse Size	Minimum Size Sectionalizing Fuse (K Type) Current Limiting Fuse Voltage Rating		
	4.16kV 3.74kV	8.32kV	12.47kV 13.2kV 13.8kV
8C			25
10C		25	
12C			40
18C	40	65	65
25C		65	100
35C	100		
40C		100	140
50C	140		
65C	140		
100C	**		

** Refer to Field Engineering for coordination.

39.7 BAY-O-NET FUSE ASSEMBLY DETAIL

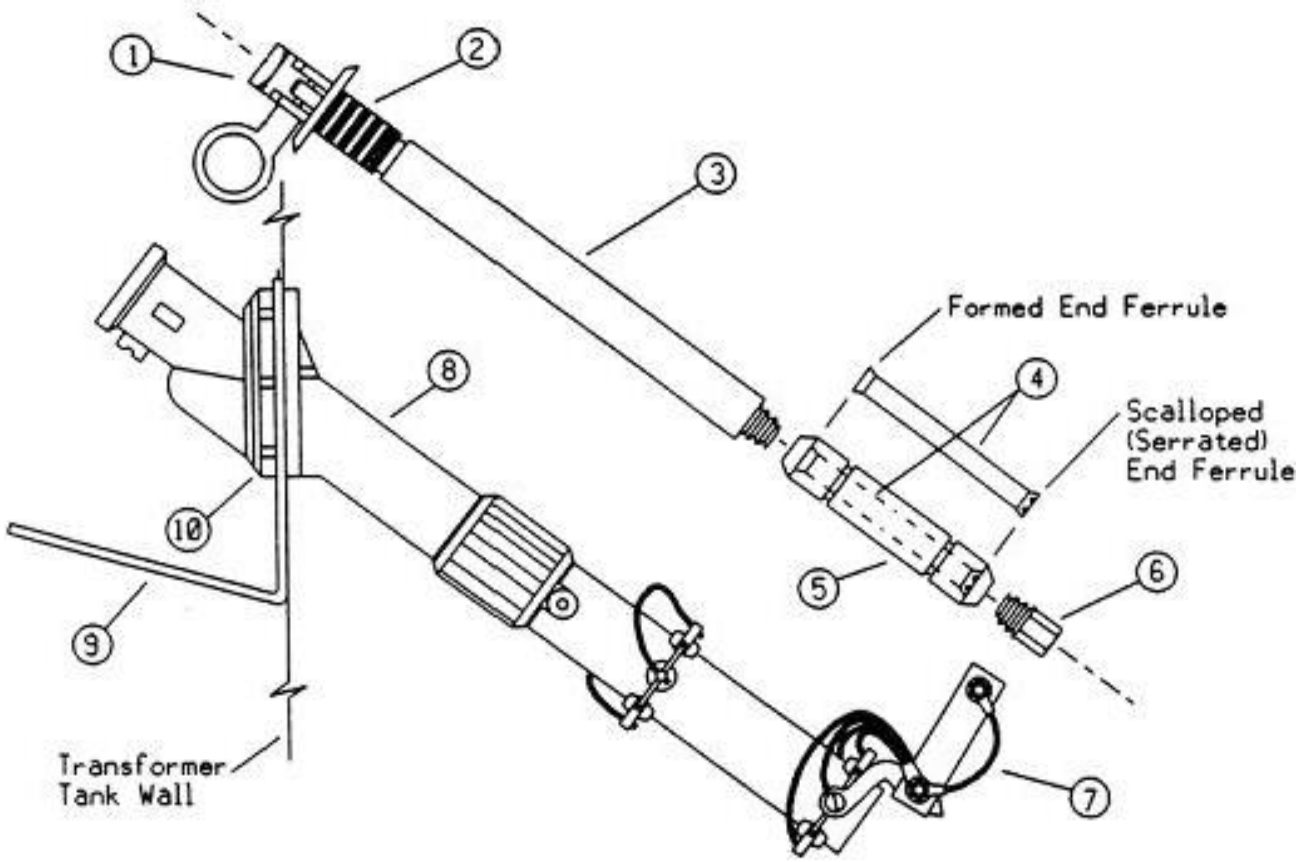


Figure 3

A. Assembly List

1. Switch Stick Operated Handle
2. Neoprene Gasket Seal
3. Inner Fuse Cartridge Holder
4. Load Sensing Fuse Link
5. Fuse Cartridge*
6. Screw-In End Plug*
7. Isolation Link
8. Outer Fuse Housing
9. Drip Shield
10. Mounting Nut and Gasket

* Note: Fuse cartridge (STD Item F3C), screw in end plug (STD Item F3CP) and inner fuse cartridge holder (STD Item F3CH) are now available as replacement parts.

Supersedes 7/20 Issue – Update to note.

39.8 FAULT CIRCUIT INDICATORS (FCI's)

Automatic reset Fault Circuit Indicators (FCI, Std. Item UF50_) are available for use to aid in trouble shooting underground systems during emergencies. The FCI's have load tracking circuitry that monitors the load and adjusts the trip current range automatically (200Amp minimum trip). During a fault, the indicator flashes a bright red LED light for 8 hours. The indicator will reset automatically on current or time based on the type. For delta systems, use time reset only. The indicators shall be mounted at cable termination points. See figure 4 for installation details.

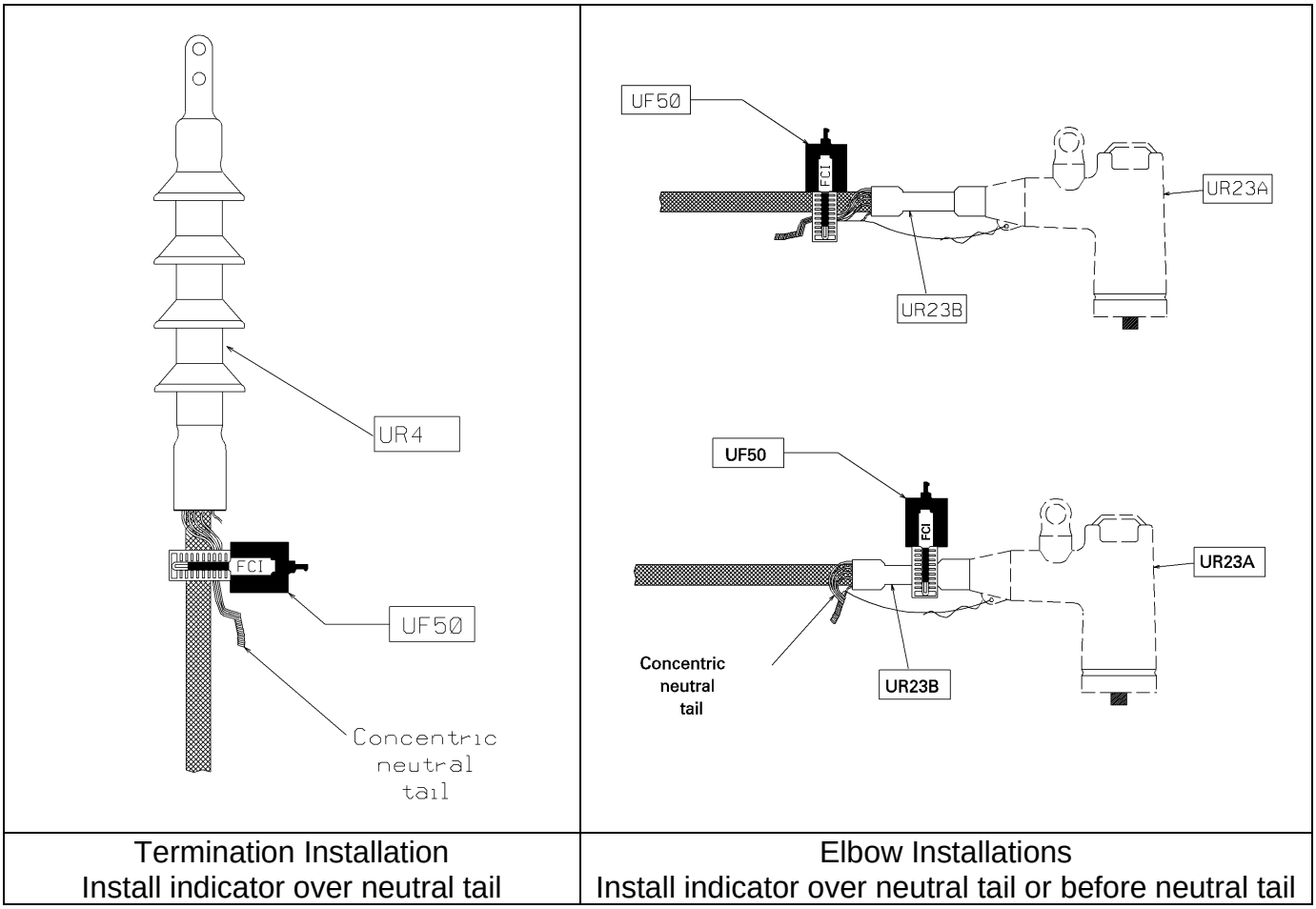
To test or reset the FCI, use reset magnet Std. Item UF50A. To test the indicator, attach reset magnet to end of switch stick and position the magnet to the left side of the indicator labeled "test" and the red light will flash. To reset the indicator, attach reset magnet to the end of a switch stick and position the magnet to the right side of the indicator labeled "reset" and the red light will stop flashing.

Section 44 and 45 explain the uses of the indicators in UCD's and URD's.

Note: When the automatic reset type FCI's are first installed, and there is more current than the minimum trip setting, the FCI needs to adjust and will begin to flash. The red LED will turn off after one minute if there is no fault current.

Supersedes 7/15Issue _ Corrected numbering formatting.

Figure 4



Termination Installation Install indicator over neutral tail	Elbow Installations Install indicator over neutral tail or before neutral tail

Version	Date	Modification	Author(s)	Approval by (Name/Title)
1.7	7/21	• Section 39.7 Update to note in figure 3.		
1.6	7/20	• Update to fuse STD Item in tables 12 and 13. • Corrected numbering formatting in pages,4,6,7,8, and 9		
1.5	7/18	• Added copyright information. • Section 39.5 updated tables 6 and 7. • Section 39.5 added new table 7a. • Added note in 39.6.		
1.4	7/15	• Updates to 39.4 table 7 • Update text 39.7		

40.0 GENERAL

This Section covers the details of installing and connecting underground single and three phase transformers. It also provides guidance on selection of dual voltage rated vs. single voltage rated transformers. While dead front transformers are the preferred transformers for 15 kV and 35 kV applications, live-front transformers will be covered for 23 kV applications and maintenance purposes. Fusing details are covered in Section 39 - Fuses, grounding details can be found in Section 44 – UCD and Section 45 – URD and lightning protection is covered in this Section.

40.1 CUSTOMER REQUIREMENTS

The Company's customer service policies require that customers "having the potential to exceed 75 kVA of transformer capacity are required to supply space for electrical equipment on private property" (*SPECIFICATIONS FOR ELECTRICAL INSTALLATIONS* or *ELECTRICAL SERVICE, INFORMATION AND REQUIREMENTS* for company specific information). This requires the customers, whose load may reasonably be expected to exceed 75 kVA at some point in the future, to provide a location for a pad-mounted transformer and pad-mounted switchgear. All secondary cable, connectors and connector fasteners shall be furnished, installed, owned and maintained by the Customer. Final electrical connections to the transformer secondary terminals shall be inspected by the Company. The Company's transformer will be equipped with bushings that accept NEMA standard two-hole spade terminals mounted in the secondary cabinet.

40.2 LOCATION

The physical location where transformers should be placed is discussed in Section 44 – UCD and Section 45 – URD. In general, transformers shall be placed as near as possible to the center of the load.

40.3 SIZING AND LOADING

ANSI/IEEE C57.91 and C57.92 "Guidelines for Loading Mineral Oil Immersed Transformers" along with recent IEEE Papers were used to determine maximum kVA loading for single and three phase pad-mounted transformers.

40.3.10 Single Phase Mini-Pads

Based on load research data for actual customer loading, it was found that single phase transformers were pre-loaded to approximately 40-60% and the peak load duration was around 2 hours. Using an ambient temperature in summer of 95 degrees Fahrenheit and 32 degrees Fahrenheit in the winter, the respective overload levels of 140% and 160% were chosen. Different preloads and overload durations may affect these overload percentages. Contact Standards Engineering for specific situations.

40.3.20 Three Phase Padmounts

Based on ANSI/IEEE temperature limits the loading was based on not exceeding a maximum hot spot winding temperature of 140 degrees Celsius. This gives a corresponding top oil temperature of approximately 110 degrees Celsius which is safely below the flash point of mineral oil.

Based on these temperature limits and an 8-hour overload cycle with a pre-load of 100% of nameplate, the overload guides were determined to be 120% of nameplate in the summer and 140% of nameplate in the winter. Different preloads and overload durations may affect these overload percentages. Contact Standards Engineering for specific situations.

40.4 INSTALLATION

Detailed transformer installation can be found in Section 44 – UCD and Section 45 – URD.

40.5 PRIMARY CABLE TERMINATIONS

40.5.10 Dead Front – Radial or Loop Feed

Use loadbreak bushing well insert (Std. Item UR36B or UR94) and loadbreak elbow connector (Std. Item UR23 or UR90) with concentric neutral cable.

40.5.20 Live Front – Radial Feed

Use cable terminators per Section 37 – Terminations.

40.6 SECONDARY CABLES

40.6.10 Three Phase Pads

Three phase pad size and number of secondary cables shall be in accordance with The National Electrical Code and shall be approved by the appropriate inspection agency or Wire Inspector of the Town or City involved. Maximum number of secondary cables to be physically connected to the Company's pad-mounted transformer is outlined below:

4 Hole Spades	6 sets 750 kcmil Max.
6 Hole Spades	8 sets 750 kcmil Max.
10 Hole Spades	10 sets 600 kcmil or 8 sets of 750 kcmil

Secondary requirements greater than this shall necessitate a separate compartment, handhole, or bus duct and should be referred to Distribution Design. Refer to Section 44 – UCD for more detail.

40.6.20 Single Phase Mini-Pads

No more than six sets of secondary conductors are permitted in a single phase mini pad. Maximum size secondary cable shall not exceed 500 kcmil.

Note: Secondary conductors installed in metallic conduit shall contain a complete set of phase conductors and a neutral conductor in each conduit to prevent excessive heating.

40.7 SECONDARY CABLE CONNECTIONS

40.7.10 Three Phase Pads

Secondary cable connections will be made with a cable to flat clamp or compression type connector, with a minimum of two holes in the flat pad and two clamping elements or two compressions per cable. See Section 44 – UCD for details of secondary cable terminations.

40.7.20 Single Phase Mini-Pads

Secondary cable connections use Std. Item UR21.

40.8 GROUNDING

Standard grounding connections are shown in Section 44 – UCD and Section 45 – URD. Bonding of the conduits in the transformer primary and secondary compartments is required when the conduit is metallic. Parking stands and feed-thru devices shall be bonded if permanently left inside transformers. Bonding of dead end insulated caps is required when they are installed on transformer bushings or feed-thru devices.

Concentric neutral conductors in a grounded wye system are current carrying conductors and shall always be connected first and removed last during installation and removal. They shall always be connected to the transformer tank before the transformer is energized.

40.9 FUSING

In general, loop feed pad-mounted transformers have internal fusing as shown in Figure 1. The following criteria of fusing apply, unless otherwise specified by Distribution Design.

A. Overhead Supplied, Radial Feed, Pad-Mounted Transformers, without internal fusing shall be fused on the riser pole in accordance with Overhead Construction Standards Section 12 – Protection.

B. Overhead Supplied, Loop Feed, Pad-Mounted Transformers, with internal fusing shall be fused on the riser pole in accordance with fuse coordination table in Overhead Construction Standards Section 12 – Protection.

C. Underground Supplied, Radial and Loop Feed, Pad-Mounted Transformers shall be fused in accordance with fuse coordination tables in Section 39 – Fuses.

D. Dual ratio transformers, equipped with fusing, shall be refused in accordance with tables in Overhead Construction Standards Section 12 – Protection whenever the primary supply voltage is changed.

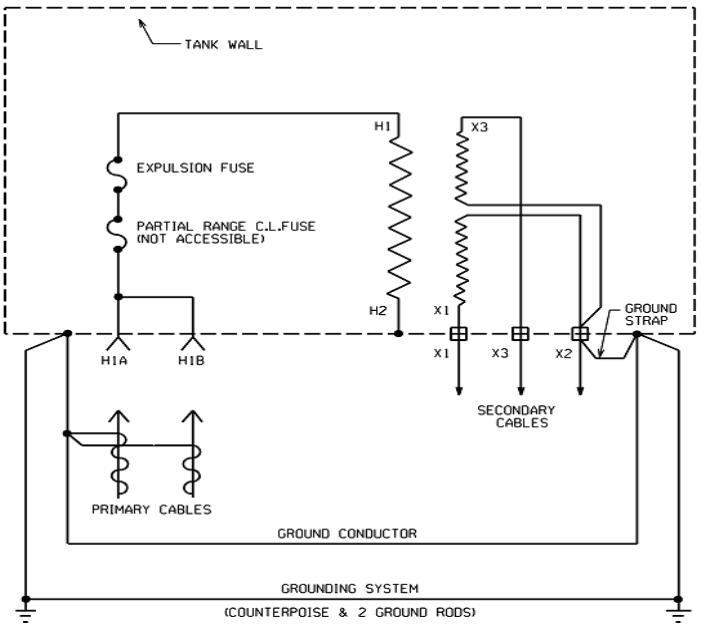


Figure 1
(Single Phase Unit Shown For Simplification)

40.10 METERING

Meter installations for single customers supplied by three phase pad-mounted transformers may be installed on the transformer.

40.11 THREE PHASE PAD-MOUNTED TRANSFORMER INSTALLATION

The size and type shall be determined by Distribution Design. Installation shall be in accordance with Section 44 – UCD.

40.12 LOOP FEED PAD-MOUNTED TRANSFORMER

Connection and grounding shown in Figure 2 are typical for a three-phase open point loop feed transformer with surge arresters. Figure 2 may be adapted for radial deadfront or for live front transformers. See Section 44 – UCD for details of secondary cable terminations.

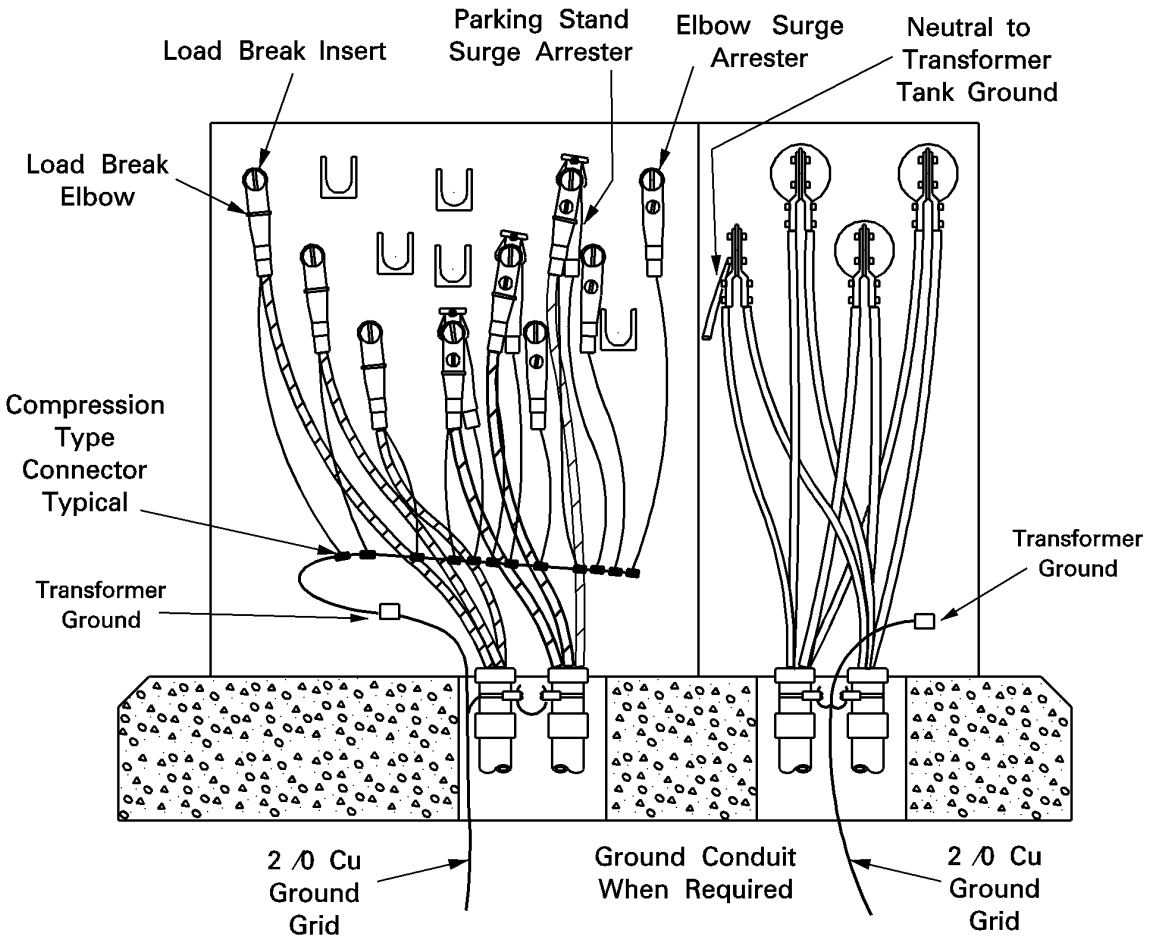


Figure 2
Loop Transformer With Parking Stand And Elbow Arresters

Figure 3 details proper tagging on transformers with tag holder and tag phrase (Std. Item UP21W and UP21P). All elbows must be tagged with Company approved tags to match the manufacturer's designation on the bushing where they would normally be installed to energize the transformer. Bushing identification tags are required in addition to cable tags.

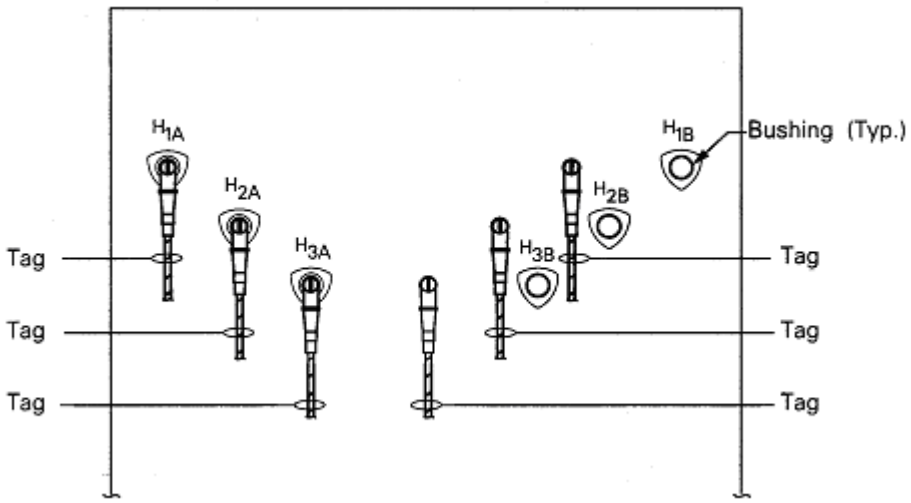


Figure 3
Primary Compartment

40.13 SURGE PROTECTION

Surge arresters are required at riser poles, transformer locations and at all open points. Figure 4, 5 and 6 detail proper grounding detail for elbow arresters and parking stand arresters. Elbow arrester (Std. Item UR40), parking stand arrester (Std. Item UR40B3) and bushing well arrester (Std. Item. UR40C) may come with braided ground leads. When installing an elbow arrester, the arrester shall be fully seated on the bushing.

Supersedes 7/08 Issue, Modified Paragraph 40.13

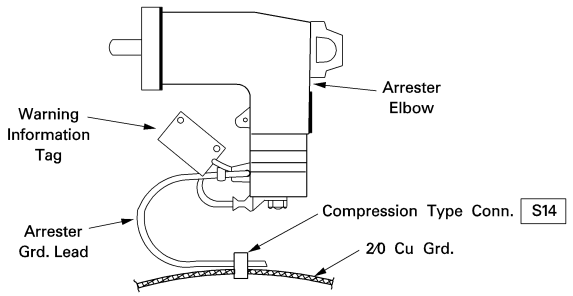
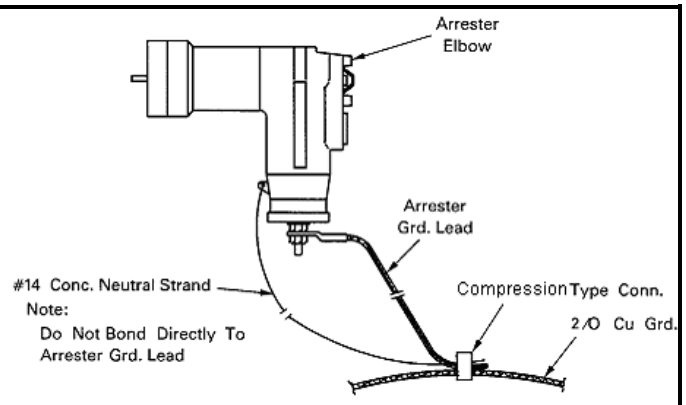
	
Elbow Arrester with braided ground attached to housing.	Elbow Arrester without ground attached to housing, install #14 concentric neutral or equivalent from housing to 2/0 Cu. system ground.

Figure 4
Arrester Elbow Grounding Detail with grounding lead (Std. Item UR40A)

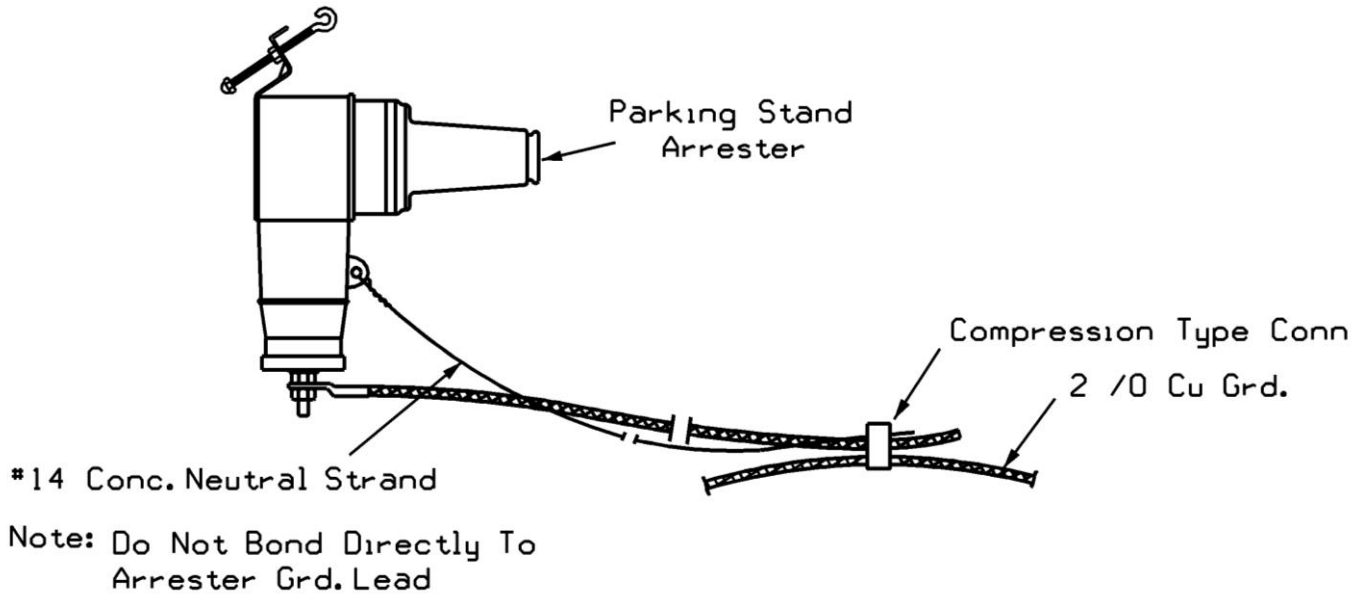


Figure 5
Arrester Parking Stand Grounding Detail (Std. Item UR40B3)

Supersedes 7/08 Issue – Moved Section 40.14 Easements to page 40-7

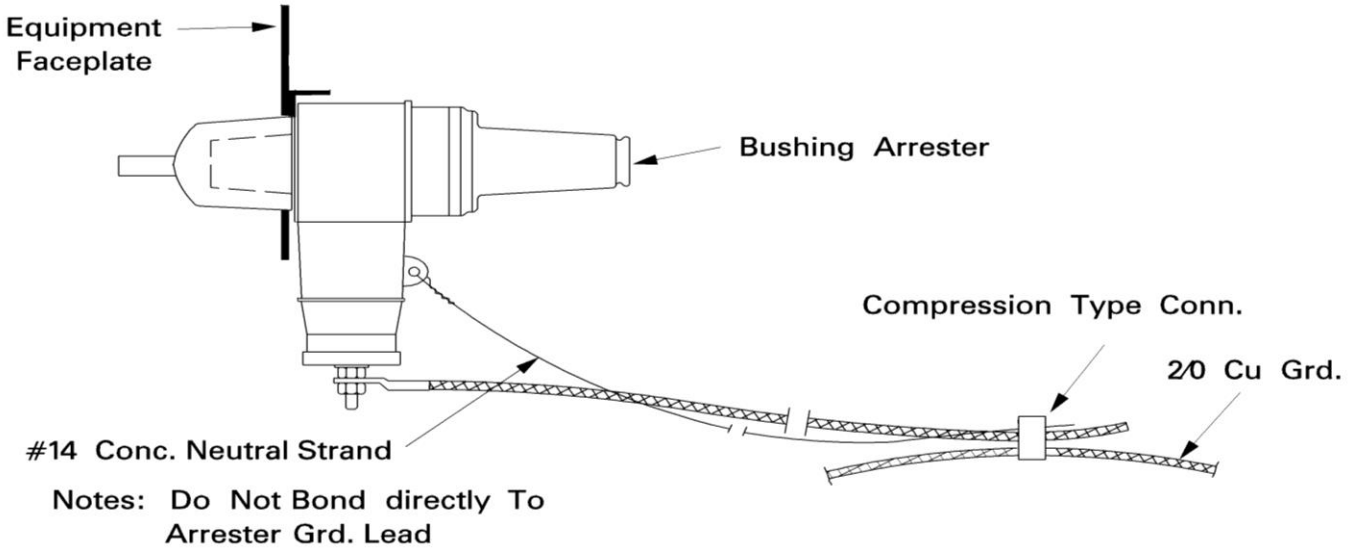


Figure 6
Bushing Arrester Grounding Detail (Std. Item UR40C)

40.14 EASEMENTS

All Company owned equipment must be located within a permanent easement. Easements shall be in accordance with Section 44 – UCD and Section 45 – URD.

40.15 PAD-MOUNTED TRANSFORMER FOUNDATION

Location shall be designated or approved by the Company. In general, transformers shall be located in accordance with Sections 44 – UCD and Section 45 – URD.

40.16 SUBWAY TRANSFORMERS

Every effort should be made to use pad-mounted transformers for new installations. Only if pad-mounted transformer locations can not be obtained, subway transformers can be installed, provided they are installed in vaults. Low profile units are available for installations with low headroom. These transformers must be located to allow pulling the loadbreak elbows from outside the vault. If it is not possible to locate the transformers with elbows being accessible, then an MVS (molded vacuum switch) must be installed. Subway transformers are available with or without internal fusing. If transformers without internal fusing are used, then an MVI (molded vacuum interrupter) shall be installed in the primary. The low-profile units are all without internal fusing. Subway transformers for use on a delta primary system are not available in loop-feed configuration. See section 41 for details on transformer vaults.

40.17 SUBSURFACE TRANSFORMERS

Subsurface transformers have been used in URD's. Subsurface transformers are for maintenance only. Subsurface transformers shall be per MS2590. If a subsurface transformer fails, it shall be replaced with a mini-pad. This shall be done by splicing the high and the low voltage cables, if necessary, in order to connect them to the mini-pad. To make these changes a pad-mounted conversion cover will be needed, choose from one of the following: Std. Items UR12P, UR12F, UR12G or UR12H. Dead-break elbows shall be changed to load-break elbows.

40.18 STEP-DOWN TRANSFORMERS

Three phase, pad-mounted step-down (or step-up) transformers are available where required to change primary voltage and where overhead transformers are not suitable.

40.19 NETWORK TRANSFORMERS

Distribution Design shall designate network transformer locations. Network transformer installation and maintenance shall be in accordance with Section 42 – Networks.

Supersedes 2/012 Issue. Text update in section 40.16

40.20 HANDLING RETURNED TRANSFORMERS

40.20.10 Procedures

The following guideline outlines procedures for handling returned distribution transformers, including overhead, pad-mounted, subsurface and subway types:

40.20.20 When To Junk Transformers

Transformers shall be junked under the following conditions:

A. Transformer rating 7.5 kVA and below.
B. Non-usable ratings – declare surplus before junking.
C. Cast iron tanks.
D. Non-standard mounting.
E. Repair parts not available.
F. Primary codes 035 and 095.
G. Tap codes 77, 78, 83 and 89.
H. PCB transformers (500 ppm and above). **WARNING:** Transformers containing PCB fluid require special handling.
I. Transformers manufactured during or before 1970 unless the unit is required for assurance/back-up.

40.20.30 When To Return Transformers To Stock For Re-issue

Return transformers to stock for re-issue, without electrical testing, if all of the following apply:

A. Transformer has **non-PCB** label.
B. Transformer was removed on routine change-out or due to new construction.
C. Transformer bushings, terminals, protective coating, and other accessory equipment are in good condition.
D. Single phase transformer with secondary voltage rating of 120/240 or 240/480 (E/2E) with internal secondary connections set up for three wire operation. This applies to transformers with three low voltage terminals 100 kVA and below.

In addition:

A. Assign new physical data code to transformer if not already assigned.
B. Inspect condition of transformer markings and replace if necessary.
C. Remove bottom portion of “Transformer On Stock Status” tag.
D. Transfer transformer to stock.

Supersedes 7/12 Issue – Eliminated Primary Codes in 40.20.20 F.

40.21 SURGE ARRESTER APPLICATION TABLE

Surge arresters shall be selected based upon the application criteria below:

PRIMARY CIRCUIT VOLTAGE	ARRESTER DUTY CYCLE RATING (kV)	MAX. CONTINUOUS OPERATING VOLTAGE	STANDARD ITEM NUMBER (HEAVY DUTY TYPE)	STANDARD ITEM NUMBER (RISER TYPE)
2400 Delta 4160 Grd Y/2400	3	2.55 kV	L3A	L3DR
4160 Delta 4800 Delta 8320 Grd Y/4800 7200 Delta	10	8.40 kV	L3D	
12470 Grd Y/7200 13200 Grd Y/7620 13800 Grd Y/7960 11000 Delta	12	10.2 kV	L3E	L3ER
11500 Delta 12000 Delta 13200 Delta 13800 Delta	15	12.7 kV	L3F	L3FR
22900 Grd Y/13200 23900 Grd Y/13800 24940 Grd Y/14400	21	17.0 kV	L3G	L3GR
34500 Grd Y/19900 22900 Delta 23000 Delta 23900 Delta 34500 Delta	27	22.0 kV	L3J	L3JR

New Page

DESCRIPTION – Code numbers specify five basic items regarding transformers as follows:

00	000	00	00	00
Type Code (Table 1)	Primary Code (Table 2)	Secondary Code (Table 3)	Tap Code (Table 4)	Fuse & Switch Code (Table 5)

TABLE 1 – TYPE CODE

KEY	
OA – Mineral Oil-Filled, Air Cooled	**LF – Less Flammable-Filled, Air Cooled**
10	Overhead – OA
11	Overhead – OA w/Stainless Steel Tank
13	Overhead – LF
17	Overhead – CSP – OA – with Built In Overload Tripout
18	Pole type Pad Mounted Deadfront
20	Auto-Transformer – OA
30	Pad-mounted – Loop Feed – Dead Front – OA
31	Pad-mounted – Loop Feed – Dead Front – OA w/Stainless Steel Tank
32	Pad-mounted – Loop Feed – Live Front – OA
34	Pad-mounted – Loop Feed – Dead Front – LF
40	Subway – OA
41	Subway – OA – Low Profile
42	Subway – LF – Walk-In Vault
50	Pad-mounted – Radial Feed – Dead Front – OA
52	Pad-mounted – Radial Feed – Live Front – OA
54	Pad-mounted – Radial Feed – Dead Front – LF
56	Pad-mounted – Radial Feed – Dead Front – Dry
60	Network – OA
62	Network – LF
65	Network – Pad-mounted – LF
70	Subsurface – Radial Feed – OA
72	Subsurface – Loop Feed – OA
80	Self-Regulated – OA
90	Station Type
99	Other – Not Listed
Note: Transformer types listed above may or may not have surge arresters.	

Supersedes 7/08 Issue - Added Type Code 42

TABLE 2 - PRIMARY CODE

KEY:

(-) Voltage Nomenclature
E_1 = $\sqrt{3}$ E
E_2 = Any Value of E Other Than E, E_1, or 2E

* - One Primary Bushing - Single Phase Overhead Transformers
** - Two Primary Bushings - Single Phase Overhead
*** - Junk Codes

SINGLE PHASE TRANSFORMERS (001 – 500)

001 – 025	E **
005	480
007	600
010	11500
011	12000
012	13800
013	22000
014	13200
015	22900
017	34400
018	34500
022	11000
023	14400

026 – 050	E/2E **
035	2300/4600 ***
040	11000/22000
042	11550/23100

076 – 088	E X 2E **
080	1200 X 2400
082	2400 X 4800
085	11000 X 22000
086	11500 X 23000

089 – 100	E X E_2 **
095	22000 X 33000 ***

101 – 150	E/E_1 Y **
108	2160/3740Y
109	2400/4160Y
112	4160/7200Y
114	4800/8320Y
116	6930/12000Y
118	7200/12470Y
119	7620/13200Y
120	7970/13800Y
125	11500/19900Y
126	12000/20780Y
127	12470/21600Y
129	13200/22860Y
131	13800/23900Y
133	14400/24940Y
140	19920/34500Y

151 - 200	E_1 Grounded Y/E *
155	3740 Grounded Y/2160
157	4160 Grounded Y/2400
159	8320 Grounded Y/4800
165	12470 Grounded Y/7200
167	13200 Grounded Y/7620
169	13800 Grounded Y/7970
175	22860 Grounded Y/13200
177	24940 Grounded Y/14400
178	34400 Grounded Y/19860
180	34500 Grounded Y/19920

Supersedes 7/12 Issue – Deleted Junk Codes for 022, 040 and 085

TABLE 2 – PRIMARY CODE (Continued)

SINGLE PHASE TRANSFORMERS (001 – 500) (Continued)

201 – 250	E/E Grounded Y **
217	13200/22860 Grounded Y
220	14400/24940 Grounded Y

251 – 300	E/E_1Y x E/E_1Y **
255	2160/3740Y x 7620/13200Y
257	2400/4160Y x 4800/8320Y
258	2400/4160Y x 7200/12470Y
259	2400/4160Y x 7620/13200Y
260	2400/4160Y x 7970/13800Y
263	2400/4160Y x 13800/23900Y
264	4160/7200Y x 7620/13200Y
265	4160/7200Y x 7970/13800Y
267	4160/7200Y x 12470/21600Y
269	4160/7200Y x 13800/23900Y
271	4160/7200Y x 14400/24900Y
272	4800/8320Y x 7200/12470Y
273	4800/8320Y x 7620/13200Y
275	4800/8320Y x 7970/13800Y
277	4800/8320Y x 14400/24940Y
280	7200/12470Y x 19920/34500Y
281	7620/13200Y x 19920/34500Y
282	7970/13800Y x 19920/34500Y

301 – 350	E1 Grd Y/E x E1 Grd Y/E *
310	3740 GrdY/2160 x 13200 GrdY/7620
315	4160 GrdY/2400 x 12470 GrdY/7200
316	4160 GrdY/2400 x 13200 GrdY/7620
317	4160 GrdY/2400 x 13800 GrdY/7970
325	8320 GrdY/4800 x 12470 GrdY/7200
326	8320 GrdY/4800 x 13200 GrdY/7620
327	8320 GrdY/4800 x 13800 GrdY/7970
330	12470 GrdY/7200 x 34500 GrdY/19920
331	13200 GrdY/7620 x 34500 GrdY/19920
332	13800 GrdY/7970 x 34500 GrdY/19920
333	13800 GrdY/7970 x 23900 GrdY/13800

401 – 425	(E/E_1 Y x E/E_1 Y x E/E_1 Y **
405	2400/4160Y x 7200/12470Y x 7620/13200Y
408	2400/4160Y x 7620/13200Y x 7970/13800Y
415	2400/4160Y x 7200/12470Y x 14400/24940Y
419	4800/8320Y x 7620/13200Y x 7970/13800Y
420	2400/4160Y x 7200/12470Y x 7970/13800Y

426 – 450	E_1 Grd. Y/E x E_1 Grd. Y/E x E_1 Grd. Y/E *
432	4160 GrdY/2400 x 13200 GrdY/7620 x 13800 GrdY/7970

451 – 460	E_1 Grd. Y/E x E_1 Grd. Y/E x E_1 Grd. Y/E x E_1 Grd. Y/E **

461 - 475	E_1 Grd Y/E x E_1 Grd Y/E x E_1 Grd Y/E x E_1 Grd Y/E *
465	3740 GrdY/2160 x 4160 GrdY/2400 x 13200 GrdY/7620 x 13800 GrdY/7970
500	Other

Supersedes 2/06 Issue – Deleted PDC 453 because this connection cannot be built

TABLE 2 – PRIMARY CODE (Continued)

THREE PHASE TRANSFORMERS (501 – 999) (Continued)

501 – 550	E	501 – 550	E
505	480	532	12470
507	600	533	13200
515	2400	534	13500
520	4160	535	13800
523	4800	537	14400
525	8320	540	22900
529	11000	542	23900
530	11500	545	34500

551 – 575	E_1Y

576 – 600	E x 2E
580	2400 x 4800
592	11500 x 23000

601 – 635	E x E_2
605	2400 x 4160
610	2400 x 13200
612	2400 x 13800
614	3740 x 13200
616	4160 x 12470
617	4160 x 13200
619	4160 x 13800
621	4800 x 8320
622	4800 x 13200
623	4800 x 13800
624	8320 x 12470
630	13800 x 22860

636 – 650	E/E_1 Y
640	2400/4160Y

651 – 675	E_1 Y/E
652	4160Y/2400

676 – 725	E_1 Grd Y/E
682	4160 GrdY/2400
684	4330 GrdY/2500
690	12470 GrdY/7200
691	13200 GrdY/7620
693	13800 GrdY/7970
695	22900 GrdY/13220
700	24900 GrdY/14400
705	34500 GrdY/19920

726 – 740	E/E_1 Y/E
730	2400/4160Y/2400

750 - 755	E_2 x E_1 Grd Y/E
750	4800 x 13200 GrdY/7620

826 – 875	E_1 Grd Y/E x E_1 Grd Y/E
828	3740 GrdY/2160 x 13200 GrdY/7620
832	4160 GrdY/2400 x 12470 GrdY/7200
833	4160 GrdY/2400 x 13200 GrdY/7620
835	4160 GrdY/2400 x 13800 GrdY/7970
840	8320 GrdY/4800 x 12470 GrdY/7200
841	8320 GrdY/4800 x 13200GrdY/7620
843	8320 GrdY/4800 x 13800 GrdY/7970
860	12470 GrdY/7200 x 34500 GrdY/19920
861	13200 GrdY/7620 x 34500 GrdY/19920
862	13800 GrdY/7970 x 34500 GrdY/19920

876 – 900	E/E_1 Grd Y/E

901 – 925	E/E_1 Y x E x E_1 Y/E
905	2400/4160Y x 2400 x 13800Y/7970

926 – 950	E x E_2 x E_2
935	4160 x 4800 x 13200

951 – 970	T
951	4160T
955	12470T
957	13200T
959	13800T

971 – 990	T x T
971	4160T x 12470T
973	4160T x 13200T
975	4160T x 13800T
980	4800T x 13200T

990 – 999	Others
997	23000 x 34500
999	Other

Supersedes 7/13 Issue – Added Code 695

TABLE 3 – SECONDARY CODE

KEY:

(-) Voltage Nomenclature
E_1 = $\sqrt{3}$ E
E_2 = Any Value of E Other Than E, E_1, or 2E

SINGLE PHASE TRANSFORMERS (01 – 50)

01 – 09	E
01	120
02	240
05	480
07	600
08	14400

21 – 24	E x 2E
21	120 x 240
22	240 x 480
23	292 x 584
24	300 x 600

31 – 40	E/E_1 Y
31	120/208Y
32	265/460Y
33	277/480Y
34	4160/7200Y
35	2400/4160Y
36	4800/8320Y
37	7200/12470Y
38	7620/13200Y
39	7970/13800Y
40	12000/20780Y

44 – 46	E/E_1 Y x E/E_1 Y
44	2400/4160Y x 4800/8320Y
45	2400/4160Y x 7200/12470Y
46	2400/4160Y x 7620/13200Y

10 – 15	E/2E
10	120/240
11	115/230
12	240/480
14	292/584

25 – 30	E x E_2
26	277 x 600
27	300 x 650
28	480 x 600
30	600 x 2400

41 – 43	E_1 Grd Y/E
41	13200 GrdY/7620
42	4160 GrdY/2400

47 – 50	Others
47	120/240/208
48	2400/4160Y x 4160/7200Y
49	120/240/480/600
50	Other

16 – 20	2E/E
16	240/120
17	480/240

THREE PHASE TRANSFORMERS (51 – 99)

51 – 57	E
52	480
53	600
54	2400
55	4800
56	11500
57	13800

61 – 65	E x 2E
61	240 x 480
63	2400 x 4800

69 – 71	E/E_1 Y
70	7200/12470Y
71	4360Y/2520

72 – 78	E_1 Y/E
72	216Y/125
73	208Y/120
74	480Y/277
75	4160Y/2400
76	13200Y/7620
77	13800Y/7970
78	600Y/346

79 – 82	E_1 Grd Y/E
79	4160 GrdY/2400
80	12470 GrdY/7200
81	13200 GrdY/7620
82	13800 GrdY/7970

83 – 85	E/E_1 Y/E
83	2400/4160Y/2400

86-87	E_1 Grd Y/E
86	11500 GrdY/6640
87	22900 GrdY/13220

90 – 94	T
91	208T/120
92	480T/277
93	480T x 240T
94	600T

95 – 99	OTHERS
95	120 x 240/208Y
96	480Y/277 x 208Y/120
97	600 x 2400 x 4800
98	480Y/277 x 600Y/346
99	600 x 2400

Supersedes 7/20 Issue – Addition of new codes 57 and 87

TABLE 4 – TAP CODE

KEY:

A = Taps Above Primary Nameplate Rating
B = Taps Below Primary Nameplate Rating

* Codes 14, 21 and 22 replaced actual codes in GIS prior to 5/20/2011 and are only used to reference GIS records preceding that date. All codes are now valid for use in GIS.

** Junk Codes (see Section 40.20)

00	**None**
01	1 - 2½ A
02	2 - 2½ A
04	4 - 2½ A
11	1 - 2½ B
12	2 - 2½ B
13	3 - 2½ B
14	4 - 2½ B
15	5 - 2½ B
21	1 - 2½ A + 3 - 2½ B
22	2 - 2½ A + 2 - 2½ B
23	3 - 2½ A + 1 - 2½ B
27	2 - 2½ A + 4 - 2½ B
29	4 - 2½ A + 2 - 2½ B
31	1 - 5 A
32	2 - 5 A
34	4 - 5 A
41	1 - 5 B
42	2 - 5 B
43	3 - 5 B
44	4 - 5 B
51	1 - 5 A + 2 - 2½ B
53	1 - 5 A + 1 - 5 B
61	1 - 10 A
65	1 - 10 B
72	4160 Volt
75	2520/2460/2400/2340/2280 Volt (Code 22*)
76	4360/4260/4160/4055/3590 Volt (Code 22*)
77	5040/4920/4680/4560 Volt **
78	8720/8520/8100/7900 Volt **
79	11275/11000/10725/10450/10175 Volt (Code 21*)
80	11800/11500/11200/10900/10600 Volt (Code 21*)
82	13090/12780/12470/12160/11850 Volt (Code 22*)
83	13200/12480/11500 Volt **
84	14400/13800/13200/12870/12540 Volt (Code 21*)
85	13860/13530/13200/12870/12540 Volt (Code 22*)
86	14400/14100/13800/13500/13200 Volt (Code 14*)
87	14400/14100/13800/13500/13200 Volt (Code 22*)
88	15600/15000/14400/13800/13200 Volt (Code 22*)
89	17200/16770/15910/15480 Volt **
90	14100/13800/13500/13200/12900 Volt (Code 21*)
92	23473/22900/22328/21755/21183 Volt (Code 21*)
94	36200/35300/34400/33500/32600 Volt (Code 22*)
96	36225/35363/34500/33638/32775 Volt (Code 22*)
98	14400/14040/13680/13320/12960 Volt (Code 14*)
99	Others

Supersedes 7/12 Issue – Update Tap Code 92

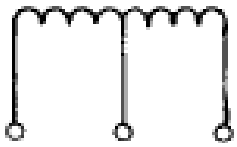
TABLE 5 – FUSE & SWITCH CODE (00 – 99)

00	None
01	Bayonet Fuse Holder (Loadbreak) With Expulsion Link Without Isolation Link Or Current Limiting Fuse
02	Bayonet Fuse Holder (Loadbreak) With Expulsion Link And With Isolation Link
04	Bayonet Fuse Holder (Loadbreak) With Current Limiting Fuse
05	Bayonet Fuse Holder (Loadbreak) With Expulsion Link And With Current Limiting Fuse Under Oil
07	Bayonet Fuse Holder (Loadbreak) With Expulsion Link Without Isolation Link Or Current Limiting Fuse And With Four Position Loadbreak Switch Under Oil
08	Bayonet Fuse Holder (Loadbreak) With Expulsion Link With Isolation Link And With Four Position Loadbreak Switch Under Oil
11	Drywell Canister (Loadbreak) With Current Limiting Fuse
12	Drywell Canister (Non-Loadbreak) With Current Limiting Fuse
21	Externally Mounted Hinge Type, Current Limiting Fuse
32	Current Limiting Fuse With Arc-Strangler Loadbreaking Device
33	Single Current Limiting Fuse (Clip Mounted) And Arc-Strangler Switchblade (Tandem-Unit Mounting)
34	Parallel Current Limiting Fuses (Clip Mounted) And Arc-Strangler Switchblade (Tandem-Unit Mounting)
35	Single Current Limiting Fuse (Hinge Mounted)
36	Parallel Current Limiting Fuse (Unitized-Hinge Mounted)
37	Single Current Limiting Fuse (Clip Mounted)
38	Parallel Current Limiting Fuse (Unitized-Clip Mounted)
51	Internal Weak Link Fuse Under Oil
53	Internal Weak Link Fuse Under Oil With Secondary Breaker
55	Secondary Breaker With No Internal Weak Link Fuse Under Oil
60	Two Position Loadbreak Switch Under Oil Without Fuse
61	Four Position Loadbreak Switch Under Oil Without Fuse
62	Four Position Loadbreak Switch Under Oil With Current Limiting Fuse
75	Three Position Deadbreak Switch With Two Electrical Interlocks Scheme
76	Three Position Mag Break Switch With Locked Energized Interlock Scheme
80	Network Protector
99	Other

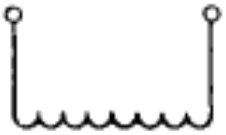
EXPLANATION OF VOLTAGE RATINGS

KEY:

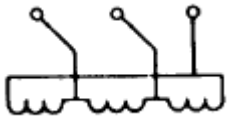
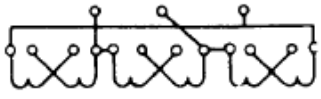
$E_1 = \sqrt{3}\ E$
E_2 = Any Value Of E Other Than E, E_1 or 2E

SINGLE PHASE TRANSFORMERS					
Primary Code Numbers	**Secondary Code Numbers**	**Symbol (Voltage)**	**Typical Rating**	**Typical Winding**	**Explanation**
001-025	01 - 09	E	34500		Indicates a winding for connection on an E volt system.
026-050	10 - 15	E/2E	120/240		Indicates a winding for multiple, series or three-wire service.
051-075	16 - 20	2E/E	240/120		Indicates a winding for 2E volts, two-wire full kVA, or for 2E/E volts three-wire service with one-half kVA available from mid-point to each outside terminal.
076-088	21 - 24	E x 2E	1200 x 2400		Indicates a winding for multiple or series operation only. (Not for three-wire service).
089-100	25 - 30	E x E_2	22000 x 33000		
101-150	31 - 40	E/E_1 Y	2400/4160 Y		Indicates a winding for connection on an E volt system or Y connection on an E_1 volt system.

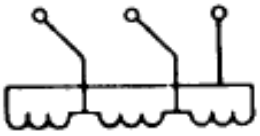
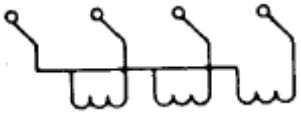
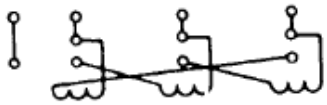
EXPLANATION OF VOLTAGE RATINGS (Continued)

SINGLE PHASE TRANSFORMERS (Continued)					
Primary Code Numbers	**Secondary Code Numbers**	**Symbol (Voltage)**	**Typical Rating**	**Typical Winding**	**Explanation**
151-200	41 - 43	E_1 GrdY/E	124700 GrdY/7200		Indicates a winding with reduced insulation at the neutral end. The neutral end may be connected directly to the tank for connection single phase or in Y on an E_1 volt system with the neutral end of the winding effectively grounded.
201-250	--	E/E_1Grd Y	7620/13200 Grd Y		Indicates a winding with reduced insulation for Y connection on an E_1 volt system with the transformer neutral effectively grounded or for connection on an E volt system.
251-300	44 - 45	E/E_1 Y x E/E_1 Y	2400/4160 Y x 7200/12470 Y		Indicates a winding for connection on an E volt system of Y connection on an E_1 volt system.
301-350	--	E_1 Grd Y/E x E_1 Grd Y/E	4160 Grd Y/2400 x 12470 Grd Y/7200		Indicates a winding with reduced insulation of the neutral end. The neutral end may be connected directly to the tank for connection single phase or in Y on an E_1 volt system with the neutral end of the winding effectively grounded.
401-425	--	E/E_1 Y x E/E_1 Y x E/E_1 Y	2400/4160 Y x 7200/12470 Y x 7620/13200 Y		Indicates a winding for connection on an E volt system or Y connection on an E_1 volt connection.

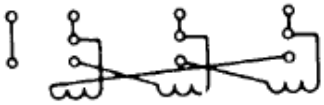
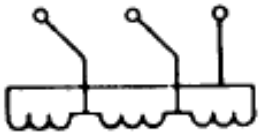
EXPLANATION OF VOLTAGE RATINGS (Continued)

SINGLE PHASE TRANSFORMERS (Continued)					
Primary Code Numbers	**Secondary Code Numbers**	**Symbol (Voltage)**	**Typical Rating**	**Typical Winding**	**Explanation**
426-450	--	E_1 Grd Y/E x E_1 Grd Y/E x E_1 Grd Y/E	4160 Grd Y/2400 x 12470 Grd Y/7200 x 13800 Grd Y/7970		Indicates a winding with reduced insulation at the neutral end. The neutral end may be connected directly to the tank for connection single phase or in Y on and E_1 volt system with the neutral end of the winding effectively grounded.
451-460	--	E/E_1 Y x E/E_1 Y x E/E_1 Y x E/E_1 Y	2400/4160 Y x 7200/12470 Y x 7620/13200 Y x 7970/13800 Y		Indicates a winding for connection on an E volt system or Y connection on an E_1 volt system.
461-475	--	E_1 Grd Y/E x E_1 Grd Y/E x E_1 Grd Y/E x E_1 Grd Y/E	3740 Grd Y/2160 x 4160 Grd Y/2400 x 13200 Grd Y/7620 x 13800 Grd Y/7970		Indicates a winding with reduced insulation at the neutral end. The neutral end may be connected directly to the tnak for connection single phase or in Y on an E_1 volt system with the neutral end of the winding effectively grounded.
(i) THREE PHASE TRANSFORMERS					
501-550	51 - 57	E	11500		Indicates a winding permanently connected.
551-575	58 - 60	E_1 Y	4160 Y		Indicates a winding permanently Y connected with the neutral isolated.
576-600	61 - 65	E x 2E	2400 x 4800		Indicates a permanently connected winding for multiple or series operation.

EXPLANATION OF VOLTAGE RATINGS (Continued)

THREE PHASE TRANSFORMERS (Continued)					
Primary Code Numbers	**Secondary Code Numbers**	**Symbol (Voltage)**	**Typical Rating**	**Typical Winding**	**Explanation**
601-635	66 - 68	E x E_2	2400 x 13200		Indicates a winding permanently connected.
636-650	69 - 71	E/E_1 Y	2400/4160 Y		Indicates a winding for connection E volts or E_1Y volts with the neutral isolated.
651-675	72 - 77	E_1 Y/E	4160 Y/2400		Indicates a winding permanently Y connected with fully insulated neutral available.
676-725	78 - 82	E_1 Grd Y/E	13800 Grd Y/7970		Indicates a winding having reduced insulation and permanently Y connected with the transformer neutral grounded.
726-740	83 - 85	E/E_1 Y/E	2400/4160 Y/2400		Indicates a winding for connection E volts or E_1Y volts with a fully insulated neutral available.
750	73 - 74	E_2 x E_1 Grd Y/E	4800 x 13200 GrdY/7620		Indicates a winding for connection E_2 volts or E_1Y volts having a reduced insulation and permanently connected with the transformer neutral grounded.

EXPLANATION OF VOLTAGE RATINGS (Continued)

THREE PHASE TRANSFORMERS (Continued)					
Primary Code Numbers	**Secondary Code Numbers**	**Symbol (Voltage)**	**Typical Rating**	**Typical Winding**	**Explanation**
826-875	--	E_1 Grd Y/E x E_1 Grd Y/E	4160 Grd Y/2400 x 13800 Grd Y/7970		Indicates a winding having reduced insulation and permanently Y connected with the transformer neutral grounded.
876-900	--	E/E_1 Grd Y/E	7970/13800 Grd Y/7970		Indicates a winding having reduced insulation for Y connection on an E_1 volt system with the transformer neutral grounded, or for connection on an E volt system.
901-925	--	E/E_1 Y/E x E_1 Y/E	2400/4160 Y/2400 x 13800 Y/7970		
926-950	--	E x E_2 x E_2	4160 x 4800 x 13200		Indicates a winding permanently connected.
951-970	90 - 94	T	13800 T		Indicates a primary winding consisting of two windings - the main and a teaser.
971-990	--	T x T	4160 T x 13800 T		Indicates a primary winding consisting of two windings - the main and a teaser.
991-999	95 - 99	Others -	Those Three Phase Transformers That Do Not Fall Into One Of The Classifications Above		

1. **NOTE VOLTAGE** marked on transformer nameplate and transformer tag. All changes to internal connections should be made in the shop.

2. **POLARITY DESIGNATION** - Additive has X1 on the right and H1 on the left as viewed from the secondary side. Subtractive has X1 and H1 on the left as viewed from the secondary side. Single phase transformers, 200 kVA and under having high voltage winding rated 8660 volts and below, have additive polarity. All other single phase transformers have subtractive polarity.

3. **SECONDARY CONNECTIONS**

   A. 120/240 (E/2E) and 240/480 (E/2E) can be connected for series, parallel or three wire operation. Transformers 100 kVA and below have three low voltage terminals and transformers 167 - 500 kVA have four low voltage terminals. See Figures 1 through 14.
   B. 240/120 (2E/E) can be connected for three wire or two wire operation, but not for parallel operation. Note - only one-half of the kVA rating available between center tap terminal and either extreme terminal. Three low voltage terminals are provided on all kVA sizes. See Figures 15 through 18.
   C. 292 x 584 (E x 2E) can be connected for series or parallel operation. Transformers will have four low voltage terminals on all kVA sizes. See Figures 8, 9, 11 and 12. This rating must be used with primary taps.
   D. 277/480 Y (E/E_1Y) and 600 (E) transformers have two low voltage terminals on all sizes. See Figures 19 through 21.

New single ratio overhead transformers for existing 600 V customers should be ordered 292 x 584 with primary taps so that 600 V can be obtained from the 584 volt connection. These transformers can also be used at 277 volts. Specify the 600 V rating for dual ratio transformers.

4. **100 kVA AND BELOW WITH E/2E VOLT SECONDARIES – PRIMARY 8660 VOLTS AND BELOW**

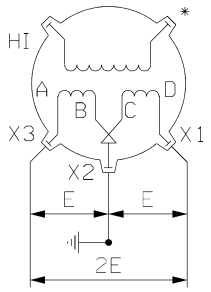


FIG. 1
(Three Wire)
Additive

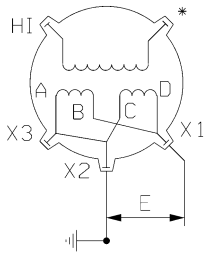


FIG. 2
(Parallel)
Additive

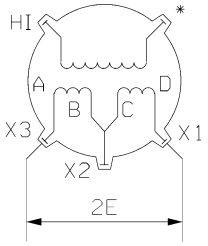


FIG. 3
(Series)
Additive

* Transformers with one primary bushing have other end of coil connected to the tank.

5. 100 kVA AND BELOW WITH E/2E VOLT SECONDARIES – PRIMARY ABOVE 8660 VOLTS

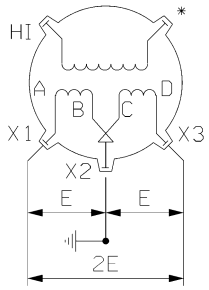


FIG. 4
(Three Wire)
Subtractive

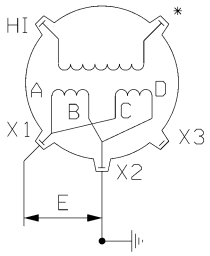


FIG. 5
(Parallel)
Subtractive

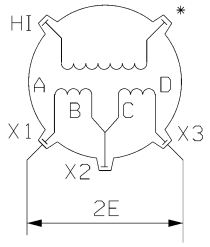


FIG. 6
(Series)
Subtractive

6. 167 kVA WITH E/2E AND 167 kVA AND BELOW WITH E X 2E VOLT SECONDARIES – PRIMARY 8660 VOLTS AND BELOW

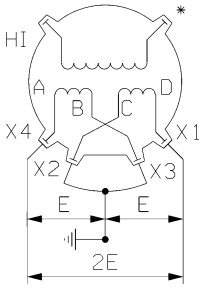


FIG. 7
(Three Wire)
Additive

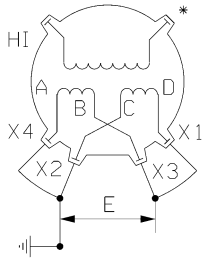


FIG. 8
(Parallel)
Additive

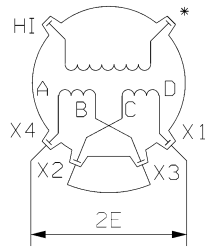


FIG. 9
(Series)
Additive

* Transformers with one primary bushing have other end of coil connected to the tank.

7. 167 kVA WITH E/2E AND 167 kVA AND BELOW WITH E X 2E VOLT SECONDARIES – PRIMARY ABOVE 8660 VOLTS

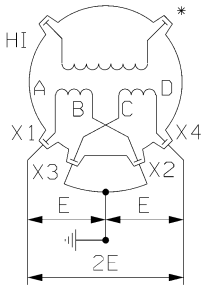


FIG. 10
(Three Wire)
Subtractive

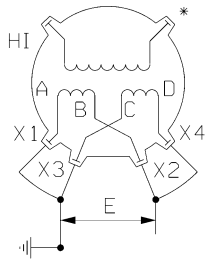


FIG. 11
(Parallel)
Subtractive

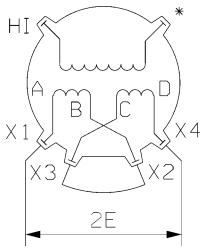


FIG. 12
(Series)
Subtractive

8. 250 – 500 kVA WITH E/2E AND E X 2E VOLT SECONDARIES – PRIMARY ABOVE AND BELOW 8660 VOLTS

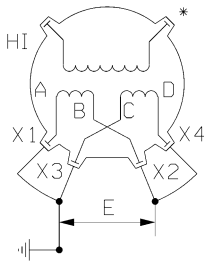


FIG. 13
(Parallel)
Subtractive

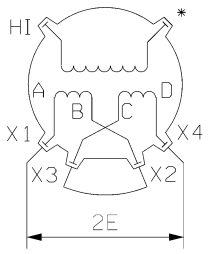


FIG. 14
(Series)
Subtractive

* Transformers with one primary bushing have other end of coil connected to the tank.

9. 167 kVA AND BELOW WITH 2E/E VOLT SECONDARIES

PRIMARY 8660 VOLTS AND BELOW

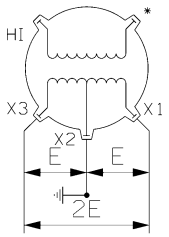


FIG. 15
(Three Wire)
Additive

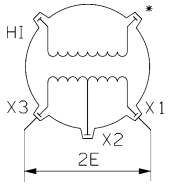


FIG. 16
(Two Wire)
Additive

PRIMARY ABOVE 8660 VOLTS

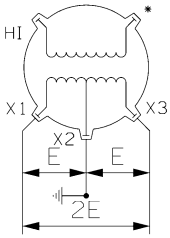


FIG. 17
(Three Wire)
Subtractive

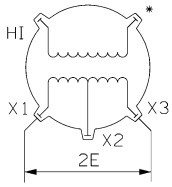


FIG. 18
(Two Wire)
Subtractive

10. 25 – 500 kVA WITH E OR E_1/Y VOLT SECONDARIES

25 – 167 kVA PRIMARY 8660 VOLTS AND BELOW

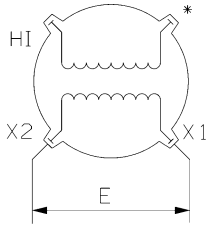


FIG. 19
Additive

250 – 500 kVA PRIMARY 8660 VOLTS AND BELOW

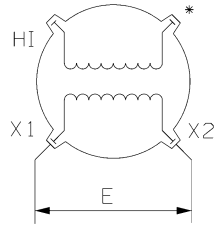


FIG. 20
Subtractive

25 – 500 kVA PRIMARY ABOVE 8660 VOLTS

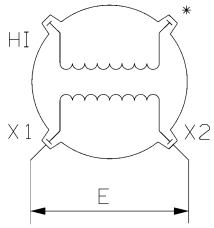
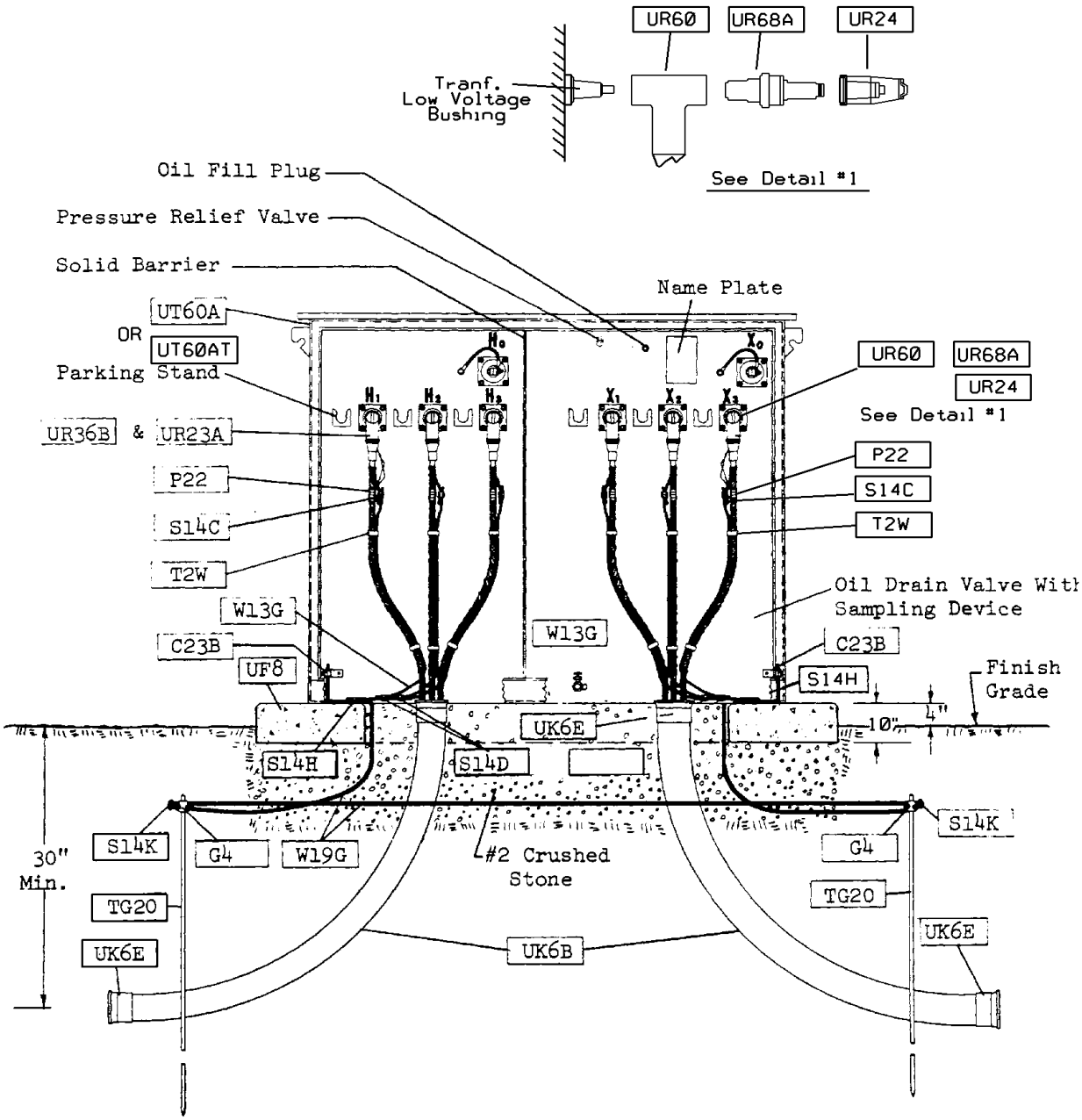
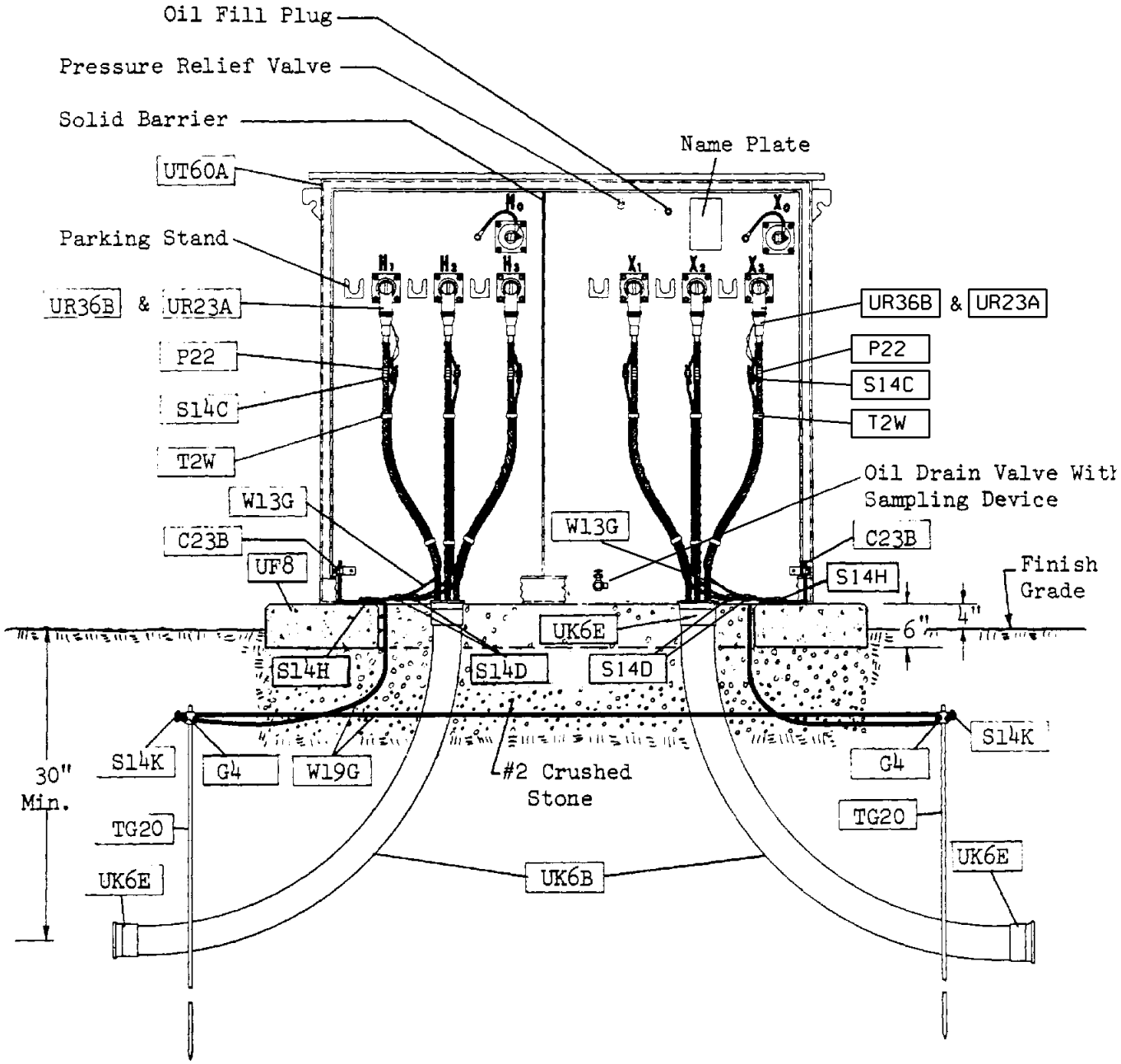


FIG. 21
Subtractive

Supersedes 1/07 Issue, Removed Cable Reference Lower Right



STEP-DOWN TRANSFORMER DETAIL 2,500kVA			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		40-101	7/08



STEPDOWN TRANSFORMER DETAIL 500-1,000kVA

ISSUE	PAGE NUMBER		
1/07	40-102	UNDERGROUND CONSTRUCTION STANDARD	ppl

Version	Date	Modification	Author(s)	Approval by (Name/Title)
6	7/20	• Update to text in section 40.16 • Add Section 40.21 Surge Arrester Table Application • Updated Pages 40-50 and 40-54, Physical Data Code Table		
5.1	03/20	• Added new secondary codes 56 and 86 to physical data code tables on page 40-54.		
5	07/15	• Revised text for 40.8 Grounding • Modified text for 40.13		
4	07/13	• Revised transformer codes for 40.20.20 (F) • Revised table codes for 40-51 & 40-53		
3	07/12	• Added process - Handling returned transformers • Modified text in Std 40-55 for Use Codes		
2	07/10	• Update PDC codes – Table 3 Page 40-54		
1	07/08	• Modified section 40.13. • Modified Figure 5 Title. • Added Type Code 11 and 31 and revised Type Code 18 description in Table 1. • Corrected Type Code 108 voltage and added Code 116 in Table 2. • Deleted PDC 453 because this connection cannot be built in Table 2. • Added Type Code 684 and removed *** from Type Code 529 in Table 2. • Added Type Code 78 in Table 3. • Removed cable reference in lower right on page 40-101.		

Supersedes 7/20 Issue – New section 41.9

41.0 GENERAL

When expanding, or developing new underground radial secondary systems the preferred way to serve a customer is from a pad mount transformer. When this is not feasible, a transformer vault may be used. In some systems, the underground secondary system is tied together creating a network system. In network systems, transformer vaults are also used for the transformers and associated equipment.

41.1 INSTALLATION REQUIREMENTS

Transformer vaults shall typically be in the sidewalk or ally way area. Other locations will require approval from the local operations area. Network vaults are available in two sizes based on the size of the network transformer and the associated equipment going into the vault.

For network transformers, up to 750kVA the minimum vault size shall be 8 feet by 20 feet by 11 feet high. For network transformers, up to 2,500kVA the minimum vault size shall be 10 feet by 22 feet by 12 feet high. Conventional network vaults have ventilation openings for cooling. In areas where grating ventilation is not feasible, a forced air ventilation style vault shall be used for cooling, see section 41.7.

For radial transformers, up to a total of 500kVA of transformation the minimum vault size shall be 10 feet by 22 feet by 7 feet 6 inches high.

Supersedes 7/15 Issue – Updates to text in 41.1.

41.2 TRANSFORMERS

Maximum transformer sizes allowed to be installed in transformer vaults will be three single phase 167 kVA transformers, for a total of 500 kVA. Transformers are to be subway type, which are available with or without bayonet fuses. Low profile single phase subway transformers are available in 25 and 50 kVA sizes. The network transformers are three phase and are available in five sizes from 500kVA to 2,500kVA.

41.3 PROTECTION

Subway transformers are required to be protected. The preferred choice is by a remotely located fuse in switchgear. If the use of switchgear is not feasible, a submersible style switch can be used. See Section 40 - Transformers for applications and Section 38 – Switches/Switchgear for various options. Subway transformers are available with bayonet fuses, except for the low-profile type. Low profile type subway transformers shall be installed off of a fused switch for protection. Subway transformers with load break elbows cannot be switched alive, see Section 38 – Switches/Switchgear for guidelines.

Network Transformers have protectors on the secondary to isolate them from the secondary grid. The high voltage side has either a mag-break or a dead-break switch. For details on the protectors and the switches see section 42.1.10 and 42.1.20 for proper application.

41.4 Entry

All vaults shall have two points of egress at opposite ends of the vault. Vaults that are greater than 8 feet deep, shall require ladders be installed to the wall, see figure 1. Existing vaults can be retrofitted with the ladder as well. The ladder is available in 14 (STD Item L14) and 18 (STD Item L18) foot lengths. Depending on the depth of the vault, the height of the ladder can be modified by cutting the excess height from the base of the ladder. The preferred installation is to have the ladder with a pitch; however existing infrastructure or lack of room in the vault may only allow vertical installation of the ladder. The lightweight Aluminum Ladders come with mounting bracket hardware kits with assemble instructions. For ladders installed at the sump hole end, ladder shall be located at least 6" away from corner of the sump pump hole.

All Ladders shall have an extendable rail (STD Item LU) attached as well. To use the ladder, pull the extendable rail upward until you hear a latching sound and the rail is locked in its open position. To release the rail, depress the yellow release handle and push the rail downward. See figures 2 and 3 for details.

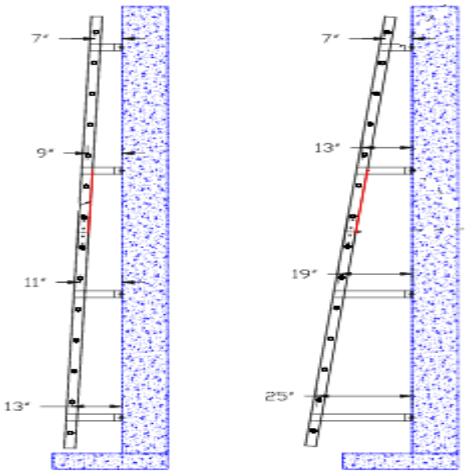


Figure 1

Figure 2

Figure 3

41.5 Sump Pump

Sump pumps are available for use in vaults to aid in minimizing water in the vaults. For new installations, work with the company's environmental engineer to determining the feasibility of the necessary required permitting for the discharge of the water. For existing sump pumps and new installations, all sump pumps shall be set inside the sump hole in a basket Std. Item UN6B with filter Std. Item UN6F or UN6F1. The pump and oil sensing probe shall be suspended just below the floor base of the vault inside the filter basket. The basket shall be bonded to the system neutral of the vault with a #4 solid copper Std. item W11F1 connected to the top part of the steel frame of the basket with connector Std. Item C18A. See figures 4, 5 and 6 of a typical installation.

Filter set into sump hole

Figure 4

Pump and oil sensor supported inside filter basket.

Figure 5

Sump discharge hose installed to drain and filter basket bonded.

Figure 6

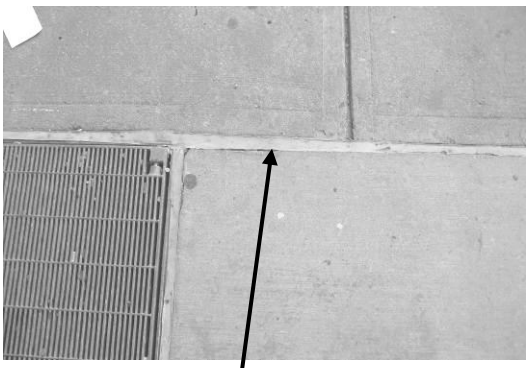
Supersedes 7/15 Issue_ Text Update in 41.4.

41.6 ROOF SECTION SEALING

Vault roof sections shall be sealed to minimize dirt and debris entry into the seam areas. To do this a sealant is installed between the seams. To prep the area to support the sealant, backer rod (Std. Item SBR_) in figure 7 shall be installed. To install this, it shall be pushed into the seam area between the sections. The backer rod is available in several thicknesses depending on the width of the seam. Once the backer rod is installed, a chalking sealant (Std. Item SBR) can be applied, see figure 8.

Backer rod Std. Items SBR__
Available in ¾", ½" and 3/8" thicknesses

Figure 7



Sealant Std. Item SBR4

Figure 8

41.7 VENTILATION

Transformer ventilation is critical to removing heat for a transformer to run efficiently. Typical natural ventilation requirement is 3 square inches of ventilated area for every kVA of transformation for installations in the street. The ventilation designs in this section for all the subway and network transformers meet this requirement. For building vault installations, refer to field engineering for specific requirements.

In some parts of the company where grating is not allowed, a forced air ventilation system can be installed. Refer to field engineering for ventilation requirements. Items such as of blowers, controls and vents are available, see Std. Items B30_ in the materials section; Figures 9 and 10 below shows vent pipes, blowers and a control. Details for installation of the vent stacks are shown in section 33.11.

Std. Item B30C and B30D ventilation stack pipes.

Figure 9

Std. Item B30B blower motor and explosion proof style B30E blower motor and control.

Figure 10

41.8 HATCH SECUREMENT

Several older hatches that are not equipped with a prefabricated locking method as the new hatch design. To secure the older style hatches a lock assembly can be fabricated by using a locking wire using (Std. Items W60) and ferrules (Std. Item W60S) as shown below in Figures 11 through 14.

Figure 11

Figure 12

Figure 13

Figure 14

41.9 EQUIPMENT SHIELDING

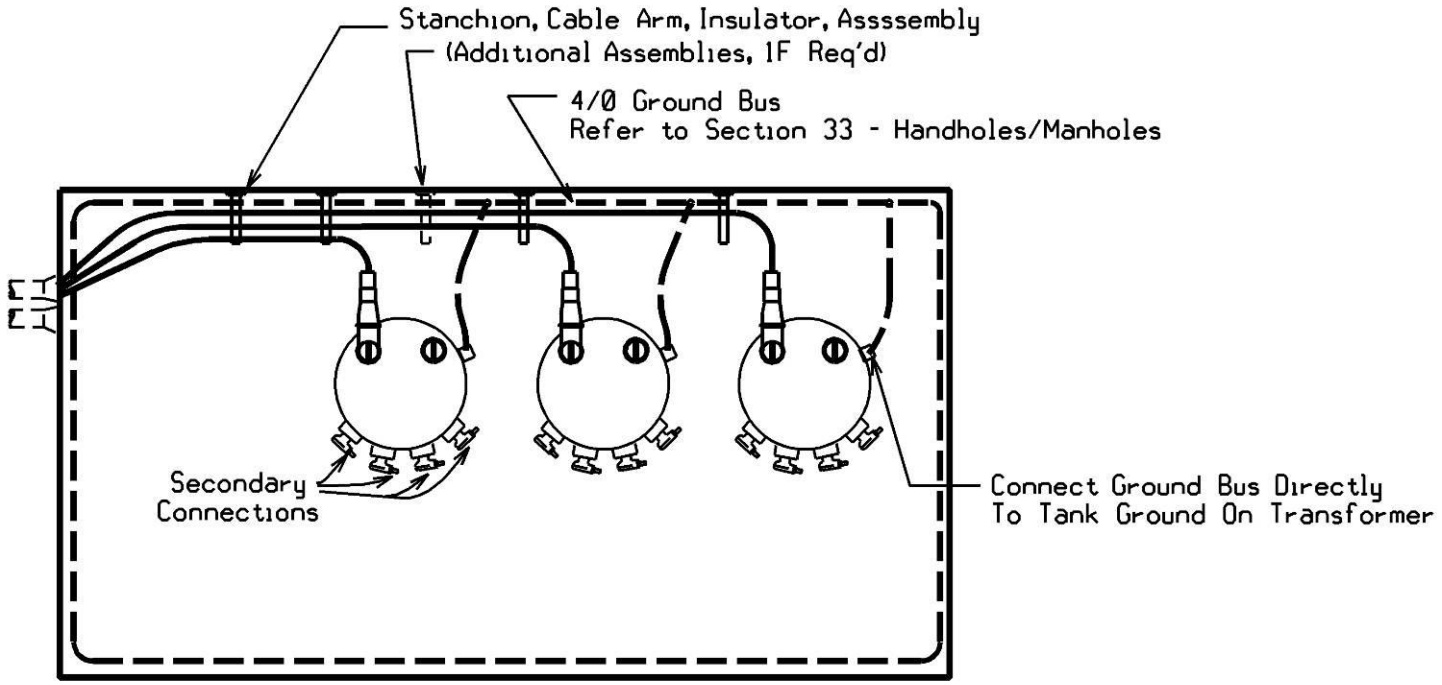
Legacy vault installations typically had grating directly over transformers and switches. This design allowed excessive debris and water to settle on top of the equipment. Over time this has impacted the longevity of the equipment.

In some locations where there is adequate clearance a shield is now available installation over the equipment for protection. The shield is a Lexan barrier (Std. item B55), the same product used in pad mount switchgear. It is set up as a 4x8 sheet that can be cut to fit the area where it is installed in. It can be supported with either carabiners/Kevlar straps or unistrut. An example of unistrut is shown below in figure 17. Detailed drawings are shown on 41-300.

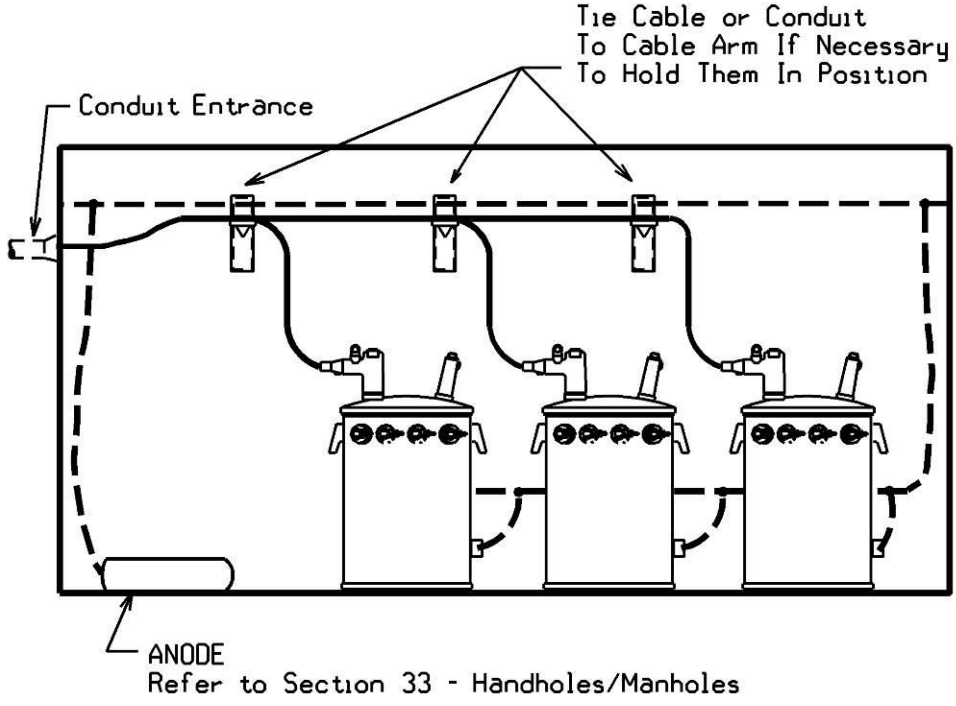
NOTE: the feasibility of the installation is dynamic as all vault installations are different. Ensure that there is a least a foot of separation between the equipment being protected for ventilation and the barrier is sloped to prevent debris from settling on top. After installation, it is advised to spot check the temperature on the equipment to ensure that the barrier has not caused the equipment to start to choke with the reduced ventilation.

Supersedes 7/15 Issue New Section 41.9.

Figure 17



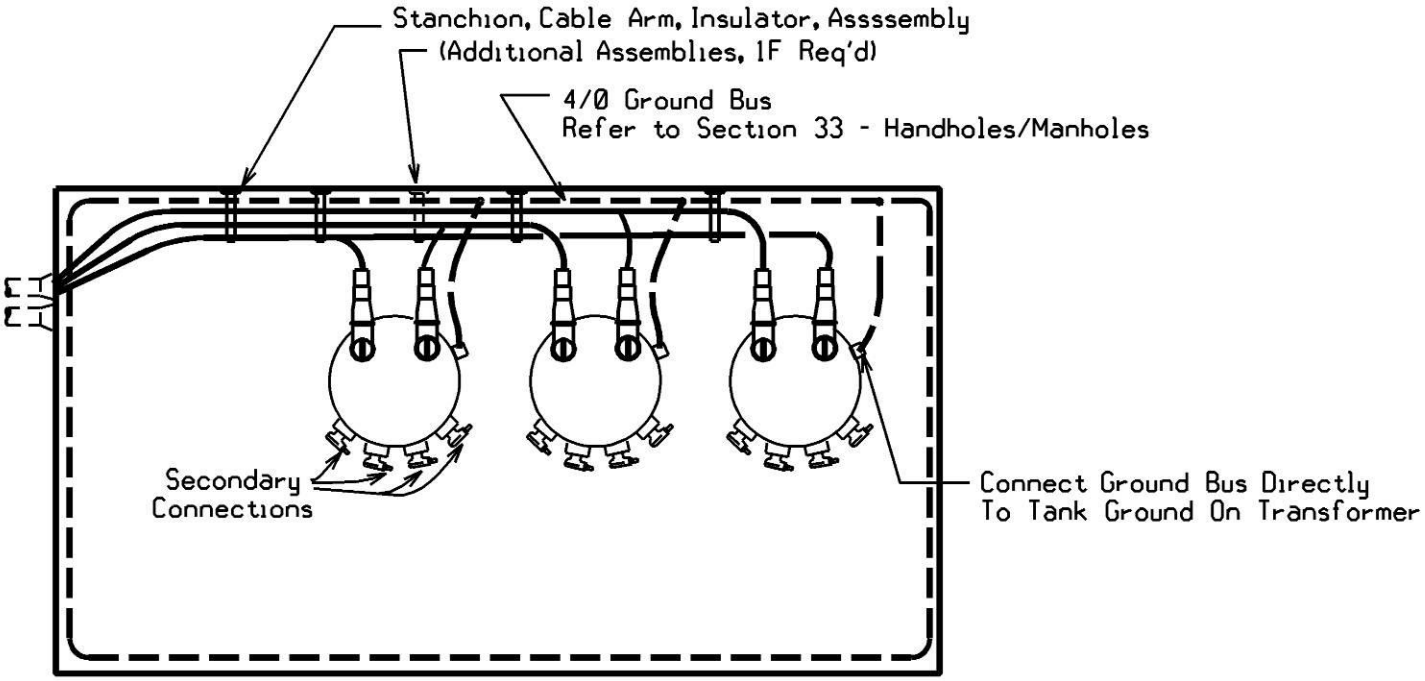
TOP VIEW



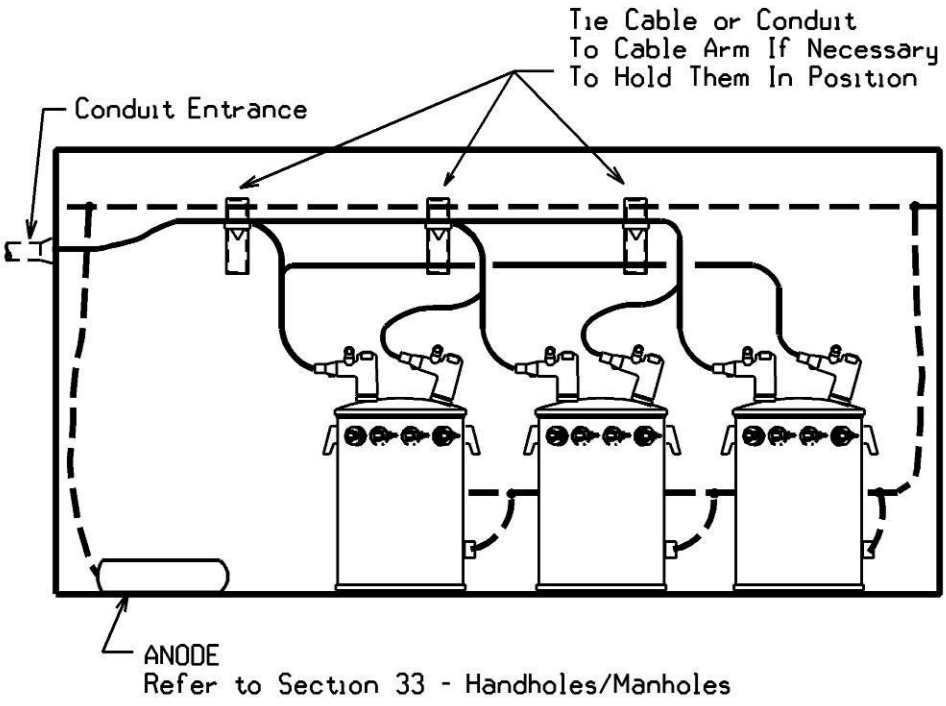
SIDE VIEW

Text Update in Title Block- Supersedes 2/06 issue.

TYPICAL VAULT CONFIGURATION WYE TRANSFORMER BANK			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER 41-100	ISSUE 7/12



TOP VIEW



SIDE VIEW

Text Update in Title Block- Supersedes Issue 2/06

TYPICAL VAULT CONFIGURATION DELTA TRANSFORMER BANK			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/12	**41-101**		

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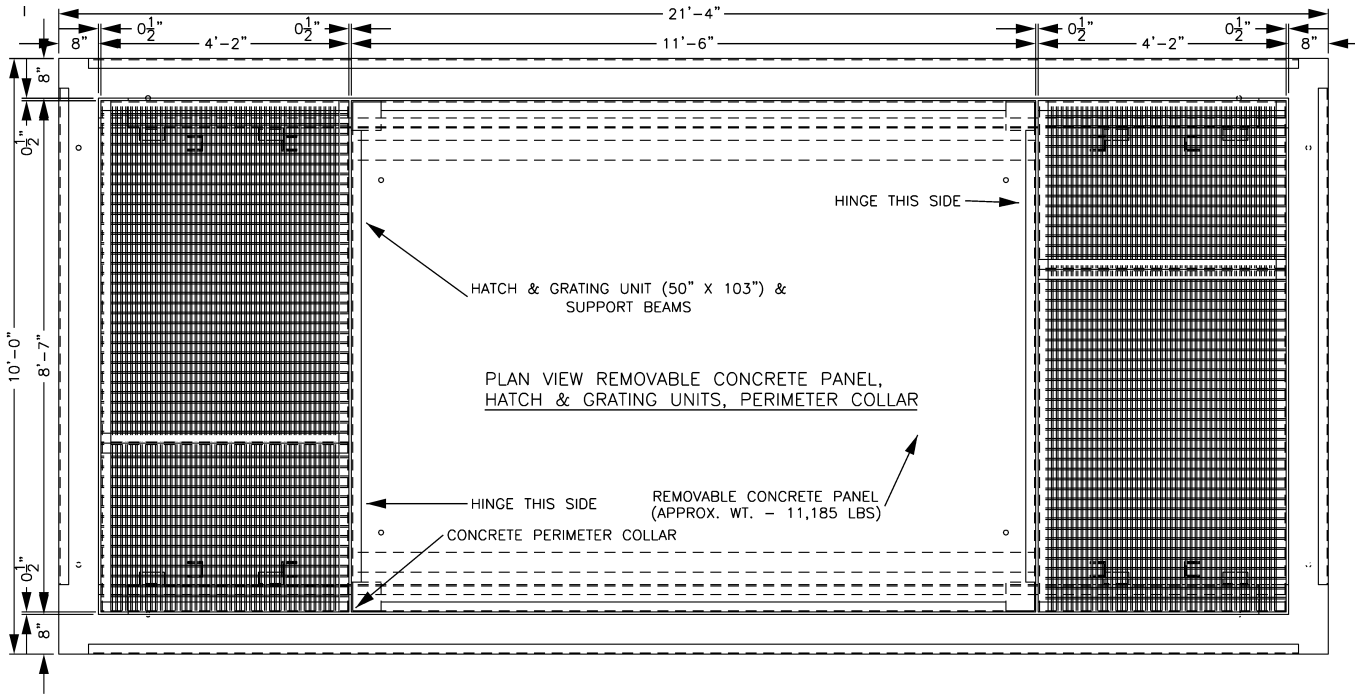
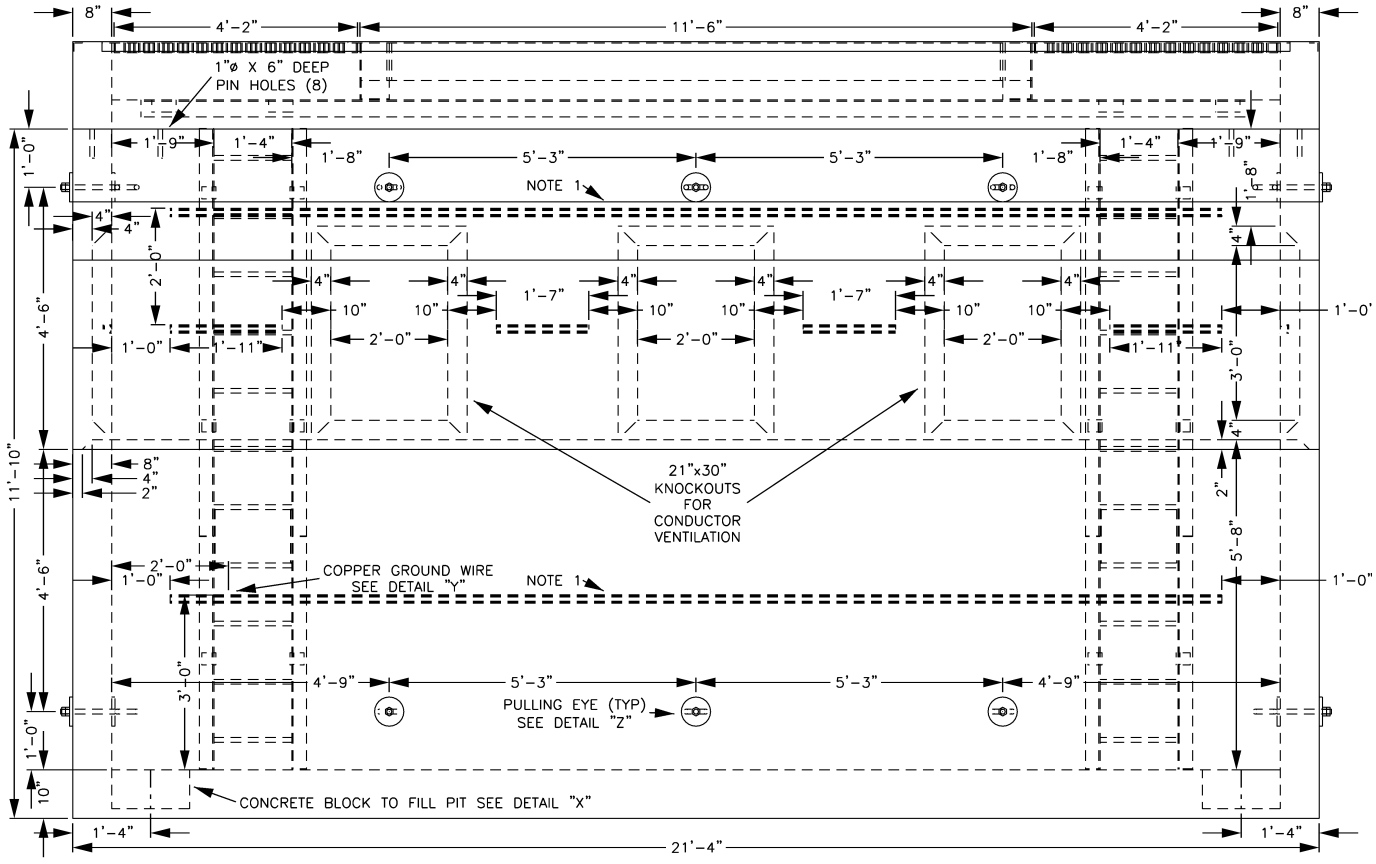
For complete details on this vault refer to MS3490 and MS3491

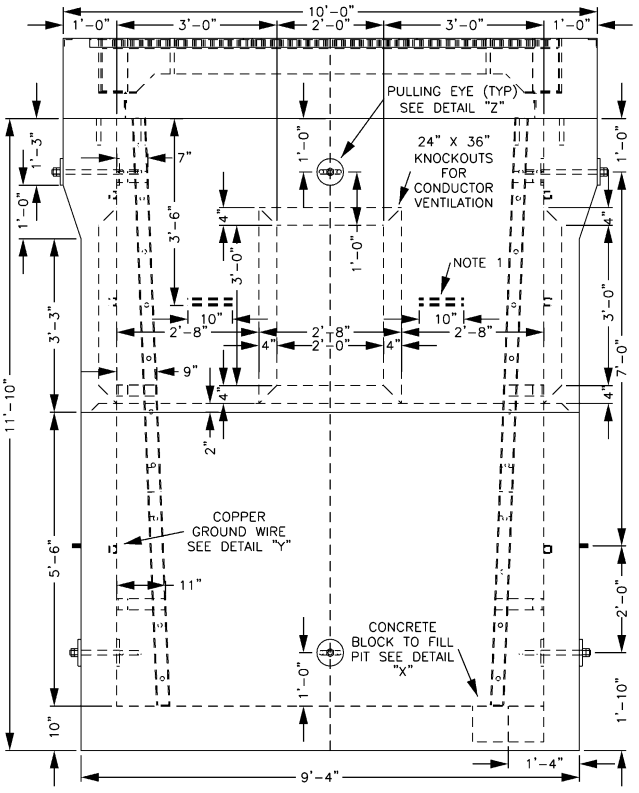




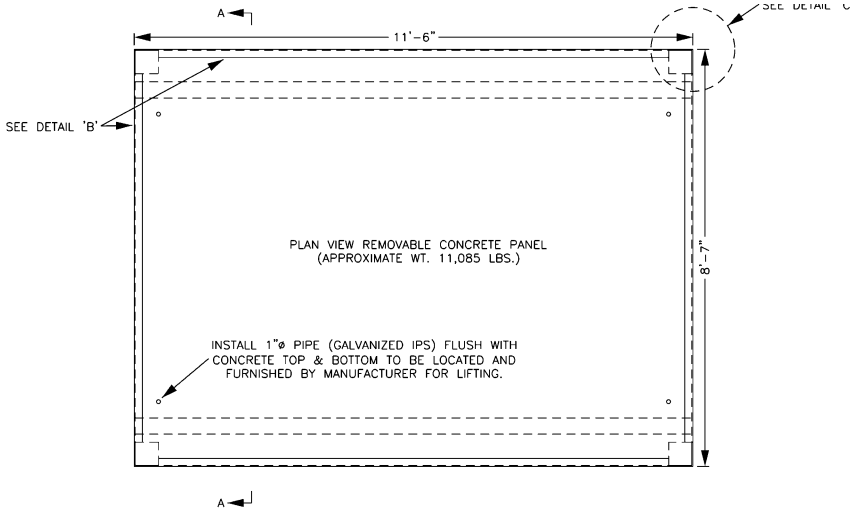
Elevation View

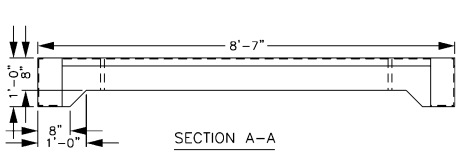
Supersedes 7/19 Issue – Drawings reformatted.

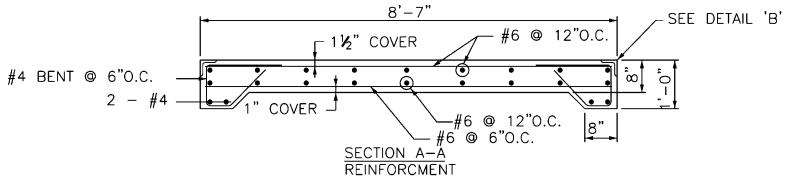
VAULT 8'X20'X11' FOR NETWORK TRANSFORMERS UP TO 750kVA			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/20	**41-200**		



Side Elevation View



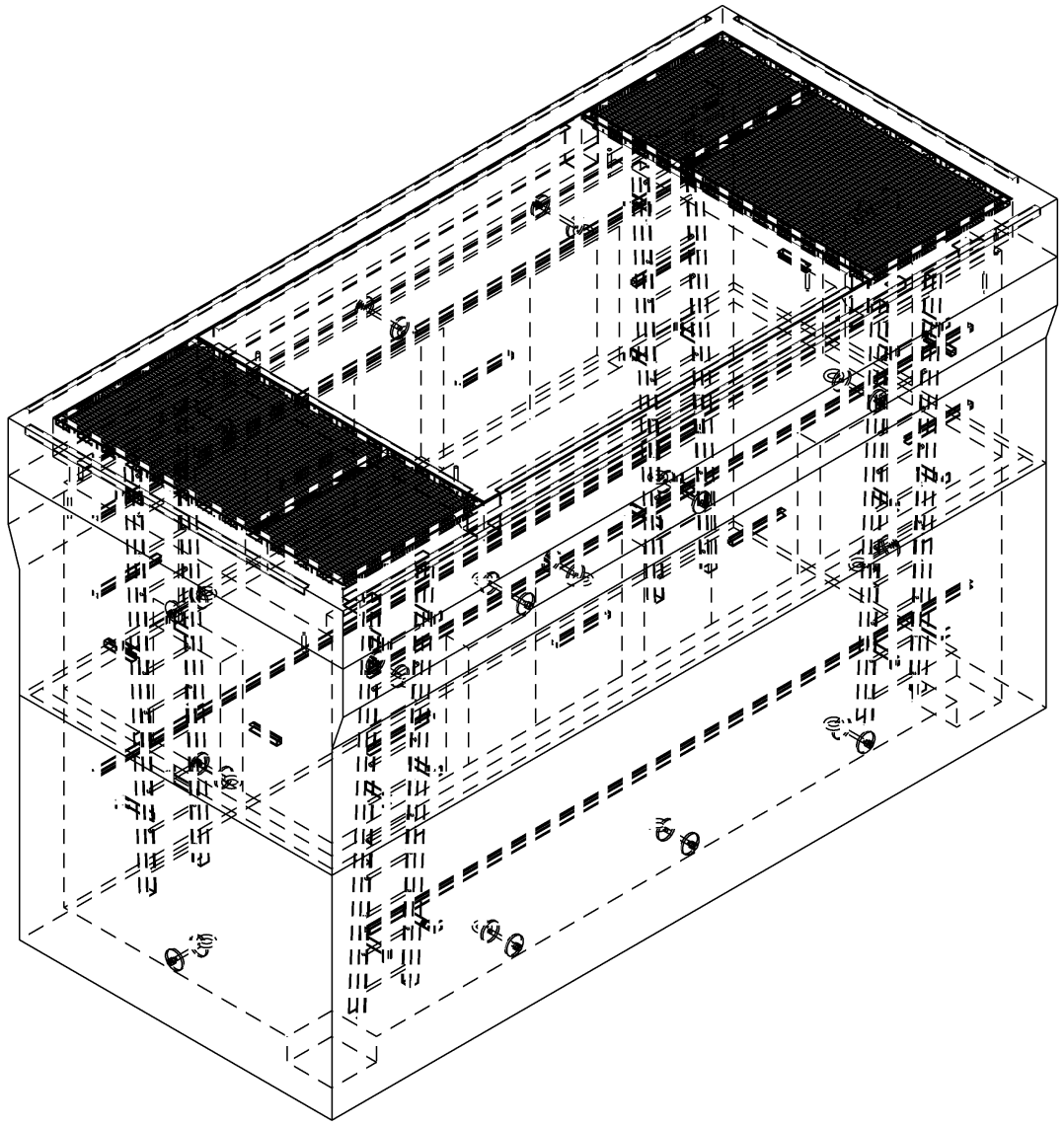




Roof Panel

VAULT 8'X20'X11' FOR NETWORK TRANSFORMERS UP TO 750kVA

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	41-201	7/20



Three D rendition of vault

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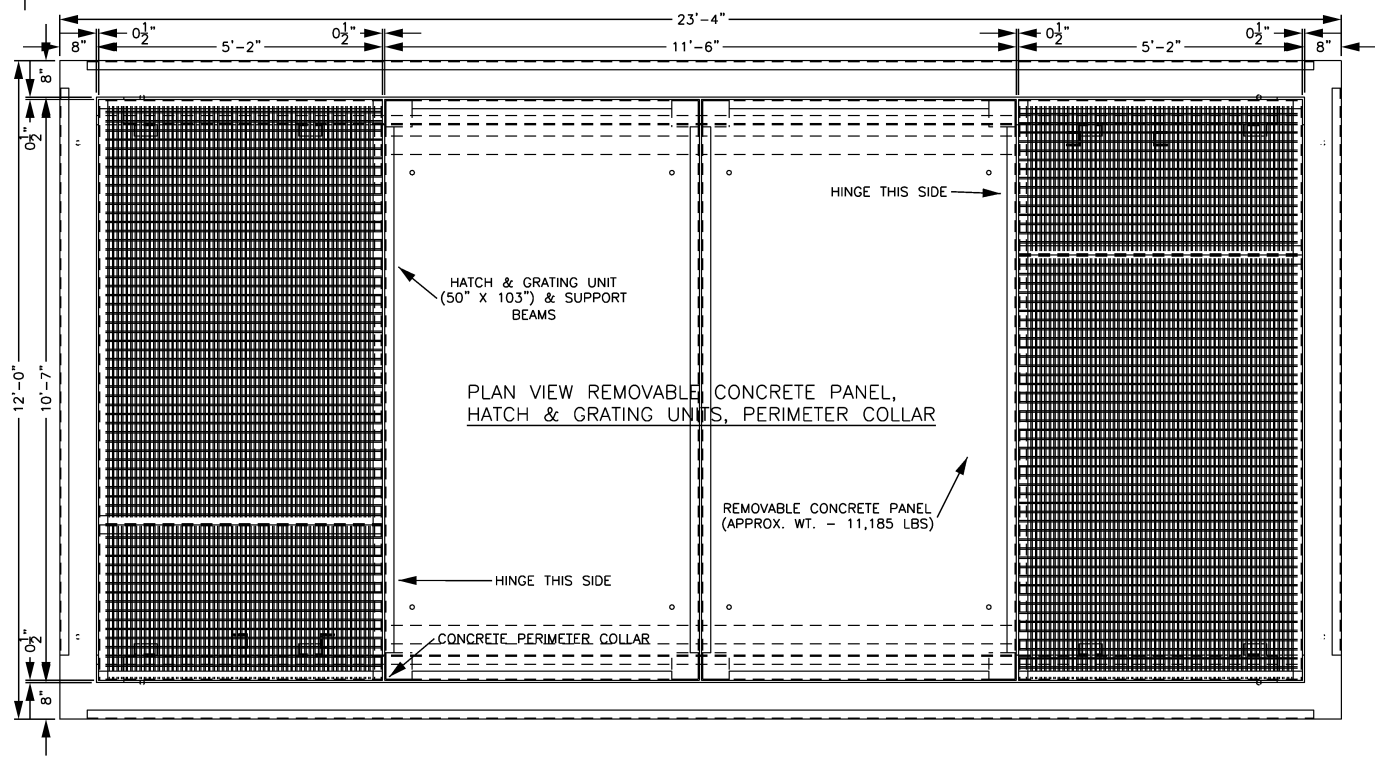
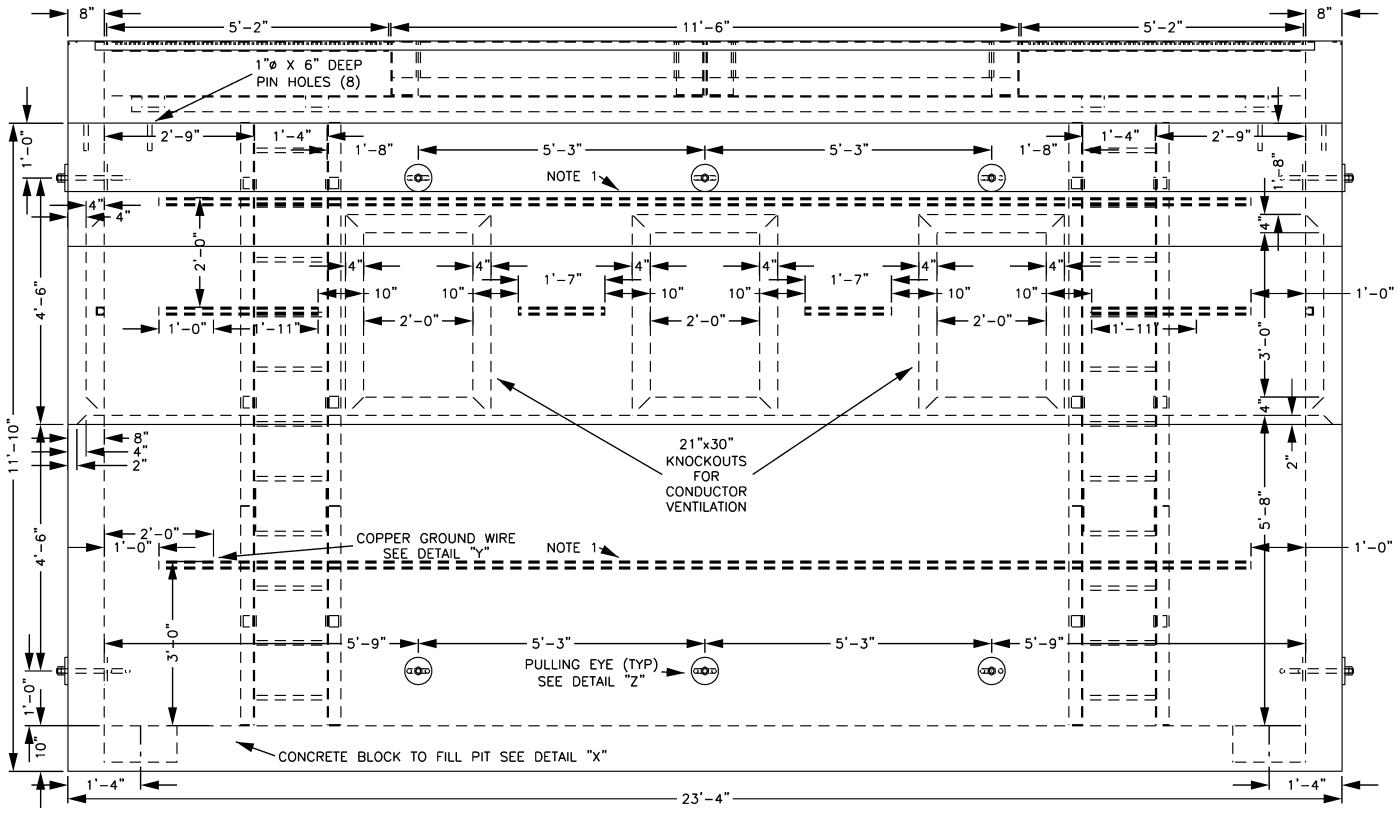
For complete details on this vault refer to MS3492 and MS3493

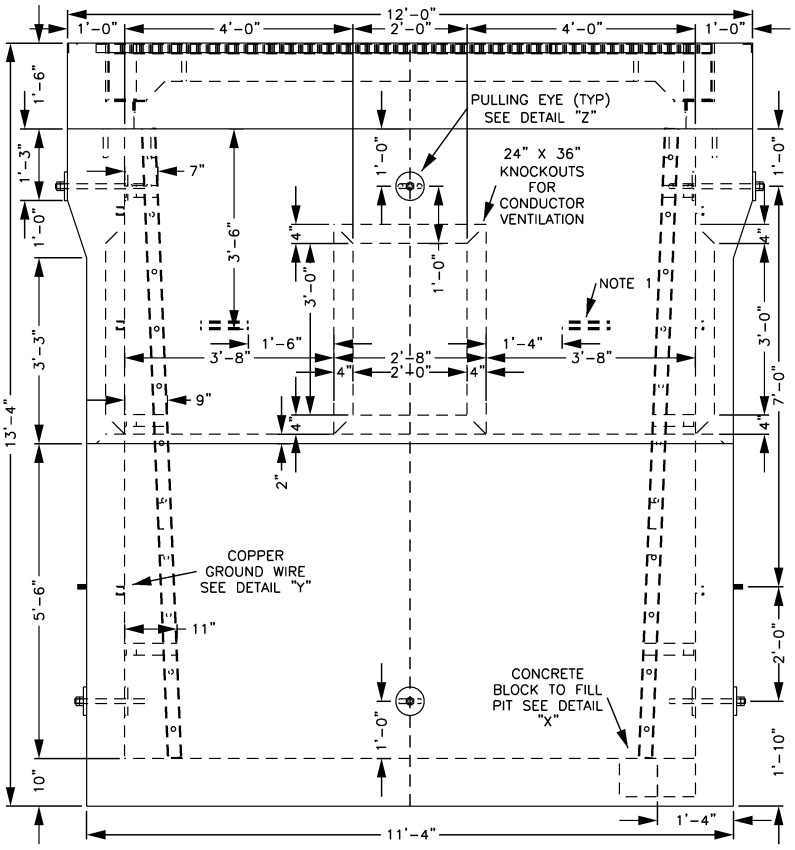




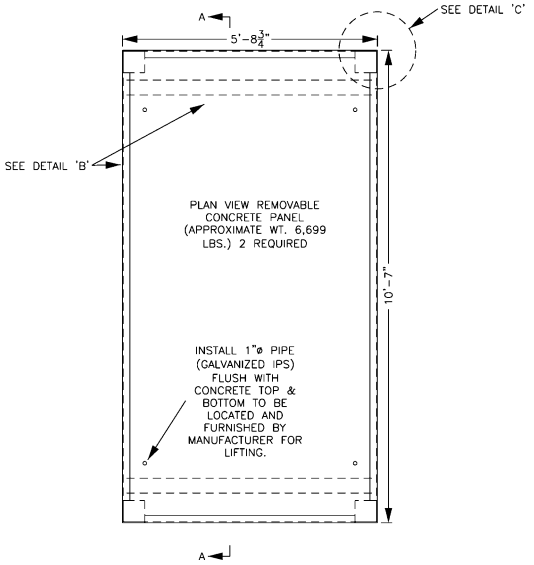
Elevation View

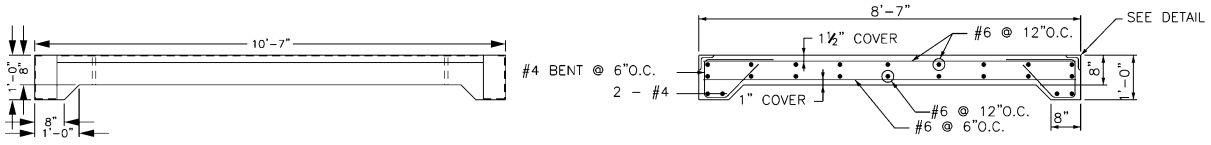
Supersedes 7/19 Issue – Drawing Reformatted.

VAULT 10'X22'X12' FOR NETWORK TRANSFORMERS UP TO 2,500kVA			
ISSUE	**PAGE NUMBER**		
7/20	**41-204**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl



Side Elevation View



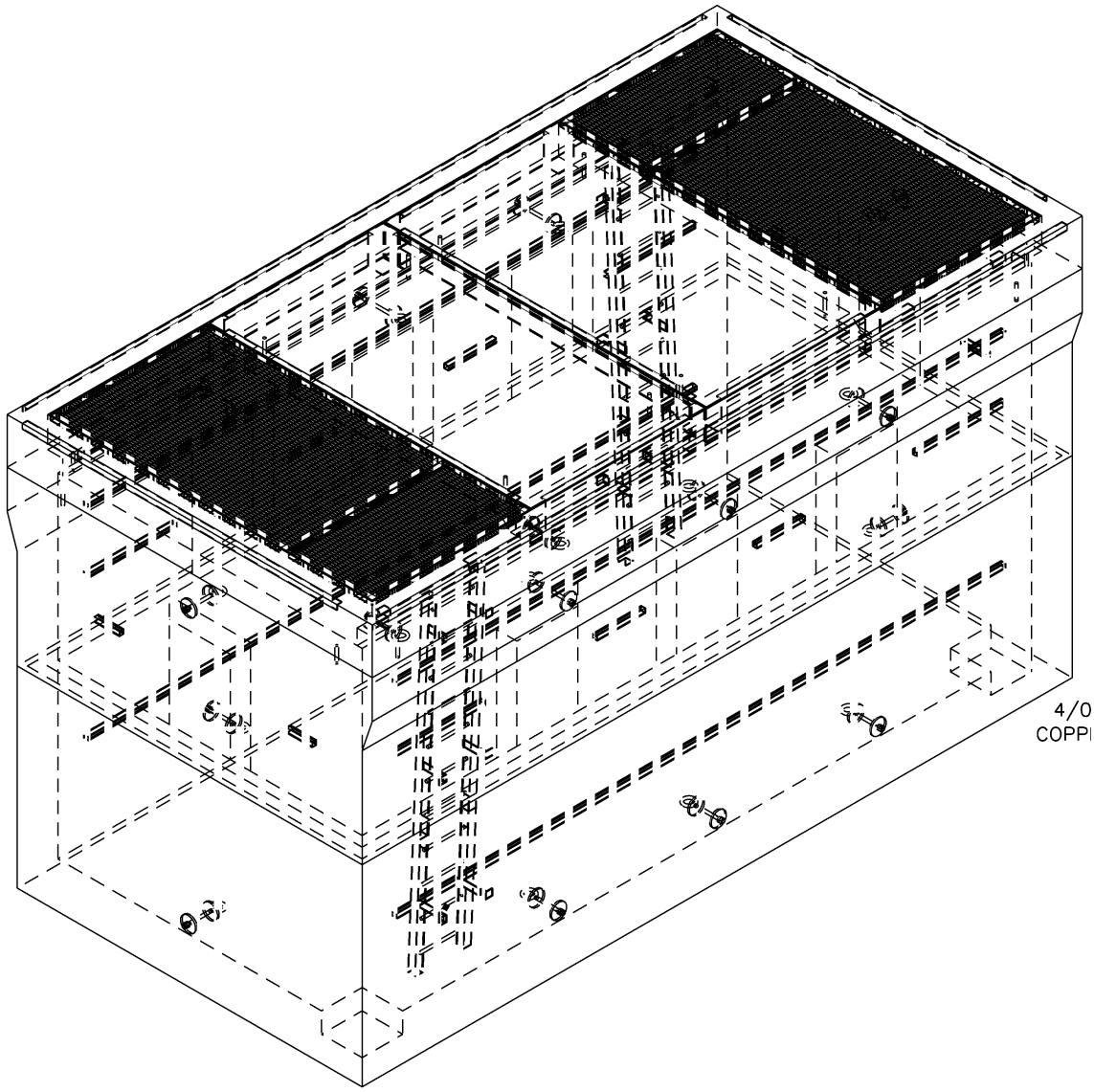


VAULT 10'X22'X12' FOR NETWORK TRANSFORMERS UP TO 2,500kVA

	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
ppl		41-205	7/20

Supersedes 7/19 Issue – Drawings reformatted.

Business Use



Three D rendition of vault.

Supersedes 7/19 Issue – Drawing Reformatted.

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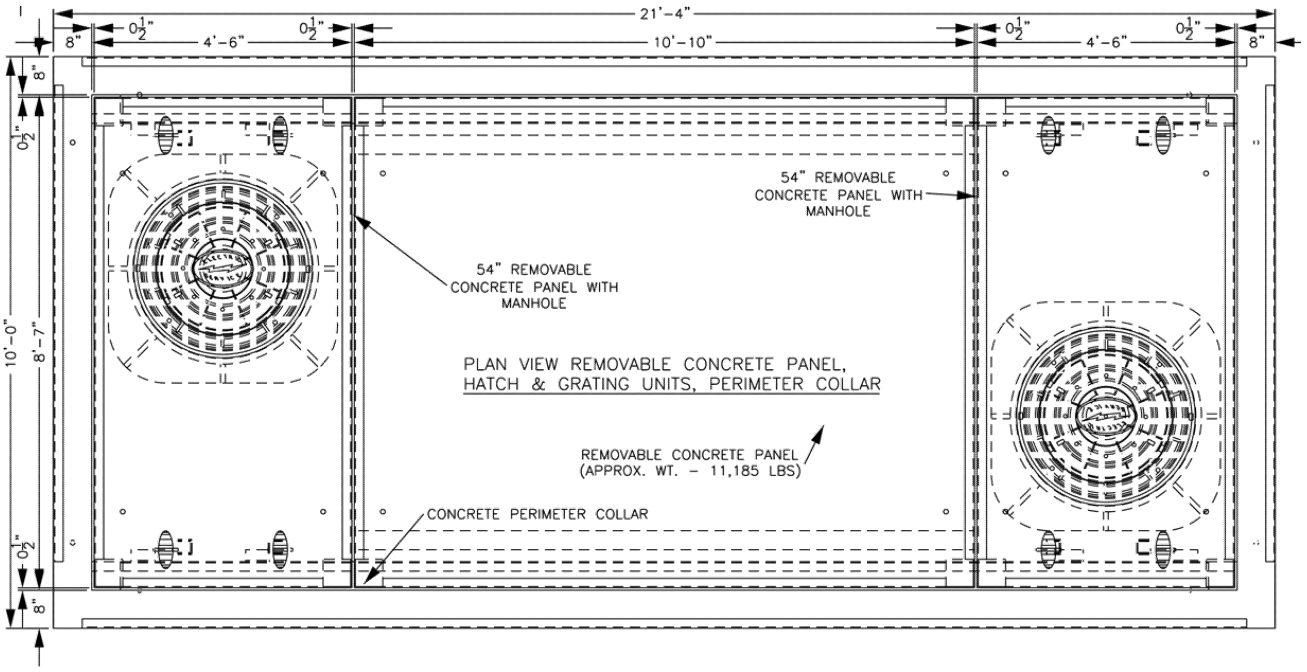
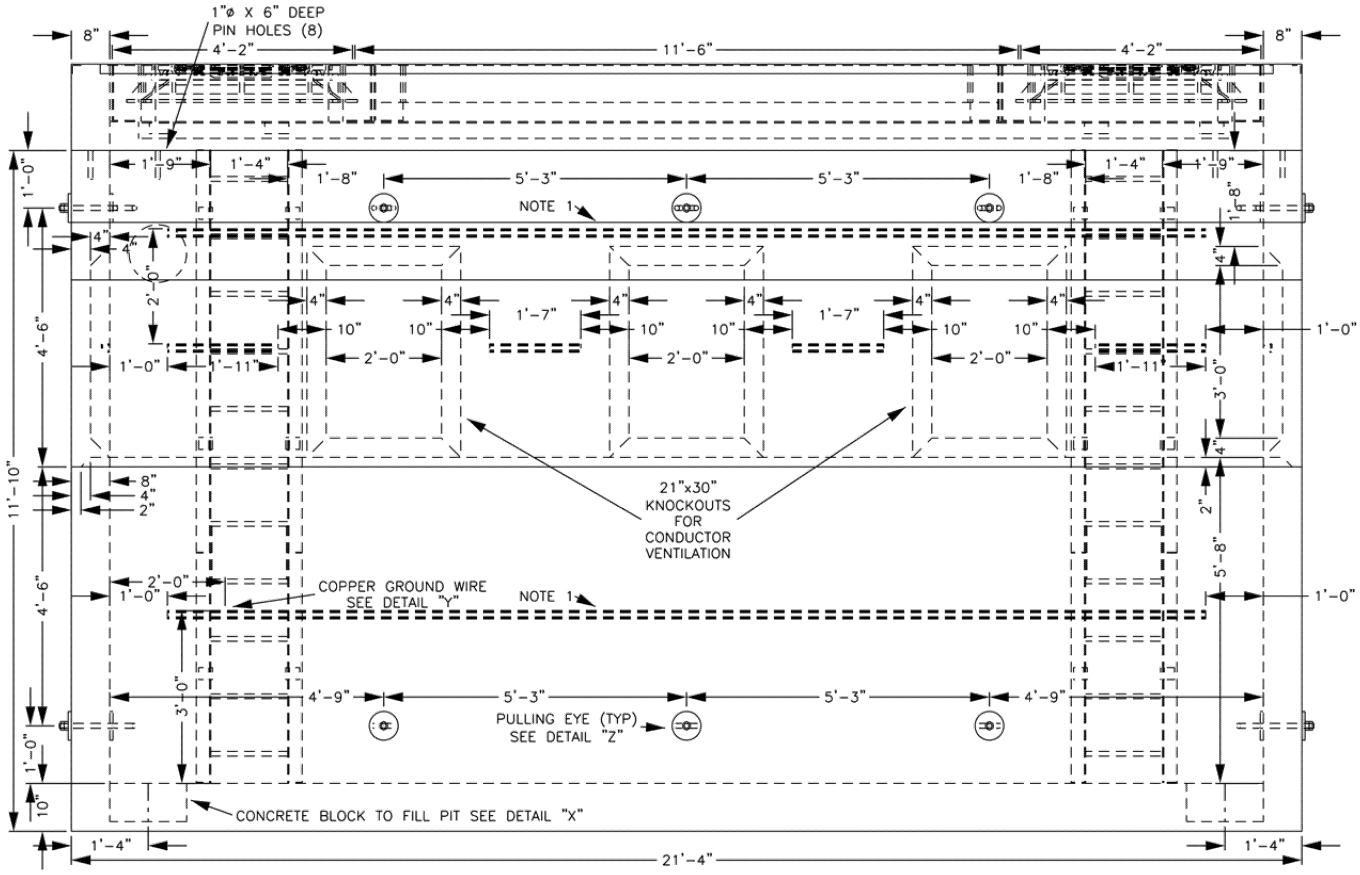
For complete details on this vault refer to MS3494

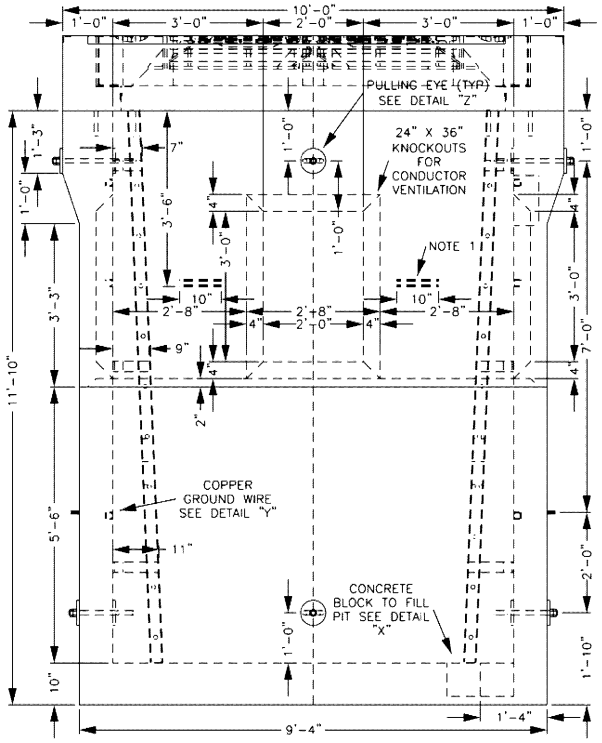




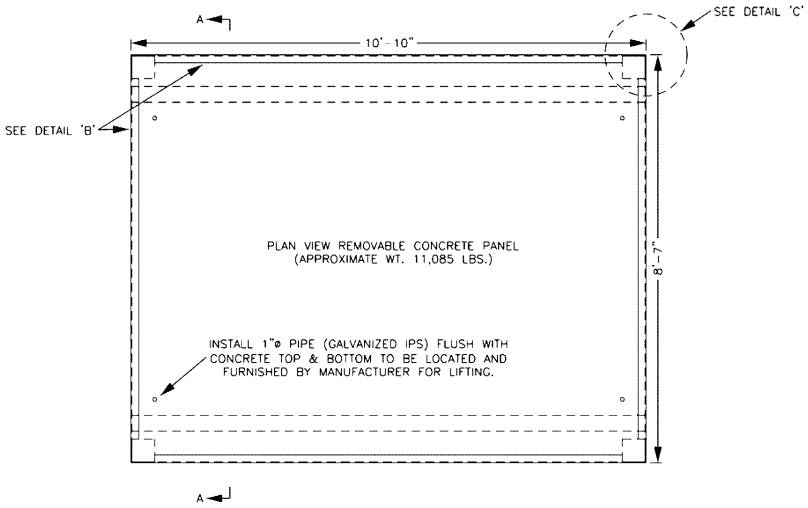
Elevation View

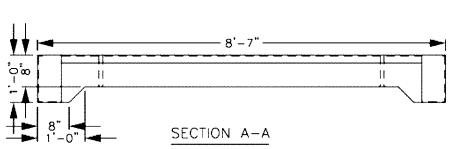
VAULT 8'X20'X11', FORCED VENTILATION (RHODE ISLAND), FOR NETWORK TRANSFORMERS UP TO 750kVA			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/20	**41-208**		

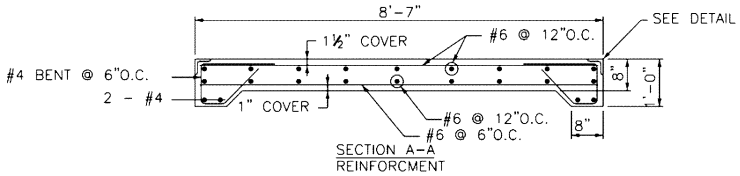
Supersedes 7/19 Issue – Drawing Reformatted.



Side Elevation View





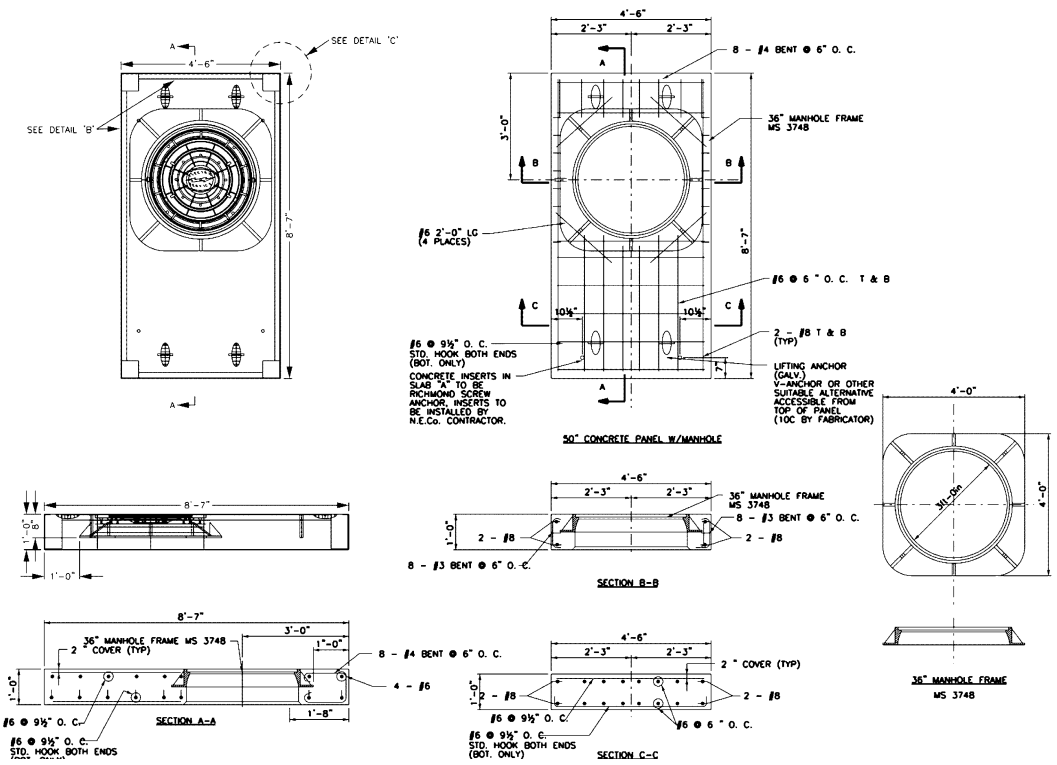


Panel Section

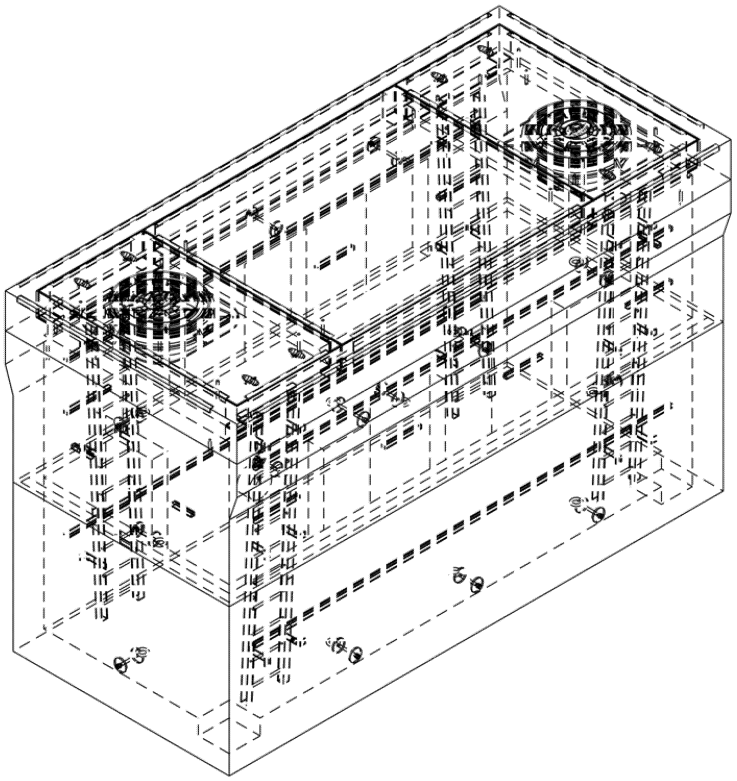
VAULT 8'X20'X11', FORCED VENTILATION (RHODE ISLAND), FOR NETWORK TRANSFORMERS UP TO 750kVA			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		41-209	7/20

Supersedes 7/19 Issue – Drawings reformatted.

Business Use



Manhole cover / frame panel

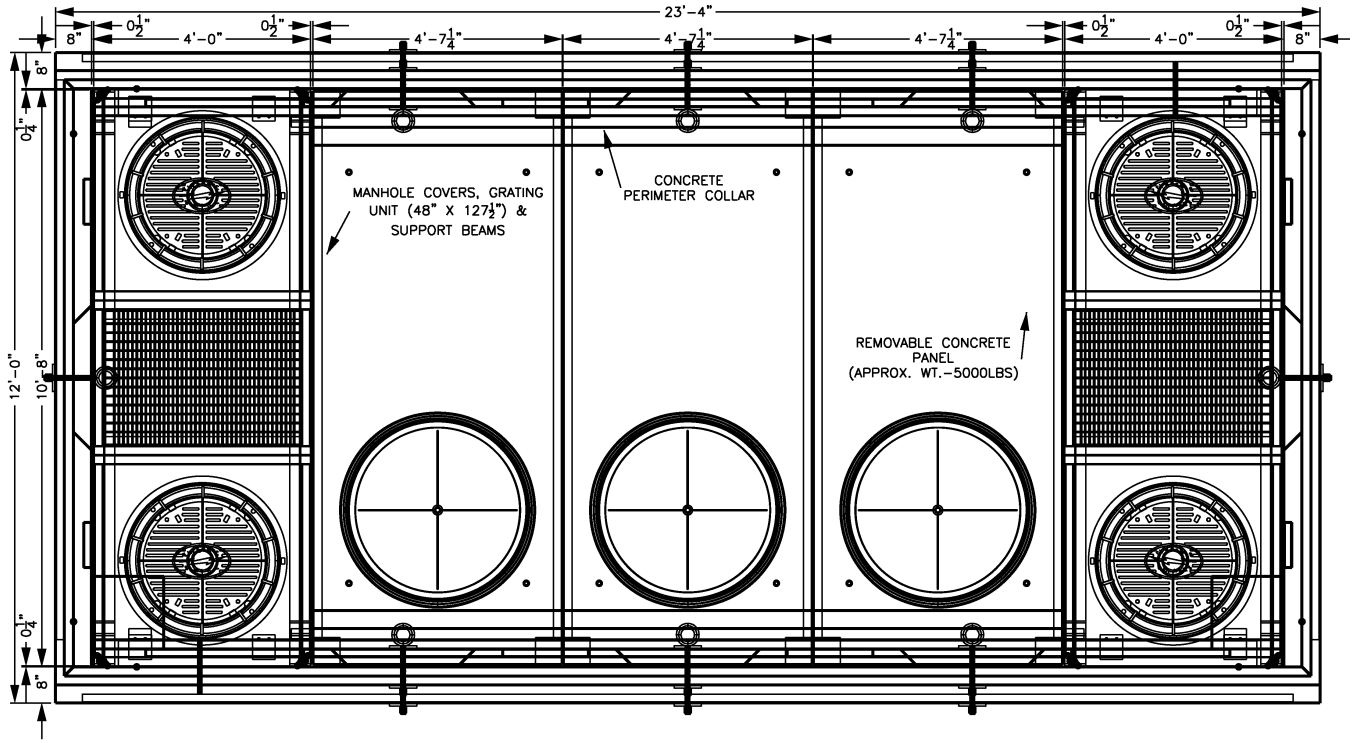


Three D rendition of the vault.

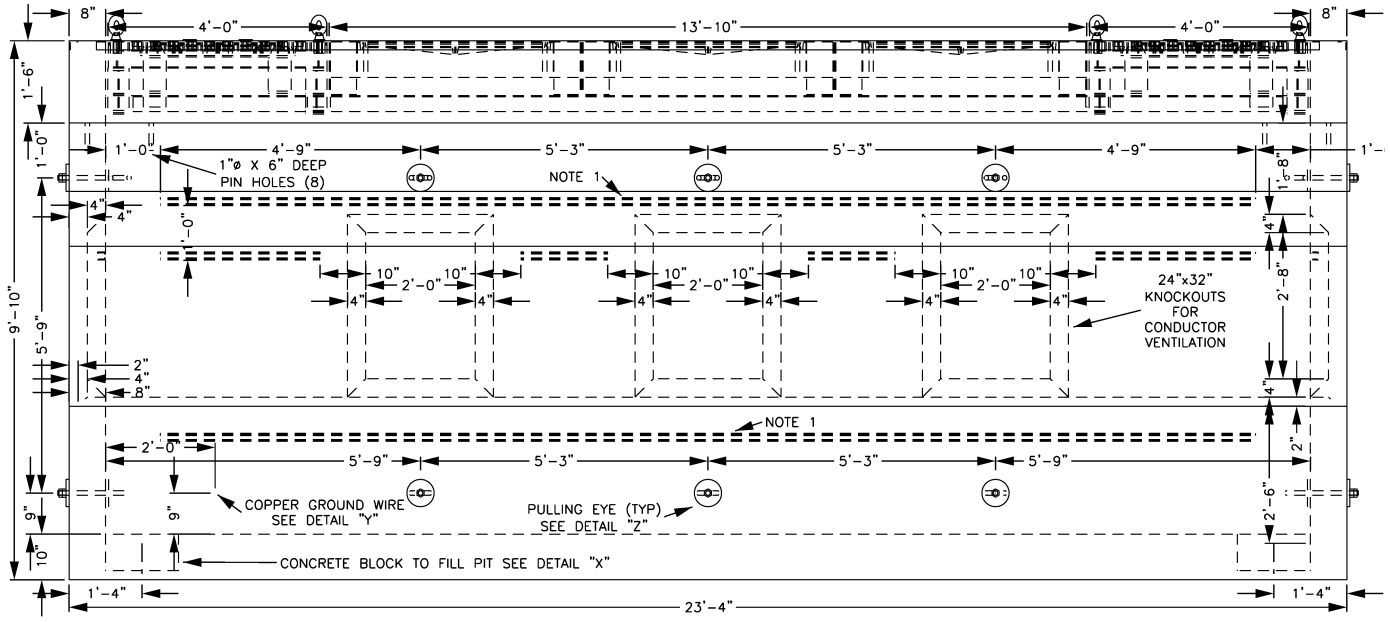
VAULT 8'X20'X11', FORCED VENTILATION (RHODE ISLAND), FOR NETWORK TRANSFORMERS UP TO 750kVA			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/20	**41-210**		

Supersedes 7/19 Issue – Drawing Reformatted.

For complete details on this vault refer to MS3495 and MS3496.



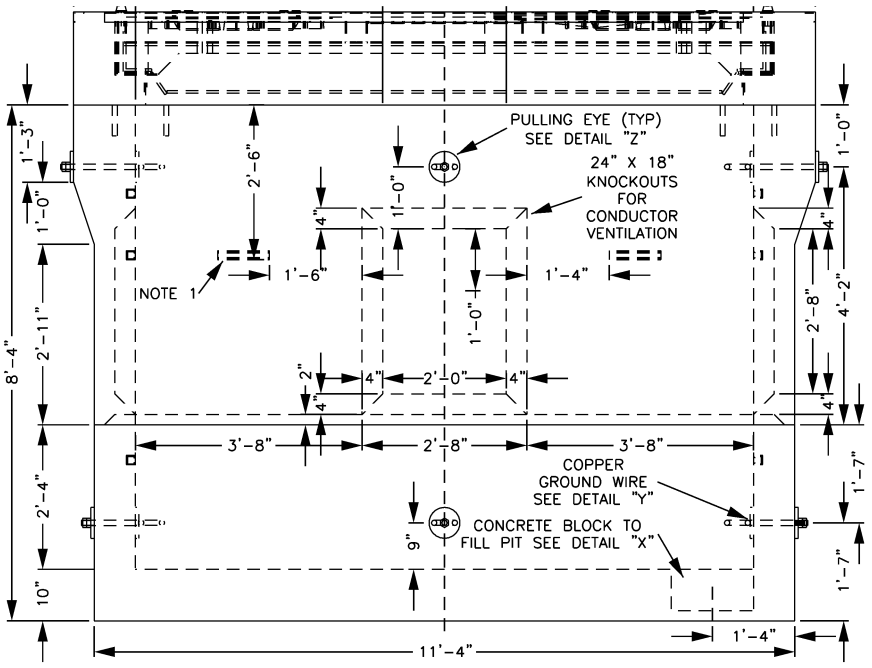
Top Plan View



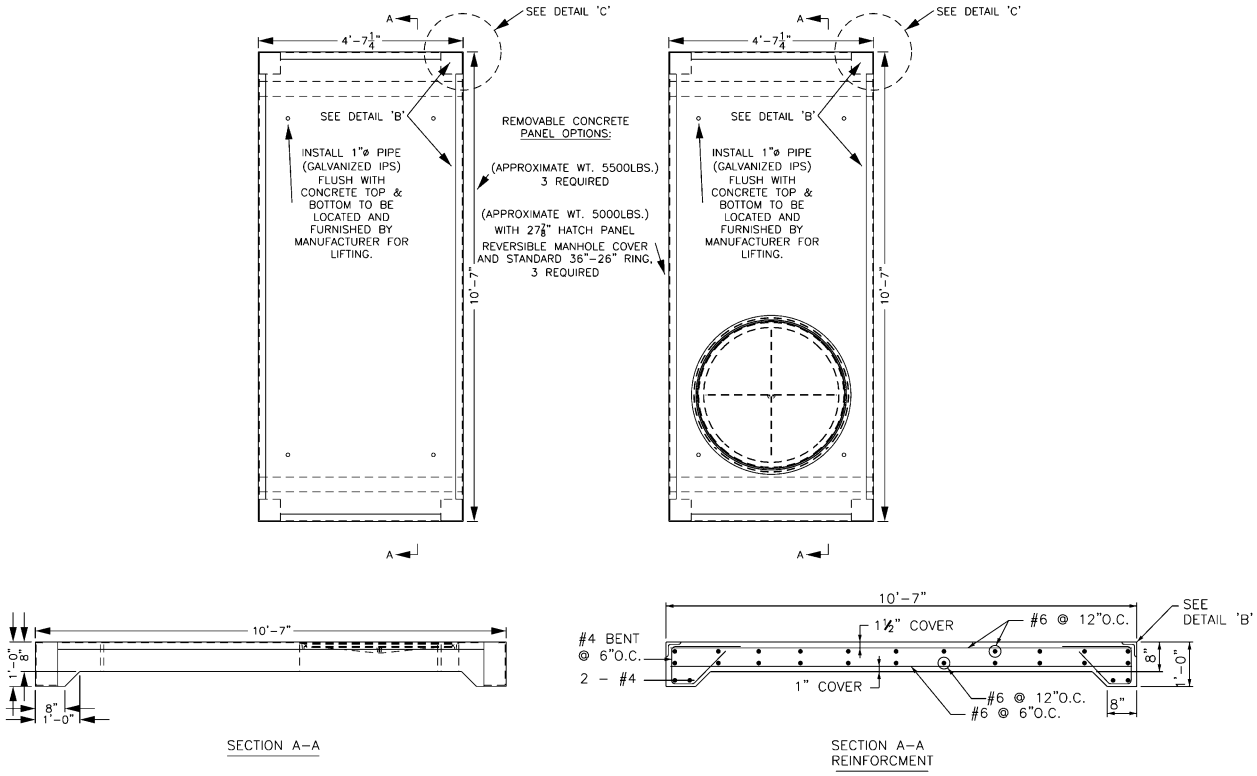
Elevation View

7/20– New Standard.

VAULT 10'X22'X7'6" FOR RADIAL TRANSFORMERS UP TO 500kVA			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		41-220	7/20

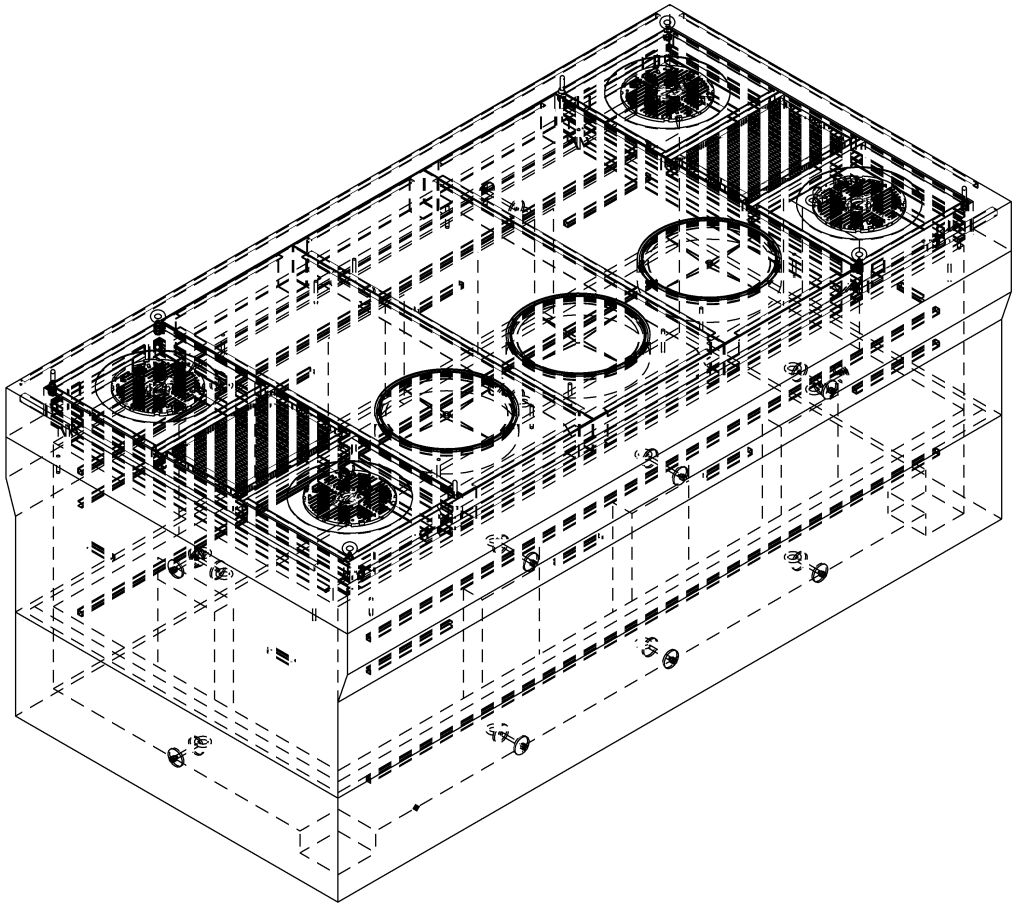


Side Elevation



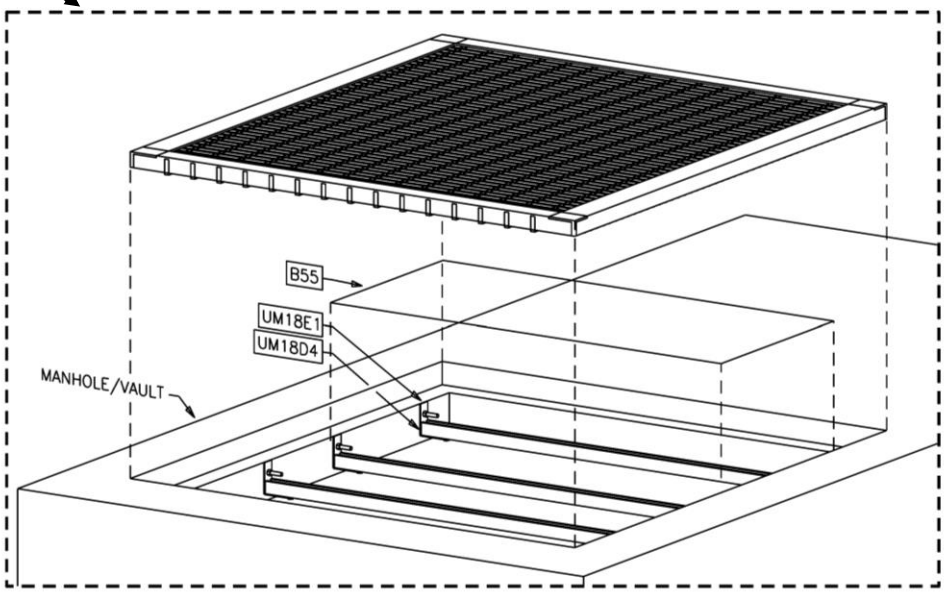
Note: Optional center solid panel is shown along with center panel with embedded manhole cover.

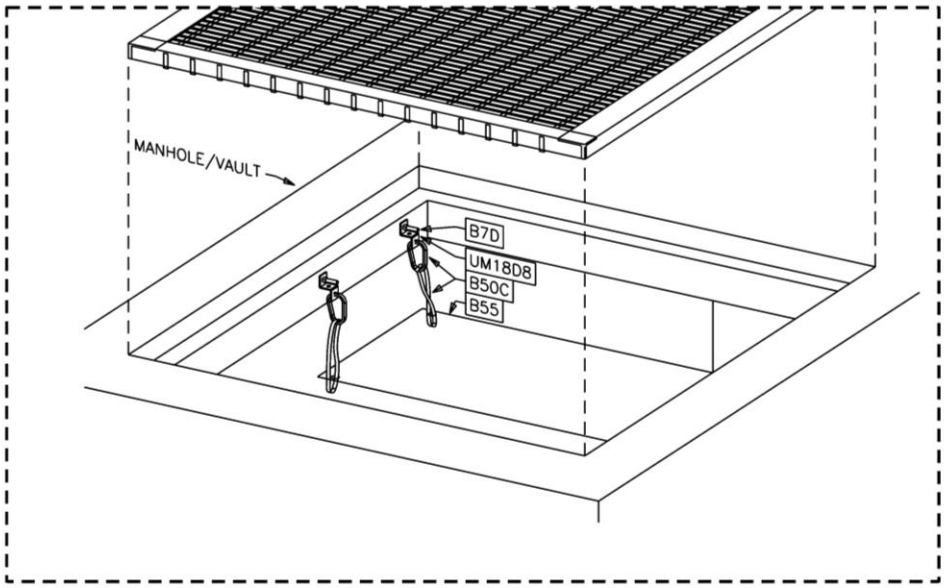
VAULT 10'X22'X7'6" FOR RADIAL TRANSFORMERS UP TO 500kVA			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/20	**41-221**		



7/20– New Standard.

Three D rendition of vault.





7/21- New Standard.

NOTES:
1. FOR CAST IN PLACE MANHOLES/VAULTS, DO NOT ATTACH STRUT OR ANCHORS INTO MANHOLE/VAULT ROOF OR COLLAR. ATTACH TO MANHOLE/VAULT WALLS.

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Version	Date	Modification	Author(s)	Approval by (Name/Title)
4.2	7/21	• New section 41.9 and drawing 41-300		
4.1	7/20	• Update to section 41-1and 41.7 • Radial transformer drawings 41-103 thru 41-120 replaced by drawings 41-220 thru 222. • Network vault drawings reformatted.		
4.0	7/19	• Updated drawings 41-200 thru 41-207 • Added new pages 41-204B and 41-204C, 41-207B and 41-207C		
3.3	7/17	• Updates to sections 41.1and 41.7. • Updates to drawings 41-200 and 41-204, sump hole and floor thickness change. • Update to drawings 41-203 and 41-207 note update. • New Drawings 41-208 thru 41-212		
3.1	7/16	• Updates to sections 41.1 • Updates to title in drawings 41-200 thru 41-207		
3.0	7/15	• Updates to sections 41.4, 41.5, 41.6, 41.7 • Updates to drawings 41-200 thru 41-207 • New Section 41.8		
2	7/10	• Updates to text in 41.0 to 41.3 • New standards 41.4 to 41.7 • New drawings 41-200 to 41-207		
1	07/06	• Updated drawings 41-100 and 41-101		

Supersedes 7/18 Issue – New Section 42.19.

Supersedes 7/20 Issue – Drawings 42-146 update.

GENERAL

The various low-voltage network systems in Rhode Island were developed based on different design criteria, assumptions, and philosophies. A consistent design philosophy and construction practice cannot be applied without a significant review and study of the existing network systems, supply, and infrastructure. Until such a review is undertaken, design criteria should continue to be applied in their present forms.

Supersedes 7/14 Issue – Updates to design criteria. In A and B.

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42.0.10 Rhode Island Design Criteria

Networks will be designed and built under single contingency design criteria. Normal and contingency voltage levels shall not exceed tolerances specified in state regulations.

Emergency limits of primary cable and ancillary equipment shall not be exceeded under first contingency conditions.

Normal ratings of secondary street mains shall generally be applied under both normal and first contingency conditions.

Transformer loading under first contingency conditions is limited by the conditions under which the unit is installed. Method of ventilation (e.g., natural or forced ventilation, open gratings or vent stacks) will determine what, if any, overload capability can be applied to a specific unit. Adequacy of that unit's network protector and the secondary cables connecting that unit to the secondary street grid must be verified prior to applying overloads.

Network protectors shall not be overloaded. The rating limitation is 100% load of nameplate rating of the protector. All design criteria shall take this into account

42.1 EQUIPMENT

42.1.10 Transformer

Network transformers (Std. Item UT50-56) shall be subway, natural ester (FR3) fluid filled, with a high-voltage disconnecting and grounding switch. The high-voltage switch shall be deadbreak on dedicated network feeders and non-dedicated feeders. Mag break high voltage switches are no longer being installed in the system, however there are still various locations which have these still in service. They were utilized only on transformers connected to a non-dedicated feeder. See MS 2595 for complete specifications.

A. Mag-Break Switch

Operation of the mag-break switch to the “open” position requires that only magnetizing current be present on the transformer. The switch has an electrical interlock that prevents switching from “closed” to “open” when the network protector is closed. This allows the switch to operate from “closed” to “open” when the primary feeder is energized provided the network protector is open. Operation of the mag-break switch from “closed” to “ground” position requires the transformer to be de-energized. A second interlock prevents switching from “closed” to “ground” when the transformer is energized.

B. Dead-Break Switch

Operation of the dead-break switch requires that the transformer be de-energized. The switch has two electrical interlocks, energized from different phases of the transformer secondary, to prevent movement of the switch from any position when the transformer is energized.

Primary terminals for new purchases after June 2015 are 900 ampere apparatus bushings. See 42-16 for further information.
If the vector diagram on a replacement transformer nameplate does not match the transformer being removed, contact Electric Materials standards for assistance with correct primary and secondary connections.

42.1.20 Network Protector

Network protectors (Std. Items UP2 and UP3) shall have a submersible enclosure. See MS 4310 for complete specifications.

Protectors shall generally be throat-mounted units, except as required by special application in which case a unit may be ordered for wall-mounting. Physical dimensions depend on the manufacturer, and published literature or approval drawings should be used to obtain that information.

Supersedes 7/17 Issue – Update to 42.1 first paragraph fluid change.

Phase rotation, if not specified at time of purchase, must be verified as correct for the particular network system on which it will be applied.

Std. Item UP3 (480Y/277 V units) are purchased with provisions for ground fault detection scheme. Std. Items UP3 do not include provisions for a heat detection scheme.

Fuses for 480Y/277 V units shall be either internal or external to the housing. Internal fuses should only be used in units having a housing specifically sized to accommodate the heat generated by such fuses. Where fuses are externally mounted to the protector housing, solid copper links should be used instead of fuses inside the housing.

Protector terminals shall be either threaded studs to accept either stud moles or spade terminals, see MS4315 for complete specifications.

Protectors are rated for 100% of the nameplate rating.

42.1.30 Secondary Cable

Secondary cable shall be copper conductor, non-conducting low-smoke zero-halogen (LSZH) thermoset compound jacket (Std. Item UC9). See MS 4141 for specifications. This cable shall be used exclusively for all network secondary applications, including, but not limited to: services, secondary mains, and network protector connections to either the street grid or to collector buses. This cable shall not be used for any other secondary system. For non network secondary cables, use standard item UC5.

Secondary street mains shall be sized according to the design of the specific network on which it will be used. In Rhode Island, 500 kcmil conductors shall not be used for new construction of street mains. In Rhode Island, all existing 500 kcmil street mains in weak areas (those areas having insufficient fault current to either burn a fault clear or to blow a full-size limiter) should have half-size limiters installed at both ends of every set.

Supersedes 7/15 Issue – Update 42.1.30.

42.2 SECONDARY PROTECTIVE DEVICES

42.2.10 Limiters – Standard Interrupting Capacity

A. Cable to cable (Std. Item UL6)

B. Cable to bus (“limiter lug”) – (Std. Item UL9)

C. Cable to mole (“molimiter”) – (Std. Item UC56)

42.2.20 Limiters –Current Limiting – (formerly “High Capacity”)

A. Cable to cable (Std. Item UL4)

B. Cable to bus (Std. Item UL5)

C. Cable to mole

42.2.30 Limiters – Half-Size

Half –size limiters are for use in areas with insufficient fault current to blow full-size limiter.

42.2.40 Limiters – Removable Link

Removable link limiters are for maintenance use on services in Pawtucket (Std. Item UL7). They may be used on radial secondary systems; however, they may not always coordinate with the internal fusing of the subway transformers.

42.2.50 Current Limiting Fuses

Current limiting fuses are high capacity Class L.

42.2.60 Network Protector Fuses – (Refer to MS 4310)

A. Copper link or low-loss alloy (Std. Item UP4)

B. Silver sand current limiting - for Westinghouse and Cutler-Hammer protectors, external mounting (Std. Item UP5).

42.3 EQUIPMENT SIZING

Network protectors must be sized according to expected transformer loading during both normal and contingency conditions. Refer to Tables 4 & 5

Table 4

Transformer Size 208Y/120 V or 216Y/125 V	ANSI Throat Size	Network Protector Preferred Size	
		AMPS	CT Ratio
500 kVA	small	1875	1600:5 (1)
750 kVA	large	2825	2500:5
1000 kVA	large	3500	3000:5
Note 1 -- All 1875-amp protectors have multi tap CT's for 800, 1200 and 1600 amps which need to be changed as appropriate.			

Table 5

Transformer Size 480Y/277 V	ANSI Throat Size	Network Protector Preferred Size	
		AMPS	CT Ratio
500 kVA	small	1875	800:5 (2)
750 kVA	small	1875	1200:5 (2)
1000 kVA	small	1875	1600:5 (2)
1500 kVA	large	2825	2500:5
2000 kVA	large	3500	3000:5
2500 kVA (1)	non-standard	4500	3500:5
Note 1 – Not a standard transformer size for new construction in Rhode IslandNote 2 – All 1875-amp protectors have multi tap CT's for 800, 1200 and 1600 amps which need to be changed as appropriate.			

42.4 EQUIPMENT RATINGS

Transformer loading above nameplate rating requires adequate ventilation. Network protectors have no overload capability and must be sized according to the loads expected from application of the appropriate design philosophy (Rhode Island).

Supersedes7/14 Issue – Removed Woonsocket in 42.2.40 and Updated MS spec in 42.2.60 and Tables 4 and 5

42.5 NETWORK SUPPLIED STREET LIGHTING

42.5.20 Unmetered Street Lighting Supplied from Network Manholes

The base of the first street light to be supplied shall contain an in-line fuse holder (Std. Item F50B) with a maximum 30 A (Std. Item F10A) series fuse. The fuses specified should provide adequate protection and be accessible from above ground for the associated circuits.

42.5.30 Maintenance of existing fuses for street lighting and traffic controller services

Fuses and fuse holders to provide protection on the line side of the customer's overcurrent protective device are for maintenance use only.

A Up to 30 amps, fuses used are Std Item F10A_ with holder Std Item F50B.

B 60 amps amp, fuse used is Std Item F11A60 with holder Std Item F50JD.

The Company shall install identification information on the cables as shown in Standards Section 35.16 – Cables.

42.6 NETWORK VAULT WIRING AND SUMP PUMP INSTALLATION

This Section covers the design, installation and construction of the general wiring arrangement for network vaults for the normal requirements and conditions commonly encountered by the Company.

These Standards shall apply to all new network vault installations and shall be followed as close as practical where the work involves rearrangement and/or rebuilding of existing installations. Special requirements or unusual conditions encountered in construction shall be referred to the Electric Material Standards and Environmental for recommendations or plans for such special requirements and conditions shall be submitted for comments or approval.

The components of the network vault general wiring arrangement shall be located so as not to hinder egress or ingress, to enhance accessibility to all components and equipment, to reduce the possibility of submersion and to reduce the exposure to corrosion (e.g. do not install components under the "drip line" formed by water and road salts).

Wiring connections to components should be made with ring-type or fork-type insulated terminal crimp connectors or wire nuts as required.

New network vaults shall be designed to prevent the discharge of transformer insulating fluid into the sewer system.

Existing vaults which contain direct drains shall be modified by retrofitting the vault with a sensing probe (Std Item UN6P) and by placing a sump pump (Std. Item UN6) inside a wire basket (Std Item UN6B) surrounded with filter felt (Std Item UN6G) see figure 1 and 2 below. The sump shall be located in a low area of the manhole or set inside a sump hole. The sump shall be wired into a termination block. See drawings 42-134 and 42-135 for wiring diagrams

Supersedes 7/14 Issue – Removed section 42.5.10. renamed 42.5.20. 42.5.30 and text updates to. 42.5.30 and 42.6

New vaults should be located and designed such that automatic operation of a sump pump would not be required. However, in locations for new vaults which require direct drains, they shall be incorporated with a sensing probe (Std Item UN6P) and by placing a sump pump (Std. Item UN6) inside a wire basket (Std Item UN6B) surrounded with filter felt (Std Item UN6G) see figure 1, 2 and 3 below. The sump shall be located in a low area of the manhole or set inside a sump hole. The sump shall be wired into a termination block. See drawings 42-134 and 42-135 for wiring diagrams

Sump pumps may be permanently installed in a vault provided the pump is wired for manual operation only. Prior to manual operation of the pump, the vault must be inspected for oil, silicone, or other contamination.

An exception to the above may be made in existing vaults where standing water is a problem. The pump system may be operated automatically provided the following criteria are met:

A. A formal investigation with environmental on where the water will be discharged to with applicable required permit's as required.

B. The vault design would allow water to migrate into a customer's facility through an adjoining door or passage way, or

C. The vault is customer-owned and the customer requires the water removed, or

D. There is a safety concern or equipment condition that requires an automatic pumping system until the problem can be resolved.

If it has been determined that automatic operation of a sump pump is required from the criteria above, then the vault shall be equipped with sensor, basket and filter as described above.

Figure 1

Figure 2

Figure 3

Supersedes 7/14 Issue – Updates to text in 42.6 and 42.7

42.7 GROUND FAULT PROTECTION SYSTEM (GFPS)

42.7.10 General

A ground fault protection system shall be installed in all new 480Y/277-volt spot network vaults. The customer shall buy, install, and wire the Company approved ground fault protection system. See ESB (Electric Service Bulletin) 757 for further details and requirements.

42.8 SECONDARY WIRING

New or replacement network secondary cable shall consist of copper conductors, cross-linked heavy-duty black chlorinated polyethylene (CPE) thermoset compound jacket (Std. Item UC9). The neutral conductor shall be full size fully insulated. Existing cable, which consists of many different types of insulation, may remain in service. Conductors shall be installed in sets of 3 phases and 1 neutral per duct.

42.8.10 Street Grid Secondary (General Network)

Conductor size shall not be changed from the existing without completing an engineering analysis. All new conductor installations shall have limiters installed at each end & junction point. Limiters shall be standard, non-replaceable type (STD Item UL9_). Current limiting (formally referred to as high capacity) limiters shall never be installed in street grids.

If a set of network secondary cable is installed in a duct section that already contains one or more sets of unlimitered lead-covered secondary's, then the existing sets of unlimitered lead-covered cable in that duct section also must have limiters installed at both ends. This is required because the fault clearing characteristic of limiters differs from the self-clearing burn off characteristics of lead-covered secondary's, and without limiters on all sets in a particular section, faults may not clear properly.

A. Rhode Island

4/0 wire (Std Item UL6C__) – except Providence where the size is 300 kcMil (Std Item UL6__)

42.8.20 Network Protector Leads to Street Grid / Collector Bus

500 kcMil conductors shall be used for the leads. The number of sets shall be determined by transformer / protector size, see Table 6 below. All sets to have limiters installed on both ends to protect individual conductors. Limiters shall be standard, non-replaceable type (STD Item UL9_). Current limiting limiters shall never be installed in protector leads connected to the street grid.

Table 6

Transformer (kVA)	216Y/125 VOLT		480Y/277 VOLT	
	In Conduit	In Air*	In Conduit	In Air*
500	4 sets 500kcmil Cu	4 sets 500kcmil Cu	4 sets 500kcmil Cu	4 sets 500kcmil Cu
750	6 sets 500kcmil Cu	5 sets 500kcmil Cu	4 sets 500kcmil Cu	4 sets 500kcmil Cu
1000	8 sets 500kcmil Cu	6 sets 500kcmil Cu	4 sets 500kcmil Cu	4 sets 500kcmil Cu
1500			6 sets 500kcmil Cu	5 sets 500kcmil Cu
2000			8 sets 500kcmil Cu	6 sets 500kcmil Cu
2500			10 sets 500kcmil Cu	8 sets 500kcmil Cu

*Note: The in air configuration assumes IPCEA de-rating factor with maintained spacing at 40°C ambient

42.8.30 Services

Conductor sizes of #2,
#4/0 and 500 may be used
for services. Services with #2 cable shall consist of only 1 conductor per phase. Limiters are

Supersedes 7/14 Issue – Text shift and updated to 42.8 and added table 6.

not required on #2 cable. All other services shall have limiters installed. Number / location / type of limiters shall be determined as follows:

A. Services from General Networks

- Services with one or two conductors per phase shall have limiters installed in each phase conductor at its origination point.
- Services with more than two conductors per phase shall have limiters installed on both ends of each phase conductor.
- Limiter type will generally be standard (Std Item UL6__) (not current limiting). There could be applications where the current limiting type are required. This determination will be made by the local network engineer
- Limiters installed on the customer's end shall be in a suitable cabinet supplied by the customer or on a customer supplied bus. In no case shall the limiters be installed such that they are connected directly to the customer's main breaker.

B. Company Owned Services from Spot Networks (Maintenance Only)

- Services with limiters for each cable shall have them installed on both ends of each phase cable.
- Limiter type for 480 volt shall be current limiting (STD Item UL4_,UL5_)
- Services with a single current limiting fuse for all cables in a phase can have the fuse installed on the protector end only (STD Item F11B_)

C. Services from Customer owned Transformer Vaults interconnected to the General Network.

- To limit available short-current circuit, customer owned conductors shall be attached to a Secondary Service Fuse enclosure (STD Item UP70FB).

D. Services Labeling

- All services including street lights leaving the manhole shall be labeled with the appropriate address or demarcation.
- Service shall also have phasing and voltage labeled.

42.8.40 Limiter Applications in Street Grid Secondary Conductors

Limiters are a critical element to the proper operation of a secondary network system. The ideal location for limiters is at every end or junction of the secondary conductors

A. New Construction

- All new cable in street grids shall be installed with limiters on each end and at each junction point
- Limiter type shall be standard (Std Item UL6__) (not current limiting)

B. Limiter Retrofit

- Limiters shall be installed in existing street grid cables as determined by engineering to increase network reliability.

42.8.50 Secondary Cable Inspection

The integrity of the secondary cables is critical to the proper operation of the network secondary system. It is possible that any secondary cable is either burned open or has a limiter which has operated, thus the affected cable will not be carrying any current. In order to locate developing problems, the network secondary cables will be inspected.

When working in a manhole or vault with network secondary conductors:

A. Visually inspect secondary conductors looking for any burned, overheated or otherwise damaged insulation
B. Check temperature of secondary conductors using the heat gun. Extremes of temperature or differences between sets going in the same direction are of interest.
C. Take current readings on each phase in each set. All cables should have some current. Cables with no current are of interest as they are likely burned off or have an open limiter.

42.8.60 Secondary Labeling

Secondary network cables for spot and the general network shall be labeled at the network protector and at the manhole/vault entry/exit conduit with label “Network” (STD Item UP21). Label the cable with the appropriate voltage label (STD ItemUP21) 120/208 or 277/480 volt as well. The cables can be labeled bundled together where feasible. Phase markings on cables shall also be installed where feasible. The cables shall also have “to” and “from” indicated as well on the tag holder indicating the next location where the cables can be accessed from.

42.9 SECONDARY SERVICE FUSE ENCLOSURE

The fuse enclosure (Std Item UP70FB) figure 4 is for use on the 208-volt secondary system to be used as an isolation service point to terminate our cables from the customers. The enclosure is wall mounted and is fully submersible rated. Amp Trap fuses (Std Item F11B_) in Table 7 shall be used in this service box to protect our system from faults.

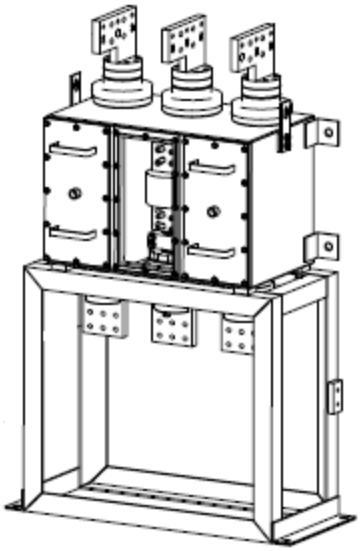


Figure 4

FUSE RATING (AMPERES)	STD ITEM
600	F11B1
800	F11B2
1000	F11B3
1200	F11B4
1600	F11B5
2000	F11B6
2500	F11B7
3000	F11B8
3500	F11B9
4000	F11B10

Table 7

Supersedes 7/14 Issue - Test Shift. Update to 42.8.60. table number in 42.9 and Figure 4 update.

42.10 PRIMARY ISOLATION SWITCH

Primary isolation switches can be used in indoor or outdoor 480-volt network systems. This switch (Std Items US40H1, US40J1 or US40K) is a vacuum fault interrupter and has the capabilities to open within 3 cycles to limit the arc flash hazard. The switch and control are fully submersible rated, careful consideration for installations in dry locations should be considered. The switch shall be installed on the source side of the network transformer. The termination points are for 600-amp Dead break elbows. The external control requires a 120-volt power. The switch has a pendant that is used for remote operation of the switch with the motor controller. Local engineering shall set the control to coordinate in the system it is installed in. The switch can be floor or wall mounted. (Wall mounted shown below, see figures 5, 6 and 7). Installation details are shown in section 38.17.

NOTE: STD. Items US40H, US40I and US40J are for use in only dry vault installations.

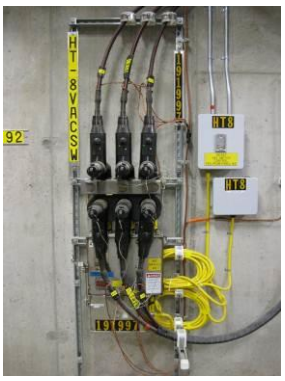


Figure 5

Figure 6

Figure 7

42.11 SECONDARY ISOLATION SWITCH

In indoor network vaults where there is a need for isolating the secondary bus from the network protectors a 600-volt isolation switch is available. This switch is high current carrying but does not have any load interrupting capabilities. The switch is ceiling mounted and currently available in 2000- and 4000-amp ratings (Std Items US60_). The switch has barrier boards and grounding studs.

Figure 8

Supersedes 7/17 Issue – Text update to 42.10

42.12 SECONDARY VAULT BUS

New standard sized network vaults can utilize a pre-fabricated secondary 600-volt bus system for installations (Std Items B60A and B60B) see figure 9. The bus spans across the long wall. In locations where this is not feasible, bus is available for field fabrication (STD Items B60D thru B60H) see figure 10

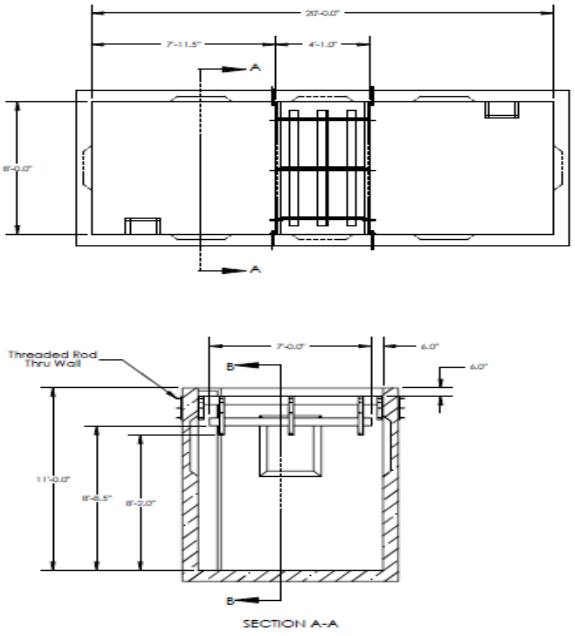


Figure 9

Figure 10

42.13 Link Box

Link boxes are available in the small style (STD Item UP7LBS) which is used on protectors up to 2000 amps. For protectors above 2000 amps a large style (STD Item UP7LB_) link box is available. The link box is fully submersible and can be pressurized. In locations where height in the vault is an issue, wall mounted link boxes are available as well. Figures 11 and 12 show a typical installation. Figures 13 and 14 show the link closed and open. To mount the link box to the protector there are several adaptor plates to allow the different mounting bolt hole patterns to align up, see tables 2 and 3.

Figure 11
Link Boxes on Protector

Figure 12
Link Boxes wall mounted

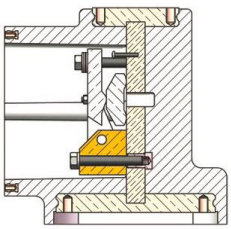


Figure 13
Link Box Closed

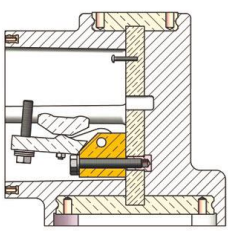


Figure 14
Link Box Open

Supersedes 7/14 Issue – Text update to section 42.13

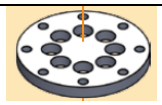
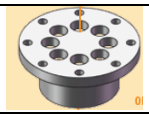
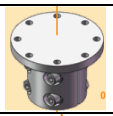
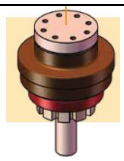
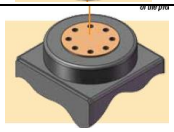
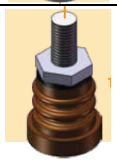
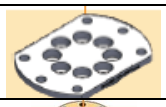
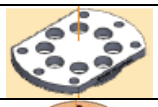
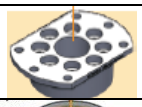
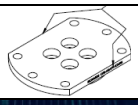
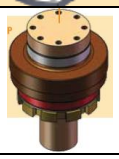
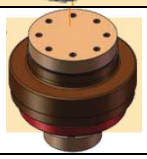
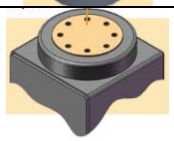
TABLE SHOWING ADAPTOR PLATES FOR MATCHING SMALL STYLE PROTECTORS UP TO 2000 AMP			
Adaptor			
Terminal Type			
Protector to use on	313NP, 137NP , MG8	CM22, CM52, CMD	THREADED STUD
STD ITEM	UP7SA1	UP7SA2	UP7SA3
SAP ITEM ID	9387052	9387054	9387095

Table 8

New Section 42.13

TABLE SHOWING ADAPTOR PLATES FOR MATCHING LARGE STYLE PROTECTORS OVER 2000 AMPS				
Adaptor				
Terminal Type				
Protector to use on	313NP	137NP,MG8, MG14	CM22,CM52, CMD	CMR8
STD ITEM	UP7LA3	UP7LA2	UP7LA1	UP7LA4
SAP ITEM ID	9386611	9386610	9386609	9387796

Note: The CMR8 adaptor can also fit on some CM22 style terminals (red 3500A style), field inspection would be required.

Table 9

42.14 Terminals

There are several available terminals available for use for terminating cables onto network protectors and link boxes. See table 4 below on which terminals can be used on the various styles of protectors. Figures of the terminals are shown in the material section and more information is available in material specification 4315 for reference.

TERMINAL SPADES FOR NETWORK PROTECTORS

STYLE	AMP RATING		313NP	137NP	147NP	CM22/CM 52	GE	WESTING HOUSE
SHORT HORIZONTAL SPADE	2000		UP7SP8* 9387365	UP7SP8* 9387365		UP7SP1 9307934		
			UP7ST6* 9387620	UP7ST6* 9387620				
SHORT HORIZONTAL SPADE	4500		UP7SP9** 9387235	UP7SP3 9307577	UP7SP3 9307577	UP7SP3 9307577		
LONG HORIZONTAL SPADE	4500		UP7SQ** 9387535	UP7SP2 9307933	UP7SP2 9307933	UP7SP2 9307933		
X LONG HORTIZONTAL SPADE	4500		UP7ST9** 9389625					
1.5INCH STUD	2000		UP7ST3* 9387190	UP7ST3* 9387190	NA	UP7ST4 9387189	UP7ST1* 9307932	
3 INCH STUD	4500		UP7ST5** 9387188	UP7ST2 9307931	UP7ST2 9307931	UP7ST2 9307931	UP7ST2 9307931	
SHORT VERTICAL SPADE	2000		UP7SP6* 9387187	UP7SP6* 9387187		UP7SP4 9307578	UP7SP6* 9387187	
LONG VERTICAL SPADE	4500		UP7SP7** 9387186	UP7SP5 9307579	UP7SP5 9307579	UP7SP5 9307579		UP7SP7** 9387186
U SHAPE	4500		UP7ST7** 9387711					
OFF SET HORIZONTAL	2000		UP7ST8** 9388842					

- * Terminal bolt hole mounting pattern also aligns up for use on small link box
- ** Terminal bolt hole mounting pattern also aligns up for use on the large link box

Table 10

Supersedes 7/15 Issue Update to table 10

42.15 Indicator Light

Indicator lights are available to install on the network protector to add an auxiliary external indication of the network protector status of open or closed. The light (STD Item UiN3SL) is installed with conduit through a port opening in the protector housing. See Figure 15 for typical installation.

Figure 15

New Standard

42.16 Transformer Bushings

Starting in June of 2015 transformers will be manufactured with 900-amp bushings to meet an updated industry standard. All new transformers received will have a nameplate near the bushings stating “900 A”, see figure 16. To properly terminate the cable onto the transformer, 900-amp elbow kits have been set up. The kit includes the elbow, connector, cable adaptor and end cap. Based on the operating area and cable the appropriate kits have been set up, see table 11 below.

			OPERATING AREA			
STANDARD ITEM	CABLE SIZE	VOLTAGE CLASS	RHODE ISLAND			
UR62C	4/0	15	x			
UR62C2	4/0	15	x			

Table 11

Notes

1) Some of the 15kV class elbow kits might contain an extra cable adaptor depending on the manufacturer’s specifications to meet our cable size requirements for both the 5 and 15kV cables in our operating system.
2) Depending on procurement, some of the elbow kits might also come with the reducing tap well build in.
3) The standard items listed ending with 2 come with a 200-amp reducing tap well and cap, depending on the room in the vault will determine if this kit is suitable.

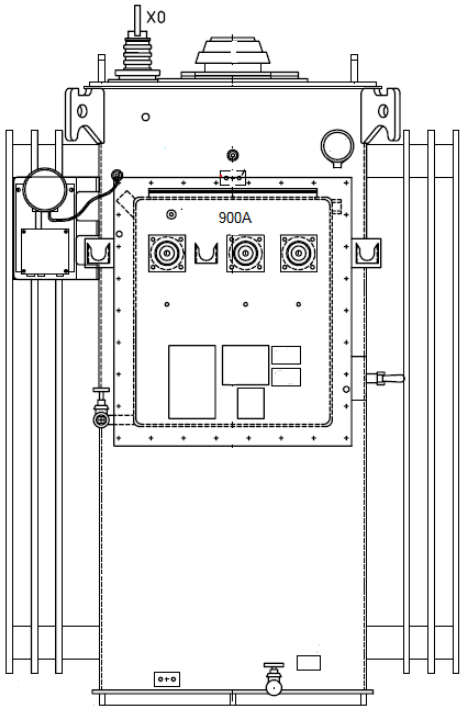


Figure 16

Supersedes 7/15 Issue- Update table 11 removed UR62A and UR62A2

42.17 Lead Wipe Bushing Replacement

Older network transformers have lead wiped cable bushings. Lead cable is no longer available to replace the bushing in kind. If work is required on the transformer an evaluation should take place to determine if the overall condition of the transformer. If the condition warrants keeping it, the termination entrance shall be rebuilt with a hand applied termination with solid dielectric cable terminated into the terminal chamber. Once completed the chamber shall be filled with “Re-Gel” encapsulant and sealed.

Re-Gel encapsulant is a two-part mixture (STD Items UR2AB and UR2SM) that come in 5-gallon containers. The Re-gel has a shelf life of one year and should be ordered as needed. The encapsulant cures to a gelatin like substance. It has a higher dielectric rating than the transformer oil, will not absorb water and is easy to remove.

Below is an example of the replacement for a 1-3/C cable entrance. Note: Several of the items are not stocked and local engineering/operations would need to work with electric material standards to develop a plan for each project.

New Standard

Figure 17

Figure 18

Once old lead cable has been removed and area cleaned, ensure wiping bell is flat and cut as required as shown in figure 17. Figure 18 shows the chamber cleaned and terminal lugs installed.

Figure 19

Figure 20

Figure 21

This example used #2 EPR cable with hand applied terminations fed thru one at a time in figures 19 and 20. Figure 21 shows the neutral mesh installed to the concentric with constant force springs. For the specific chamber to be modified, contact Electric Material Standards if needed for assistance on hand applied termination.

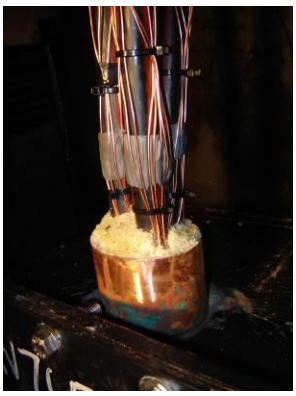


Figure 22 Figure 23 Figure 24

For the cables coming thru the entrance foam sealant was apllied along with mastic as shown in figure 22. Figures 23 and 24 show the installation of a 3 finger heat shrink boot applied. For 3-1/C entrances three separate entrys and seals would have to be made.


Figure 25 Figure 26 Figure 27

Figure 25 shows the Re-Gel containers and figure 26 shows the Regel pump system. The final part of the installation shows the mixture being installed into the chamber of the terminal compartment shown in figure 27.

42.18 Explosion Proof Blower System

New vault installations that require forced ventilation shall use an explosion proof blower, controller and thermostat shown in figure 28 below. Wiring diagrams are shown on pages 42-139 and 42-140 for the blowers. on page 42-139,

Figure 28

Supersedes 7/15 Issue – New section 42.18

42.19 Network Communications

Communications for the network is available. The following items can be tied in for communicatons: transformer and switch fluid level gauge, transformrer tempurature gauge, DGA of the transformer, network protector and water level in the vault. The means for comunication will be in DNP-3 format, via cellular. The information will be available for local operating areas and regional control. Parameters for information being sent to regional control can alarm operations for real time system issues that occor with the items intergrated into the communications system. Refer to drawings 42-145 through 42-147 for wiring layout and diagrams.

42.19.10 Gauges

a) DGA (Dissolved Gas Analysis) gauge Std Item UN8S_. The guage monitors hydrogen levels in the network transformer. There are two styles available. The first style is mounted in the head space of the network transformer. It is compatible for use with air or nitrogen filled in the head space. The second style is mounted by the drain plug of the network transformer. It is compatible for use with Mineral oil, FR3 fluid or Silicone fluid.
Notes: Connect the gauge with a striaght pipe from the tranformer. Bends in the connection will reflect accuacy of the gauge. Gauge requires 24 volt DC power (which will come from the communications control). Output wiring to go to junction box on network protector.

b) Fluid level gauge Std. Item UN10T_. Passive magnetic float style affixed to the side wall of the transformer and or switch chamber. For use to retrofit transformer manufactured prior to 2018, current transformers are already equiped with a communicating ready gauge.. Gauge to provide a 1.5k to 15k ohm potentiometer output to convert to fluid level.
Note: Output wiring to junction box on network protector. If retrofitting the gauge locate the model number from the existing gauge to get the proper replacment gauge as shown in the materials section.

c) Tempurature level gauge Std. Item UN10T_. Drywell probe style. For use for retrofitting gauges on network transformers manufactured prior to 2018, current transformers are already equiped with a communications ready gauge. Two styles of this gauge are available. The UN10T_ style requires a 120-volt ac power and provides a 4 to 20 ma output to convert to tempurature. The UN10TR style requires 5-volt DC power from the relay and is resistive tempurature dectector style that converts a DC signal back into the relay. Transformers manufactured after June of 2020 will come with the UN10TR style.
Note: Output wiring to junction box on network protector. If retrofitting the gauge locate the model number from the existing gauge to get the proper replacment gauge as shown in the materials section.

d) Junction box STD. Item UN9K. The junction box mounts to the side of the protector through accessory port. The junction box comes as a kit to include wiring to tie into the protector. Wiring from gauges, switches and sensors terminate inside the box.

e) Water level sensor STD. Item UN9W. The water level gauge mounts to the wall of the vault.
Note: Output wiring to junction box on network protector.

Supersedes 7/19 issue- Update in 42.19.10c.

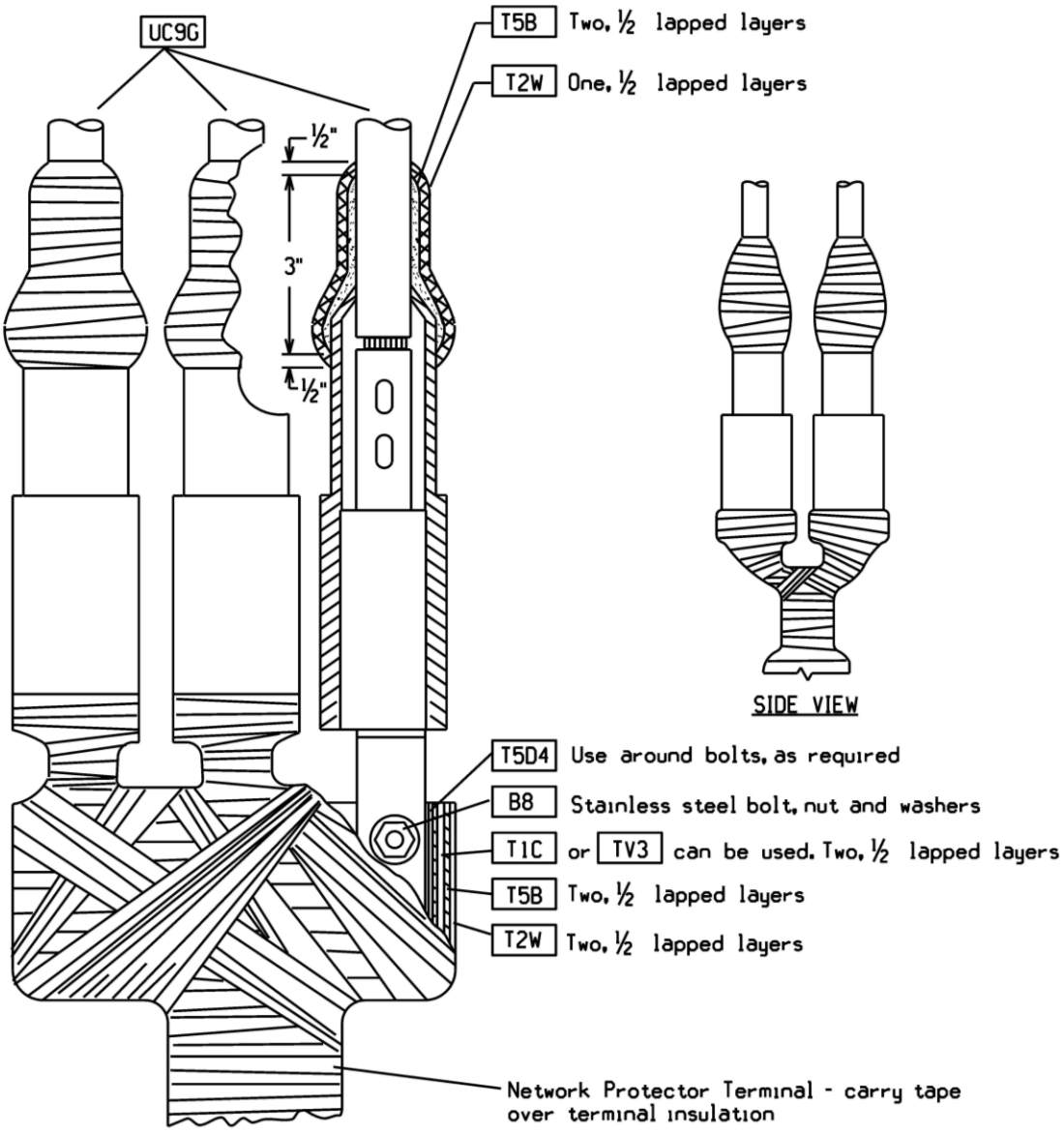
42.19.20 Communications

The network shall use a cellular means for communications. All data will be daisy chained through the junction boxes from each transformer protector to the radio box. Each relay and DGA will have an assigned IP addresses The radio box shall house the standard style GE orbit radio system along with ac to dc transformer to power the radio and DGA sensors.
Note: Telecom Ops shall perform a communication study up front to ensure cellular means is sufficient. The radio box will require 120-volt ac power and when installed in outdoor vaults it shall be located near the grate access with slack to be able to remove the radio box for maintenance outside of the vault. Telecom survey will also depict proper location for antenna installation.

42.19.30 Relays

Network protector relays need to be checked for communicating style in DNP-3 format. Protectors manufactured from ETI after 2012 are communicating style. Protectors manufactured from Eaton after 2020 are communicating style. All styles of relays are available as communicating, see materials section STD. Item UP6_. Note: A plan outage will be required for the communicating style relay to reprogram the DNP address.

Supersedes 2/06 issue- Added TV3 tape option.



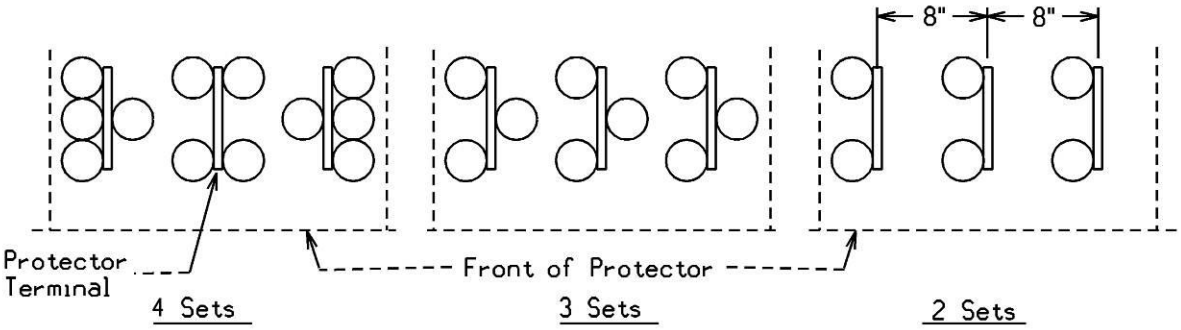
NOTE:

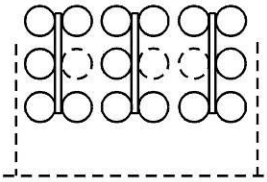
With maximum dimensioned high capacity limiter lug (UL5) shown, taping is difficult, but possible with lugs placed as shown on standard protector terminal. If conditions permit, protector terminal may be extended to provide more room for taping. See drawing 12-104 for method of extending protector terminal and drawings 12-102 & 12-103 for limiter lug arrangements for different size protectors.

INSTALLATION DETAILS - LIMITER LUGS ON NETWORK PROTECTOR TERMINALS

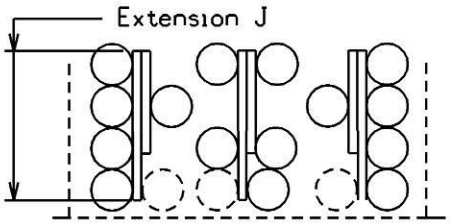
42-101
MPR 7/5/17

RECOMMENDED ARRANGEMENTS - Install limiters in arrangements shown unless shown otherwise on installation drawing.

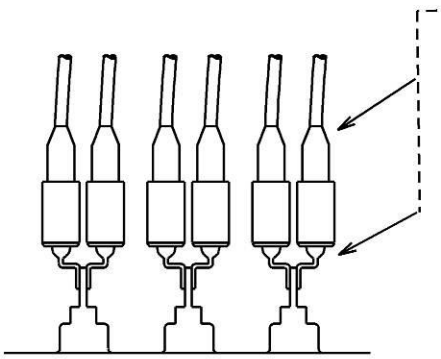




5 or 6 Sets (small UL5 or UL6 only)



5 or 6 Sets (Large UL5)



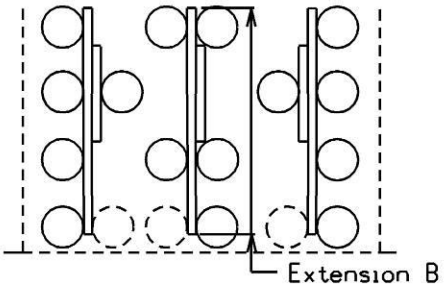
Typical
Side View

General Notes

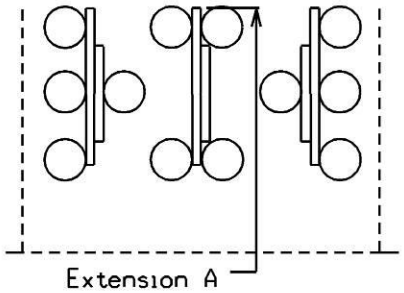
When specified, a vertical extension, as shown on page 42-104 shall be furnished.

When specified, extensions shall be provided with tabs (See Tab Detail page 42-104) to permit pre-taping of extensions.

ALTERNATE ARRANGEMETNS - When specified on the installation drawings, extensions A or B (See page 42-104) shall be installed as shown below.

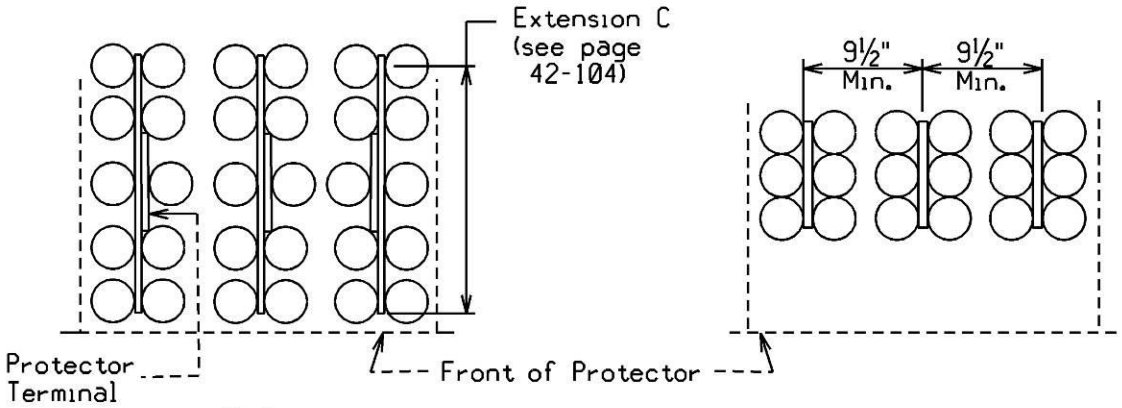


5 or 6 Sets of Limiter Lugs



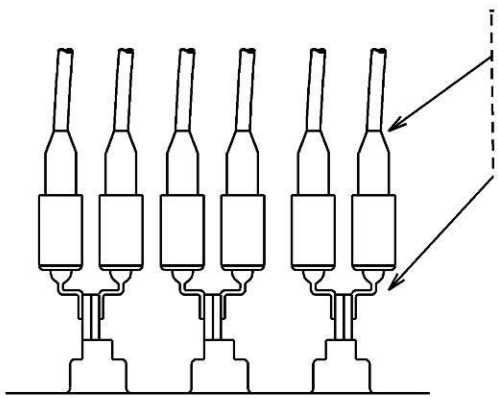
4 Sets of Limiter Lugs

RECOMMENDED ARRANGEMENTS - Install limiters in arrangements shown unless shown otherwise on installation drawing.



10 Sets

6 Sets



---See page 42-101 for taping details.

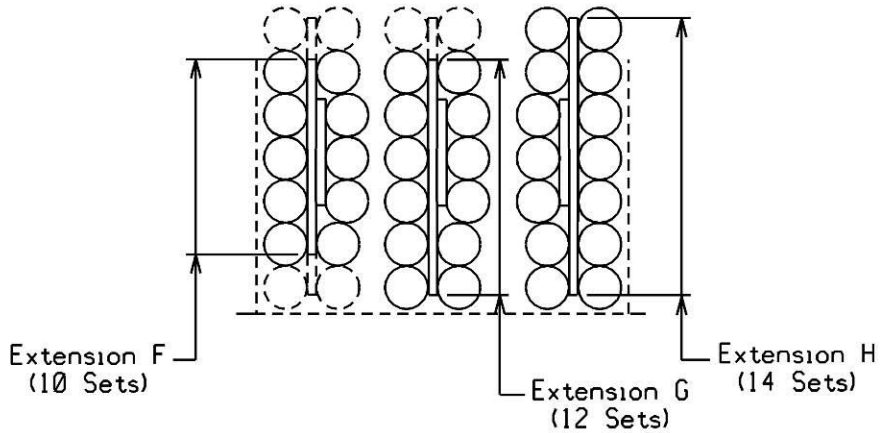
Typical
Side View

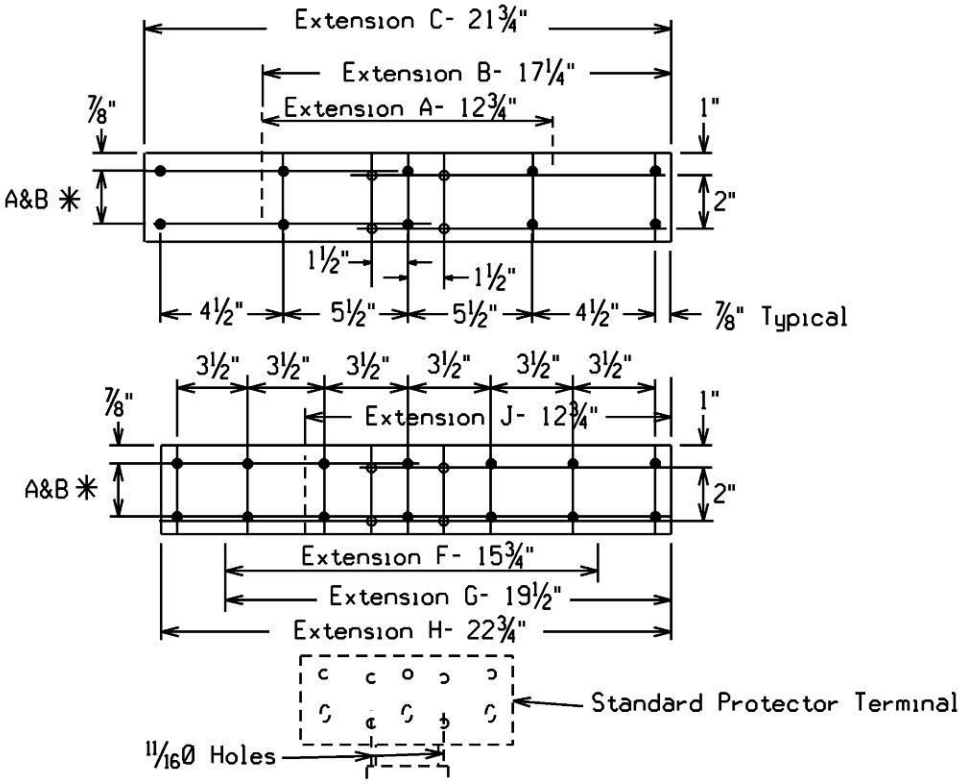
General Notes

When specified, a vertical extension, as shown on page 42-104 shall be furnished.

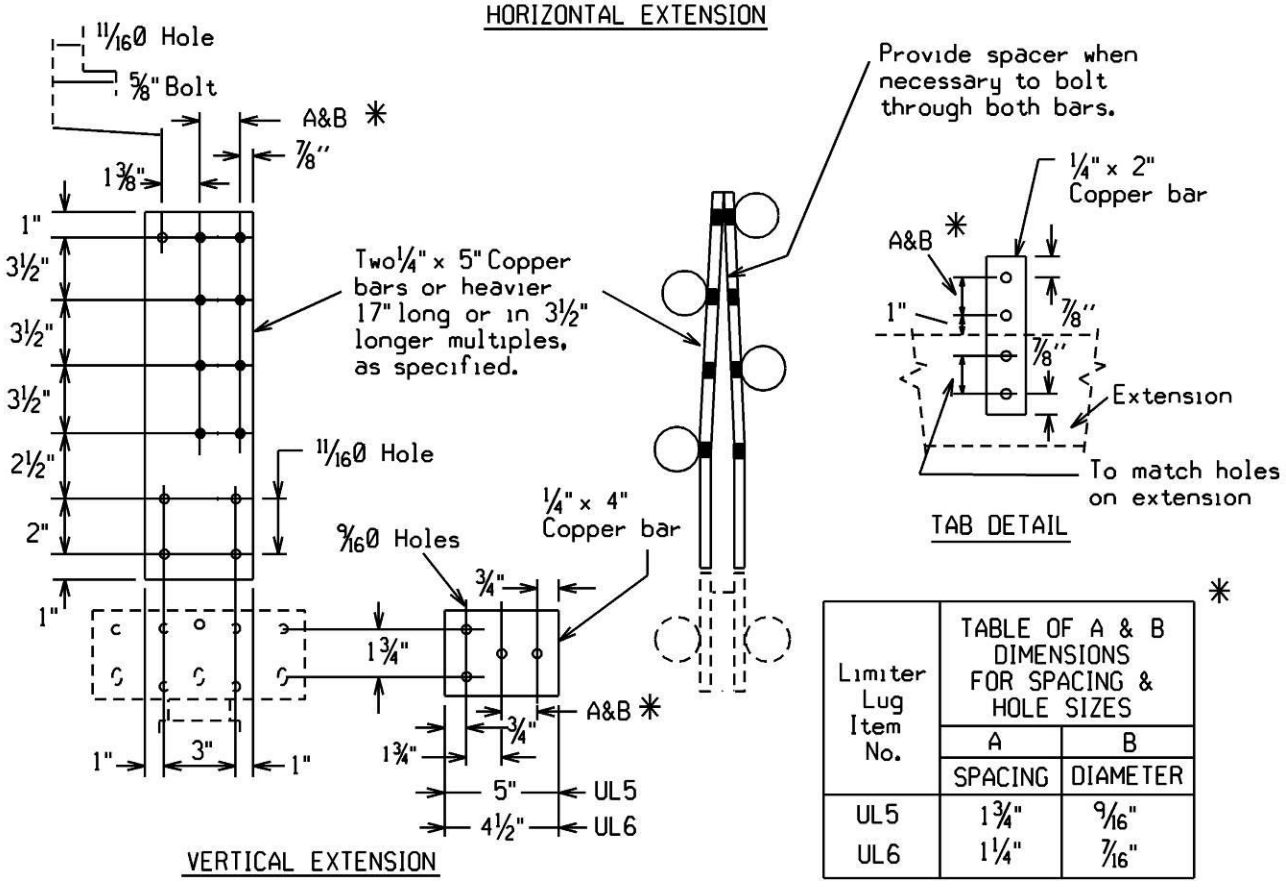
When specified, extensions shall be provided with tabs (See Tab Detail page 42-104) to permit pre-taping of extensions.

ALTERNATE ARRANGEMETNS - When specified on the installation drawings, extensions F, G or H (See page 42-104) shall be installed as shown below.





HORIZONTAL EXTENSION



VERTICAL EXTENSION

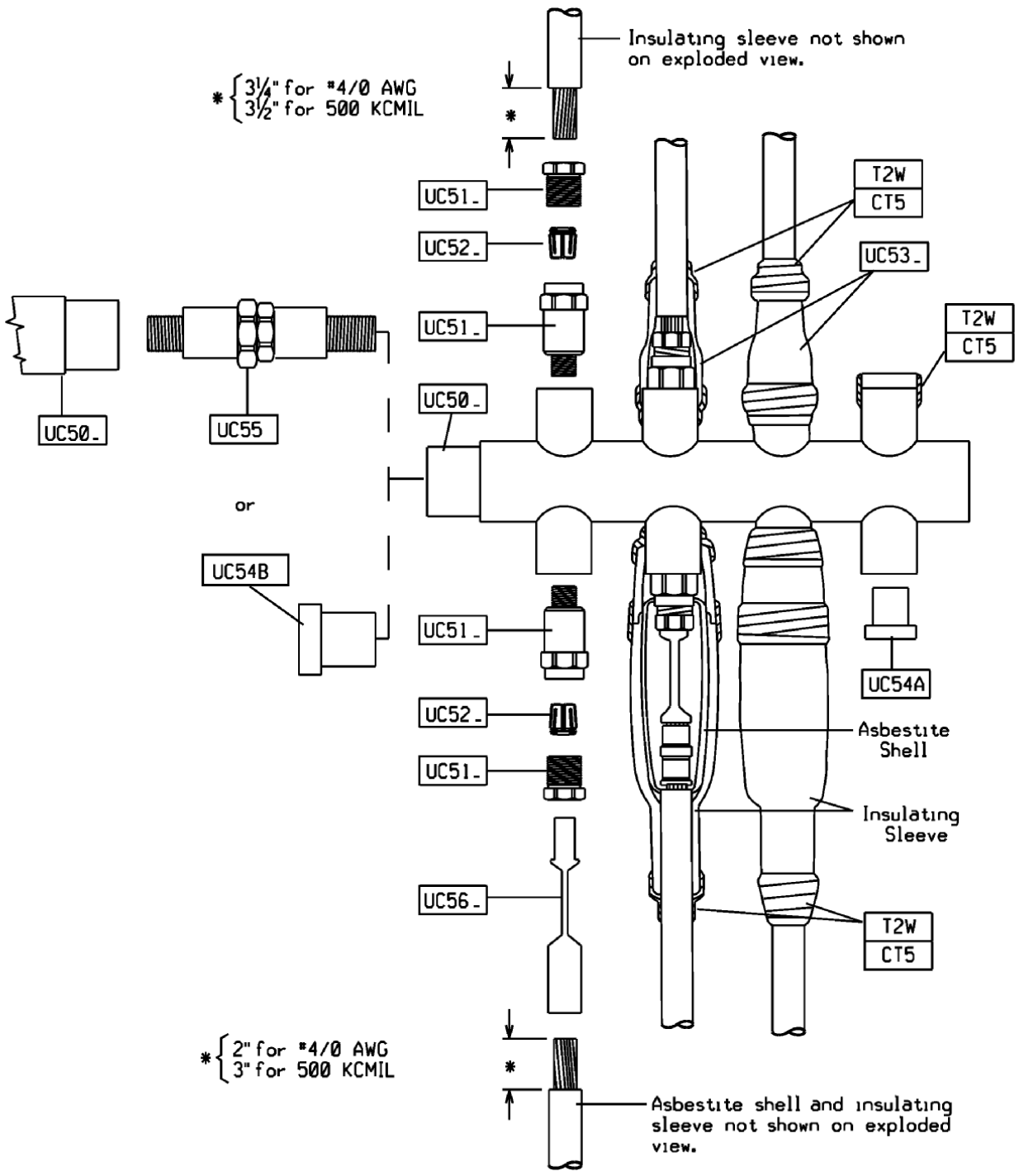
TAB DETAIL

Limiter Lug Item No.	TABLE OF A & B DIMENSIONS FOR SPACING & HOLE SIZES	
	A	B
	SPACING	DIAMETER
UL5	1¾"	9/16"
UL6	1¼"	7/16"

✳

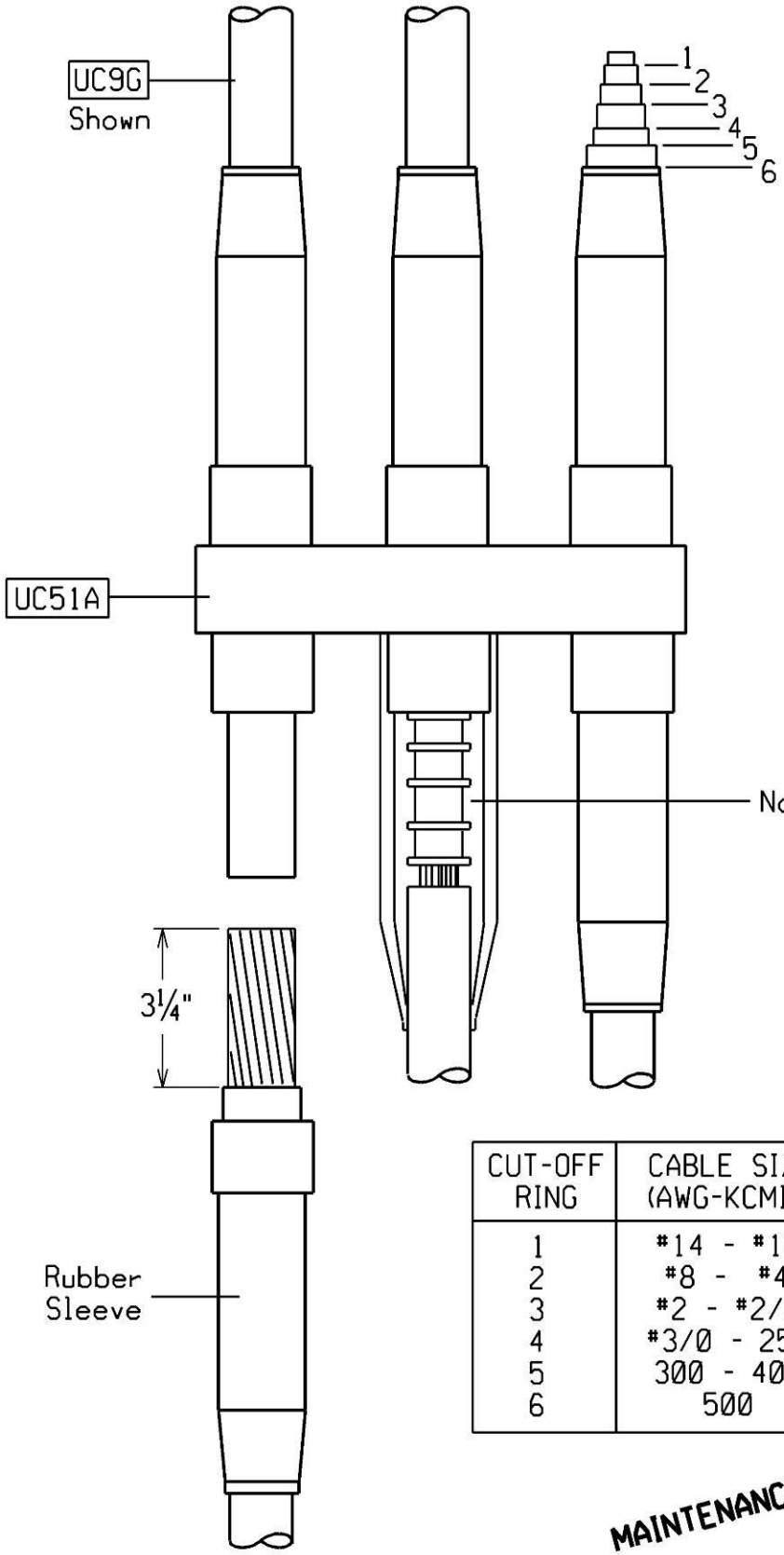
PROTECTOR TERMINAL EXTENSIONS FOR USE WITH STANDARD LIMITER LUGS

Supersedes 2/06 Issue – Drawing and note update to add CT5



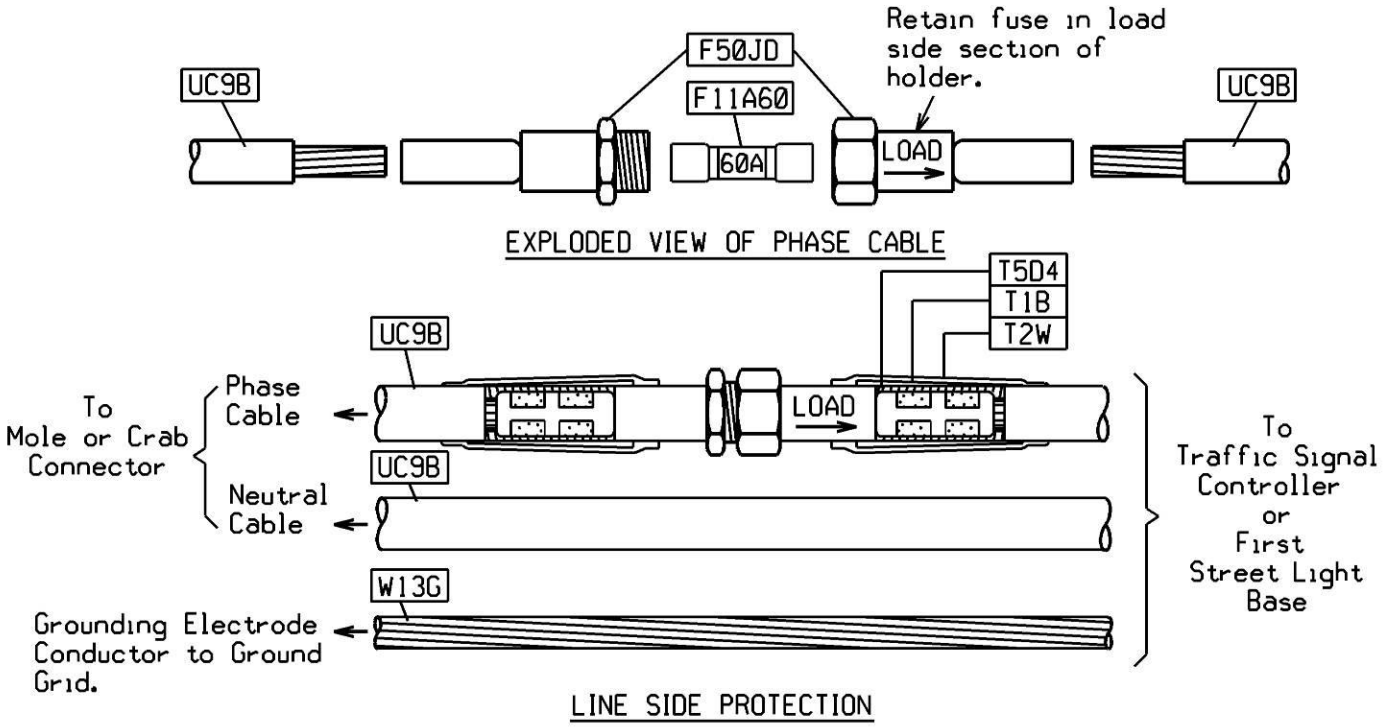
Notes:

1. For terminating neutral cables, use two-hole terminal lug connectors (Std. Item C9) and bolt to field fabricated copper bus bar ¼ inch minimum thickness using stainless steel hardware (Std. Item B8).
2. To seal mole limiter assembly from water, install rubber & scotch tape (Std Item CT5_) over the vinyl tape (STD Item T2W).

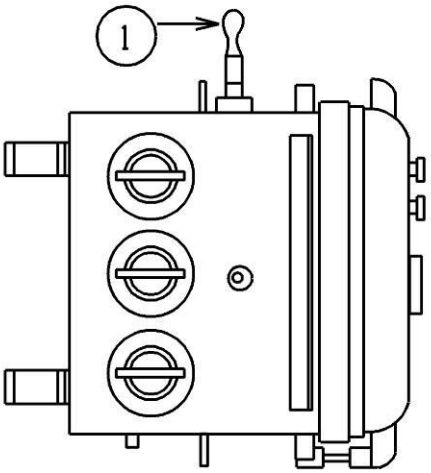


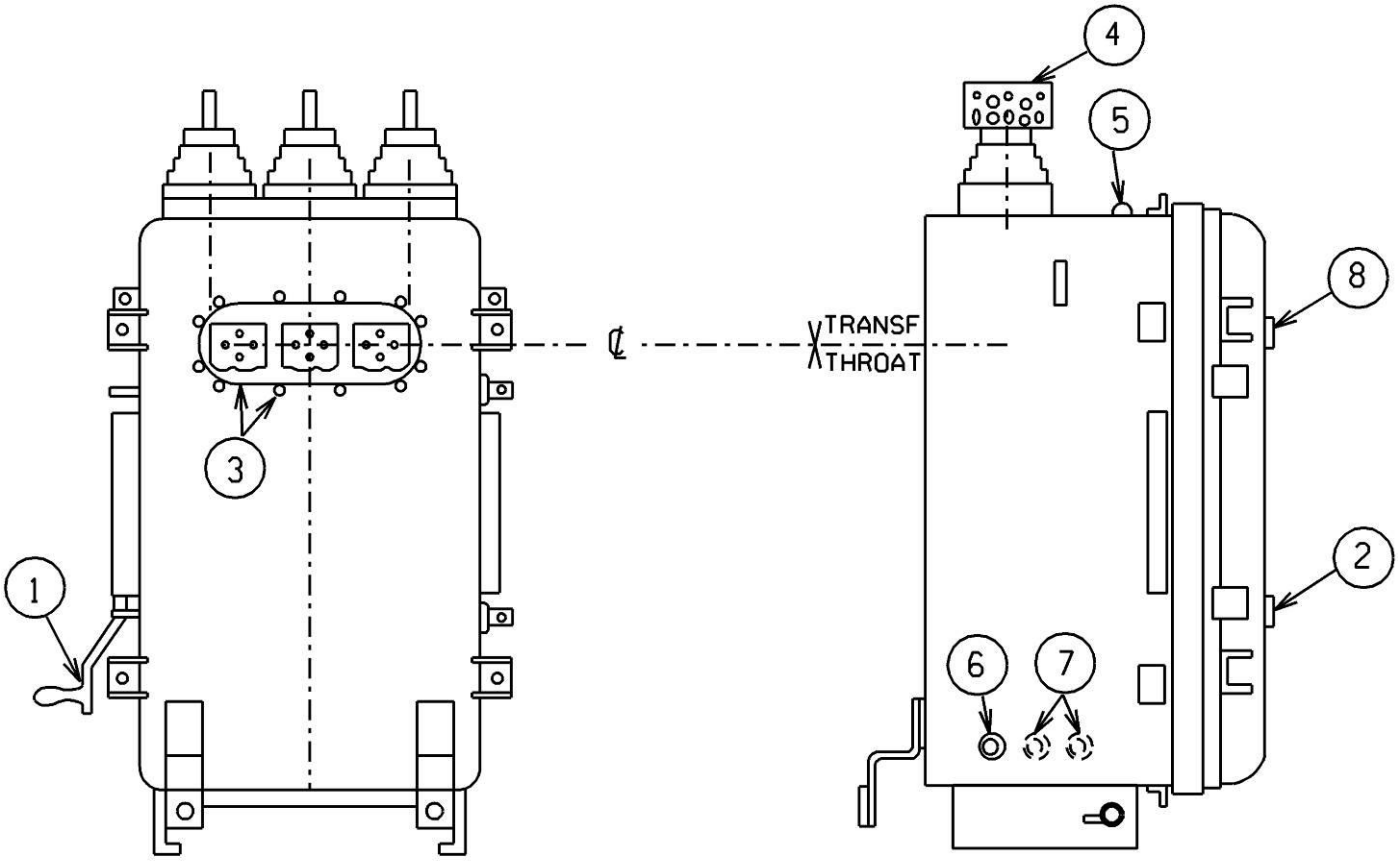
CUT-OFF RING	CABLE SIZE (AWG-KCMIL)
1	#14 - #10
2	#8 - #4
3	#2 - #2/0
4	#3/0 - 250
5	300 - 400
6	500

MAINTENANCE WORK ONLY



1. Operating Handle
2. Window for Position Indicator & operation Counter
3. Mounting Holes and Opening
4. Spade Type Terminals
5. Pressure Test Valve
6. Porcelain Bushing for Indicating Light
7. Porcelain Bushings for Auxiliary Relay to the ground fault Protection scheme on 480Y/277V Protectors Only.
8. Windows for Inspecting Fuses.





BACK VIEW

SIDE VIEW

Notes:

1. See MS 2596 for complete specifications.
2. Locations of some features may vary with manufacturer.
3. Mounting holes and opening size vary with protector size.

NETWORK PROTECTOR SPADE TERMINALS AND INTERNAL FUSES			
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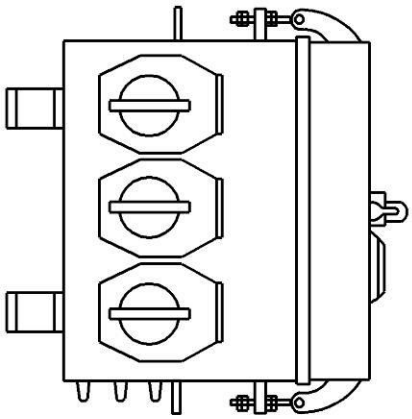
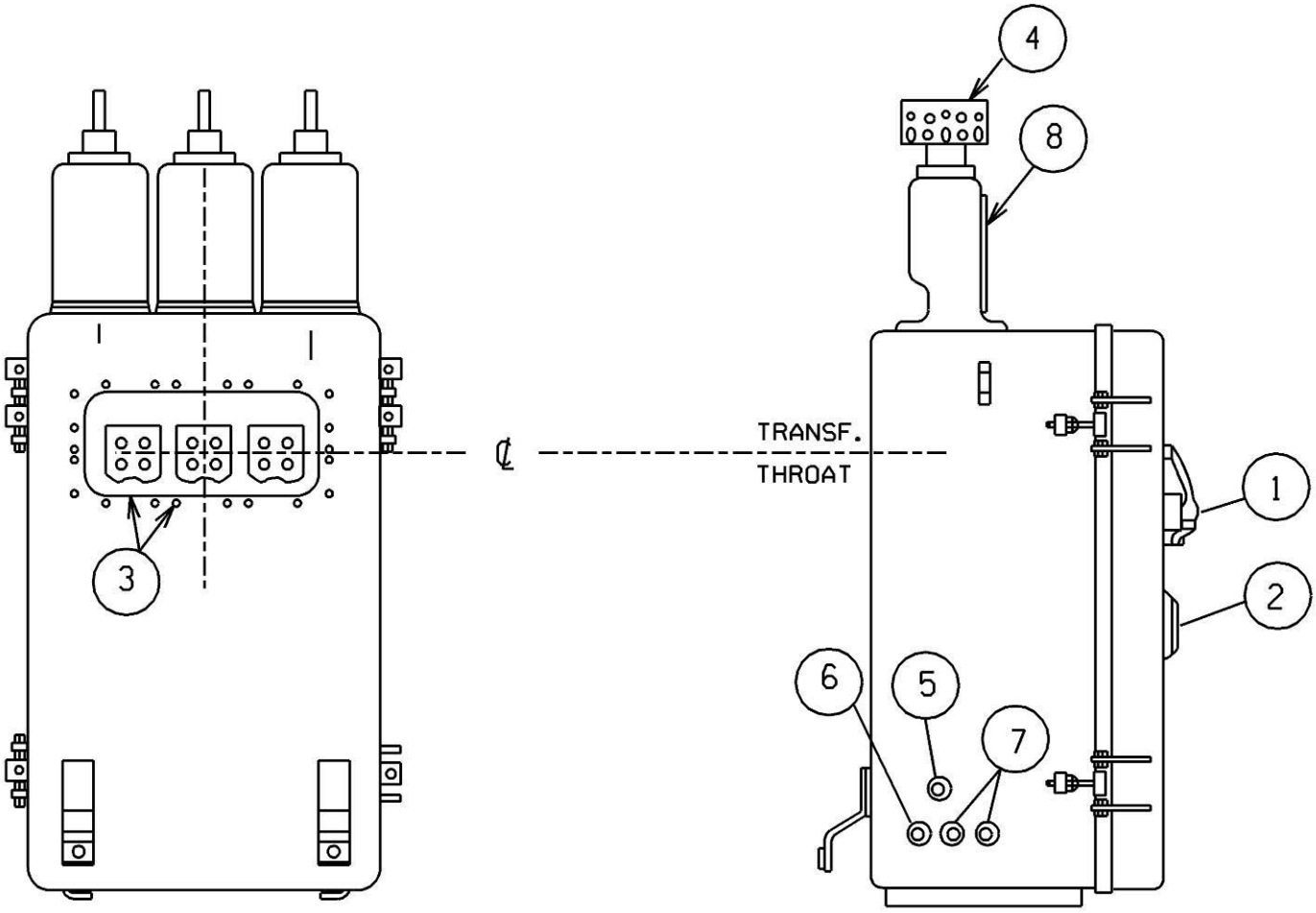
2/06	**42-113**		

1. Operating Handle
2. Window for Position Indicator & operation Counter
3. Mounting Holes and Opening
4. Spade Type Terminals
5. Pressure Test Valve
6. Porcelain Bushing for Indicating Light
7. Porcelain Bushings for Auxiliary Relay to the ground fault Protection scheme on 480Y/277V Protectors Only.
8. Removable Cover on Fuse Housing.





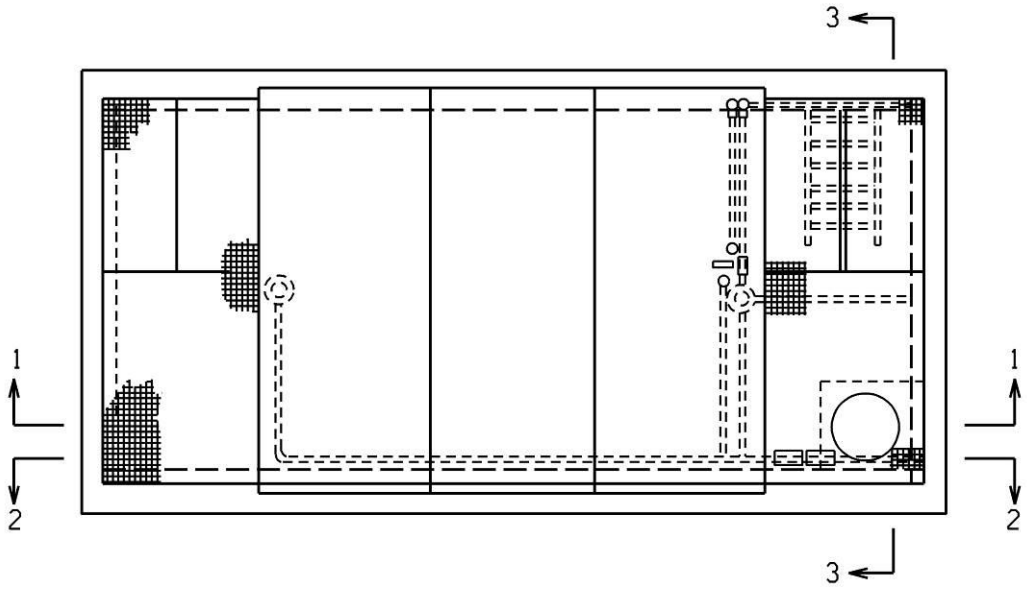
BACK VIEW

SIDE VIEW

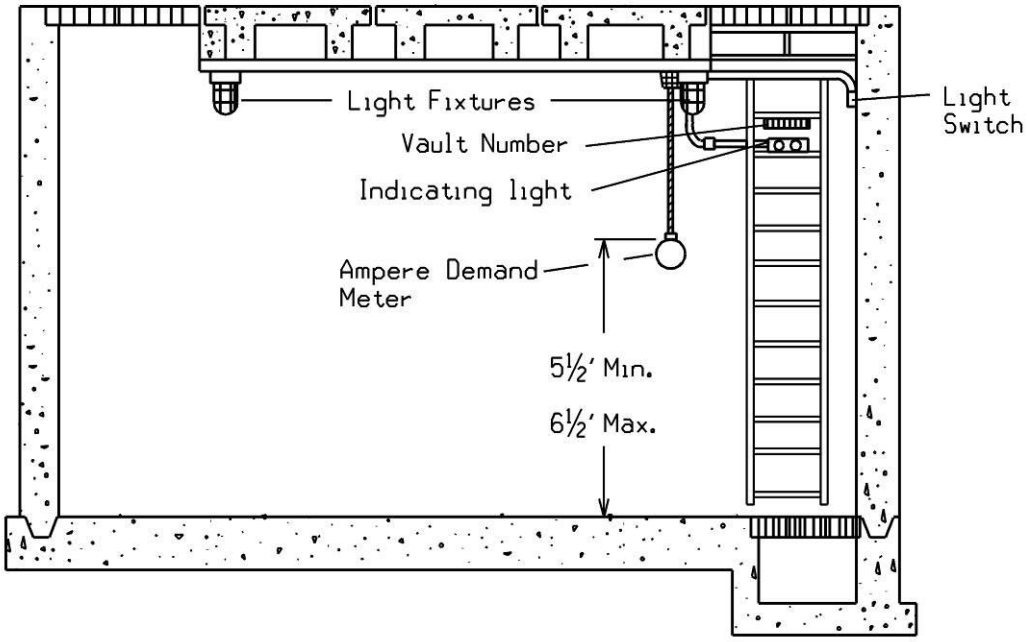
Notes:

1. See MS 2596 for complete specifications.
2. Locations of some features may vary with manufacturer.
3. Mounting holes and opening size vary with protector size.

NETWORK PROTECTOR SPADE TERMINALS AND EXTERNAL FUSES			
ppl	**UNDERGROUND CONSTRUCTION STANDARD**	**PAGE NUMBER**	**ISSUE**
		42-116	**2/06**



PLAN

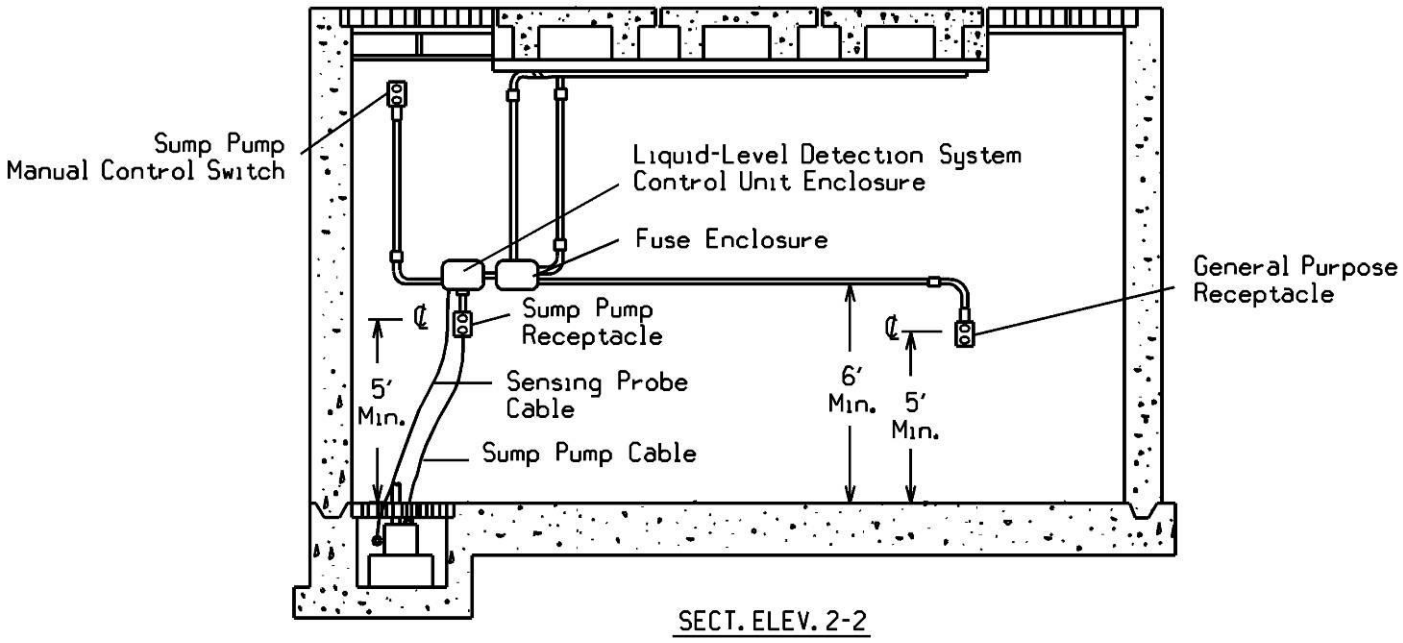


SECT. ELEV. 1-1

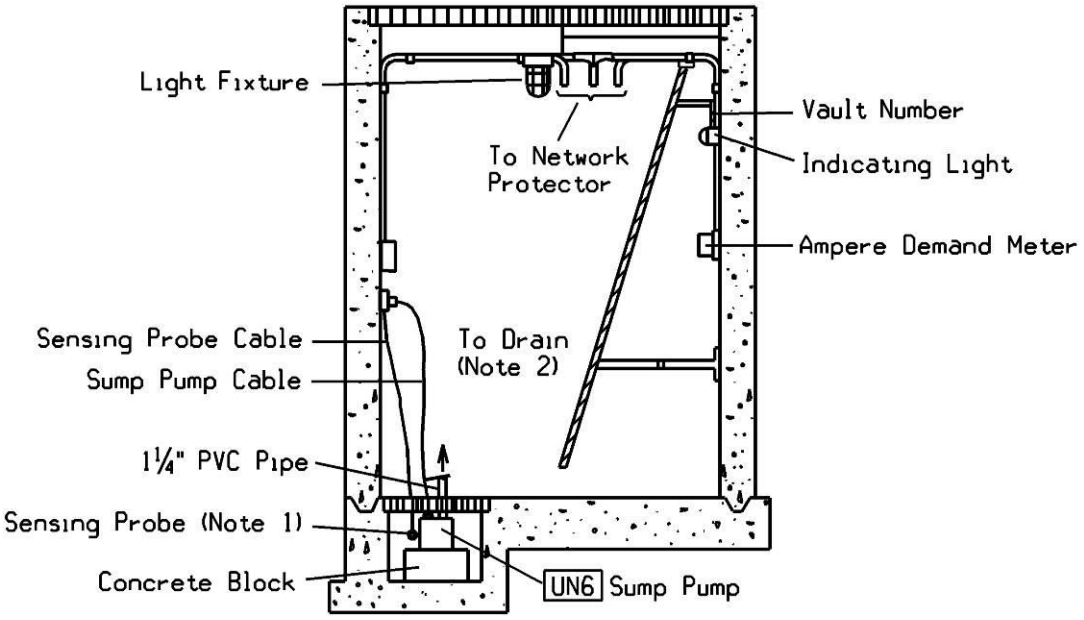
Supersedes 2/06 Issue. added note 3

Notes:

1. See drawing 42-123 for Section 2-2 and 3-3.
2. Install indicating light and ampere demand meter if required.
3. Vaults are available in different sizes based on the size of the network transformer, see 41 1 for details.



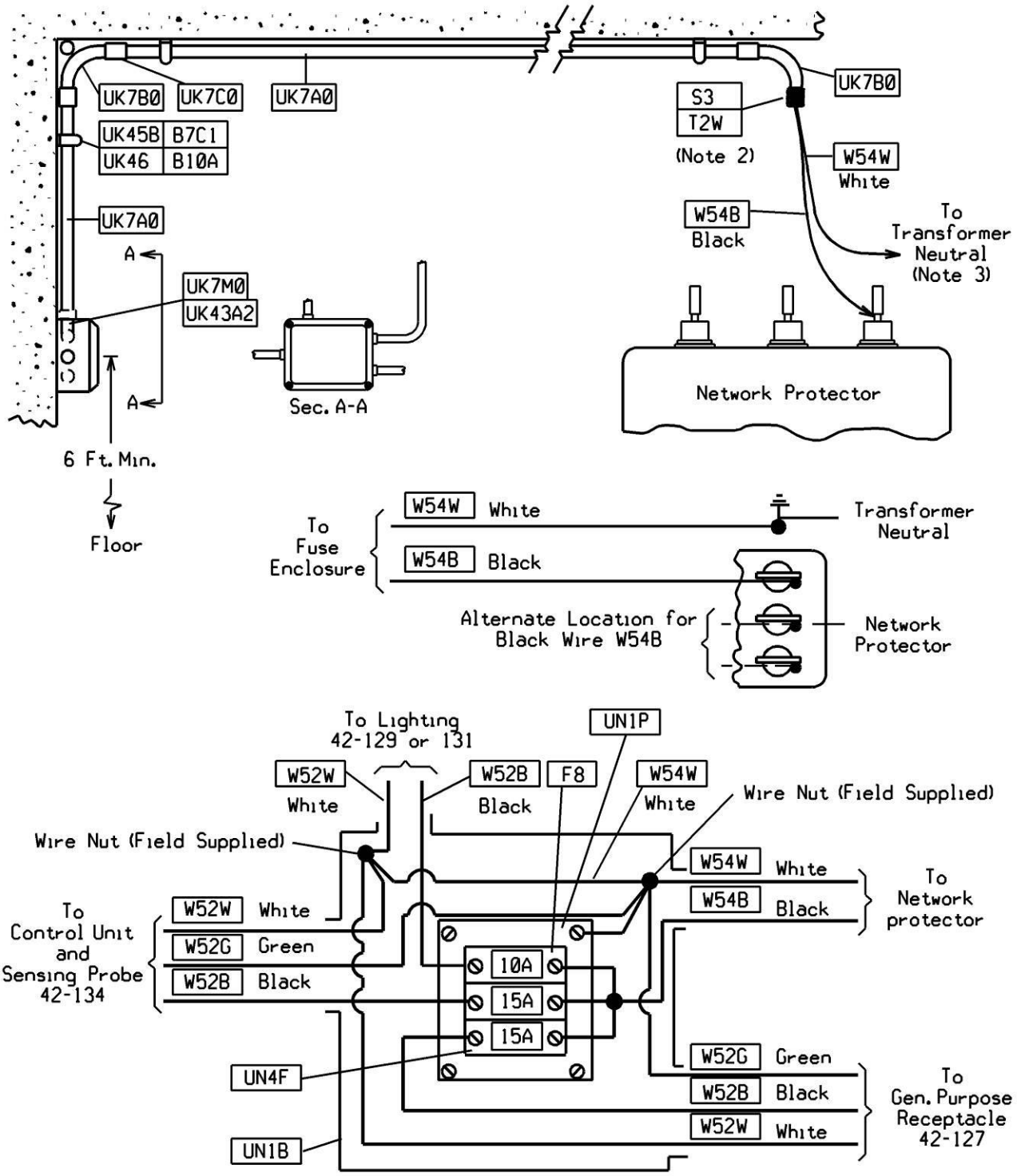
SECT. ELEV. 2-2



SECT. ELEV. 3-3

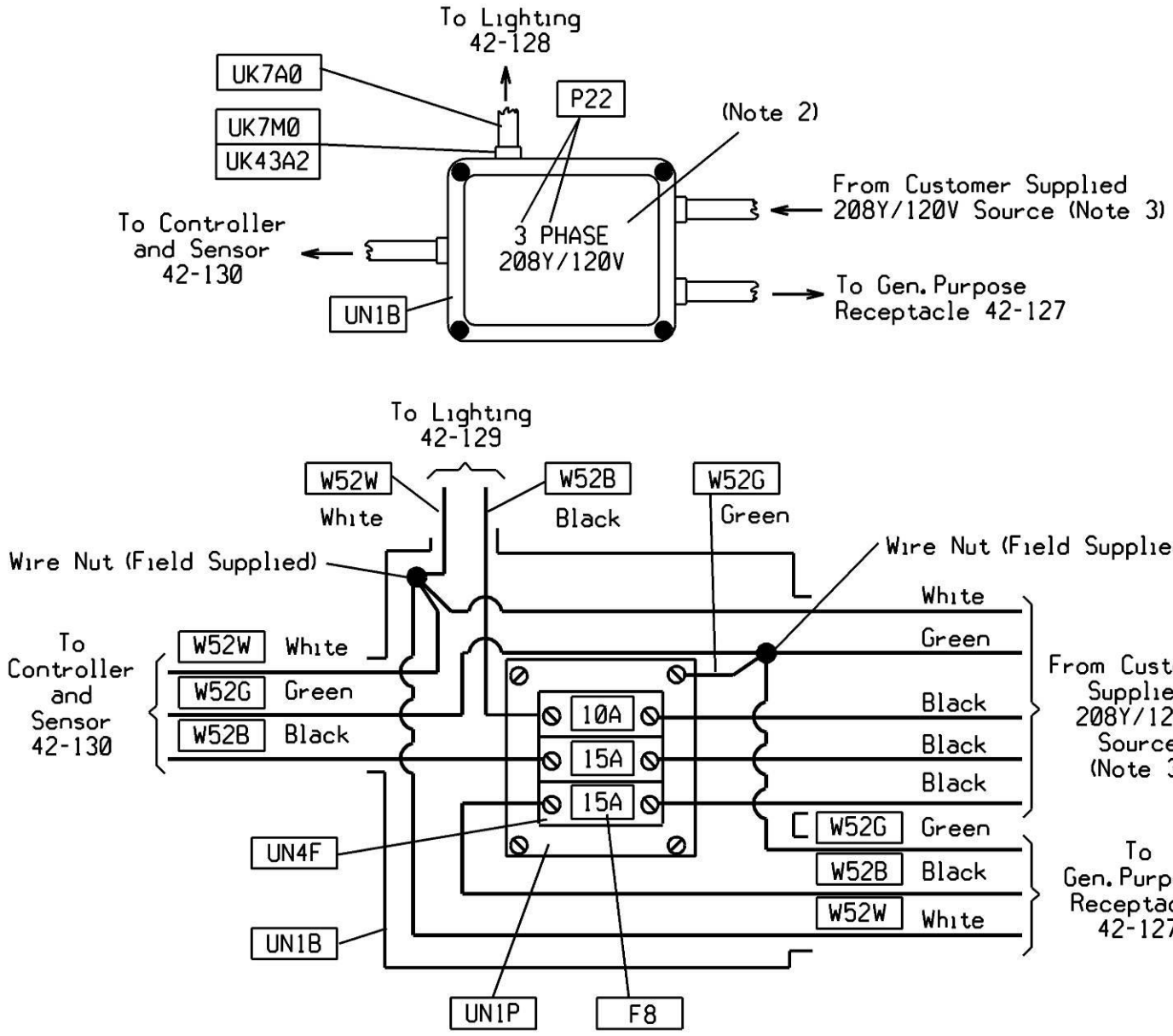
Notes:

1. Locate the Sensing Probe end as shown on Page 42-134.
2. Use Check valve (Std. Item UN6V) to prevent backfeed from drain.
3. Install indicating light and ampere demand meter if required.



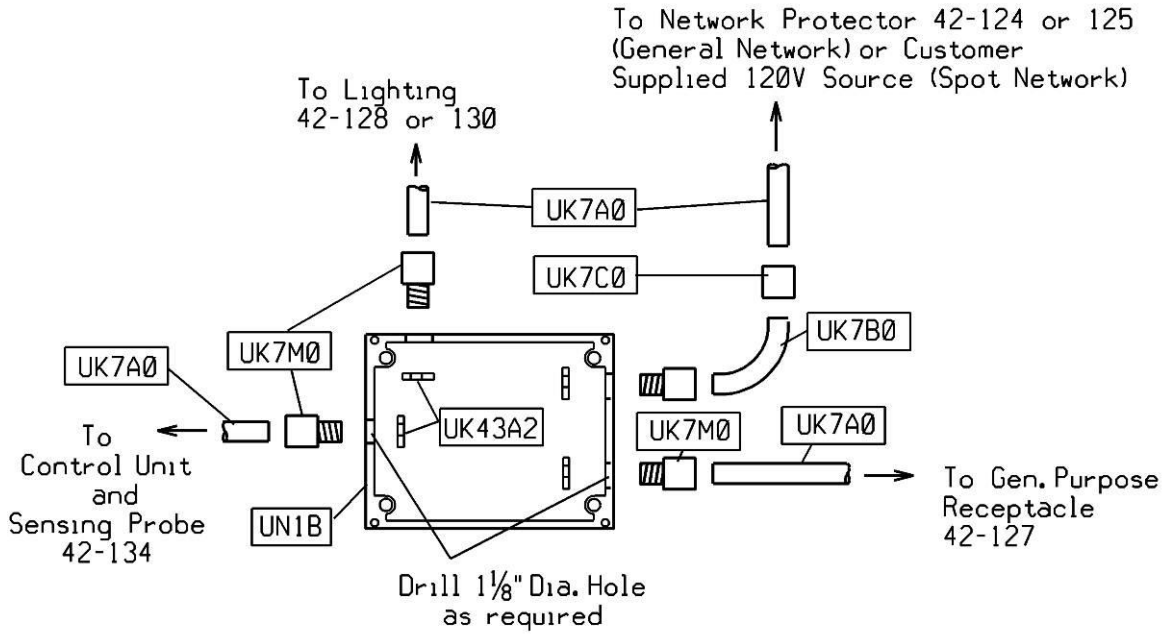
Notes:

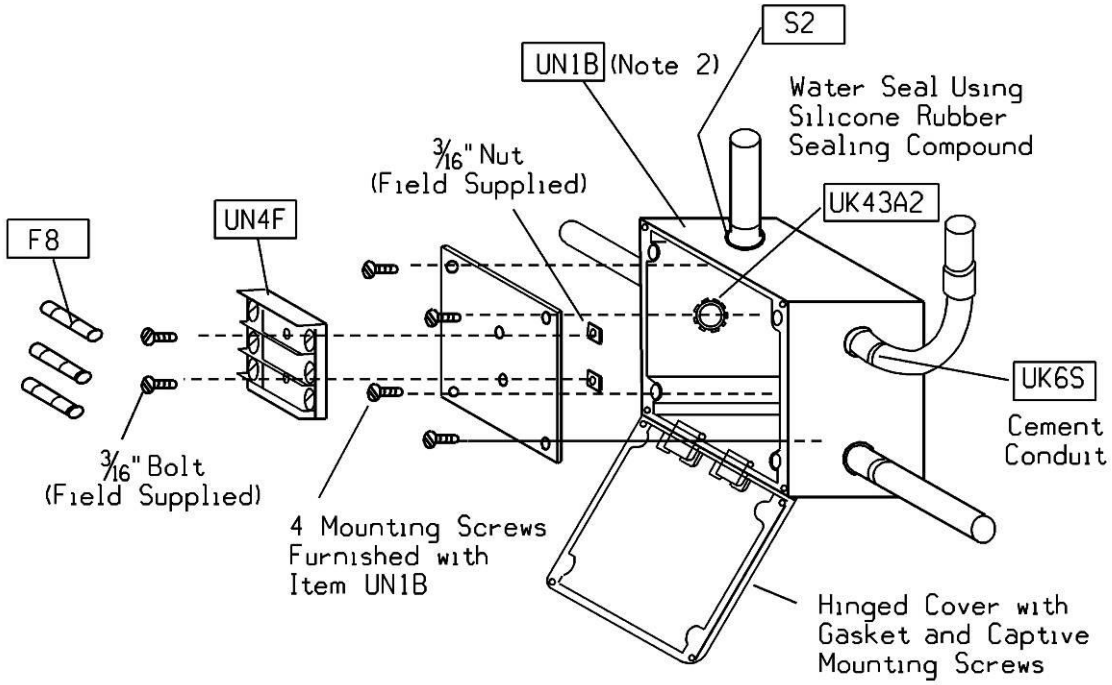
1. See Page 42-126 for fuse enclosure installation details.
2. Water seal conduit opening with sealing compound (Std. Item S3) and vinyl plastic tape (Std. Item T2W).
3. Connect to protector spade terminal using the ¼ inch – 20 tapped hole and screw provided.
4. Label the circuit associated with each fuse on the inside of the enclosure cover for future reference.



Notes:

1. See Page 42-126 for fuse enclosure installation details.
2. Label the circuit associated with each fuse on the inside of the enclosure cover for future reference. Label the outside of the enclosure cover with 3 PHASE 208Y/120 V for future reference.
3. The customer shall furnish, install, own and maintain an approved watertight ¾ inch non-metallic three-phase circuit protected by a 30 A. circuit breaker or fuse consisting of five single conductors of #10 stranded copper-coded black, white and green (phase, neutral and equipment ground respectively) through the conduit system and terminate using approved wire nuts in the junction box.

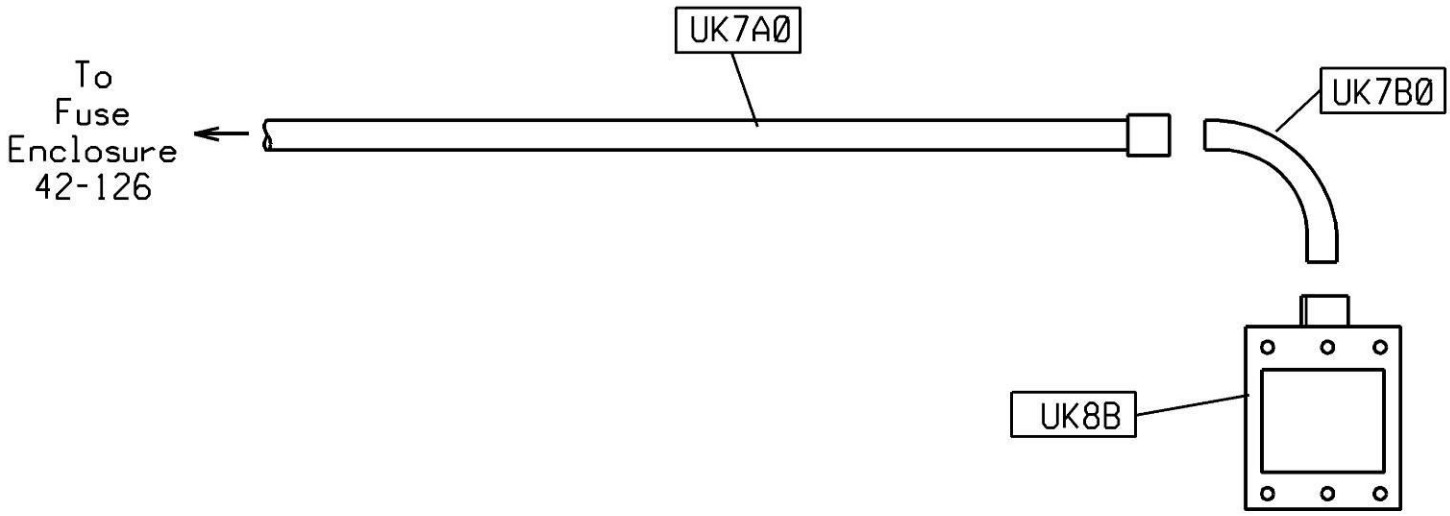


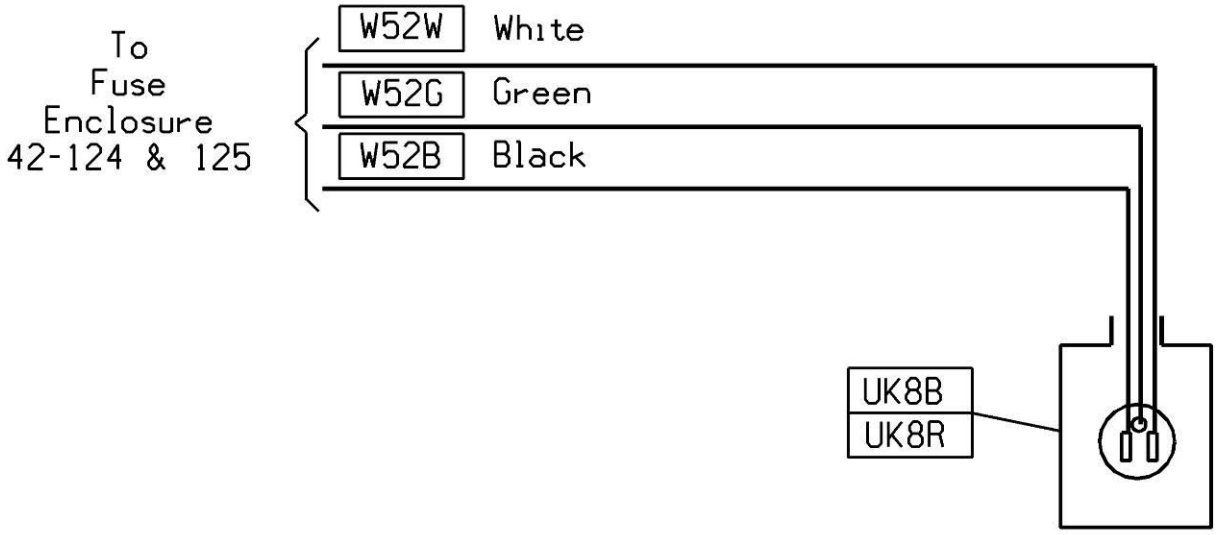


Notes:

1. See Pages 42-124 and 42-125 for typical details and schematic diagram.
2. Mount enclosure box (Std. Item UN1B) to wall using ¼ inch machine bolts (Std. Item B10A) and ¼ inch machine bolt anchors (Std. Item B7C1).

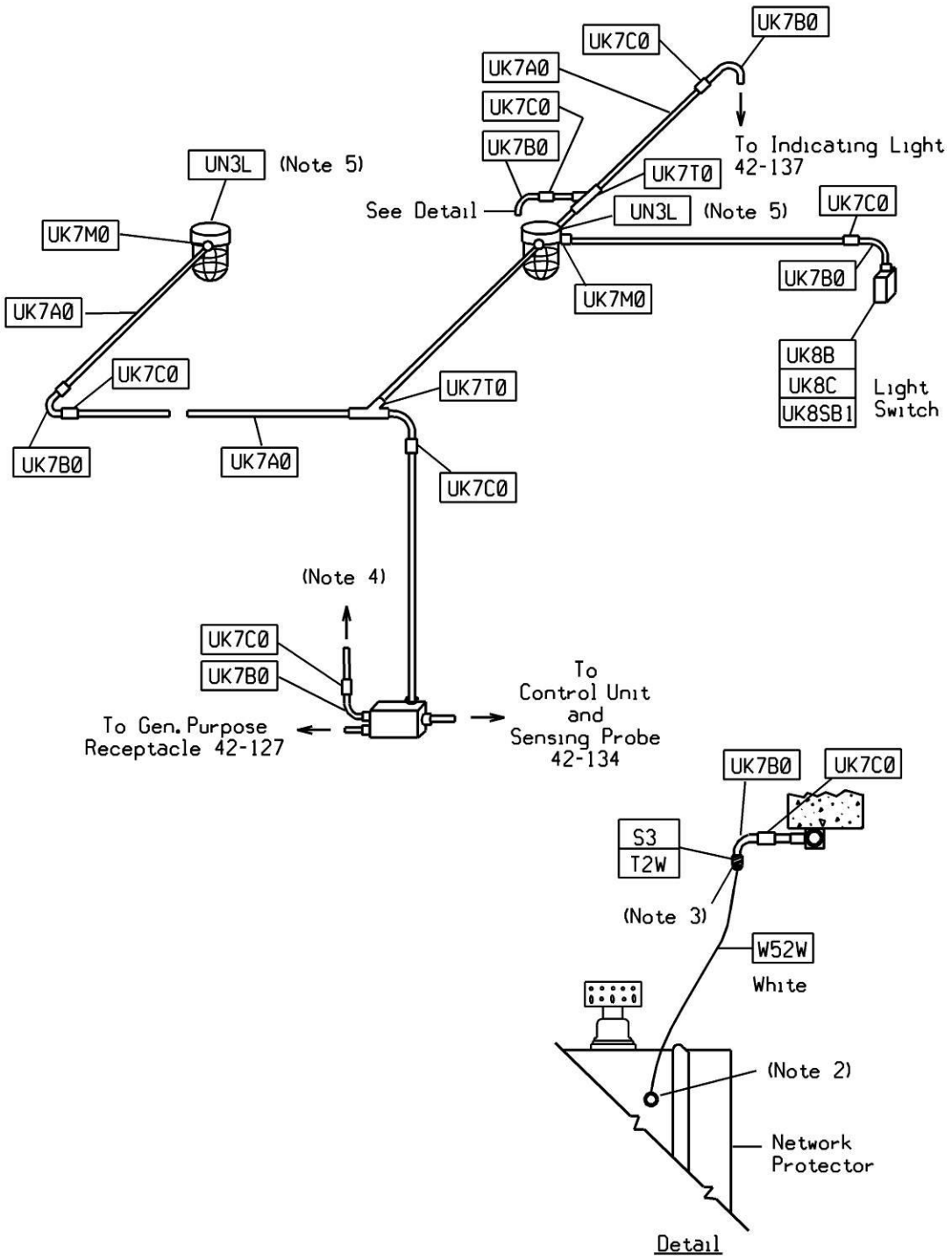
NETWORK VAULT FUSE ENCLOSURE INSTALLATION DETAILS			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
2/06	**42-126**		





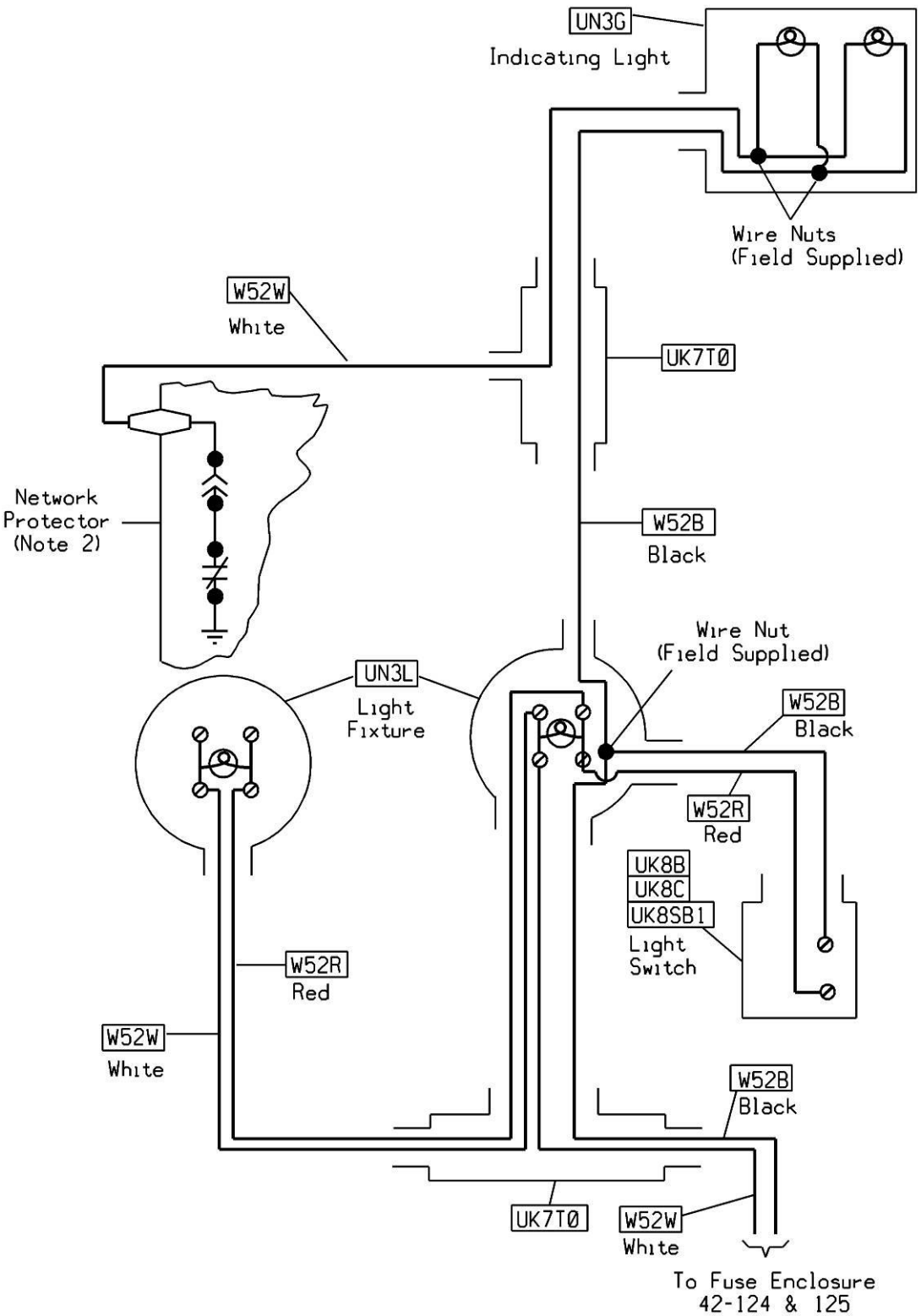
NETWORK VAULT GENERAL PURPOSE RECEPTACLE AND COVER
TYPICAL DETAIL AND SCHEMATIC DIAGRAM

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	42-127	2/06



Notes:

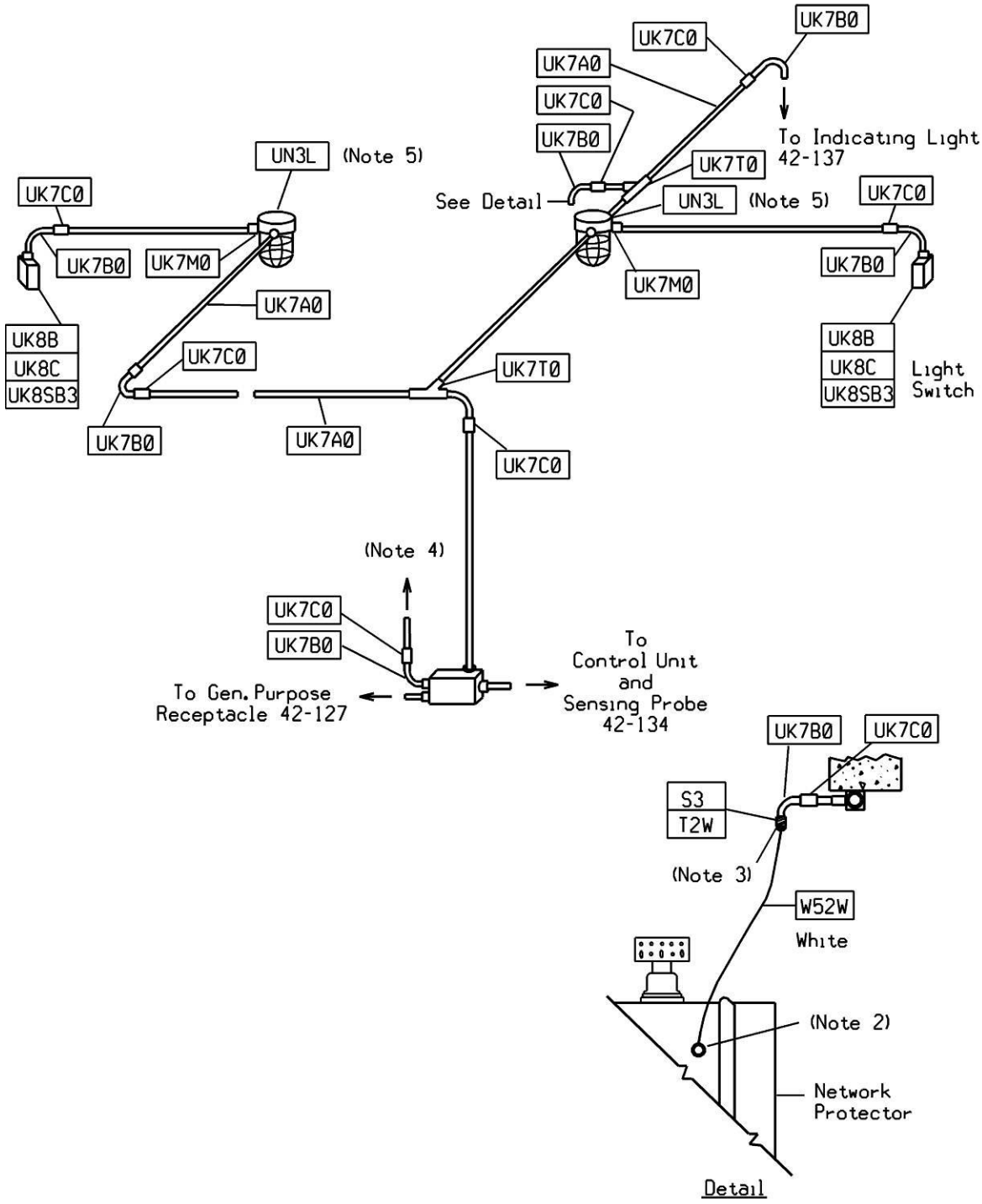
1. See Page 42-129 for schematic diagram.
2. Insulate bushing (spark plug) with insulating tape (Std. Item T5B) and vinyl tape (Std. Item T2W).
3. Water seal conduit opening with sealing compound (Std. Item S3) and vinyl tape (Std. Item T2W).
4. To network protector (general network) or to customer supplied 120 V source (spot network), see Pages 42-124 thru 42-126.
5. Use 100-Watt maximum incandescent light bulb.



Notes:

1. See Page 42-128 for installation details.
2. See Page 42-113 for protector general arrangements and accessories.

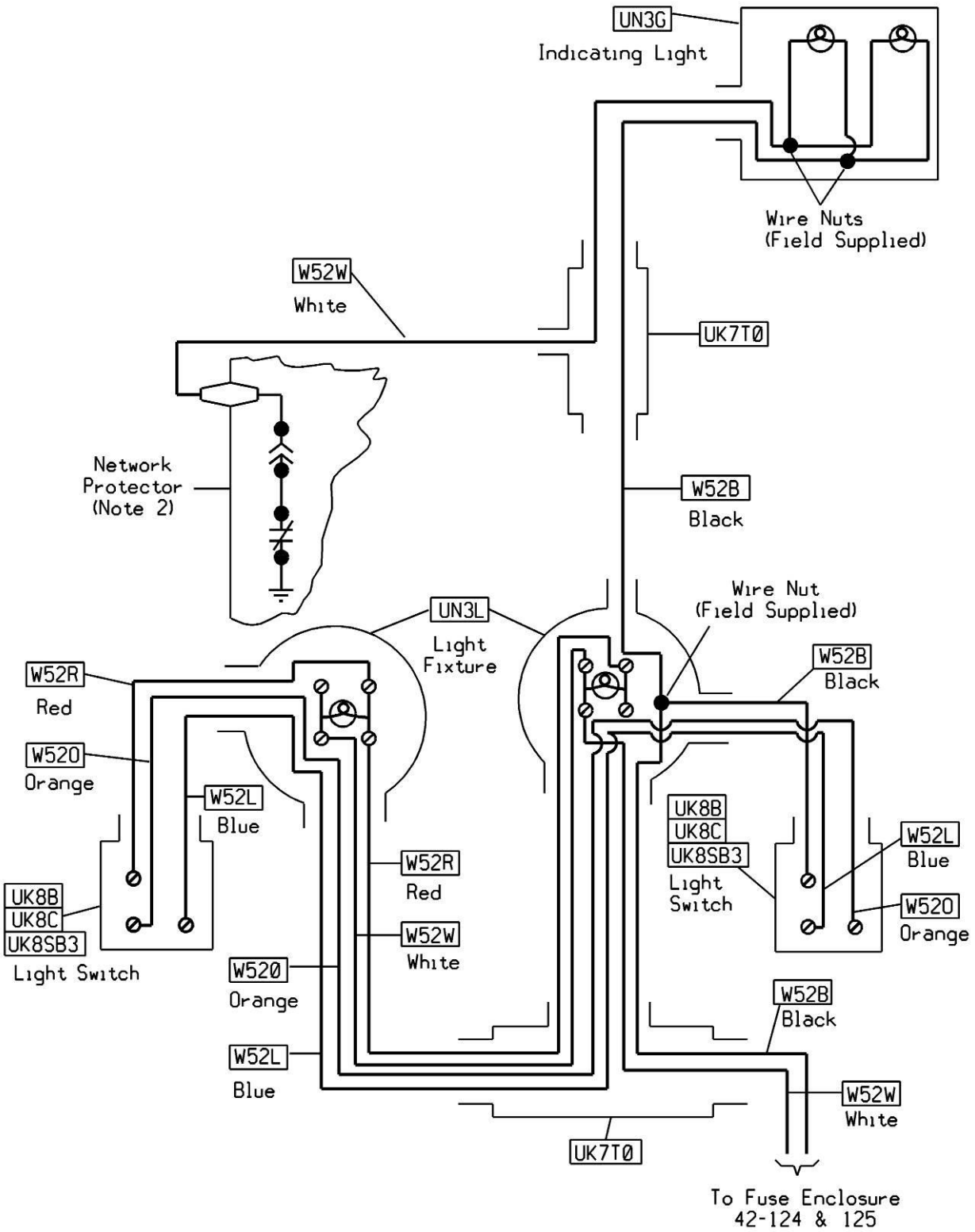
NETWORK VAULT GENERAL LIGHTING AND INDICATING LIGHT TYPICAL SCHEMATIC DIAGRAM – SINGLE ENTRY VAULT			
ppl	**UNDERGROUND CONSTRUCTION STANDARD**	**PAGE NUMBER**	**ISSUE**
		42-129	**2/06**



Notes:

1. See Page 42-131 for schematic diagram.
2. Insulate bushing (spark plug) with insulating tape (Std. Item T5B) and vinyl tape (Std. Item T2W).
3. Water seal conduit opening with sealing compound (Std. Item S3) and vinyl tape (Std. Item T2W)/
4. To network protector (general network) or to customer supplied 120 V source (spot network), see Pages 42-124 thru 42-126.
5. Use 100-Watt maximum incandescent light bulb.

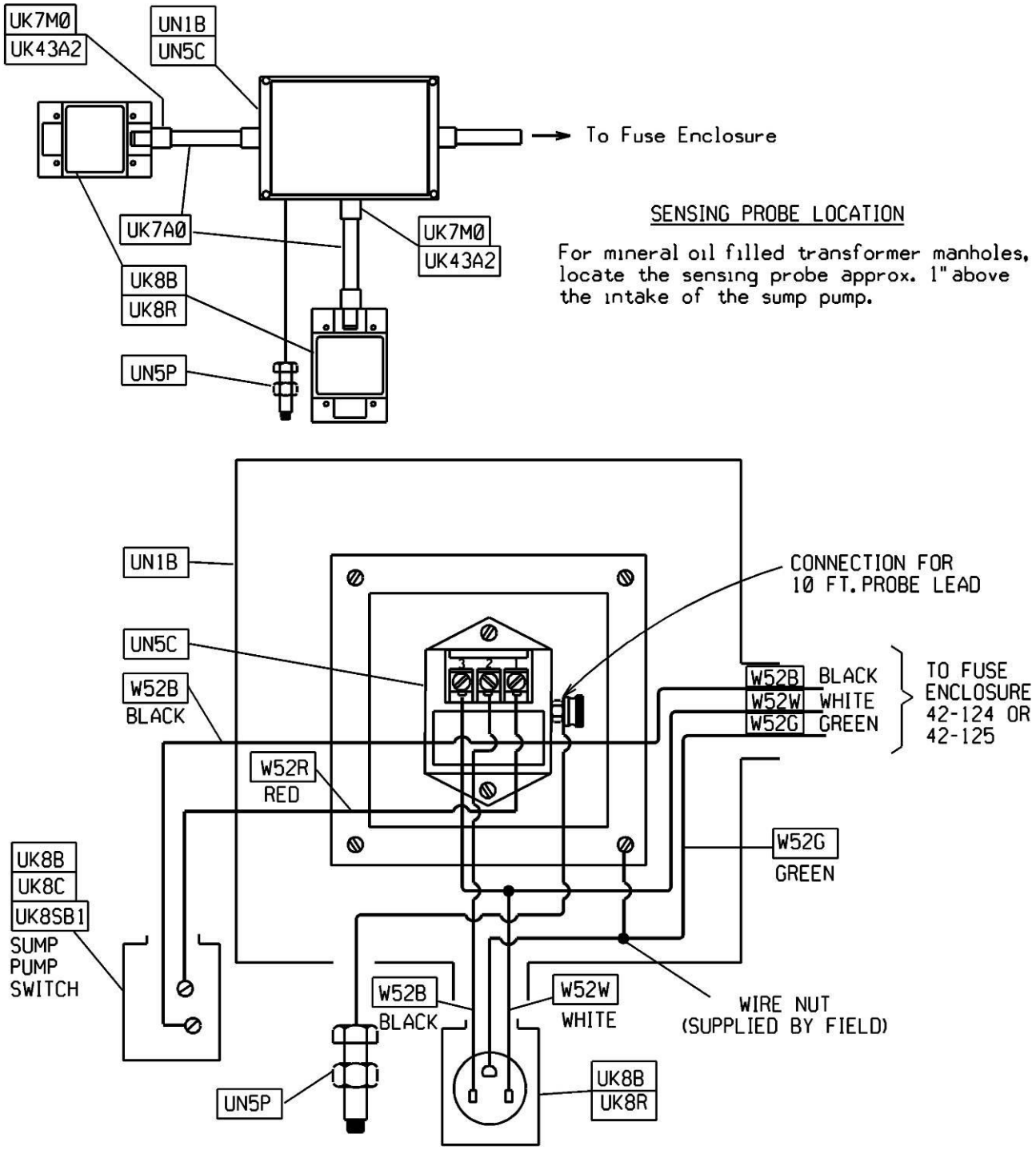
NETWORK VAULT GENERAL LIGHTING TYPICAL DETAILS – DOUBLE ENTRY VAULT			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
2/06	**42-130**		



Notes:

1. See Page 42-130 for installation details.
2. See Page 42-113 for protector general arrangements and accessories.

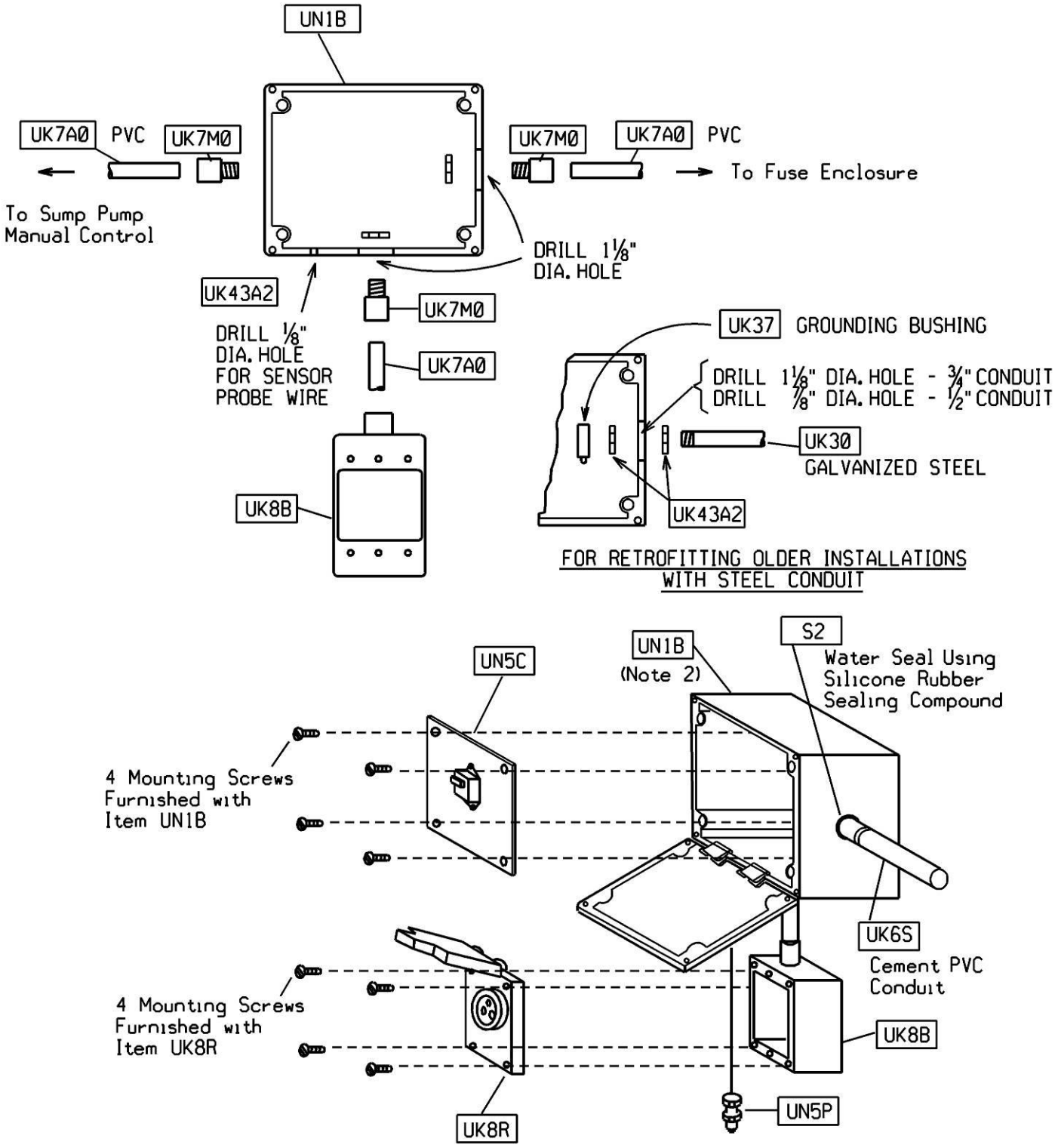
NETWORK VAULT GENERAL LIGHTING AND INDICATING LIGHT TYPICAL SCHEMATIC DIAGRAM – DOUBLE ENTRY VAULT			
ppl	**UNDERGROUND CONSTRUCTION STANDARD**	**PAGE NUMBER**	**ISSUE**
		42-131	**2/06**



Notes:

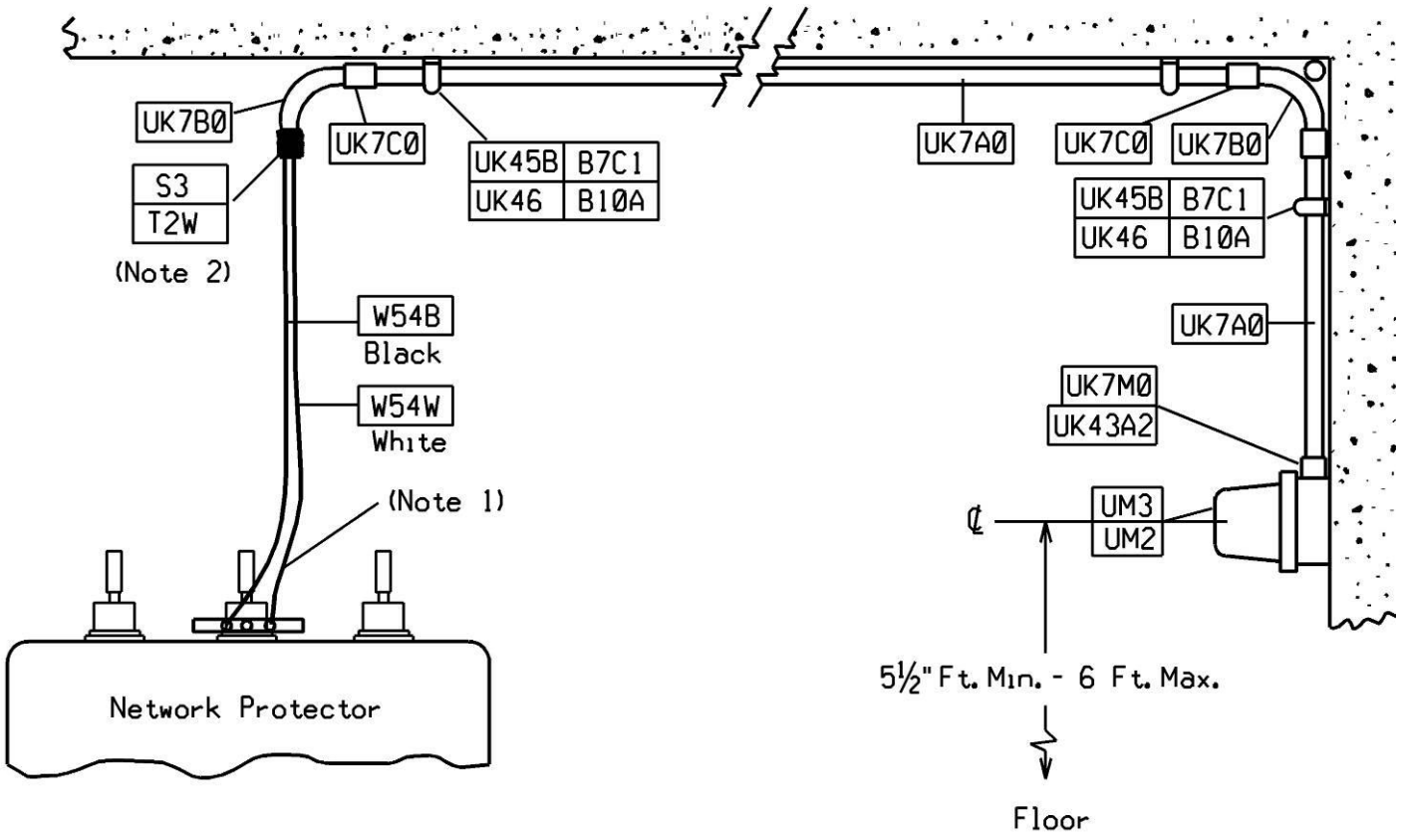
1. See Page 42-135 for installation details.
2. For retrofitting existing installations, replace the existing box receptacle assembly associated with the sump pump, with the above assembly. For retrofitting older installations using galvanized steel conduit for the equipment grounding conductor (no bare or green wire inside conduit), install grounding bushing (Std. Item UK37) on the galvanized steel conduit and connect it to the green wires in the control unit.

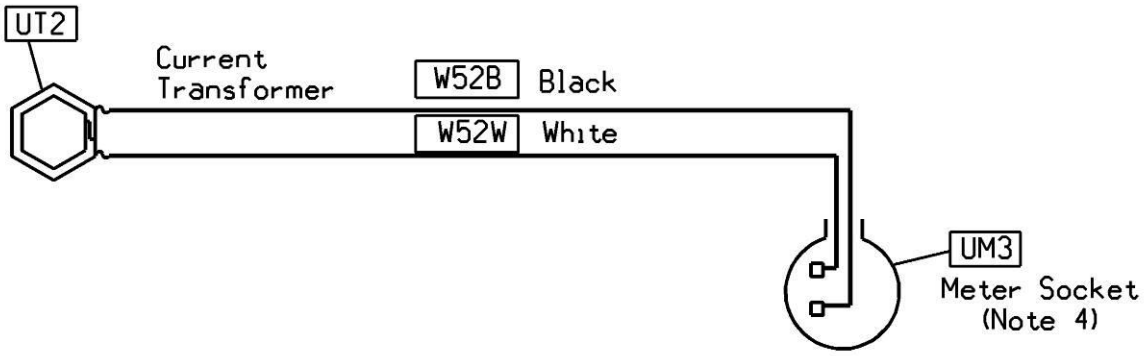
NETWORK VAULT CONTROL UNIT, SENSING PROBE & SUMP PUMP RECEPTACLE TYPICAL DETAIL AND SCHEMATIC DIAGRAM			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
2/06	**42-134**		



Notes:

1. See Page 42-134 for typical details and schematic diagram.
2. Mount enclosure box (Std. Item UN1B) to wall using ¼ inch machine bolts (Std. Item B10A) and ¼ inch machine bolt anchors (Std. Item B7C1).

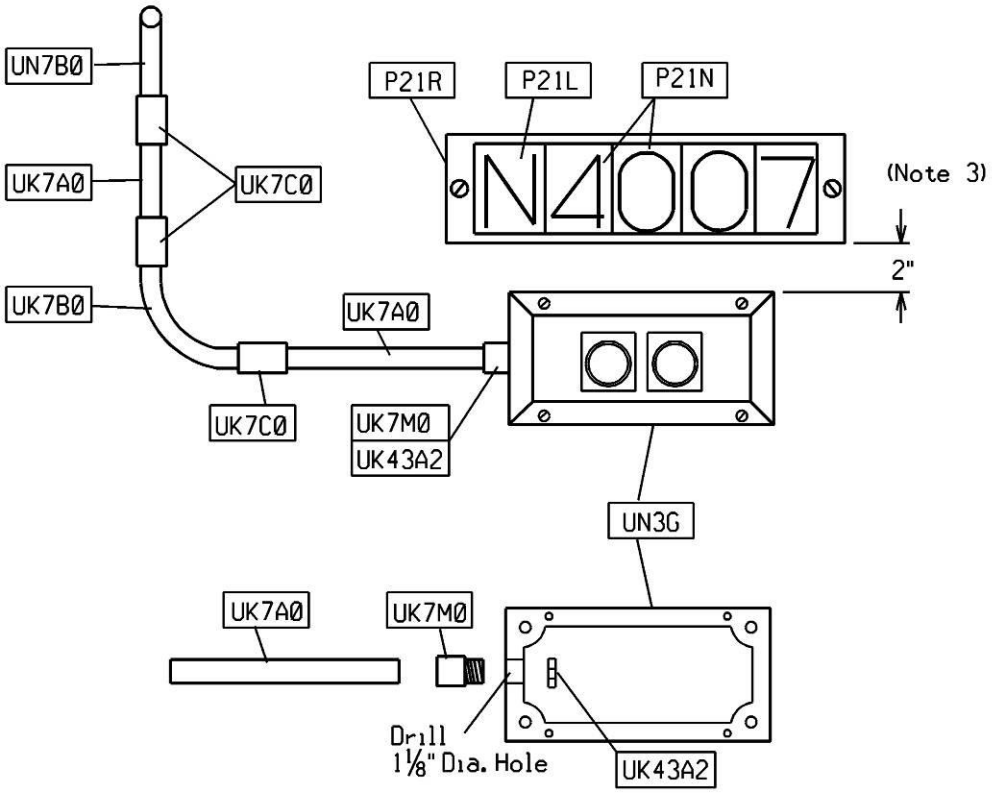


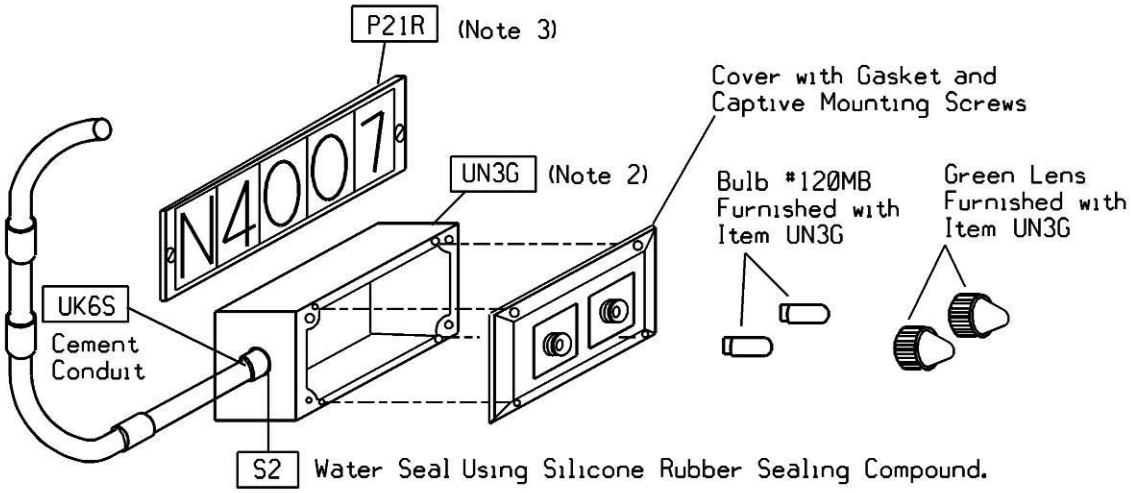


Notes:

1. Attach current transformer (CT) to center protector bushing as shown. Place CT so that the bushing is centered inside the CT and tape in position.
2. Water seal conduit opening with sealing compound (Std. Item S3) and vinyl plastic tape (Std. Item T2W).
3. See Pages 42-138 and 42-139 for sizing the current transformer.
4. Mount meter socket (Std. Item UM3) to wall using ¼ inch machine bolts (Std. Item B10A) and ¼ inch machine bolt anchors (Std. Item B7C1).

NETWORK VAULT MAXIMUM INDICATING AMMETER INSTALLATION DETAILS AND SCHEMATIC DIAGRAM			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
2/06	**42-136**		





Notes:

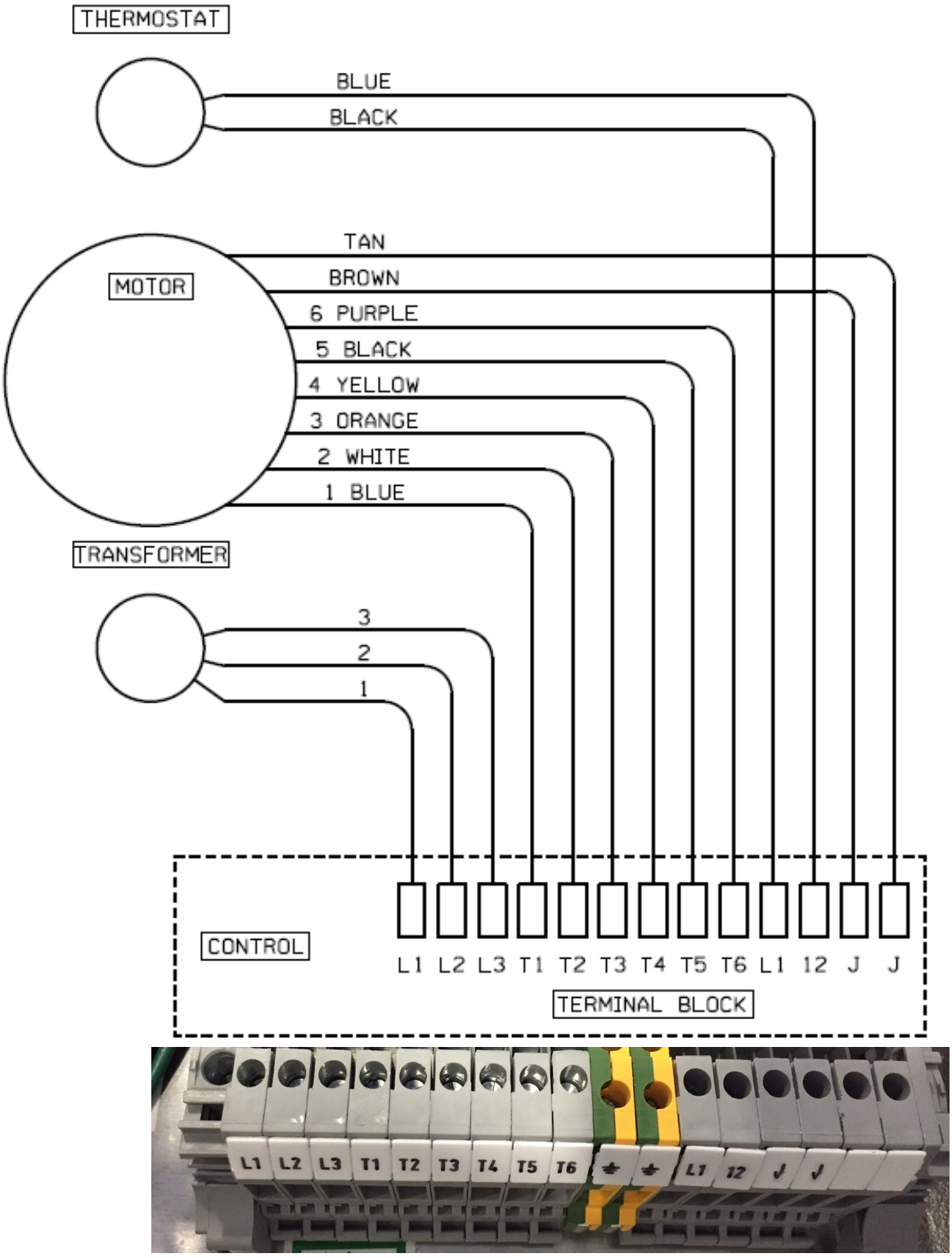
1. See Pages 42-128 thru 42-131 for typical details and schematic diagrams.
2. Mount indicating light box (Std. Item UN3G) to wall using ¼ inch machine bolts (Std. Item B10A) and ¼ inch machine bolt anchors (Std. Item B7C1). Mounting holes may need to be slightly enlarged to accommodate head of machine bolt.
3. Mount manhole identification number mounting panel (Std. Item P21R) and reflective vinyl letter (Std. Item P21L) and numbers (Std. Item P21N) to wall using ¼ inch machine bolts (Std. Item B10A) and ¼ inch machine bolt anchors (Std. Item B7C1). Mounting holes may need to be slightly enlarged to accommodate machine bolts.

NETWORK TRANSFORMER SIZE (KVA)	NETWORK TRANSFORMER LOW VOLTAGE (VOLTS)	RATED TRANSFORMER FULL LOAD CURRENT (AMPERES)	140% RATED TRANSFORMER FULL LOAD CURRENT (AMPERES)	CURRENT TRANSFORMER		MULTIPLIER FOR 1000A. FULL SCALE MAX. INDICATING DEMAND AMMETER, ITEM UM2B
				RATIO*	ITEM	
300	216Y/125	835	1170	1200/5	UT2D5	1.2
500		1390	1950	2000/5	UT2F5	2.0
750		2080	2910	3000/5	UT2H5	3.0
1000		2780	3890	4000/5	UT2K5	4.0
500	480Y/277	605	850	1200/5	UT2D5	1.2
750		905	1270	1200/5**	UT2D5	1.2
1000		1205	1690	2000/5	UT2F5	2.0
1500		1805	2530	3000/5	UT2H5	3.0
2000		2405	3370	4000/5	UT2K5	4.0
2500		3010	4215	4000/5**	UT2K5	4.0

* Values below 20% of full scale on maximum indicating demand ammeter, item UM2B cannot be read. Current transformer ratios were selected so that loadings between approximately 30% and 140% of network transformer full load current would appear on the readable portion of the ammeter scale. These values should cover most transformer loadings under normal network operating conditions and during contingency conditions.

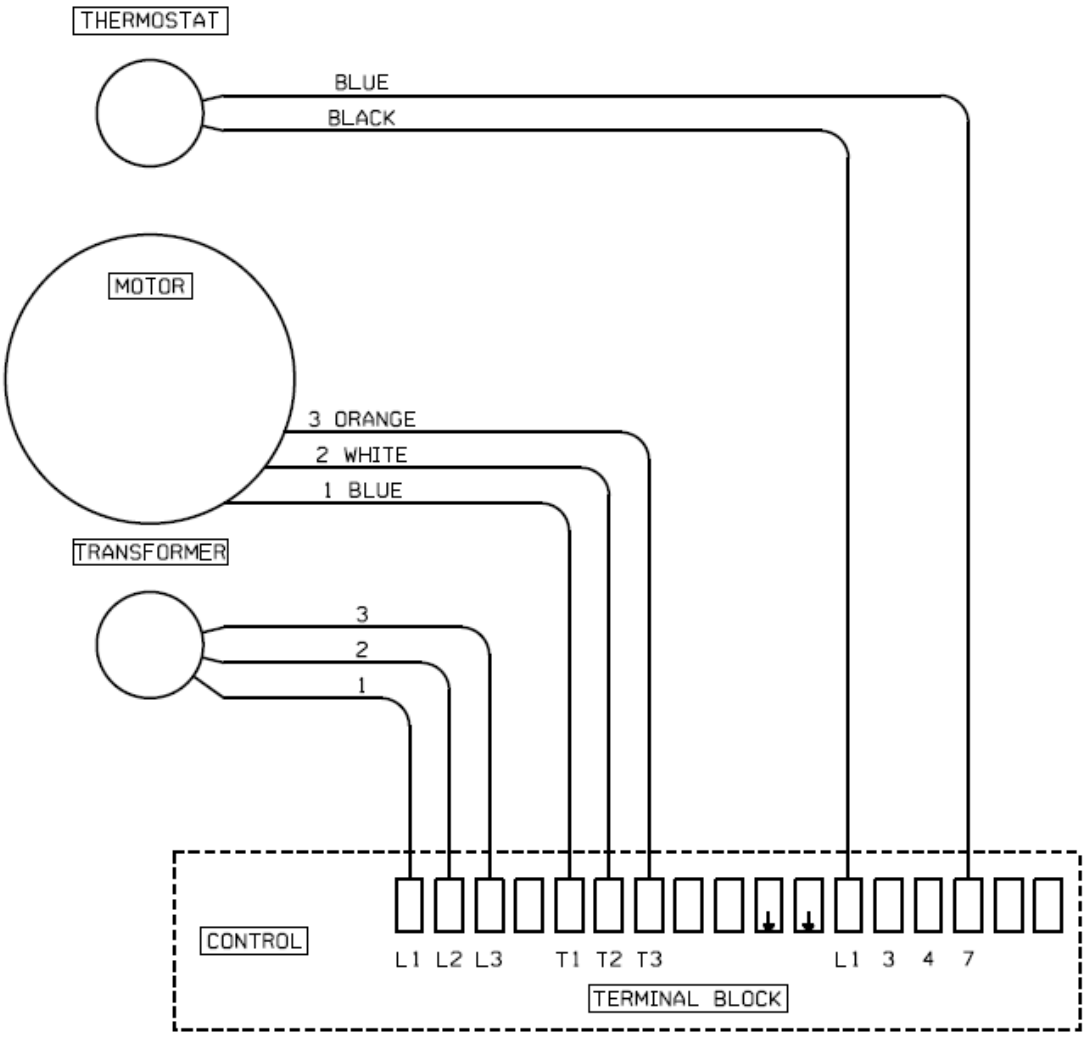
** Current transformer ratio does not allow for loading between approximately 133% and 140% of network transformer full load current to appear on the readable portion of the ammeter scale. For applications where this may impose a problem, refer to the Engineering Department for recommendations.

Supersedes 7/16 Issue – Update to drawing and note.

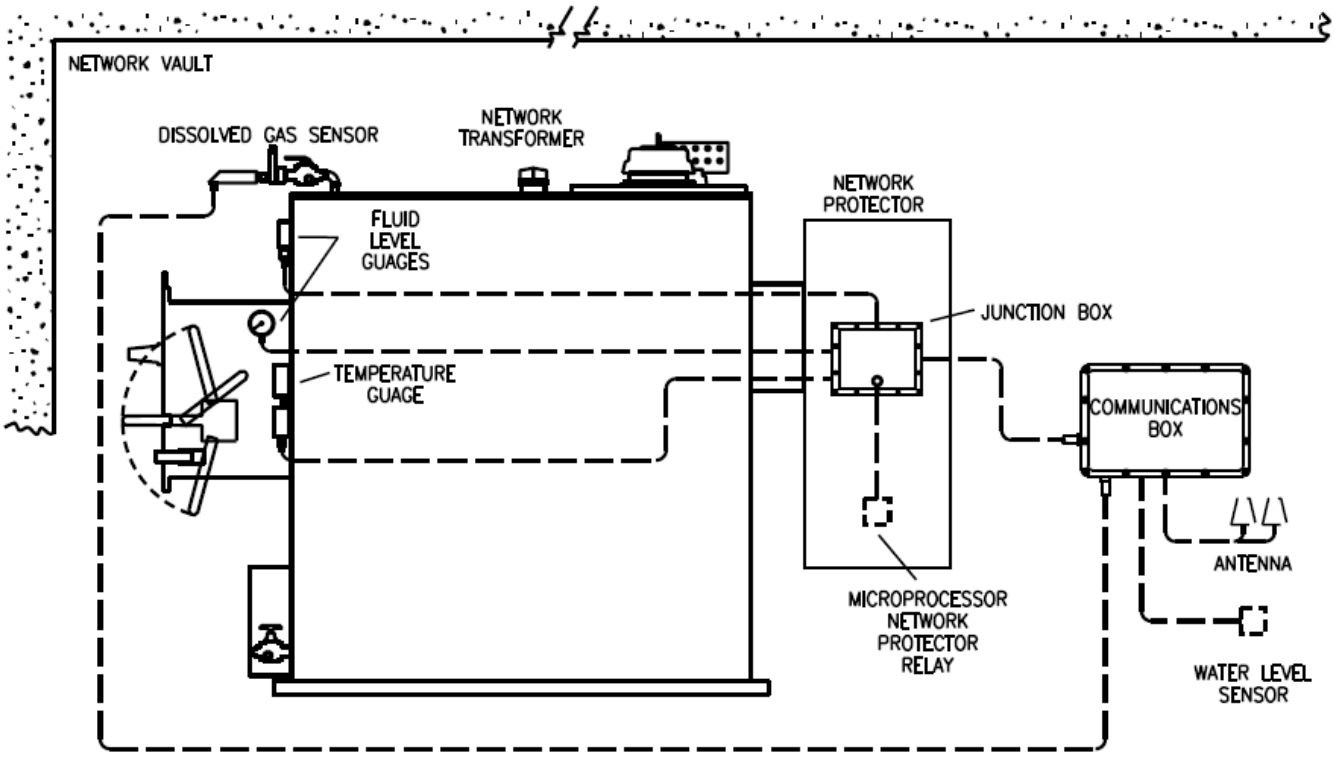


One-line wire diagram for installing a two-speed explosion proof blower motor. Diagram shows the wires from the motor to control and from thermostat to control. Terminal block image in the control is also shown for reference.

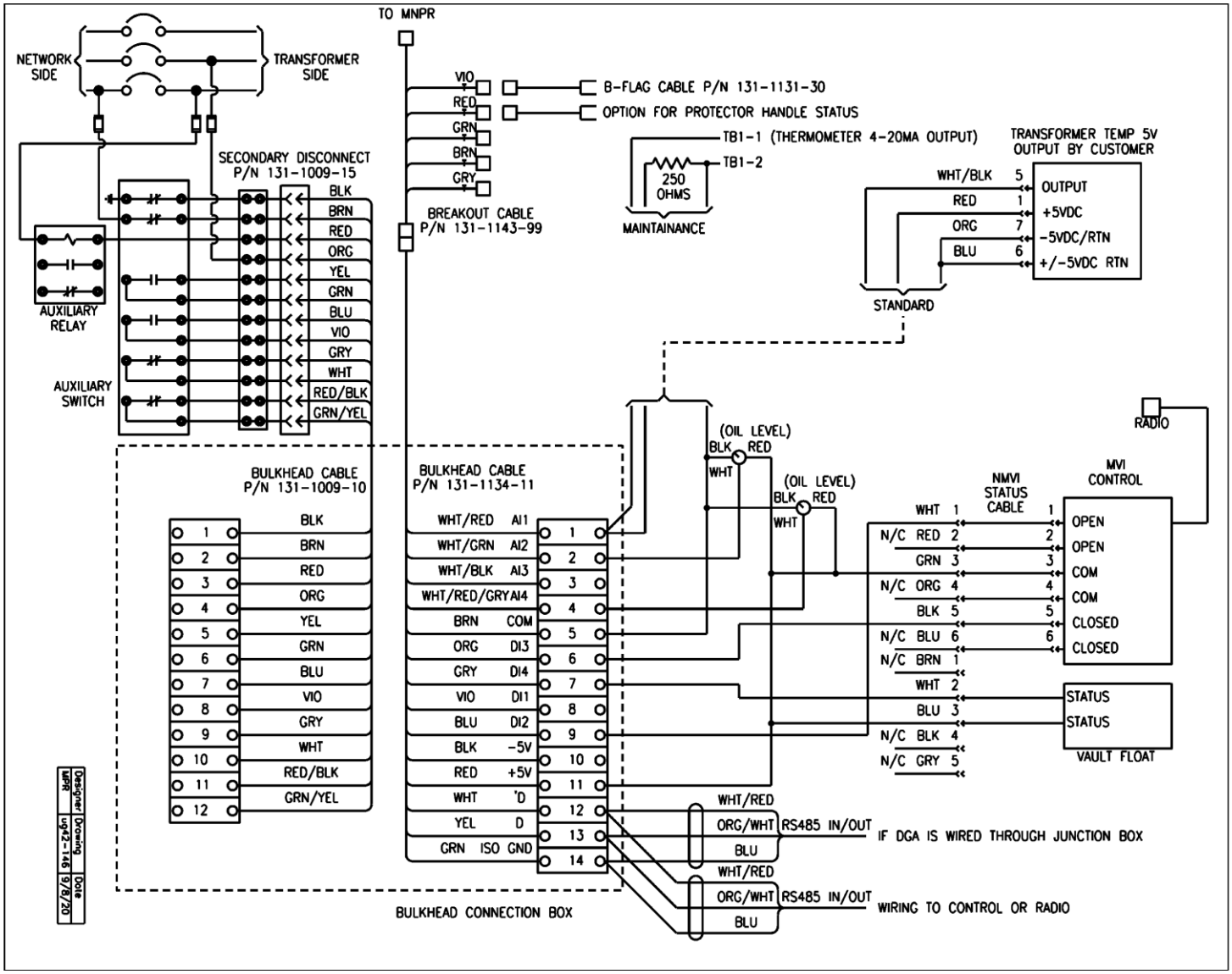
EXPLOSION PROOF BLOWER MOTOR WIRING DIAGRAM TWO SPEED			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		42-139	7/17



One-line wire diagram for installing a single speed explosion proof blower motor. Diagram shows the wires from the motor to control and from thermostat to control. Terminal block image in the control is also shown for reference.



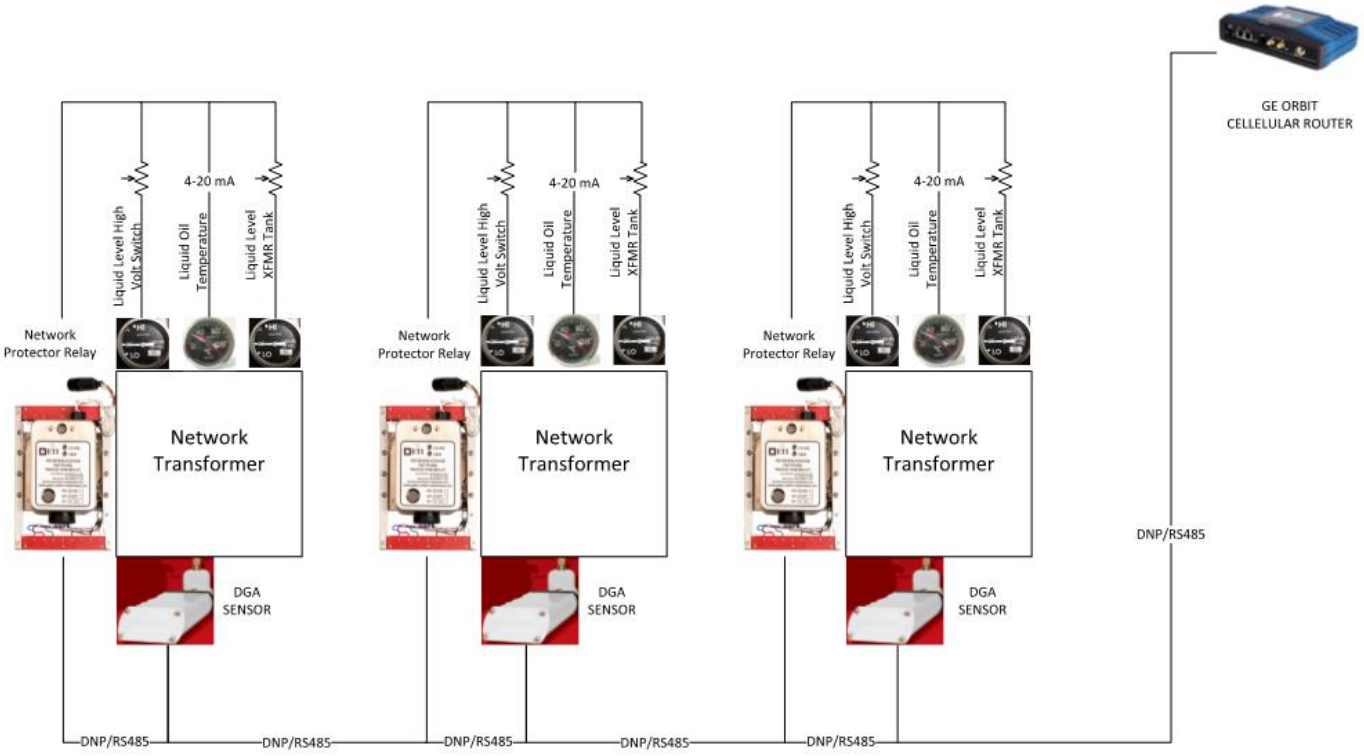
Typical network transformer showing communications wired in.



Wiring diagram of ETI relay

Supersedes 7/20 Issue. Drawing update

Future wiring diagram of Eaton relay.



Typical one line installation diagram

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Version	Date	Modification	Author(s)	Approval by (Name/Title)
1.13	7/21	• Drawings update 42-146 and 146A.		
1.12	7/20	• Update to section 42.19 • Drawings update 42-146. • New Drawings 42-146A, B and C		
1.11	7/19	• New section 42.19 • New drawings 42-145, 42-146 and 42-147		
1.10	7/18	• Update to sections 42.1, 42.10 and 42.16		
1.9	7/17	• Update to section 42, 42.10 and 42.18 • Update to drawing 42-101 • Update to diagram 42-139. • New diagram added 42-140.		
1.8	7/16	• Update to sections 42.1, 42.8 and 42.14 • New section 42.18 • Added new terminal to section 42.14 • New diagram added 42-139		
1.5	7/15	• Updates to 42.0, 42.1, 42.2, 42.3, 42.4, 42.5, 42.6 42.7, 42.8, 42.9 and 42.14 • Update to tables 2, 3, 4, 5 and 10 • New table 6 • Update to figure 4. • New sections 42.15,42.16 and 42.17		
1.2	7/14	• Update to sections 42.0, 42.1, 42.3, 42.6 and 42.8 • New Sections 42.9, 42-10, 42.11, 42.12, 42.13 and 42.14 • Update to drawing 42-109, 42-122		
1	07/08	• Section 42.8 Added • Modify A and C paragraphs in 42.0.10 • Modify 420.0.10 C & D, 42.0.20 • Modify 42.2.10, Text Shift • Modify 42.2, Text Shift • Modify 42.3, Text Shift • Modify 42.5.30 C, Text Shift • New Section 42.8		

Supersedes Issue 7/18

New Standard – 7/18

43.0 GENERAL

This standard covers the requirements for third party attachments in the conventional manhole and duct underground system.

The installation of third party attachments in the following are prohibited:

a) Network manhole and duct system.
b) PPL owned vault / manhole with transformers.
c) PPL owned vault / manhole with switches.

Construction Guideline for Compliance with Construction Standards
3rd Party Fiber Optic Systems

All construction work shall be conducted in a professional and workmanlike manner, consistent with any applicable federal, state, and local laws and ordinances, as well as, adherence to PPL's core business requirements and generally accepted safety, operational, reliability and engineering requirements for such construction and maintenance work, including but not limited to, the latest editions of the Manual of Construction Procedures (Blue Book), current National Electrical Code (NEC), National Electrical Safety Code (NESC), Occupational Safety and Health Act (OSHA), and PPL Construction Standard requirements and PPL Safety requirements.
.

New Construction — All new construction shall be built to current PPL Construction Standards. A few examples of new construction would include but not be limited to;

- Installation of a new service off existing fiber: If a new service installation requires additional work and/or fiber upgrades in multiple manholes or vaults; those affected manholes or vaults shall be built to the current PPL standard installation of a new fiber in existing inner duct.
- Upgrading of existing Fiber Cable.

Existing Construction - When replacing a fiber in kind, existing safety concerns (such as clearances) and potential reliability issues such as obstructions to PPL cable and conduit at the structure, shall be addressed by Licensee as part of the work that is being performed. By way of example but without limitation, all fiber/splice cases must be fireproofed, labeled, and secured to the roof. The existing structure (manhole/vault) doesn't not need to be brought into compliance with the current Distribution Standard Section 43.2 provided that the work being done maintains the integrity of the original structure's construction to be determined in the sole discretion of PPL.

43.1 MANHOLES

43.1.10 Manhole Conduit Selection:

Third party underground attachments require prior PPL approval and oversight with an appointed inspector during installation. All work and oversight by the company shall be fully reimbursable.

Applications for conduit occupancy require PPL review and may be denied if available conduits are required by PPL it its sole discretion for planned future projects and system upgrades. In addition to the conduits required for planned future projects and system upgrades, two spare conduits shall be available for use by PPL for unplanned circumstances.

Supersedes Issue 7/18- Added construction guideline in 43.0 and text update in 43.1.10.

Third party attachments shall be in the center of the duct bank of open conduits in the manhole duct face opening as shown in Figure 1. If the center ducts are not available, then approval from local engineering is required.
Note: Installing fiber in the outer ducts can reduce feeder capacities if feeder cables have to be installed in the middle ducts.

43.1.20 Manhole Conduit Sealing Products:

Where required by local operating areas the following sealants shall only be used, no other substitutions allowed.

a) Fireproof sealing Asbesco FP200 fire rated foam.
b) Water stop sealing Polywater FST foam duct sealant.

43.2 SPLICING

Splices are not allowed in the manhole. When splices are required they shall be located and made in an alternate structure.

43.3 RACKING

a) Third party attachments in two-piece precast manholes shall be racked to the roof near the side wall training away from chimney entry of the manhole as shown in figure 1.

b) Third party attachments in four-piece precast manholes or brick roof manholes shall be racked on the upper wall as shown in figure 2.

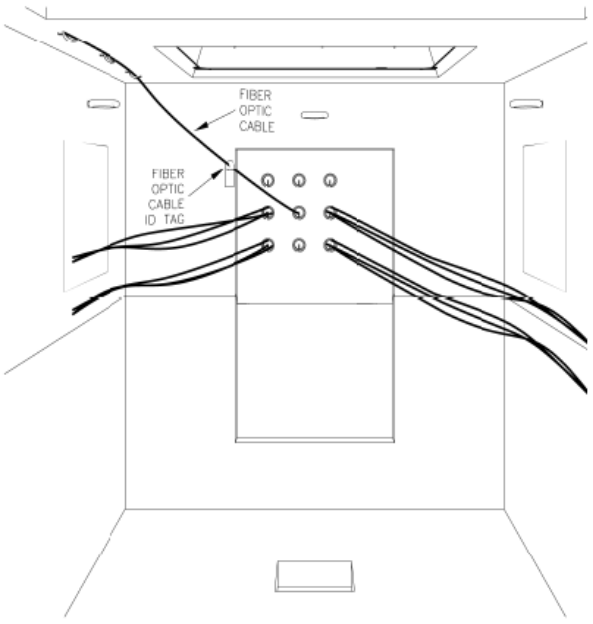


Figure 1

Cutaway of a typical precast manhole with fiber attached on roof.

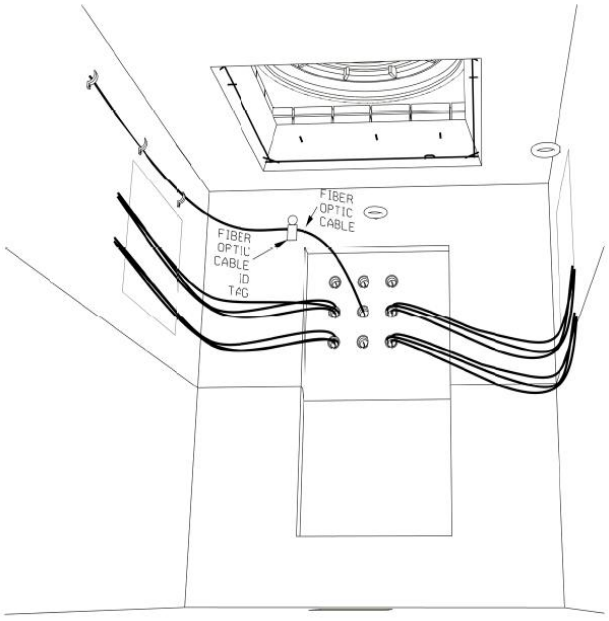


Figure 2

Cutaway of a typical brick manhole with fiber attached on wall.

Supersedes 7/18 Issue – Text update 43.3

43.4 Labeling

Third party attachments in manholes shall be clearly labeled. The labeling shall be 1 inch minimum lettering. Sample labeling shall be presented for approval before installation starts. The labeling shall be affixed to the cable at the entry and exit points of the conduit from the manhole. Labeling shall also include the name of the company and 24-hour emergency contact phone number.

43.5 Arc & Fire Proofing

Third party attachments shall have a fireproof shielding encapsulated in the outer jacket per article 770 in the NEC or be wrapped with arc and fireproofing materials on all cables. The material shall be of 3M Fire Retardant Electric Arc Tape 77 Black or an approved equivalent. Section 35.13 covers how to wrap the cable.

Supersedes 7/18 Issue – Text update in 43.4

Version	Date	Modification	Author(s)	Approval by (Name/Title)
1.1	7/20	• Added guideline in section 43.0 • Added text in 43.1.10 • Text Updates in section 43.3 and 43.4		
1.0	7/18	• New Standard		

New Standard - 7/18

Supersedes 7/18 Issue. Updated transformer rating range for 44-114.

Supersedes 7/18 Issue – Updated transformer rating range for 44-116.

44.0 GENERAL

The following Standard is the practice to be followed when designing and installing Underground Commercial Developments (UCD). This Standard shall apply to primary and secondary systems installed by both the Company and/or the customer/developer.

44.1 CLEARANCE FROM BUILDINGS AND OBJECTS

Air insulated equipment shall have a 5 foot minimum clearance from buildings. In the absence of industry accepted or municipal requirements, oil insulated equipment shall be located in compliance with the minimum clearances indicated on Pages 44-101 and 44-102. For existing buildings, the transformer shall not block access to existing building systems, such as wall mounted fire sprinkler systems. The building owner's and/or tenant's fire insurance carrier or local inspection authority may restrict the proximity of the equipment to doors, windows or combustible materials. It is the customer/developer's responsibility to determine the acceptability of the proposed location of the equipment.

The clearances, line of sight, shall apply to doorways, windows, ventilation ducts and fire escapes. When line of sight distances cannot be met practically, refer to Distribution Design.

44.2 ACCESSIBILITY

Equipment shall be located within 10 feet of a way open to vehicular traffic and a minimum distance from any structure such as poles, fences, etc. as a means to permit accessibility for installation and maintenance. A minimum of 10 feet of clear space shall be maintained in front of the equipment doors to permit installation and removal of separable connectors and fuses with shotgun stick.

44.3 MECHANICAL PROTECTION

Whenever possible, equipment should be located so it is not subject to vehicular damage. If this is not feasible, adequate guards such as concrete filled pipes shall be installed in place to protect the equipment prior to delivery. Refer to Section 44.16 for details.

44.4 NOISE LEVEL

When locating transformers or other equipment, consideration should be given to the effect of noise on adjacent occupancies.

44.5 FINISHED GRADE

Finished grade shall gradually slope away from padmount transformer. Slope to be no more than 1" per foot. The slope limit shall extend 10 feet out in the front of the transformer and 5 feet out on the sides.

44.6 EASMENTS

Requirements for underground construction and associated pad-mounted equipment shall be determined for each site by Distribution Design. All Company owned equipment must be located within a permanent easement. The customer/developer shall grant such permanent easements, including rights of access to each easement, to the Company. Easements must be in place prior to installation of any Company owned equipment.

44.7 CLEAN FILL CERTIFICATION

The customer/developer shall certify, to the Company, that areas in which the Company is to perform installation or maintenance work are free of pre-existing contamination by hazardous wastes or materials and indemnify the Company for any claims, costs, expenses, suits, demands, citations, fines, or damages of any kind arising from the presence of any such contamination.

Supersedes 7/08 Issue – Text Update 44.1, 44.3 and 44.5

44.8 TRENCH AND DUCTLINE

Underground cable installations shall be installed in accordance with the latest edition of the Electric Service Bulletins 754 and 759B. State tariff policies vary with respect to installation method and the allocation of work responsibility between the customer and the company. Typical trench cross sections can be found on page 44-125.

44.9 RISER POLE

The Company shall designate conduit riser locations on the pole. Riser pole installation and maintenance shall be in accordance with Section 48 – Risers.

44.10 SWITCH / SWITCHGEAR

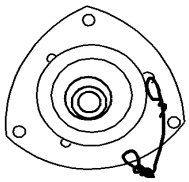
The Company shall designate switches and switchgear locations. Switchgear installation and maintenance shall be in accordance with Section 38 – Switches/Switchgear.

44.11 PAD-MOUNTED TRANSFORMER INSTALLATION

The type and size of pad-mounted transformers shall be determined by Distribution Design. Installation and grounding shall be in accordance with Pages 44-104 thru 44-107 and Section 44.22. The transformer in most instances is to be installed, owned and maintained by the Company. Special ownership arrangements shall be referred to Distribution Design.

44.12 PRIMARY CABLE AND TERMINATIONS

In general, jacketed cable per Section 35 - Cables, cold shrink terminators, and loadbreak elbows per Section 37 - Terminations, shall be specified. Distribution Design shall size and specify cable for special designs. The Company will furnish, install, own and maintain all primary cable and terminations. Ground all primary bushing inserts as shown in Figure 1. Bond feed-thru devices and parking stands if permanently left in switch enclosures or transformers. Insulated dead end caps shall be bonded to the ground grid.



Note: Use a minimum of #14 AWG Solid Copper or equivalent to bond bushing insert to mounting plate, the preferred wire is bare #12 AWG Solid Copper, tinned soft drawn Standard Item UC2V, Item ID 4015004.

Figure 1
Primary Bushing Grounding Detail
*****Only One Phase Shown For Clarity*

44.13 SECONDARY CABLES

Secondary cables shall be installed underground in customer/developer furnished, installed, owned and maintained conduit system or raceway. Conditions requiring more secondary cables than the Company's transformer secondary terminals can accommodate may require the customer/developer to supply an intermediate secondary cable collecting bus to make a transition from National Electrical Code required cable capabilities (required to match main switch), to actual load cable capabilities. The need for any additional secondary connector bus pad-mounted compartment shall be determined by Distribution Design.

Supersedes 7/11 Issue – Text Updates 44.12

44.13.10 Three Phase Pads

Size and number of secondary cables shall be in accordance with the NEC and shall be approved by the wire inspector of the town or city involved. Maximum number of secondary cables to be physically connected to the Company's pad-mounted transformer is outlined below:

4 Hole Spades	6 sets 750 kcmil Max.
6 Hole Spades	8 sets 750 kcmil Max.
10 Hole Spades	10 sets 600 kcmil or 8 sets of 750 kcmil

Secondary requirements greater than this shall necessitate a separate compartment, handhole, or bus duct, and should be referred to Distribution Design.
All acceptable spade terminals are shown in Figures 2, 3 and 4. Minimum terminal thickness is to be ¼ inch, with $^{9}/_{16}$ inch holes.

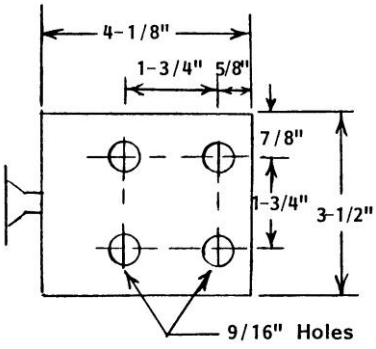


Figure 2

kVA Rating	L.V. Rating
75 – 300	208Y/120
75 – 500	480Y/277

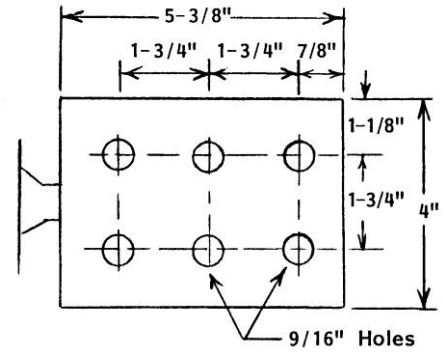


Figure 3

kVA Rating	L.V. Rating
500	208Y/120
750 – 1500	480Y/277

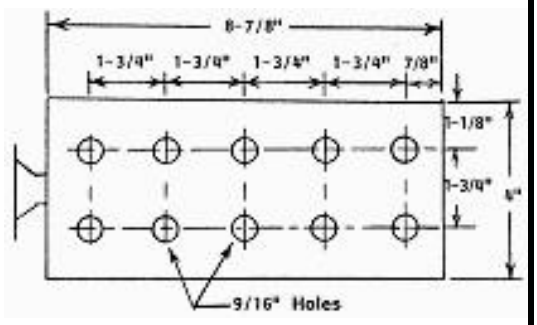


Figure 4

kVA Rating	L.V. Rating
750 – 1000	208Y/120
2000 – 2500	480Y/277

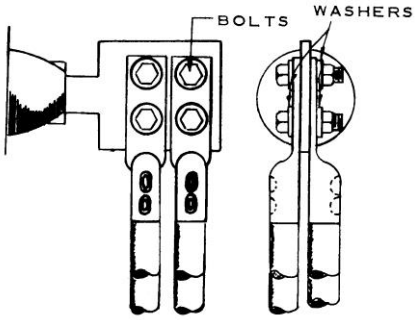


Figure 5
4 Cables – 500 kcmil & Below

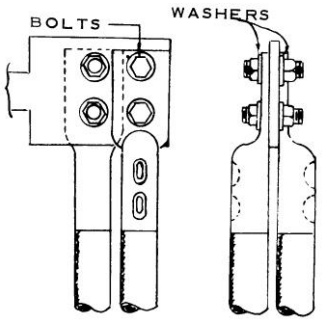


Figure 6

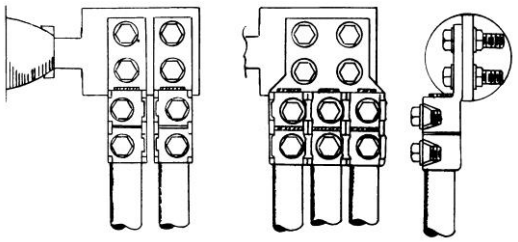


Figure 7

Notes:

1. Figure 5 – Compression connections will accommodate up to four cables with a maximum individual lug width of 1¼ inch.

2. Figure 6 – Compression connections will accommodate two cables with lug greater than 1¾ inch width.

3. Figure 7 – Typical example of bolted connections for two, four or six cables to maximum capacity of lug.

44.14 SECONDARY CONNECTIONS

All connectors and connector fasteners shall be furnished, installed, owned and maintained by the customer/developer. Connectors shall be approved by the Company prior to purchase. Final electrical connection to the transformer secondary terminals shall be inspected by the Company. The customer/developer shall make all final connections to the spades of the padmount transformer to a final torque of 40 foot pounds. Size and number of secondary cables shall be in accordance with the NEC and shall be approved by the wire inspector for the town or city involved.

The customer/developer shall supply aluminum connectors for use with aluminum cable or bronze connectors for use with copper cable. Tin plated connectors can also be used as an alternate connector for aluminum and bronze connectors. Connector shall be a cable to flat clamp or compression type connector, with a minimum of two holes in the flat pad and two clamping elements or two compressions per cable, and must be approved by Standards Engineering.

Maintenance, adding or reconnecting secondary cables to the secondary compartment of the transformer once energized shall be coordinated through the local field office.

44.14.10 Bolted Connections

A. A flat washer is placed between the concave side of the belleville washer and the surface of the member being joined. The belleville is thus captured between the head of the bolt and the large flat washer. The flat washer should have an outside diameter greater than the flattened belleville's such that no overhand results. Select a flat washer that is twice as thick as the belleville for strength. (If not available, stack two or three thinner washers to achieve the same effect).

B. With the belleville washer captured between the flat washer and the bolt head, fit the assembly into its hole. When the washers are fitted in position, there should be no interference with washers of adjacent bolts and no overhang over surface edges.

C. Tighten the nut on the bolt (with a washer of its own) until a sudden, noticeable increase in torque is required to continue. The belleville washer is now flat. It is not necessary to "back off" the nut after tightening to this point.

D. Bolts and flat washers shall be grade 304 stainless steel. Belleville washers shall be grade 301 stainless steel. Nuts shall be waxed and be grade 316 stainless steel.

Supersedes 7/11 Issue – Typo corrected in 44.14

Table 1
Stainless Steel Fasteners

Description	Std. Item
½" x 1½" Bolt & Nut	B8C15
½" x 2" Bolt & Nut	B8C20
Flat Round Washer	B8W3
Bellville Washer	B8W10

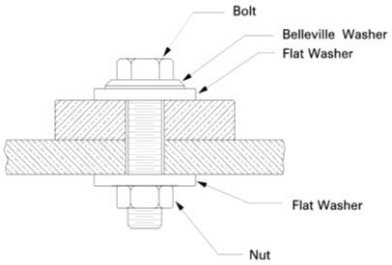


Figure 8

44.15 METERING

Meter location and type shall be determined by the Company. Meters shall be furnished and installed by the Company.

44.16 BOLLARDS

Bollards shall consist of 6 inch minimum diameter hot dip galvanized or painted steel pipes, filled with concrete. Painted steel pipes shall be painted with OSHA Safety Yellow Paint. Yellow plastic bollard covers are available (Std Item C80) if bollard can not be painted at the time of installation. Bollards are to be 5 feet above the ground and a minimum of 4 feet below the ground. Concrete is to be crowned on top of all bollards. Bollards are to be set in a 12" minimum concrete footing from the base to within 6" from finished grade. See drawing details on page 44-111.

The number and locations of bollards shall be determined by Distribution Design, taking into account proximity to traffic and to buildings as well as other barriers to traffic. Suggested bollard locations and dimensions are shown on Page 44-110. Distribution Design will determine which bollards are required by marking Page 44-110 as described in Note 2. Delivery of equipment shall not take place until required bollards have been installed. The location of bollards shall not impede a door opening of 100 degrees.

Bollards shall be installed with due care to avoid interfering with ground grid and conduits. Refer to Section 44.20 for concrete pad dimensions.

Supersedes 7/11 Issue – Text Update 44.16

44.17 CONCRETE PAD

Concrete shall conform to Section 31 – General (Mix M-4) for ready mix concrete. All exposed edges shall have a ¾ inch chamfer.

44.18 REINFORCING

Reinforcing to be #5 grade 60 bars and shall conform to ASTM STANDARD A-615 of latest date. Reinforcing rods are to be located in center of the slab, with a minimum of 2 inches of clearance from face of concrete.

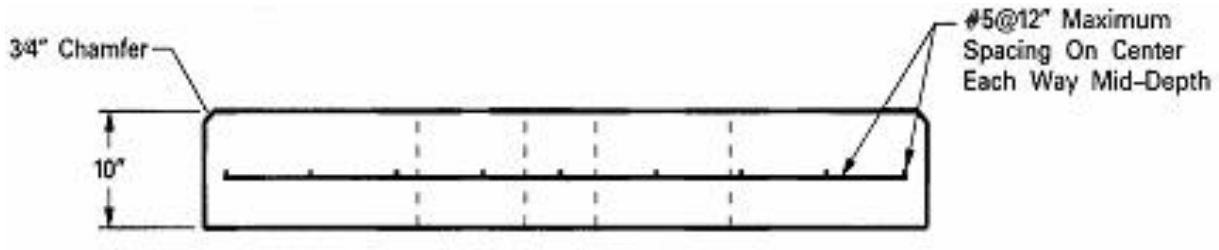


Figure 9

44.19 SAND AND GRAVEL

Place concrete slab on a base of 2 inches of sand and 12 inches of gravel as shown on Pages 44-113 thru 44-116. The gravel shall be thoroughly compacted and the sand thoroughly wetted immediately before placing the concrete.

44.20 PRECAST / POURED SLAB AND CONDUIT ENTRY

Conduit shall be installed as shown on Pages 44-113 thru 44-116 before slab is poured. Use 36 inch radius sweeps, with couplings, nipples and bushings as required. Sweeps for primary cables shall be galvanized steel or PVC rigid direct burial type. Conduits shall be raised a minimum of 1 inch over the concrete slab. The owner of the conduits shall install the bell ends onto the conduits. Expanding foam (Std. Item UF10) will be used to fill the conduits around the cables to prevent oil from entering the conduit in the event of a leak. Empty conduits shall be sealed using a conduit plugs (Std. Item UK34_). Sealing of conduits shall be done by the owner of the cables in the conduits. Additional information on installation and maintenance of conduit shall be in accordance with Section 32 – Conduit.

After the concrete is cured, the remainder of the conduit primary and secondary openings through pad will be sealed with grout. Fill the conduit primary and secondary openings with sand (no aggregate) to a grade of 4 inches below the top of the concrete pad. Place a layer of concrete grout (no aggregate) 1 to 2 inches thick on top of the sand layer to seal the conduit entrance. Do not cover the conduit ground clamps with grout. Expanding foam can also be used as an alternate to filling in the conduit area with sand and sealing the top with grout. Sealing of the openings shall be done by the installer of the pad and conduits.

44.21 GROUND GRID

The ground grid shall be 2/0, bare, soft drawn, 19 strand copper wire. The wire shall be installed 12 inches below grade and located around the transformer pad as shown on Page 44-117. Bond ground wire to all exposed metallic conduit (sweeps) and leave 3 feet of wire above pad for grounding transformer, one lead in the primary conduit opening and the other lead in the secondary conduit opening. The neutrals from the cables connecting to ground grid shall be a compression type connector. Up to three separate neutrals from the cables can be bundled together with a compression connector.

Two ⅝ inch diameter, 8 feet long copper weld ground rods (Std. Item TG20) and approved connectors shall be installed. The top of the ground rods shall be 12” below finish grade. Leave the ground rods and grid exposed until inspected by the Company. The ground grid is to be complete, backfilled and all metallic conduits bonded prior to energizing the transformer.

Connections to ground grid to be made as shown on Page 44-117 Details A and B, except that exothermic welding ("cad weld") shall be an acceptable alternative to compression or bolted connections. Bolted connectors are only acceptable for the connections to the ground rods.

Supersedes 7/11 Issue – Text update 44.21

44.22 OIL CONTAINMENT

This is to be used where oil containment is required by local authorities or where otherwise justified. This liner system will significantly slow the migration of oil into the under laying sub grade, allowing additional time to initiate a cleanup response. The polypropylene geotextile allows the passage of water but absorbs small quantities of oil.

This design is intended to confine 100% of total transformer oil present, with a 20% reserve margin, for up to 36 hours. If additional confinement is desired consult Distribution Design.

Oil curb should be installed with concrete in accordance with Mix #4 per Section 31 – General. Reinforcement to be four #4, grade 60 rods, 6 inches on center as shown. Bend rods around corners. Fill area between slab and curb with 1½ inches uniformly graded crushed rock and line with 2 layers of geotextile liner as shown. Geotextile liners to be separated by a 6 inch layer of well compacted, silty sand and gravel mix. Geotextile liner shall be 16 oz. polypropylene geotextile - all seams to overlap a minimum of 12 inches. See Page 44-120 for construction detail.

44.23 CABLE TAGS

Primary cables shall be identified in each handhole, manhole, vault, enclosure, riser pole, transformer and switchgear and at every termination point. Identification shall be a minimum of the circuit number, next location and phase marking. For cables of one circuit that are bundled together, one tag can be used to indicate the circuit and location on the bundled set of cables. Individual tags are available with a variety of phrases (e.g. A Phase; To Riser; To MH; XMFR – Std. Item UP21P). Utilize the phrase tags to clarify the next location of the cable. The phase shall be included at terminations. In three phase loop feed transformers, the bushing (H1A, H2A, etc.) shall be included.

Secondary cables are owned and maintained by the customer in most cases. There is no specific requirement for labeling customer owned cables. When the secondary cables are owned by PPL, these shall be clearly tagged and the labels indicate the location they go to.

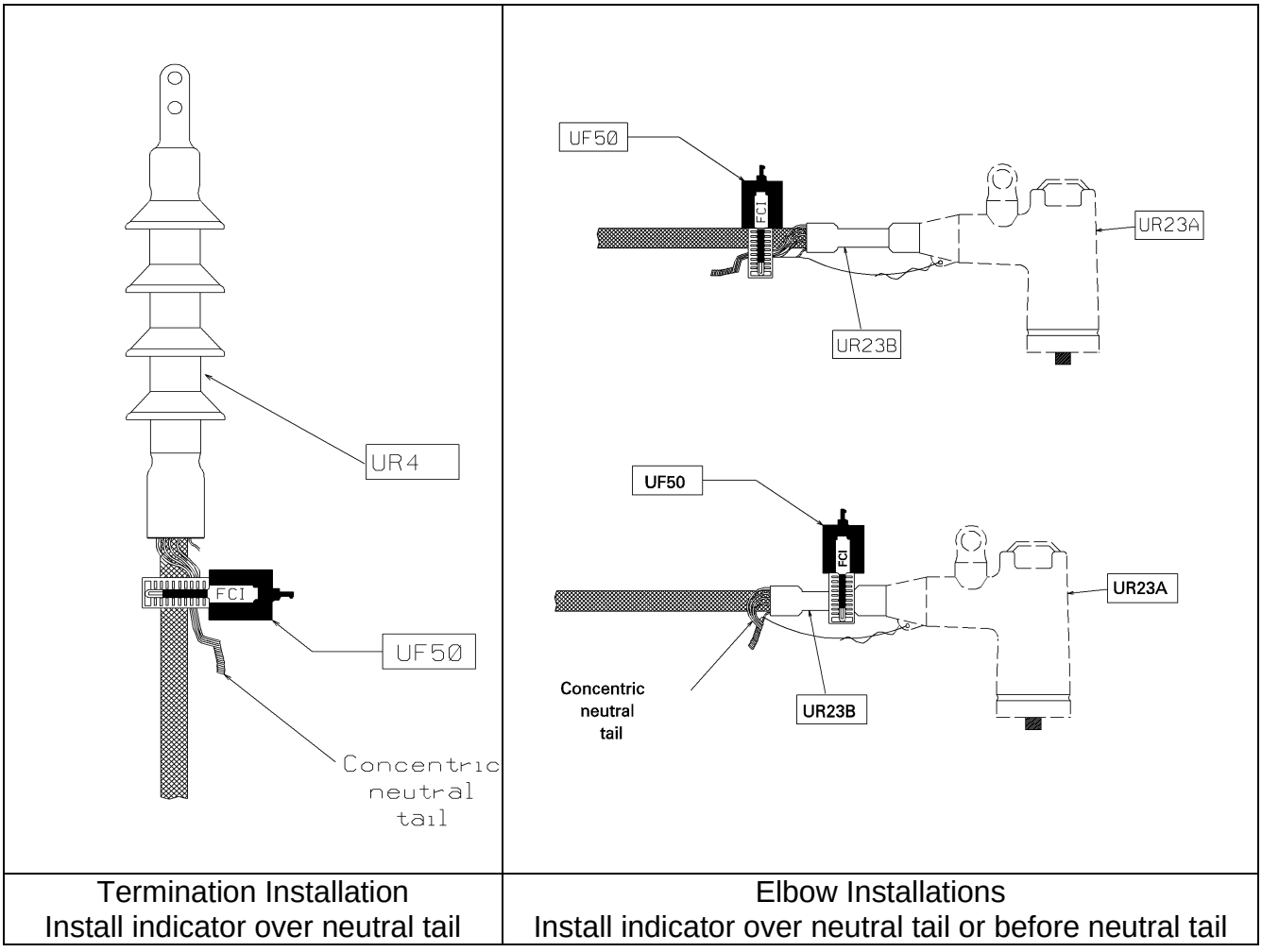
See Section 35.16. “Cable Identification Tags”

A complete selection of numbers and letters, 3 sizes of tag holders, various phrase tags and cable ties can be found in Section 50 – Materials Catalog.

Supersedes 7/16 Issue – Updated 44.23

44.24 FAULT INDICATORS

Fault indicators can be used in underground commercial distribution. Fault indicators have an 8 hour reset. Two styles are available (see Std. Item UF50), time or time and current reset. The indicators can be installed in switchgears and padmounts at the cable termination points. Figure 13 shows how to install the indicator. To minimize outage restoration times fiber optic leads (Std Item UF50CC) can be installed to provide a visible external display of the indictor flashing. The fiber optic lead plugs in to the end of the indicator and the display light is mounted thru the switchgear or padmount. Distribution Field Engineering can provide recommendations on where the indicators shall be used.



Termination Installation Install indicator over neutral tail	Elbow Installations Install indicator over neutral tail or before neutral tail

Figure 13

Supersedes 7/07 Issue – Text update 44.24

44.25 TRANSFORMER INSTALLATION IDENTIFICATION

Padmounted transformers shall have an identification location installed to identify the number or name of the specific location of the transformer. Place 2 x 3 self adhesive decals (STD. Item P21) on the outside of the right side door of the padmount. See the drawing on page 44-123 for the transformer location number. Install decals so as to be easily visible from the street, parking area or driveway.

44.26 TRANSFORMER SIGNS

Padmounted Equipment shall have warning decal (STD. Item P25P) installed on the outside front door, see drawing on page 43-123 and danger decals (STD. Item P25PD) installed on the inside of the transformer compartment per the general section of the standards book.

New Standards

44.27 STORM HARDENING – DISTRIBUTION GRID RESILIENCY

PPL has developed material and design criteria to address areas subject to flooding from rivers, lakes and sea waters. Also, areas where the effect of salt spray from coastal storms and heavy road salt contamination affect the integrity of pad-mounted electrical equipment. The following are recommendations when placing equipment in such areas:

A. Increase the elevation above the flood plain of electrical equipment such as transformers and switches in areas subject to flooding. This is achieved by building foundations inside reinforced concrete walls provided with oil containment and handrails for fall protection. Check with the local building authority of the city or town since many locations are starting to adopt building regulations in areas subject to flooding.
B. Incorporation of rust-resistant stainless steel cabinets in our designs for all submersible switches and transformers and some pad-mounted switches and transformers.
C. Use of sealing foam inside conduits to prevent water intrusion in structures has been made a requirement for all manholes and equipment foundations.
D. Use of dead front terminations inside underground switches and transformers, instead of live-front. All switches are designed with 200A and 600A pre-molded elbows and jacket seals that protect concentric neutrals. This helps avoid moisture intrusion in cable terminations, insulation and metallic shield breakdown that could cause outages.
E. Use of Molded Vacuum Switches in underground systems to sectionalize and protect loads. These switches allow us to provide fusing off main line underground circuits.
F. Use of insulated copper crabs and flood-seal connectors in manholes and hand-holes resistant to corrosion and that prevent failure of connector. Most cable conductors in our underground systems are copper.

Consult with Standards Engineering about these recommended practices.

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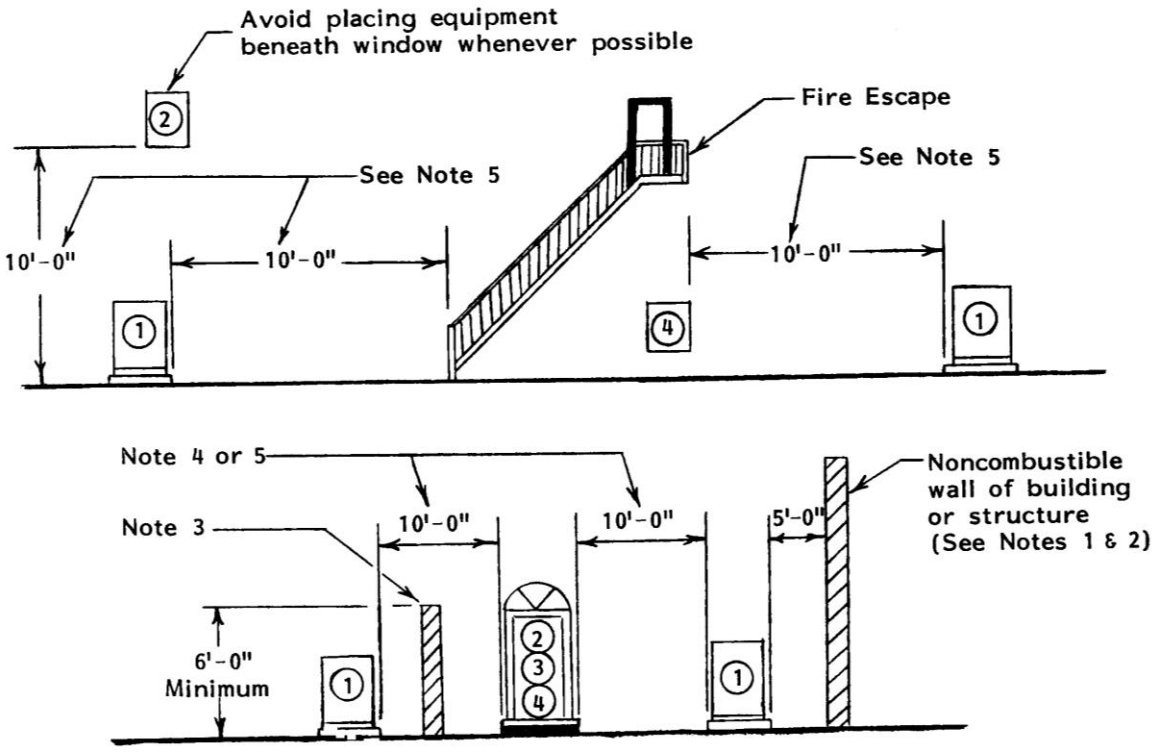


Legend	
①	Equipment, oil insulated
②	Window
③	Door
④	Ventilating Duct

Notes:

1. Noncombustible material is defined as a material that will not ignite, burn, support combustion or release flammable vapors, when subjected to fire or heat, or as described by the latest edition of the NFPA-220.

2. No portion of a building or building structure shall overhang any part of the pad-mounted equipment.

3. In cases where required distances cannot be met, a noncombustible barrier, 6 foot minimum height, shall be constructed. This barrier shall be designed to provide adequate fire protection to the existing structure. A design for this structure shall be prepared and sealed by the customer's Professional Engineer or Registered Architect and shall be further approved by the local authority having jurisdiction of building code enforcement.

4. For exits from a public assembly room, such as an auditorium, a 10 foot minimum clearance should be increased to 25 feet, unless there is a barrier.

5. This requirement may vary between individual states. Refer to the building code regulations for the state involved.

Clearances from objects:

A. An area measuring 10 feet from any point of the transformer pad shall be kept free of all:

- buried water lines, storm drain lines, gas lines, sewer lines and other electric lines;
- underground fuel storage tanks; and
- above grade fire hydrants, cell towers, self contained diesel or diesel byproduct fuel generators and outdoor enclosed generators.

NOTE: With the use of a noncombustible barrier (see note 3), the 10 foot clearance may be reduced to not less than five (5) feet from the edge of the transformer pad. The customer or their authorized representative shall obtain this clearance reduction approval from the company and the local AHJ (authority having jurisdiction) as necessary, prior to the noncombustible barrier installation.

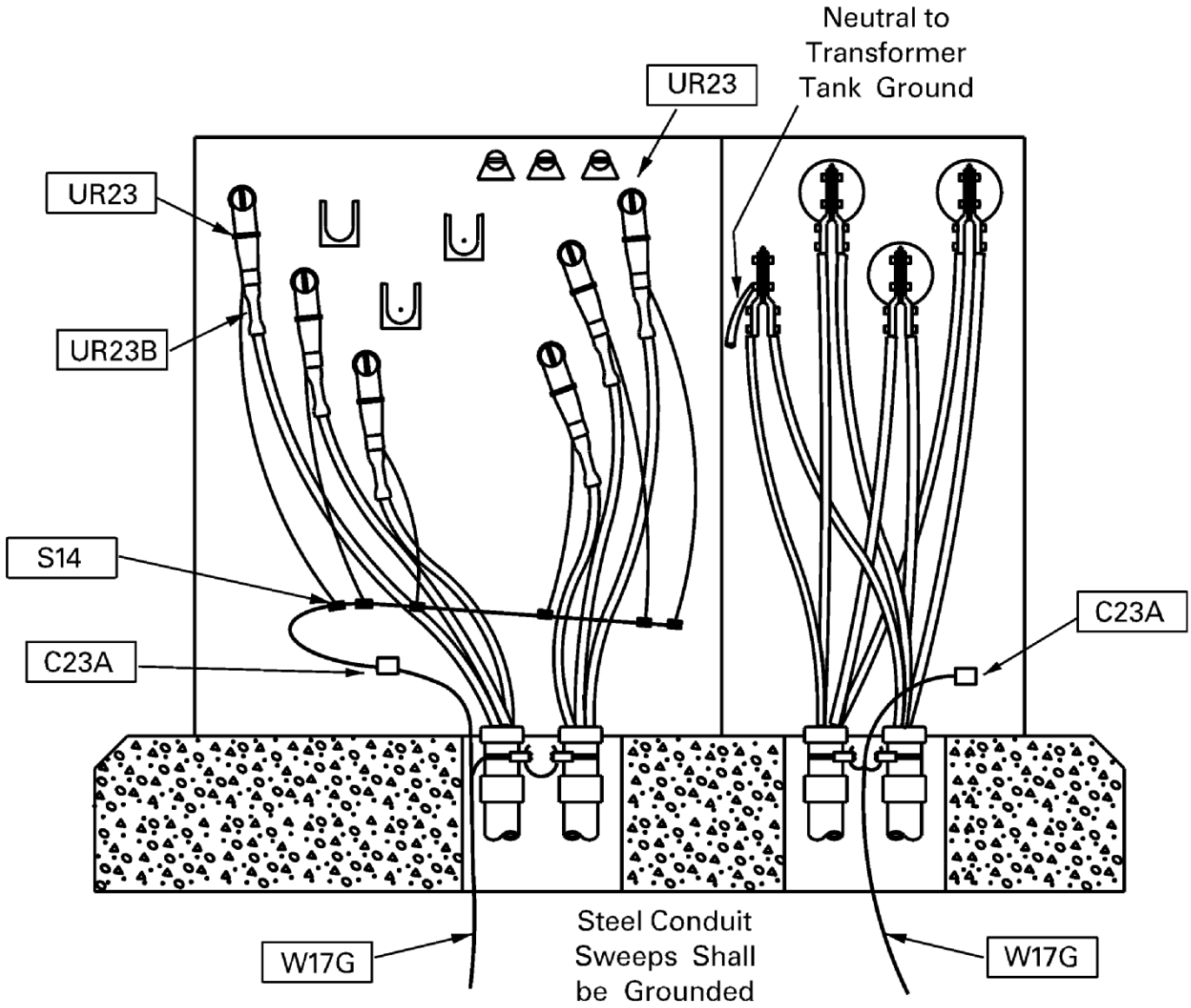
B. An area measuring 25 feet from any point of the transformer pad shall be kept free of all:

- exposed water lines, gas piping, sewer lines:
- open conductor electric lines; and
- above grade gas meters or regulator vents, fuel storage tanks or dispensing units, and non-enclosed gasoline/ propane/ LP or LNG gas fueled generators.

NOTE: The 25 ft. clearance may be reduced to 10 ft. with a noncombustible barrier (see note 3) and shall not be less than five (5) feet from the edge of the transformer pad. The customer or their authorized representative shall obtain this clearance reduction approval from the company and the local AHJ (authority having jusidiction) as necessary, prior to the noncombustible barrier installation.

Supersedes 7/08 Issue – Text Update

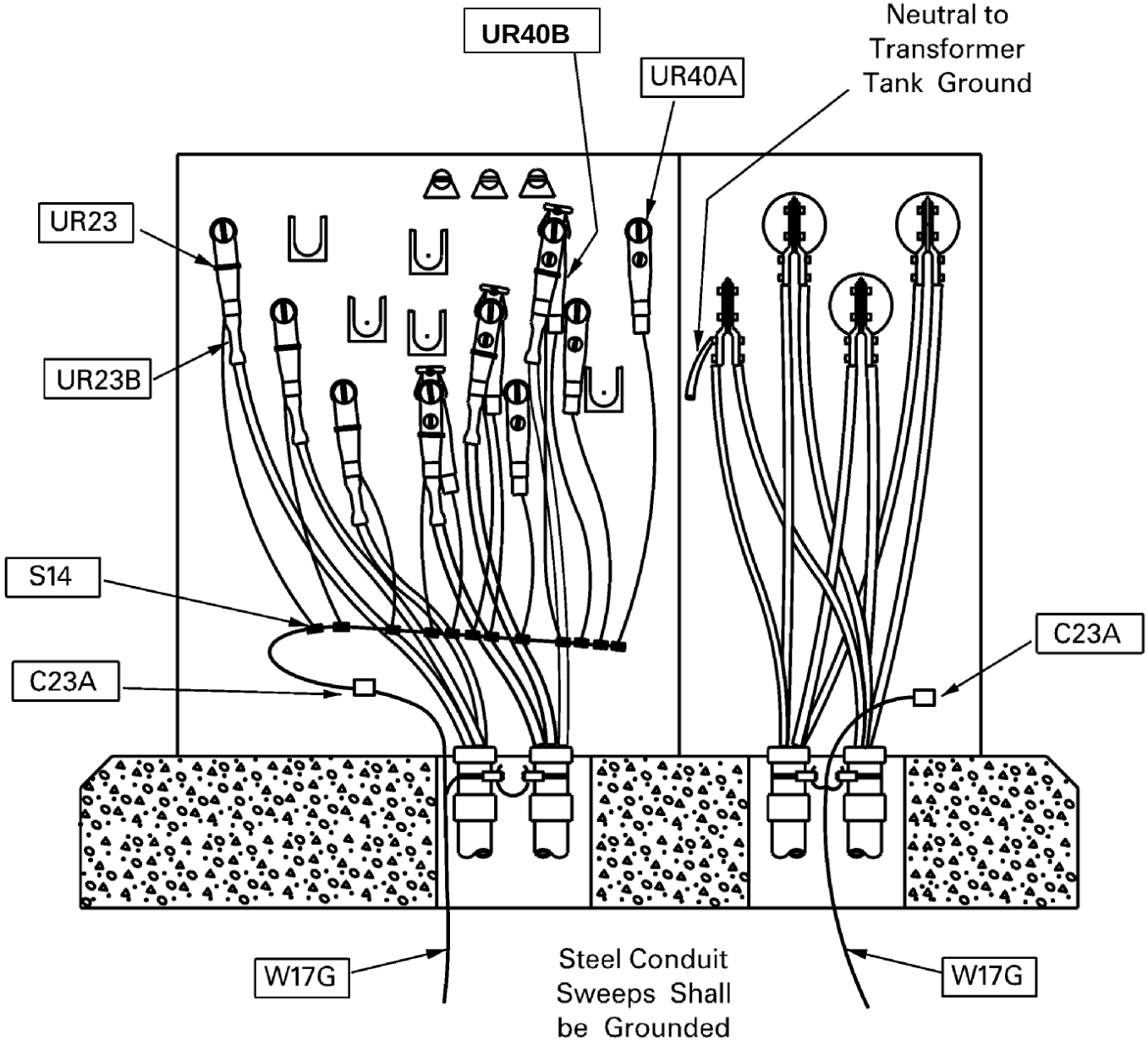
Std. Item	UT42_, UT47_	(A) = Kva Size (B) = Primary Code (C) = Secondary Code (D) = Tap Code
CU	TPM30T(A)K(B)P(C)S(D)TLF	
MU	@TPM30T(A)K(B)P(C)S(D)TLF	



Supersedes 7/07 Issue - Added Std. Items

LOOP FEED PADMOUNT TRANSFORMER INSTALLATION

Std. Item	UT42_, UT47_	(A) = Kva Size (B) = Primary Code (C) = Secondary Code (D) = Tap Code
CU	TPM30T(A)K(B)P(C)S(D)TLF	
MU	@TPM30T(A)K(B)P(C)S(D)TOP	

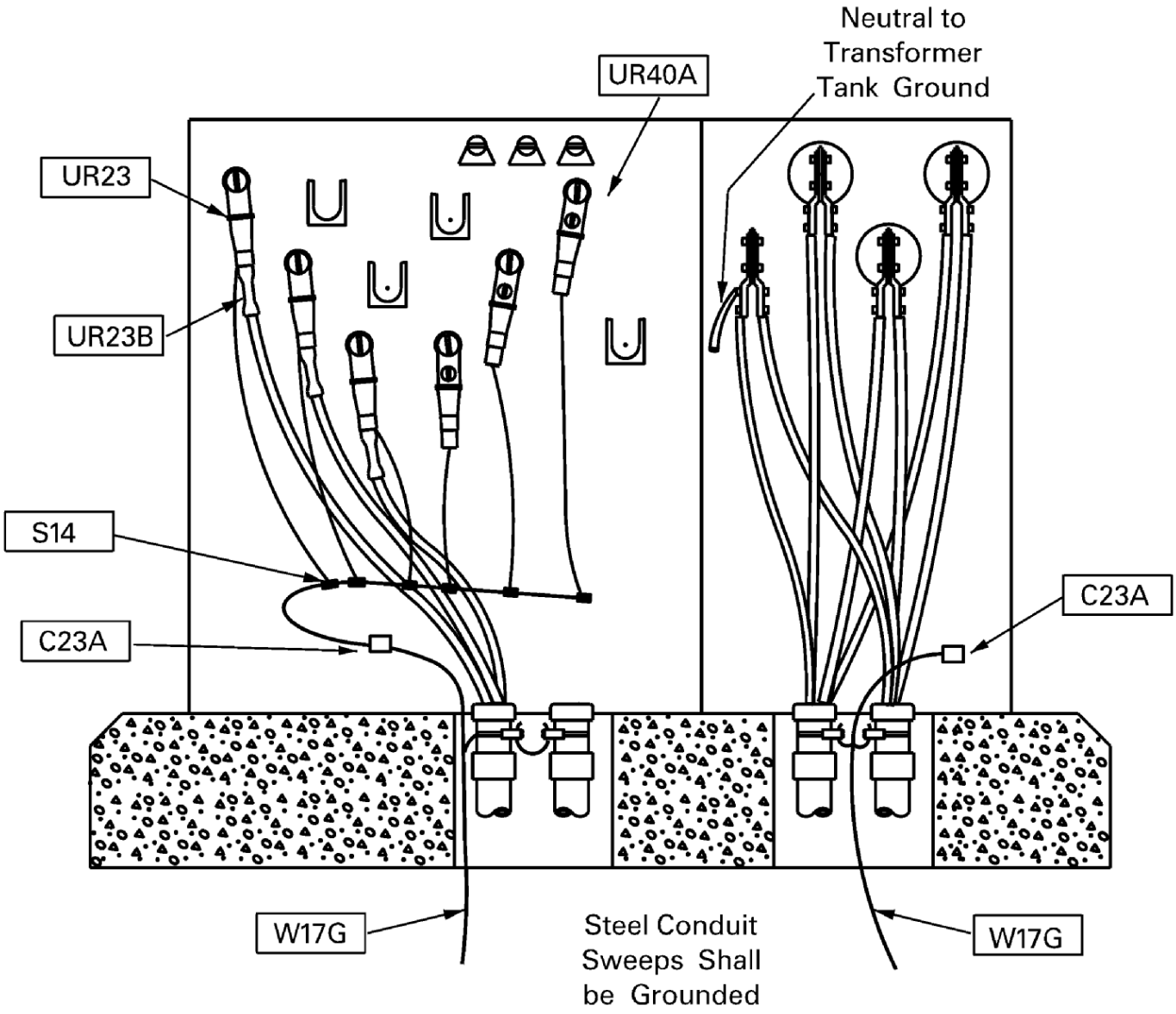


Supersedes 7/11 Issue – Correct Std Item UR40B

LOOP FEED PADMOUNT TRANSFORMER INSTALLATION WITH OPEN POINT

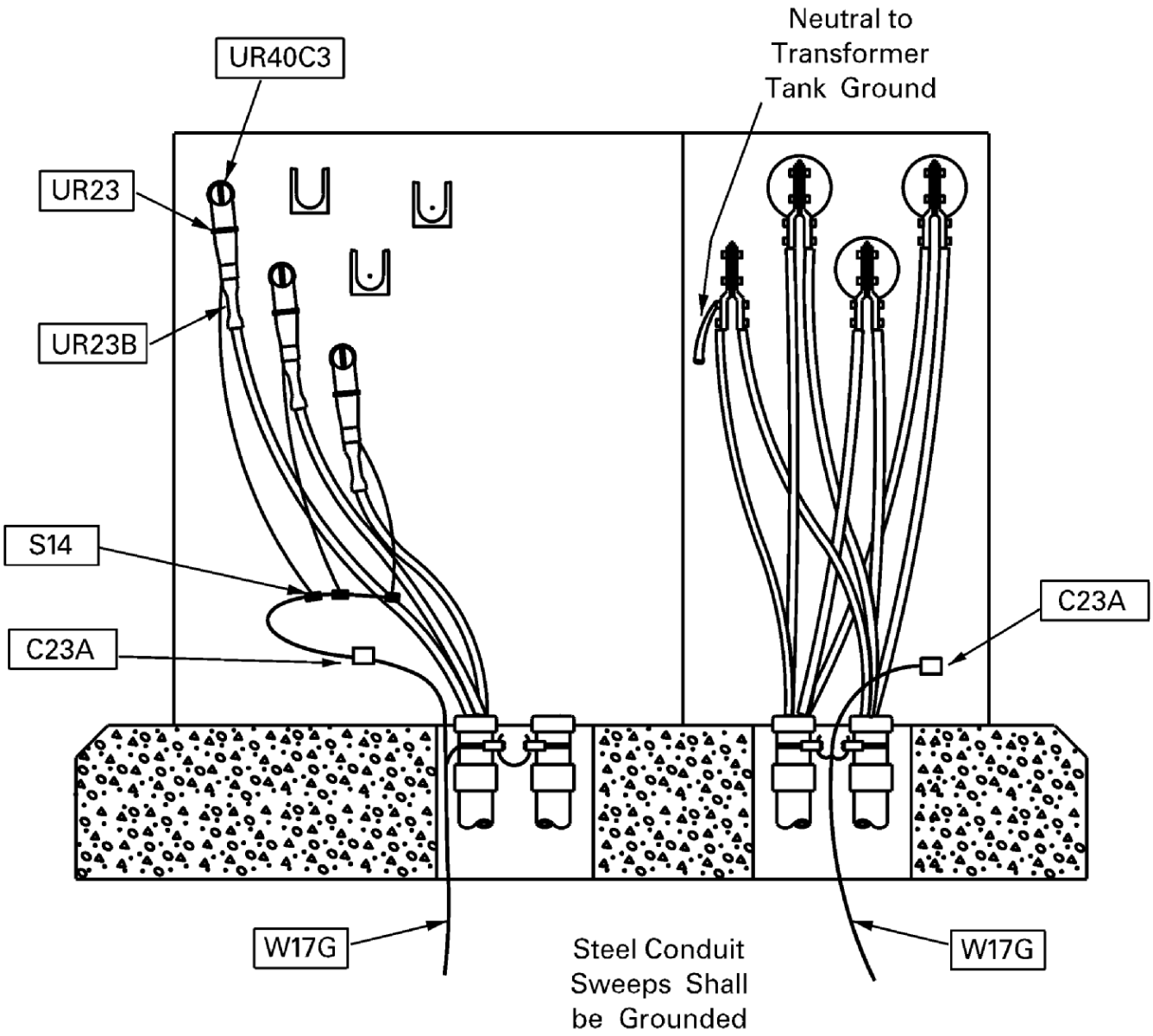
Std. Item	UT42_, UT47_	(A) = Kva Size (B) = Primary Code (C) = Secondary Code (D) = Tap Code
CU	TPM30T(A)K(B)P(C)S(D)TLF	
MU	@TPM30T(A)K(B)P(C)S(D)TRF	

Supersedes 7/07 Issue - Added Std. Items



LOOP FEED PADMOUNT TRANSFORMER INSTALLATION RADIAL FEED

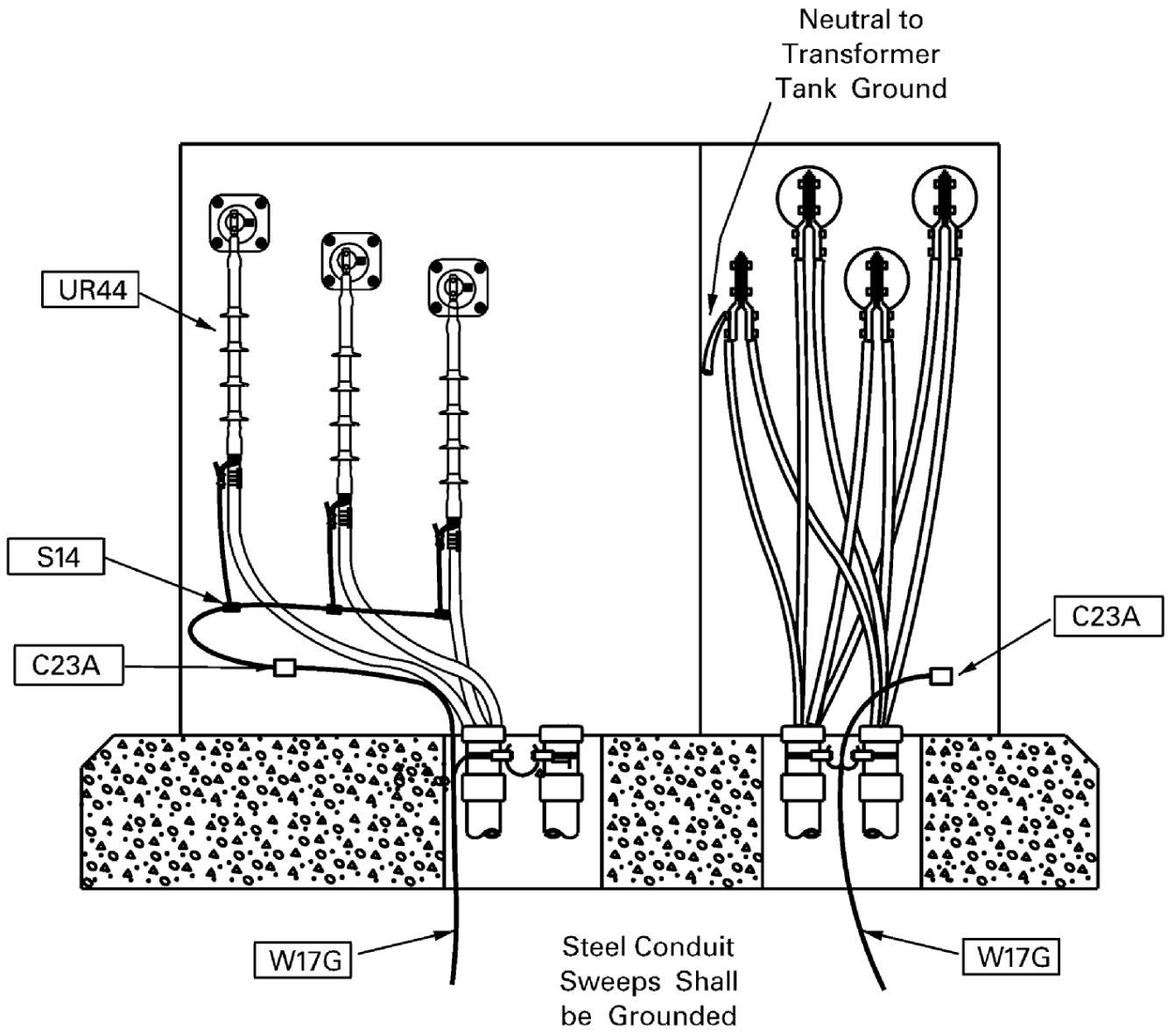
Std. Item	UT41_, UT46_	(A) = Kva Size (B) = Primary Code (C) = Secondary Code (D) = Tap Code
CU	TPM50T(A)K(B)P(C)S(D)TRF	
MU	@TPM50T(A)K(B)P(C)S(D)TRF	



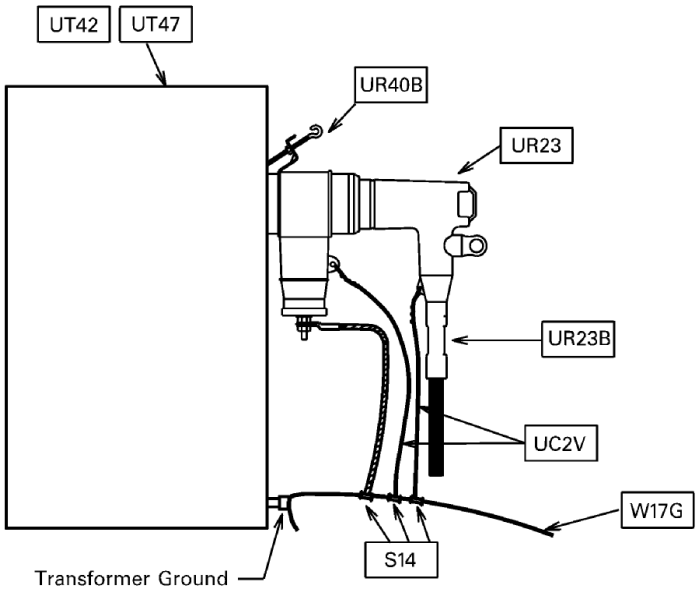
Supersedes 1/07 Issue – Drawing Update

Std. Item	UT45_	(A) = Kva Size (B) = Primary Code (C) = Secondary Code (D) = Tap Code
CU	TPM52T(A)K(B)P(C)S(D)TRF	
MU	@TPM52T(A)K(B)P(C)S(D)TRF	

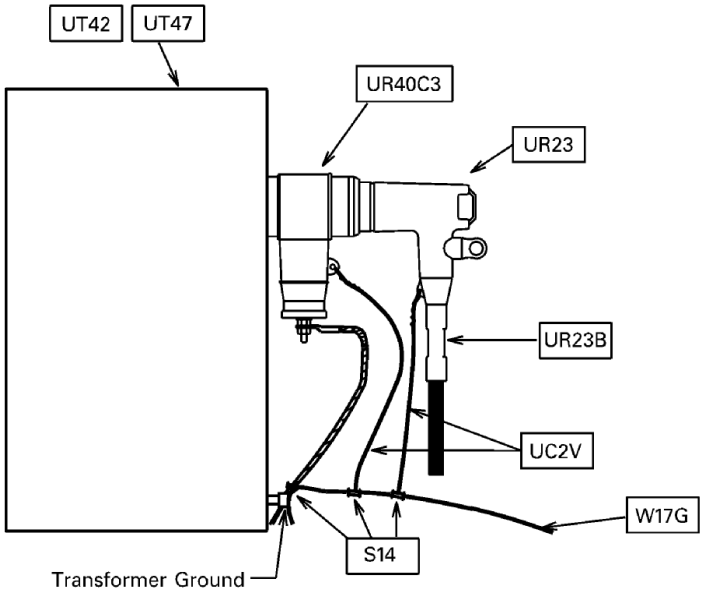
Supersedes 1/07 Issue – Added Std. Item.



Std. Item	CU
UR40B3	CLFA15KNE
UR23A	CLBE200
UR23A1	CLBE2001/0NE
UR23A2	CLBE2002/1NE
UR23A4	CLBE4/0
UR23B	INCL IN CLBE_
W17G	C20CSTBC
S14F OR G	INCL IN CLBE_



SIDE VIEW
PARKING STAND ARRESTER ON LOOP FEED TRANSFORMER



SIDE VIEW
BUSHING WELL ARRESTER ON LOOP FEED TRANSFORMER

Supersedes 7/07 Issue – Added Std. Items and Note.

Note: On all elbow style padmounted equipment, all housings arresters, elbows and insulating caps shall have a bond wire tied between these devices and ground. This will keep the potential of these devices at zero. Use a minimum of #14 AWG Solid Copper or equivalent to bond equipment housing to the ground, the preferred wire is bare #12 AWG Solid Copper, tinned soft drawn Standard Item UC2V, Item ID 4015004.

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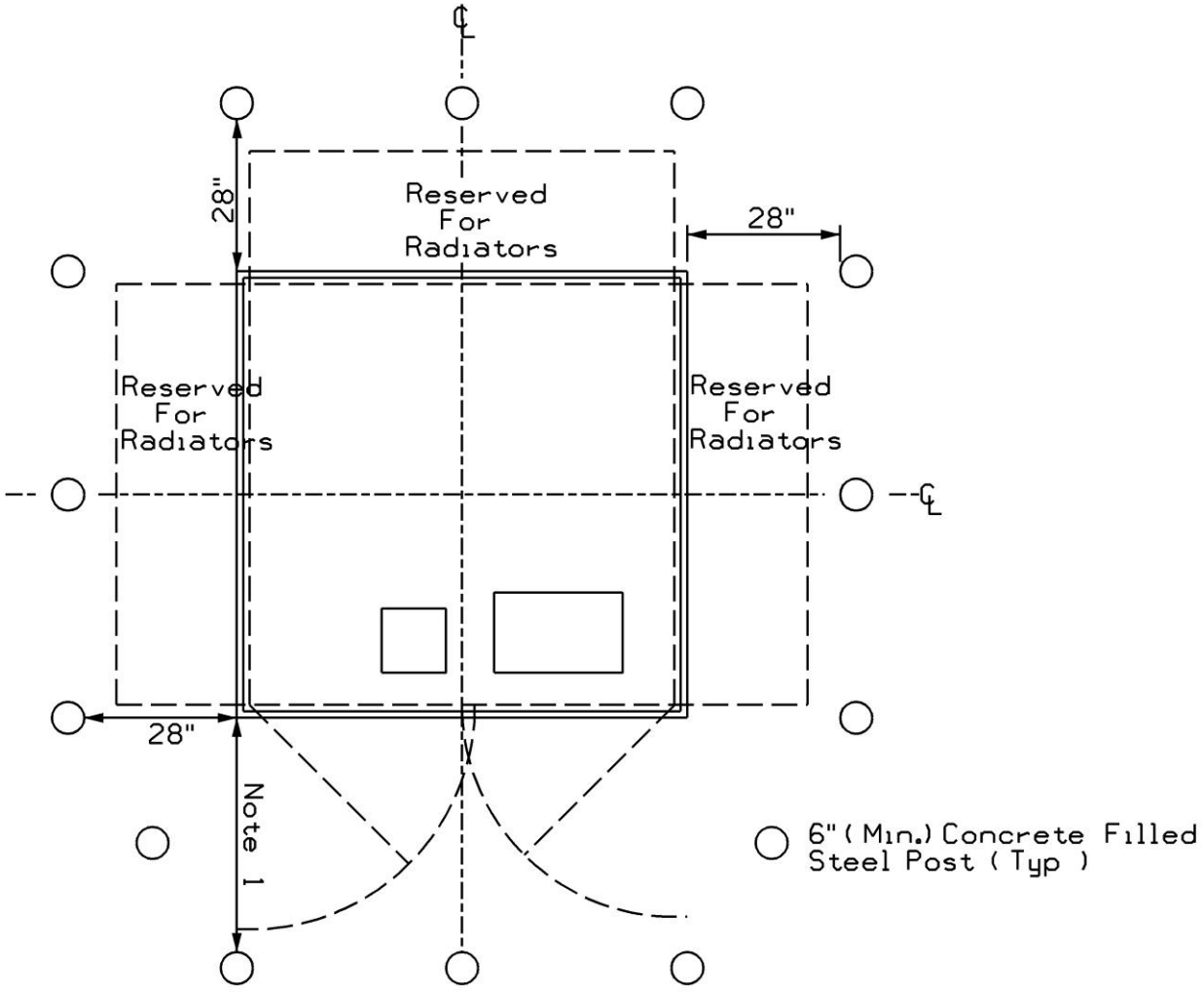


10' Clear Space From Front Of Pad

Notes:

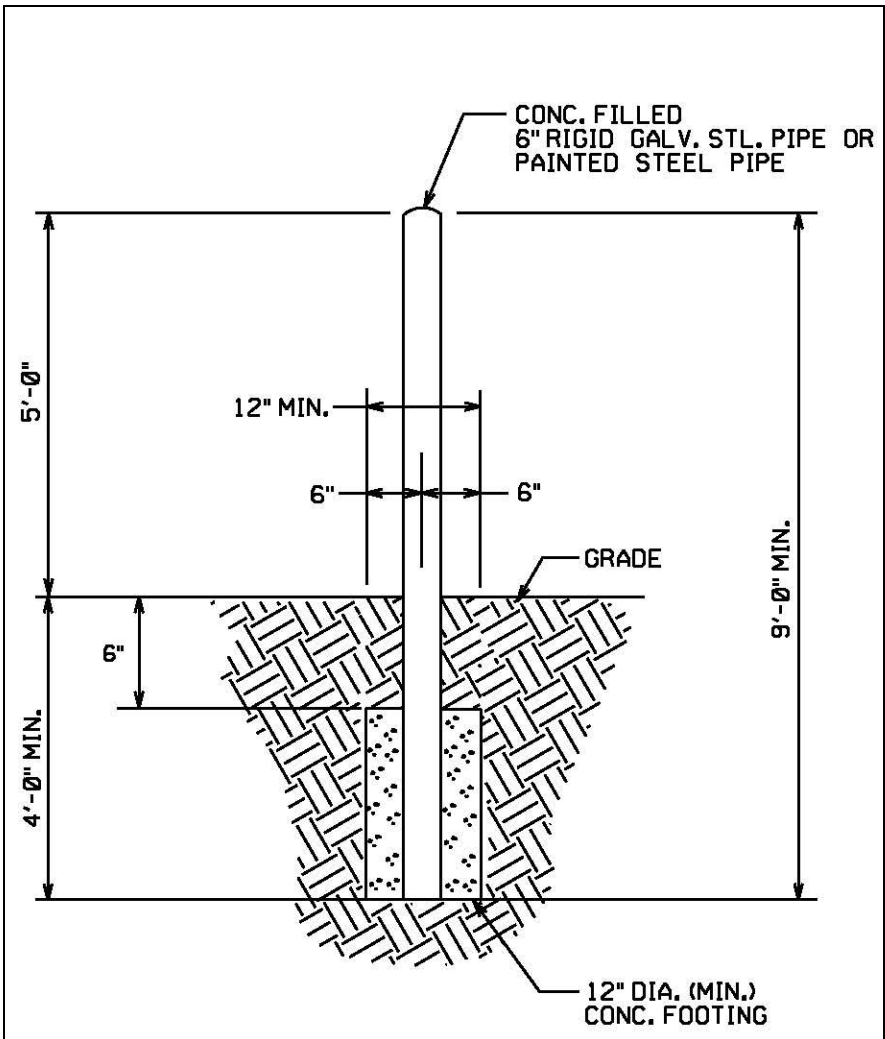
1. 6 foot minimum clearance.

2. Distribution Design shall designate the number and location of Bollards by marking the Bollards of this drawing as follows:

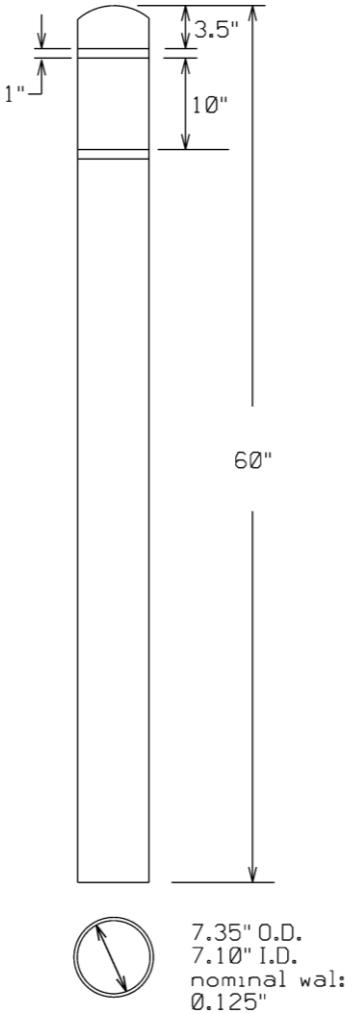
Bollards Required	●
Bollards Not Required	⊗

Std. Item

Std. Item	C80
CU	KCSSSCYFP

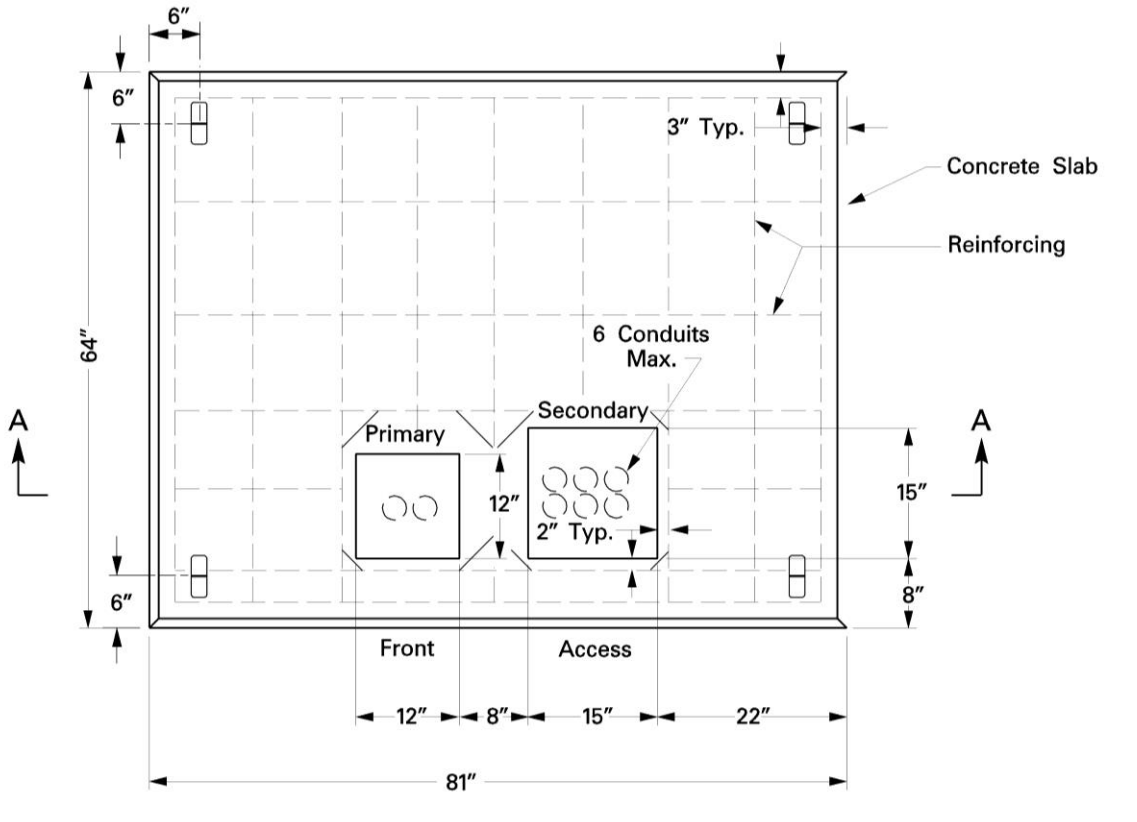


TYPICAL BOLLARD DETAIL

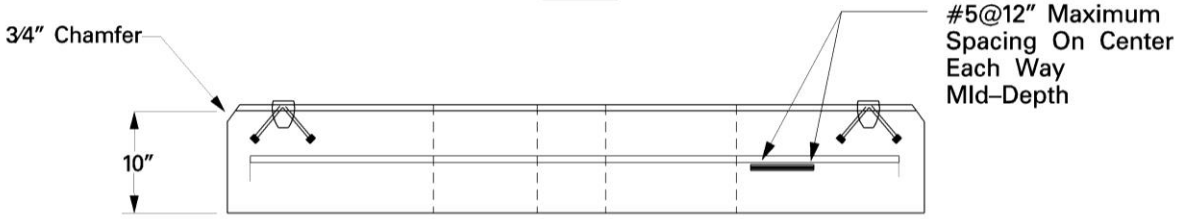


YELLOW PLASTIC COVER, USE FOR BOLLARDS THAT CAN NOT BE PAINTED DURING TIME OF INSTALLATION

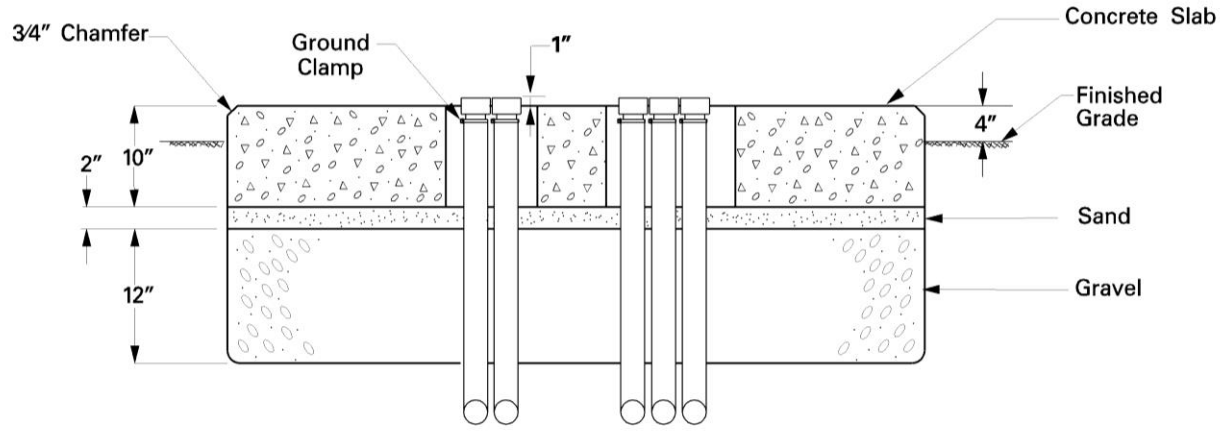
Profile Item	
Std. Item	UF8A
CU	TTFPC2582



PLAN



REBAR DIAGRAM



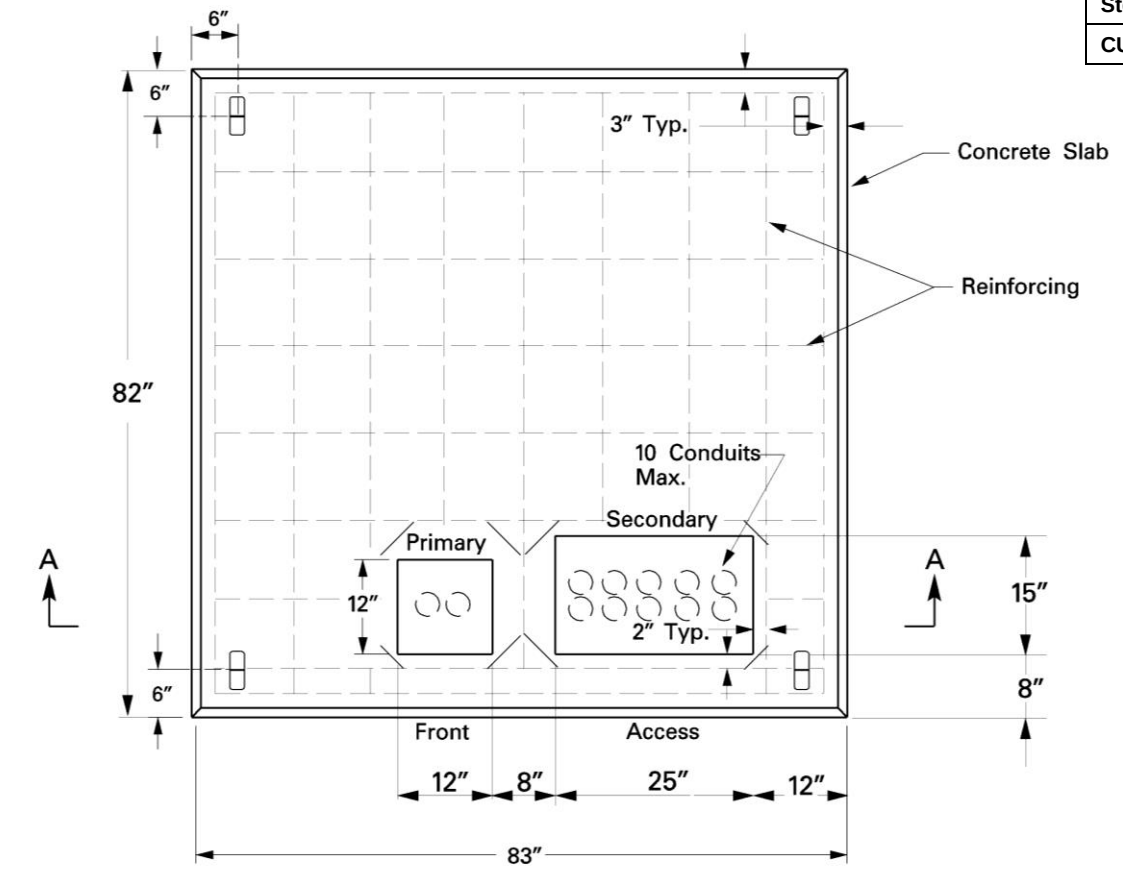
SECTION A–A

Supersedes 1/07 Issue – Added Std. Item.

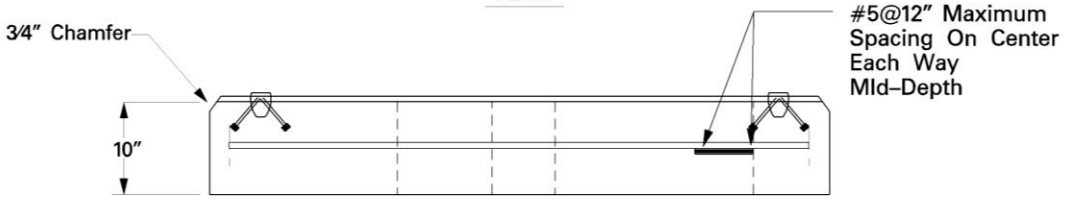
CONCRETE SLAB FOR 75-500kVA THREE PHASE TRANSFORMERS 15kV CIRCUITS			
	PAGE NUMBER		
7/11	**44-113**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl

Store Room Item	
Std. Item	UF8B
CU	TTPC2583

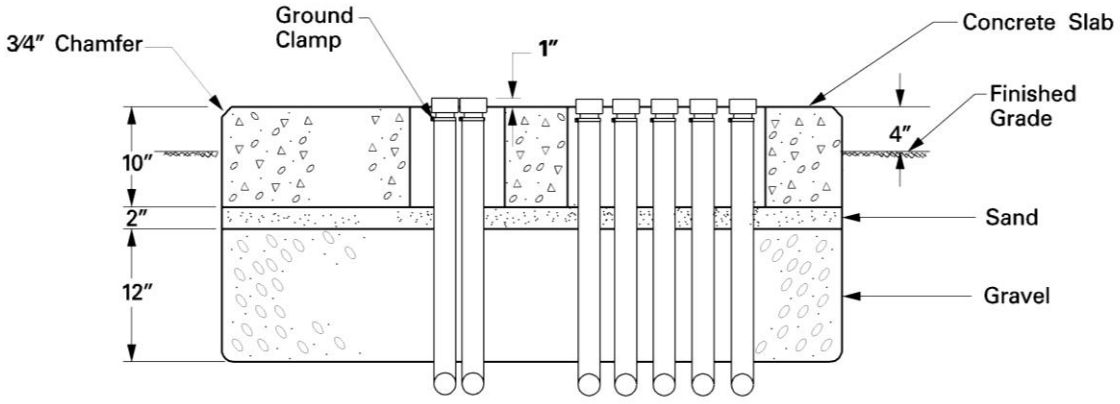
Supersedes 1/11 Issue – Updated transformer rating range.



PLAN



REBAR DIAGRAM

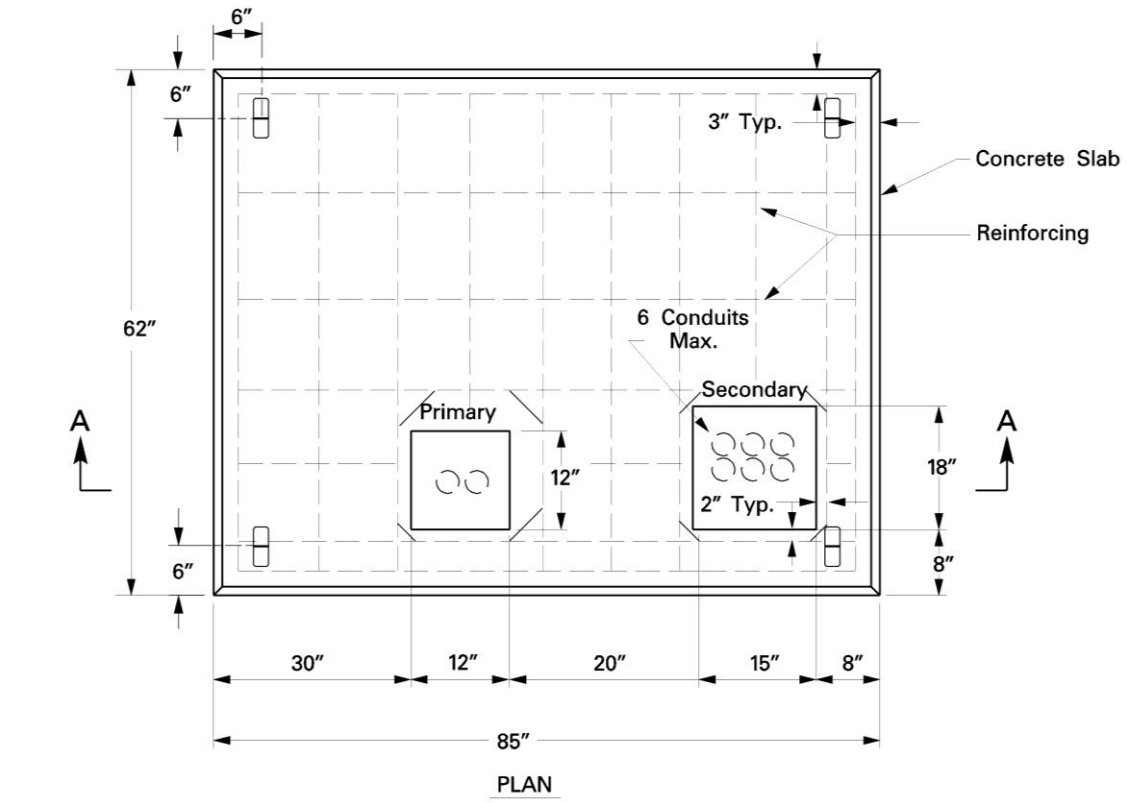


SECTION A–A

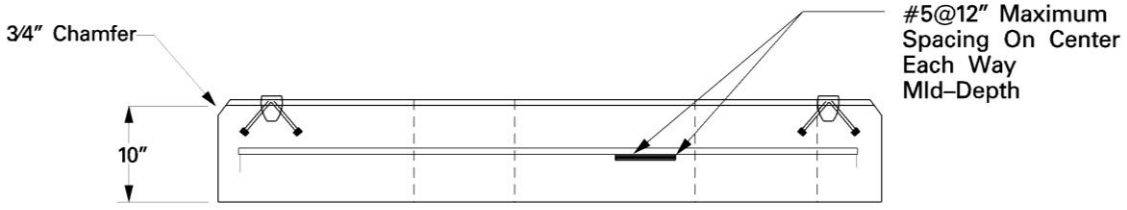
CONCRETE SLAB FOR 750-1500 kVA THREE PHASE TRANSFORMERS 15kV CIRCUITS

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	44-114	7/20

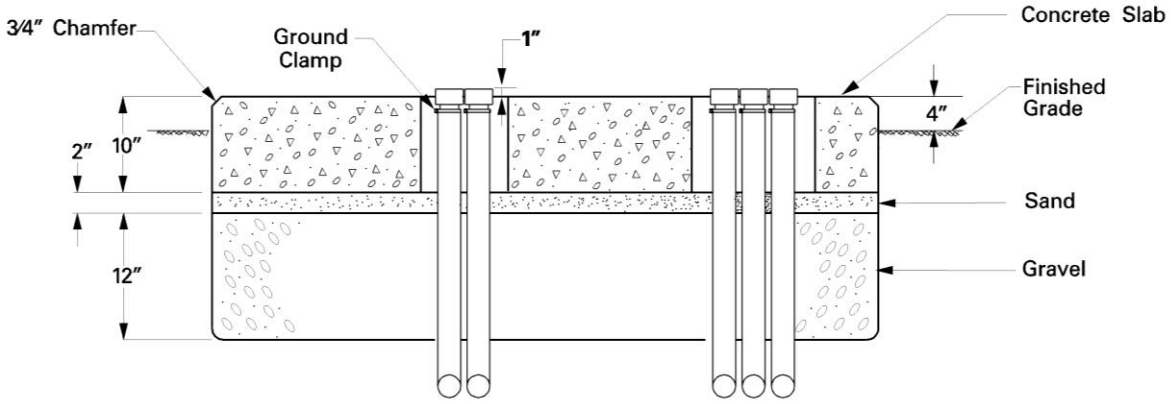
Profile Item	
Std. Item	UF8C
CU	TTFPC2584



PLAN



REBAR DIAGRAM

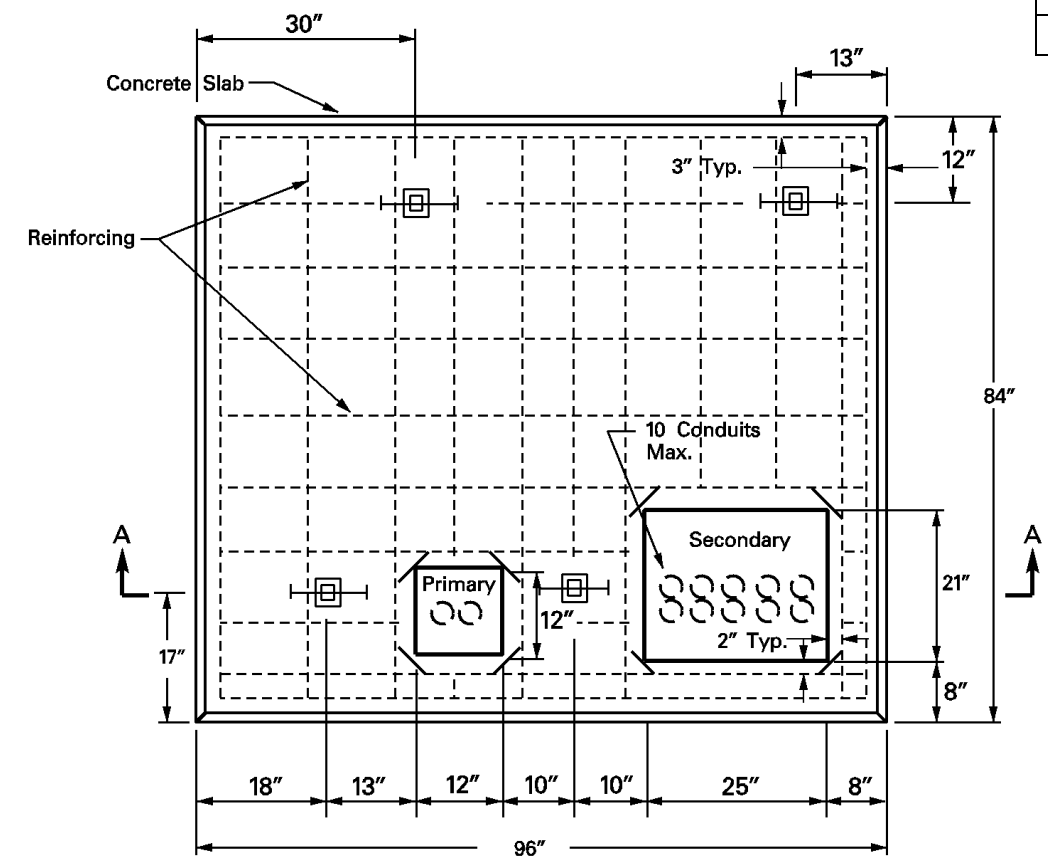


SECTION A–A

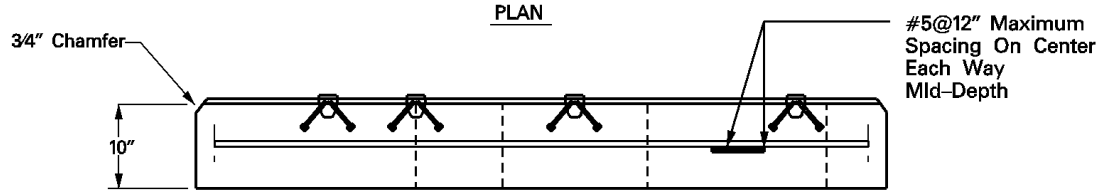
Supersedes 1/07 Issue – Added Std. Item.

CONCRETE SLAB FOR 75 – 300 kVA THREE PHASE TRANSFORMERS 25 - 35 kV CIRCUITS			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/11	**44-115**		

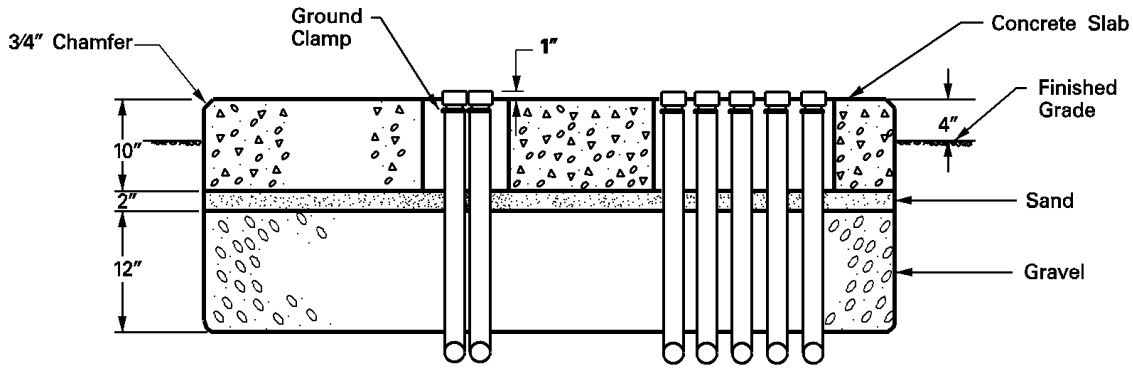
Profile Item	
Std. Item	UF8D
CU	TTFPC2585



PLAN



REBAR DIAGRAM

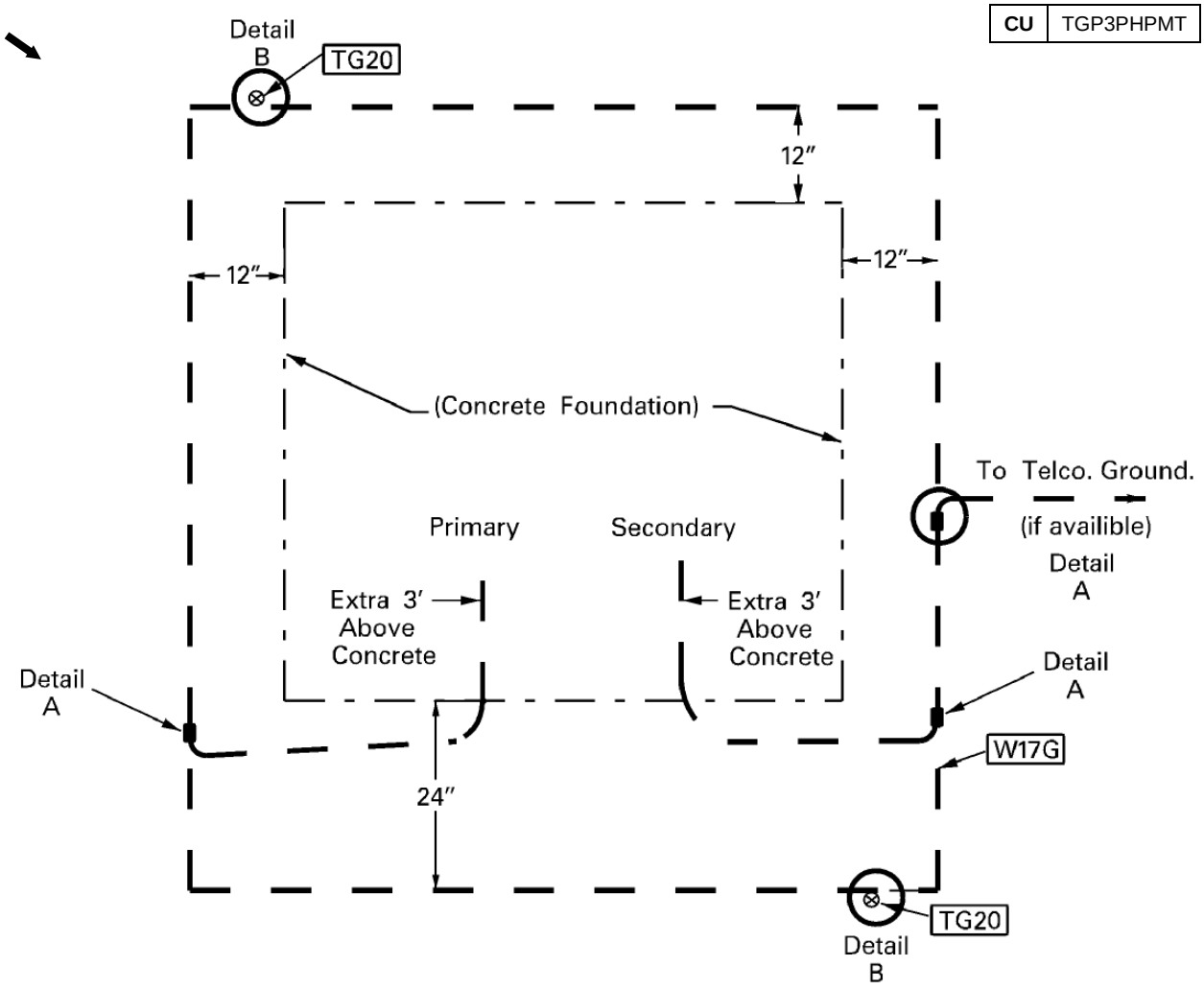


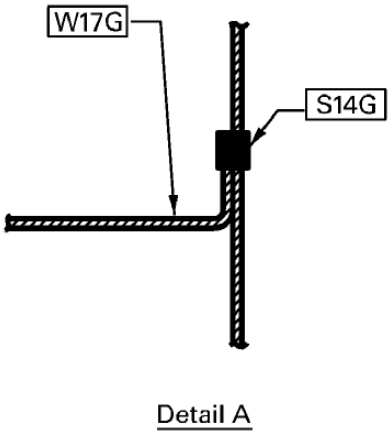
SECTION A–A

Supersedes 7/11 Issue – Updated transformer rating range.

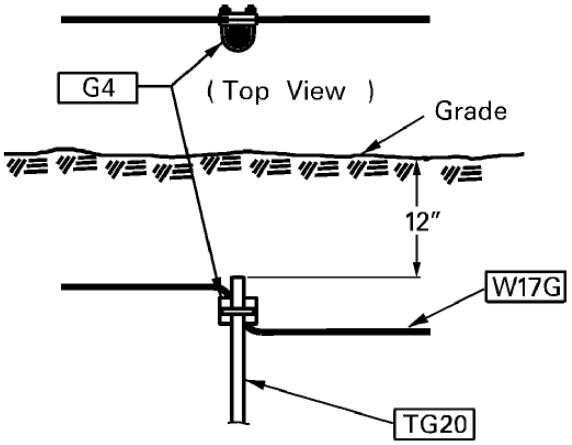
CONCRETE SLAB FOR 500 – 2500 kVA THREE PHASE TRANSFORMERS 15 – 35 kV CIRCUITS			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		44-116	7/20

CU	TGP3PHPMT





Detail A

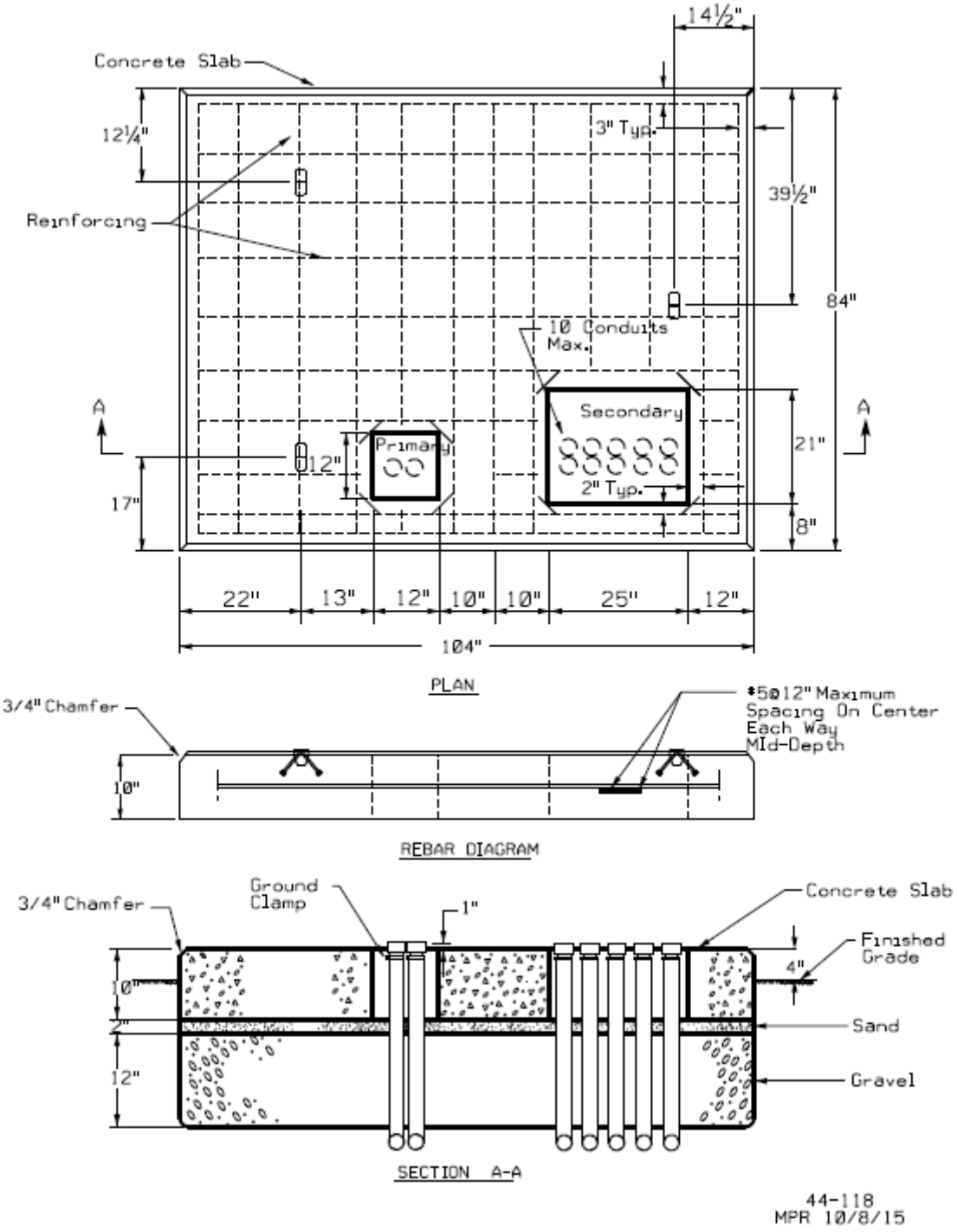


Detail B

Supersedes 7/08 Issue - Drawing Updated with Std Items.

GROUND GRID INSTALLATION DETAILS			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/11	**44-117**		

Profile Item	
Std. Item	UF8G
Item ID	1002228
CU	TTFPCUR8_



CONCRETE SLAB FOR 5000 KVA THREE PHASE TRANSFORMERS 25 – 35 KV CIRCUITS			
ppl	**UNDERGROUND CONSTRUCTION STANDARD**	**PAGE NUMBER**	**ISSUE**
		44-118	**7/16**

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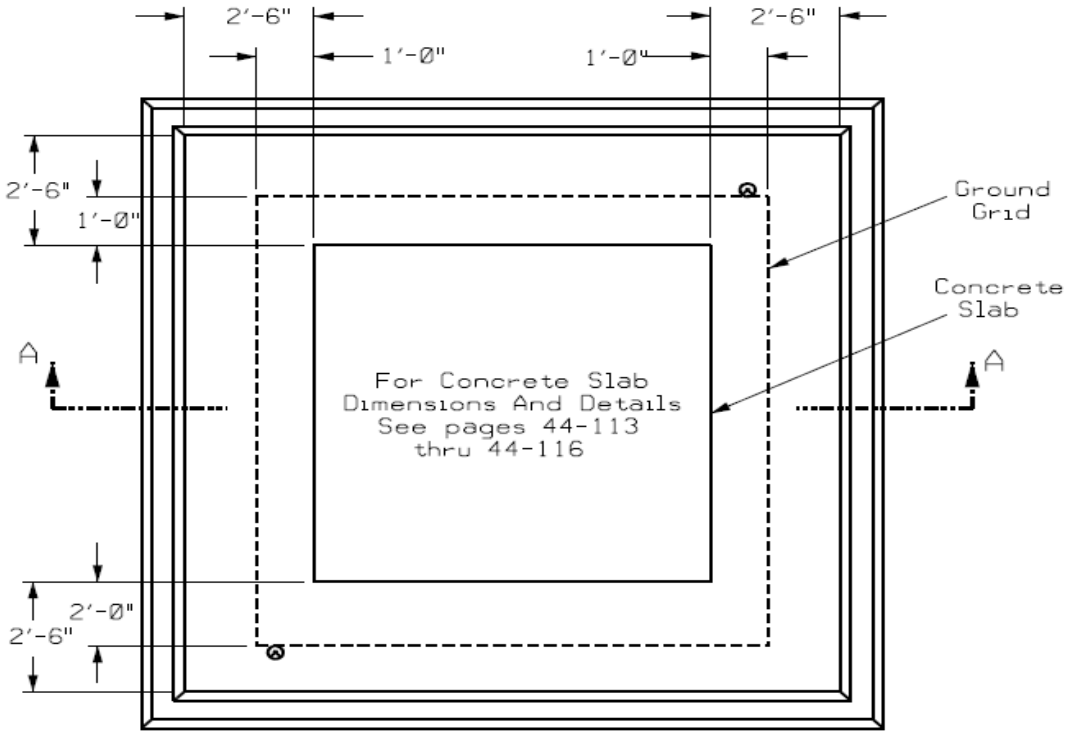
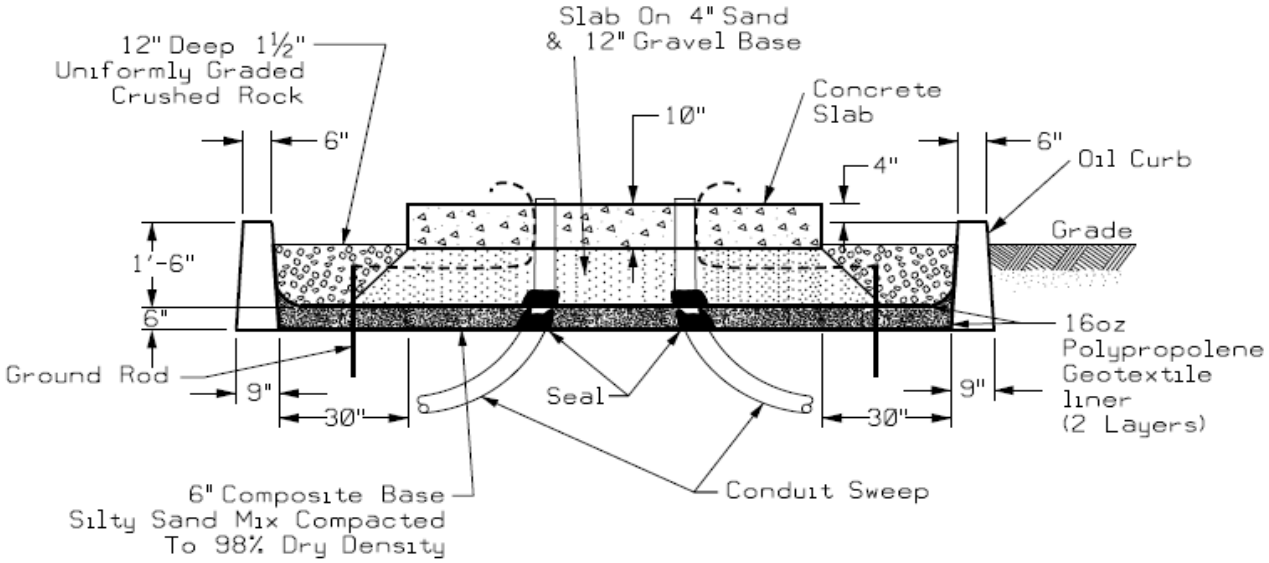
Profile Item	
Std. Item	UF7_
CU	TCCUF7A
CU	TCCUF7B



Typical Cross Section of Containment Pad A-A



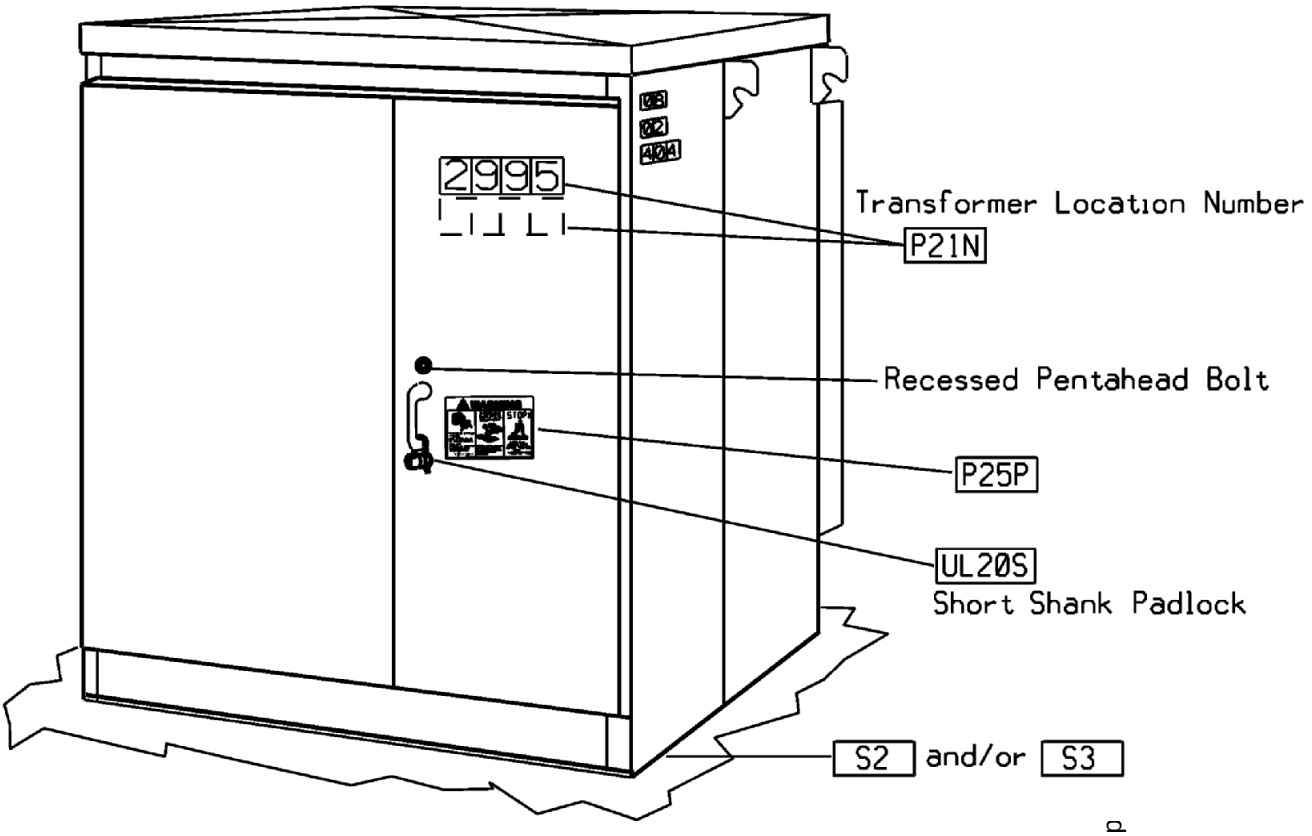
Section A-A

07/07/15 MPR
44-120

Supersedes 7/11 Issue – Drawing Update Section A-A

OIL CONTAINMENT INSTALLATION DETAIL			
ppl	**UNDERGROUND CONSTRUCTION STANDARD**	**PAGE NUMBER**	**ISSUE**
		44-120	**7/16**

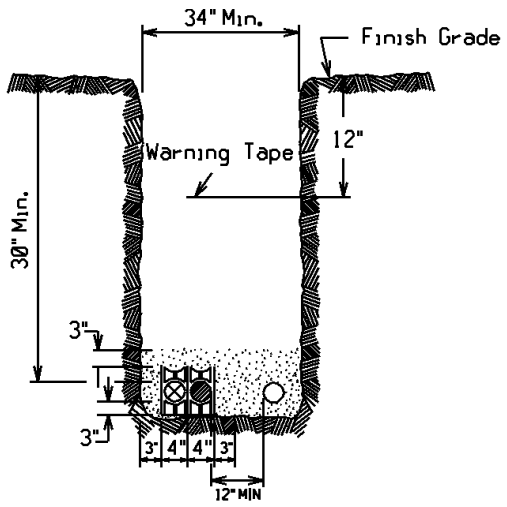
Std. Item	CU
P21N	TP21N_
P25P	TP25P
UL20S	TUL2OT
S2	CS2
S3	CS3



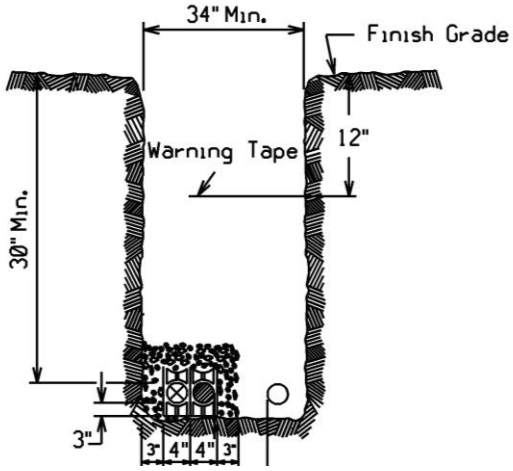
d Std. Item.

Supersedes 2/06 Issue - Drawing Update and added notes

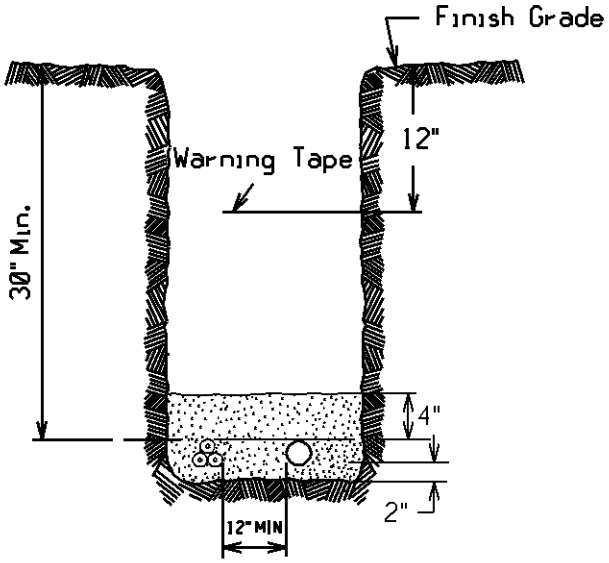
Conduit Trench



Conduit in Concrete Trench



Direct Burial Trench



Note: If more than one set of primary is in trench, separate primary by 6" minimum.

Legend

- Base Spacer
- Intermediate Spacer
- Primary Electric Duct
- Communication Duct or Cable
- Spare Duct
- Direct Burial
- Concrete
- Sand

TYPICAL TRENCHES			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		44-125	7/08

Version	Date	Modification	Author(s)	Approval by (Name/Title)
6.0	7/20	• Typo corrected on page 44-4 • Updated titles for 44-114 and 44-116		
5.0	7/18	• Updated Section 44.16-Bollards • Updated Section 44.23-Cable Tags • Added section 44.27-Grid Resiliency		
4.0	7/16	• Updated section 44.23 cable tags • Updated drawing for 44-120 • New drawing 44-118		
3.0	7/15	• Updated text in sections 44.12 and 44.21 • Updated drawing in 44-120		
2.0	7/11	• Updated text in sections 44.1, 44.3, 44.5 , 44.8, 44.12, 44.14, 44.14.10, 44.16, 44.20, 44.21, 44.24, 44-102, 44-1-8, 44-111 and 44-123. • New sections 44.25 and 44.26 • Drawing updates to 44-108, 44-44-120 and 44-123. • Added Std. Items to Drawings.		
1.0	07/08	• Updated sections 44.1, 44.8, 44.14, 44.16, 44.20, 44.21, 44.23, • Inserted 44.42 (new section). • Updated page 44-111 - added bollard cover to drawing. • Updated drawing on page 44-117. • New drawing on page 44-125.		

Supersedes 7/19 Issue – Text Edits

Supersedes 7/18 Issue – Updated Standard 45-125 & 45-127

45.0 GENERAL

This Section outlines general construction practices for Underground Residential Developments (URD). In general, these practices shall apply to 15 kV, 200 A, single phase class of equipment.

It is intended to apply these practices to qualifying residential developments in accordance with Company Policy.

For specific layout and design practices refer to the URD Design Guide available on the Distribution Engineering Services website.

45.1 PRIMARY CABLE

Primary cables shall consist of a single jacketed #2 aluminum conductor, solid dielectric insulated cable, with full size copper concentric neutral (Std. Item UC11BC).

Cable shall have a semi-conducting jacket and is to be used in all conduit and direct buried installations. This cable is suitable for random lay where other communications cables are present.

45.2 SECONDARY CABLE

Secondary cable shall consist of triplexed (three single conductors twisted together), 4/0 or 350 kcmil aluminum conductor (Std. Item UC8). Typical ampacities for the above secondary cables are detailed in Table 1. These ampacities are shown as a guide only. For specific installations, refer to Distribution Design.

Table 1
Typical Ampacity For URD Secondary Cable

Cable Size	Ampacity In Conduit (Amps)	Ampacity Direct Buried (Amps)
1/0 AL*	185	205
4/0 AL	265	300
350 AL	360	400

* For Reference Purposes Only

Supersedes 1/07 Issue – Text edits for 45.3

45.3 INSTALLATION

Current tariffs require a conduit and cable system in Rhode Island. Where possible it is preferred to go beyond the minimum requirements and install the system in conduit where appropriate.

Conduit systems shall consist of a primary conduit with cable in it and a spare conduit. Spare conduit shall be installed along the entire route of the primary cable and terminated at the base of the riser pole in a 90 degree sweep, with a coupling and conduit plug (Refer to Section 48 – Risers). A spare conduit is not required to be installed in a looped system.

Direct buried systems shall consist of random lay cables, most often in a joint trench with other communications cables. One or more 3 inch spare conduit(s) shall be installed perpendicular to the pavement at all road crossings. Concrete encasement of the conduit at road crossings is required where local tariffs allow it. The conduit(s) shall be sealed with a conduit plug(s) (Std. Item UK6G).

45.4 JOINT TRENCHING

Joint trenching involves the utilization of the same trench by a combination of utilities including electric primary cable (60I V to 15,000 V), electric secondary / street light cable (600 V and below), buried communication cable including telephone and CATV, and/or natural gas lines. Direct buried electric cable shall not be installed in a joint trench with water lines, fuel lines, steam lines, or sewers, including both sanitary and storm type. Joint trenching with communication cable including telephone and CATV and/or natural gas lines shall be utilized when practical.

45.5 EQUIPMENT LOCATION

Requirements for underground construction and associated pad-mounted equipment shall be determined for each development by Distribution Design. All Company owned equipment must be located within a permanent easement. The customer / developer shall grant such permanent easements, including rights of access to each easement, to the Company. Easements must be in place prior to installation of any Company owned equipment.

The location of the easement strip, the trench within the easement strip and the placement of the electric cable shall be such as to avoid above ground and underground structures and obstructions. To avoid interfering with future installation by other utilities, the trench should be run parallel with the centerline of the street.

Pad-mounted equipment and below-grade submersible equipment (e.g. transformer foundations), transformer enclosures, secondary service handholes, etc. shall be located in the easement strip and should be placed between the trench and the private property side of the easement strip. A minimum separation of 12 inches of well tamped and/or undisturbed earth should be maintained between the trench and any pad-mounted or below-grade utility structures (e.g. transformer foundations). The separation of the trench from the edge of the easement strip should be as large as necessary to permit maintenance of the buried facilities.

In those areas where water and/or sewer lateral stubs have been installed, future excavation for connection to the stubs must be anticipated. These stubs usually terminate at the property line or up to two feet on the private property side of the front lot (street) line. The stubs should be considered in locating the trench. Water and sewer laterals should be installed in advance of the electric distribution facilities.

The electric primary cable shall normally be placed on the private property side of the trench. Communication cables and gas lines shall normally be placed on the public way side of the trench.

45.6 EXCAVATION

The width and depth of the trench will vary dependent upon the number and type of utilities occupying the trench. The width of the trench should be kept to a minimum. The excavation shall conform on plan, depth and grade to those shown on the detailed construction drawings. The trench shall be uniformly graded and the bottom of the trench shall be well tamped and/or of undisturbed earth, free of rocks and any sharp projections. Before placement of direct buried cable, a 2 inch protective layer of sand or rock-free sandy loam shall be placed on the trench bottom. Typical trench cross sections are shown on Pages 46-100 thru 46-101.

45.7 BACKFILL

The Company shall inspect the cable installation prior to backfilling and shall also approve or reject the proposed backfill material. All backfill material shall be free of objects that may damage the cable / conduit installation. Trenches in streets or other areas that may pose an undue hazard or an inconvenience to the public shall be backfilled as soon as possible.

Selected backfill shall be carefully placed around the cable / conduit and to a point a minimum of 4 inches above the cable / conduit. The selected backfill shall consist of sand or rock-free sandy loam. This selected backfill shall be compacted by foot-walking and hand tamping.

The remainder of the backfill shall be in 6 inch layers and each layer shall be well tamped with a mechanical tamper after a 6 inch covering is in place. The backfill material shall be dense and compacted sufficiently to prevent further settling. This backfill shall consist of sand or earth or a mixture. This backfill may contain rocks provided the rocks do not exceed 2 inches in any direction or with sharp edges likely to cause damage. Rocks shall not comprise more than 50% of the backfill material by volume. Selected backfill shall not contain shell, ash, cinder or frozen material.

Trenches with gas mains installed are to be backfilled with soil free of rocks or other debris that may damage the pipe surfaces. Before installing a gas line in the joint trench, all other occupants shall have their respective facilities installed and backfilled with the required minimum cover of 12 inches.

CLEARANCES

45.8.10 General

The minimum burial depth between the top of the completed primary conduit or direct buried primary cable and finished grade is 30 inches. All conduits / cables entering equipment enclosures, such as, transformer foundations or pull / splice boxes, shall remain at the required 30 inch depth until protected by the enclosure.

If these minimum burial depths cannot be achieved due to excessive ledge or solid rock conditions or when trench encroaches paved areas subject to vehicular traffic, the following guidelines may be applied. Every attempt should be made to achieve the 30 inch minimal clearance prior to implementing these supplemental instructions.

A. Conduit Applications

Supplemental protection is required to prevent potential damage. The minimum excavation depth can be reduced to 21 inches and the conduit encased in concrete. The concrete envelope is to be a minimum of 3 inches thick in all directions around the conduit (Refer to Section 32 – Conduit). Minimum cover over the concrete encasement shall not be less than 12 inches.

B. Direct Buried Applications

If a 30 inch burial depth cannot be achieved, the cable must be placed in a 3 inch conduit encased in concrete. The minimum excavation depth can be reduced to 21 inches. The concrete envelope is to be a minimum of 3 inches thick in all directions around the conduit. Minimum cover over the concrete encasement shall not be less than 12 inches.

The minimum burial depth for secondary conduits / cables shall be 24 inches.

Greater depths than those indicated may be required dependent upon field conditions, other utilities occupying a joint trench, and other common factors.

45.8.20 Communication Cables

Direct buried communication cable, including telephone and CATV, may be buried at the same depth with the direct buried electric cable with no deliberate separation between facilities, provided all parties involved are in agreement and provided the primary electric cable has a semi-conducting jacket. All communication boxes shall be a minimum of two feet away from any electric company boxpad, pullbox or handhole. Also, communication equipment shall not be placed in front of any electric company equipment.

Supersedes 7/14 Issue – Added text to 45.8.20

45.8.30 Natural Gas Lines

Direct buried electric cable shall be separated from gas lines by a minimum of 12 inches in any direction. Gas lines shall normally be located above the electric cable, provided a minimum of 12 inches of vertical separation is maintained. Gas lines shall not be located at the same depth as the electric cable.

45.9 MARKING TAPE

Marking tape shall be installed in the cable trench above all electric conduit / cable. The tape (Std. Item UT8) shall be installed approximately 12 to 18 inches below finish grade to prevent dig-ins of underground cable. The installation shall take place during the backfill of the cable trench.

45.10 TYPICAL TRENCH DETAILS

The trench cross sections shown on Pages 45-100 thru 45-101 illustrate typical combinations of joint facilities and the minimum clearance and separation required for areas where the finish grade has been established. For those areas where only rough grade (rough grade being grade within 6 inches of finish grade) has been established, an additional 6 inches should be added to the depths given to maintain the minimum depths required.

45.11 CABLE PULLING

Primary cables shall be installed utilizing the pulling eyes at the transformer foundation, and in instances requiring it, a primary cable pull/splice box having pulling eyes installed in them for this purpose.

Primary cable pulling tension shall be limited to 730 pounds. **ALL CABLE PULLS REGARDLESS OF THEIR LENGTHS SHALL USE PULLING LUBRICANT (Std. Item UC75) IN ACCORDANCE WITH RECOMMENDED PRACTICES.**

Additionally, cable "reel drag" shall be minimized by attending the cable reel and hand feeding the cable in at the feed point as it is pulled from the pulling end. Minimizing "reel drag" dramatically reduces cable pulling tensions.

Cable pulling sheaves of proper diameter shall be used during pulling to prevent cable damage from bends less than the minimum radius recommended. Refer to Section 35 – Cables for further information on recommended minimum bending radius for cable. Proper pulling techniques will insure normal life expectancies for cable and will also prevent damage to conduit ends inside transformer foundations and pull/splice boxes.

Cold shrink cable end seals (Std. Item UC90) shall be used on primary cables to keep moisture out of the cable during all phases of installation.

Secondary cables shall be pulled into the transformer foundation, utilizing the pulling eye in the transformer foundation installed for this purpose.

Where cable must be pulled between secondary handholes, these distances should be kept short (limited typically to road crossing widths) and the number of conduit bends should be minimized as pulling by hand will be necessary.

45.12 CABLE SPLICING

Splicing shall be in accordance with Section 36 – Connectors / Splices. Cold shrink splice jackets (Std. Item UR75) shall be employed to cover all pre-molded straight cable joints.

A primary pull / splice box (Std. Item UR6) shall be employed where specified by Distribution Design. Cable should be trained such that splices are installed along the long walls of splice boxes as shown in Figure 1.

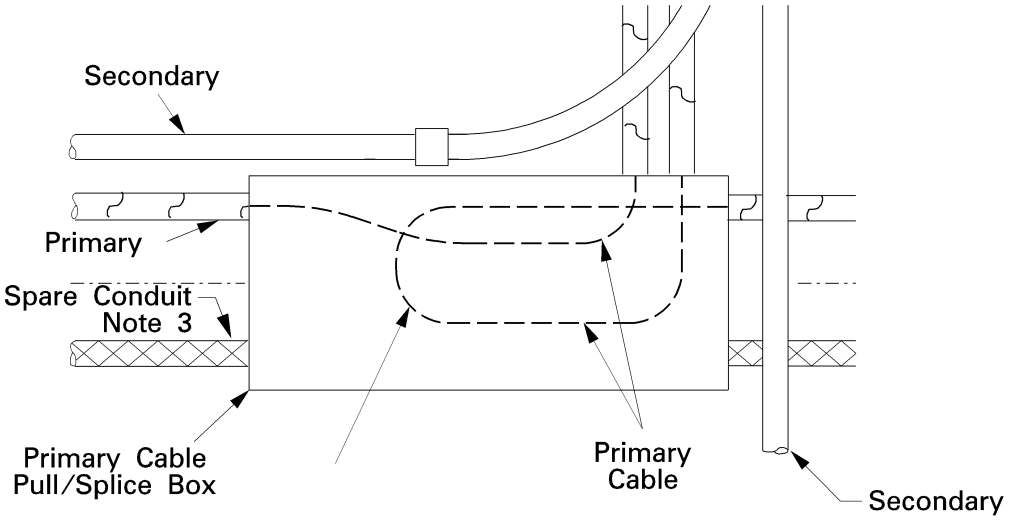


Figure 1
Primary Cable Training In Pull / Splice Box

When training primary cables in transformer foundations and pull/splice boxes, it is important to meet or exceed the cable's minimum bending radius, refer to Section 35 – Cables.

45.13 CABLE TERMINATING

Cable terminating shall be in accordance with Section 37 – Terminations.

45.13.10 Loadbreak Elbow Connectors

Loadbreak elbow connectors shall be installed on dead front pad-mounted transformers and similar equipment using universal bushing wells and loadbreak bushing inserts.

Jacket cutback sealing kits (Std. Item UR23B) are required to reseal the cable jacket.

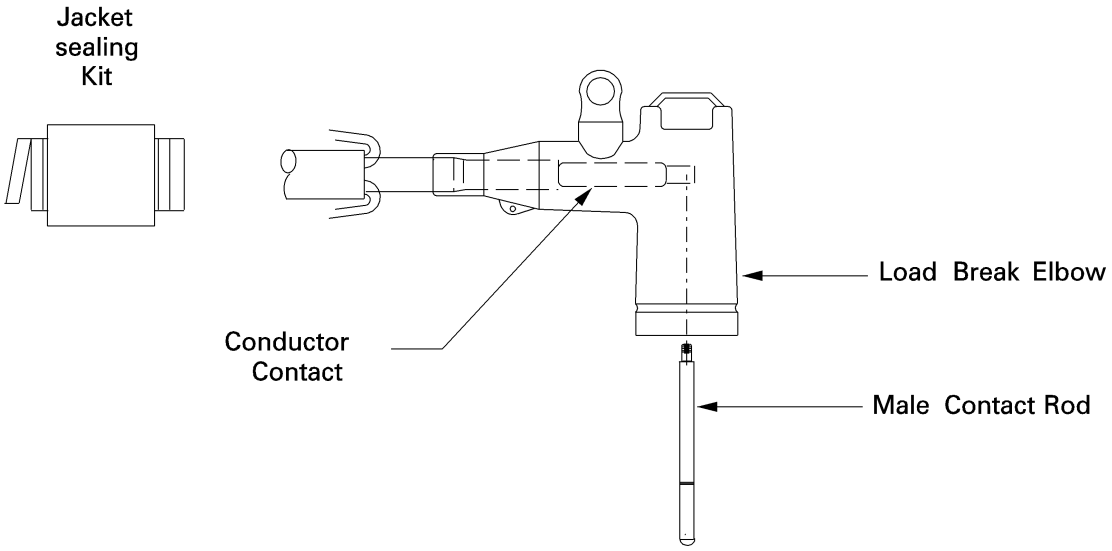


Figure 2

45.13.20 Cold Shrink Terminators

Cold shrink terminators shall be in accordance with Section 37 – Terminators and are to be used on riser poles and live front pad-mounted equipment (live front pad-mounted equipment to be used only when specified by Distribution Design). Terminator kits specified for jacketed concentric neutral cable provide a weatherproof seal at the jacket cutback.

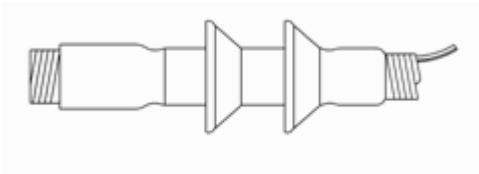


Figure 3

45.14 SURGE PROTECTION

Surge protection shall be in accordance with Section 40 – Transformers. Surge arresters must be applied at all riser poles and at all open points.

The importance of short surge arrester primary and ground leads in parallel with riser pole terminators cannot be overstated. This practice is depicted in Section 48 – Risers.

Before energizing primary cables, make sure surge arrester leads are connected properly at the riser pole, and at open points as required. When installing an elbow arrester, the arrester shall be fully seated on the bushing.

45.15 CABLE IDENTIFICATION AND TAGGING

45.15.10 Primary Cable Systems

A. Application

To provide identification system for primary URD cables so that the physical location of the terminal points of the cable can readily be determined.

B. Procedure

(Refer to Figure 4) – Each transformer manhole, pad-mounted transformer, primary pull/splice box, enclosure or primary handhole in each development will be initially numbered consecutively starting with #1. Additions to the system will be numbered with the next consecutive number. In some operating areas equipment has been labeled by house number, in these areas future numbering can remain the same to minimize confusion and keep consistency in the operating area. All cable tags shall represent where the cable is going to.

C. Identify Location

Identify location by stamping castings, covers, or by placing decals on tamper shields or on pad-mounted transformers.

D. Tags

Refer to Section 50 – Materials Catalog (Std. Item UP21). Select appropriate plastic tags, insert into tag holder, and attach it to cable.

Supersedes 7/14 Issue – Text edit section 45.14

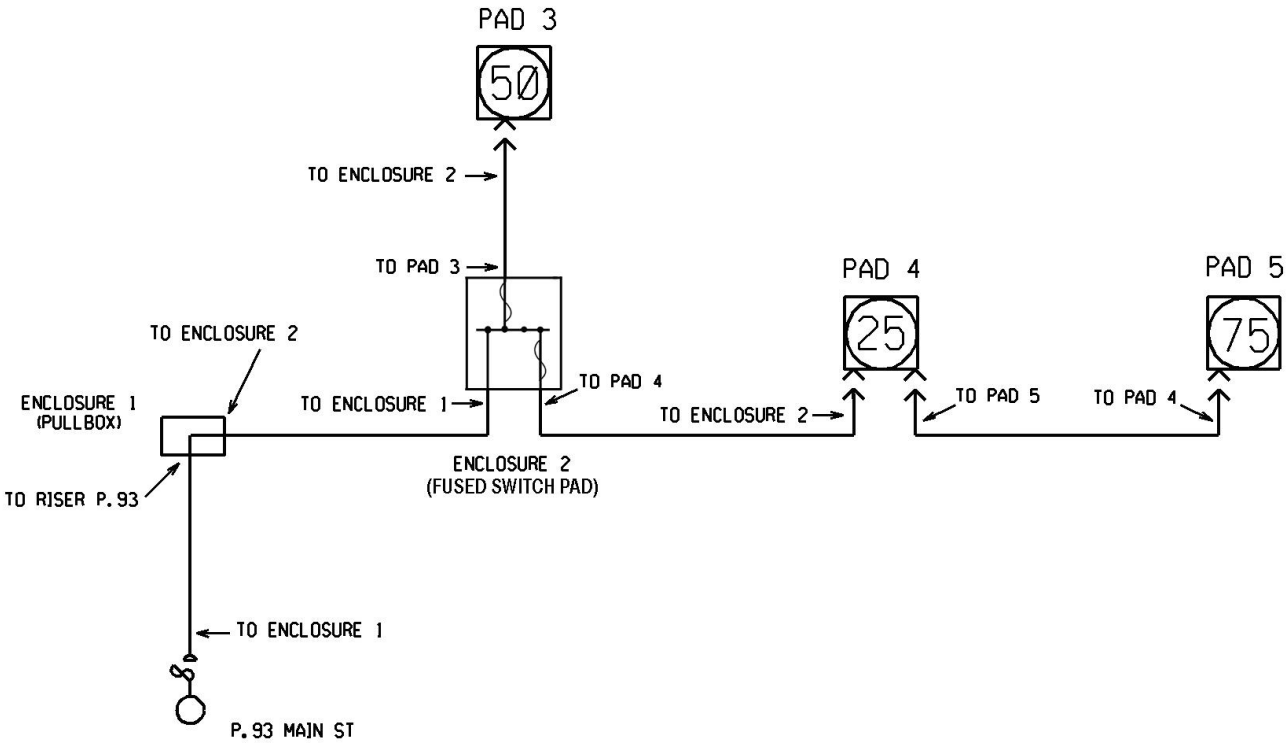


Figure 4
Primary Cable Tagging & Identification

45.15.20 Secondary Cable Tagging And Identification System

A. Application

To provide identification system for secondary URD cables so that the physical location of the terminal points of the cable can be readily determined.

B. Company Owned Cable to Transformer

Labels are available to identify Company owned 600 V secondary cable. "Company Owned" label followed by a dash and the handhole identifies the transformer that houses the other end of the cable.

Figure 5

Supersedes 7/11 Issue –Updated 45.15.20 B and Figure 5

C. Company Owned Secondary Cable to Handhole

The label "Company Owned identifies the cable owned by the Company. The number (e.g. 15-1) identifies the handhole location that houses the other end of the cable.

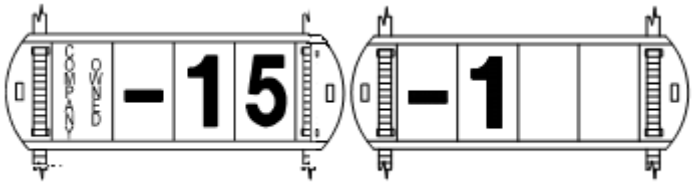


Figure 6

D. Customer Owned Service Cable

The label "Customer Owned" identifies the customer owned 600 V service cable. The number (e.g. 155) identifies the customer's building or apartment number. Customer service cable will terminate at either a handhole or padmount transformer.

Figure 7

E. Parallel Secondary Service

For parallel secondary services, install a parallel service tag (Std. Item UP21P) in the tagholder along with the building or apartment number.

Figure 8

Figure 9

Supersedes 7/07 Updated 45.15.20 C, D and E. Updated Figures 6, 7 and 9

45.16 SINGLE INSULATED SECONDARY BUSES – ALUMINUM 600V

45.16.10 Single Allen Set Screw (#10 – 500 kcmil)

The single Allen set screw insulated secondary connector is designed for connecting insulated copper and/or aluminum secondary, service lateral and street light cables with a cable range of #10 stranded through 500 kcmil stranded. The insulated secondary bus is available with 4, 6 or 8 positions.

The insulated secondary connector is suitable for service handhole, submersible transformer enclosure and direct burial applications when operated on 600 V or lower voltage class systems.

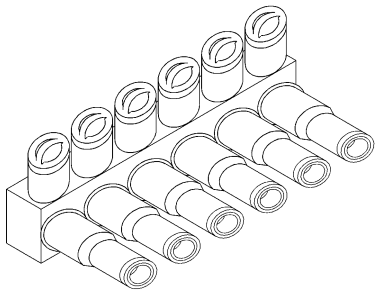


Figure 10
Single Allen Set Screw Insulated Secondary Bus

Table 2
Insulated Aluminum Bus

Std. Item	Number Of Terminals	Length (Inches ±)	Range
UR15A4	4	4.7	#10 – 500 kcmil
UR15A6	6	7.1	
UR15A8	8		

1. Remove the cable insulation down to the conductor 1⅛ inch from the end of the cable. Do NOT pencil the cable.

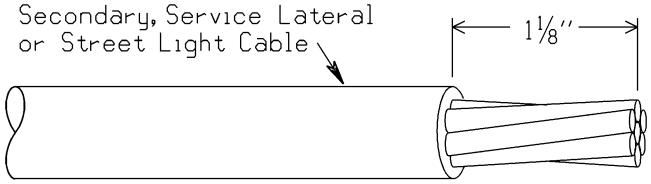


Figure 11

2. Select the cable port to be used and remove the cable adapter from the cable port. Ensure that the bus is pre-filled with oxide inhibitor. If the cable adapter is required, remove and discard the plastic dust cap and select the cut line that corresponds to the cable size being used. Cut the cable adapter at the proper cut line and slide the cable adapter onto the cable.

   Note: For 500 kcmil cable, discard the cable adapter and slide the cable directly into the cable port.

Supersedes 2/06 Issue – Added 45.23

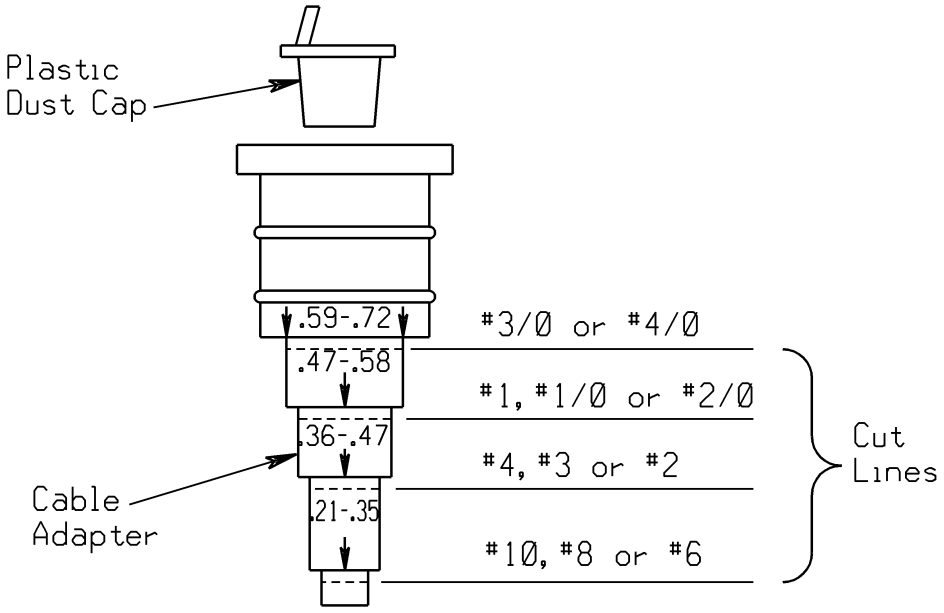


Figure 12

3. Remove the rubber plug from the respective set screw port and loosen the 5/16 inch Allen head set screw. Push the cable and cable adapter (if present) into the cable port of the connector until the conductor bottoms in the connector and the cable adapter (if present) is flush against the bottom edge of the cable port. Exposed bare conductor shall be wire brushed and cleaned immediately before insertion into the connector. While holding the cable and cable adapter (if present) in place tighten the Allen head set screw until the cable is secured in the connector. Replace the rubber plug into the set screw port. Install the proper cable identification numbers as instructed in Section 45.11.

4. Once the cable adapter seal has been cut or pierced and the cable removed, only the same size cable or larger size cable can be reinstalled in the cable adapter. NEVER USE A CUT OR PIERCED CABLE ADAPTER TO SEAL A CABLE PORT. ALL SET SCREW PORTS MUST BE SEALED WITH RUBBER PLUGS AND ALL UNOCCUPIED CABLE PORS MUST BE SEALED WITH UNCUT OR UNPIERCED CABLE ADAPTERS TO MAINTAIN A COMPLETE WATERTIGHT SEAL.

45.17 SECONDARY HANDHOLE ENCLOSURES

URD secondary cables and insulated connector buses are contained in secondary handhole enclosures. These secondary handhole enclosures can accommodate connections between other secondary's, customer house services or streetlights. They are made of fiberglass or high density polyethylene (HDPE) and opening dimensions are roughly 30' x 17'.

Currently, there are three approved secondary handholes available. Std Item UR10F (9309540) is approved with only limited use specific to maintenance in Rhode Island. Std Item UR10G (9309539) is the approved handhole to be used in Rhode Island for all applications. Lastly, Std Item UR10PE is an older version of UR10F with smaller dimensions and should only be used when required.

45.17.10 Rhode Island URD Conduit Systems

Handholes installed in Rhode Island URD conduit systems (figure 13a) are about 30" tall with polymer concrete frames/covers and have knock-out holes for conduit insertion (Std. Item

Supersedes 2/06 – Added new content for 45.17

UR10G-9309539). Older URD systems may be direct buried and have smaller size handholes. Detail drawings in pages 45-106 and 45-107.

45.17.20 URD Direct Buried Systems

Handholes installed in (figure 13b) URD direct buried systems are about 17' tall and come with flat covers (Std. Item UR10F-9309540). Detail drawing in page 45-108.

To avoid corrosion and possible failure of connector buses from high water tables, pedestal covers (domes) are available as replacement covers in areas exposed to flooding. (Std. Item UR10FD-9387806).

Figure 13a

Figure 13b

45.18 SECONDARY CABLE STRAIGHT SPLICE

45.18.10 Application

Use for repairing faulted, direct buried, aluminum conductors, or for piecing out cable where required. Connector should be used on straight sections of cable only and care should be taken to avoid bends near the splice.

1. Connector – Select appropriate connector from Table 3.
2. Thoroughly clean surface of cables to be spliced.
3. Make a smooth cut on each end of housing to match cable diameter.
4. Lubricate cables and splice housing with silicone grease. Slide housing parts over cable ends.
5. Using appropriate tools square cut ends of cable and skin insulation the depth of the connector plus ¼ inch. Cut insulation squarely being careful not to nick conductor.
6. Wire brush conductors and insert into connector. Compress connector, referring to Section 34 – Tools / Dies for tools and dies. File any sharp burrs and wipe off excess compound and filings on connector.
7. Slide housing over connector.

Supersedes 2/06 Issue – Added 45.17.20

Table 3
Splice Housing And Connector

Secondary Cable Size	Cable O.D. Inches	Housing	Connector*
1/0	0.54	UR76CS	UC61B
4/0	0.70		UC61C
350	0.88		UC61D

* Connector to be used on Aluminum conductors only.

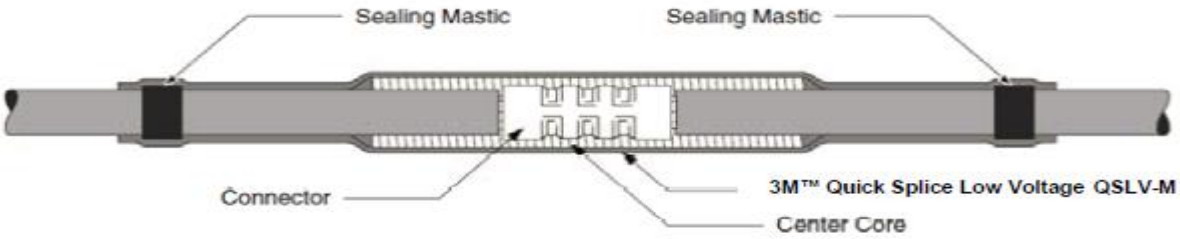


Figure 14
Secondary Cable Straight Splice

45.19 SINGLE PHASE PAD-MOUNTED TRANSFORMER INSTALLATION

45.19.10 Application

URD developments will utilize loop feed, dead-front, pad-mounted transformers (Std. Item UT31). Transformers will be 15 kV in the following standard sizes: 25 kVA, 50 kVA, 75 kVA, 100 kVA and 167 kVA. In residential developments, initial transformer sizes should be limited to 25 kVA, 50 kVA & 75 kVA sizes. Transformer sizes of 100 kVA and 167 kVA should be used to change out overloaded transformers.

45.19.20 Location

Transformers are to be located in the easement area as depicted on Pages 45-115 and 46-116. Transformers should be orientated such that the compartment cover faces the street. The easement area must be clear of obstructions that would interfere with the installation or removal of fuses or elbows when using a shotgun stick.

45.19.30 Transformer Foundation & Cover

A reinforced fiberglass box pad (Std. Item UR8) shall be used as the foundation for the transformer in all installations of conduit systems. UR9F shall be used in direct burial applications.

If there is a change in the final grade of an existing transformer installation, the 10 inch vault pad adapter (Std. Item UR9) may be used to raise the elevation of the transformer. The vault pad adapters are stackable; therefore if more than 10 inches is required the correct grade may be achieved by stacking the appropriate number of adapters. The box-pad cover shall be installed to protect cables prior to actual transformer installation.

45.19.35 Transformer Oil Containment

This is to be used where oil containment is required by local authorities or where otherwise justified. The liner system, made up of layers of fabric and silty sand, will significantly slow down the migration of oil into the underlying sub-grade allowing additional time to initiate clean up response. The 16 Oz polypropylene geo-textile fabric (Item ID# F70) allows the passage of water but absorbs small quantities of oil. This design is intended to confine 100% of total transformer oil present, with a 20% reserve margin for up to 36 hours. If additional confinement is desired consult Distribution Design. See pages 45-143 and 45-144 for construction details.

Supersedes 7/12 – Replaced Figure 14 and Housing in Table 3

45.19.40 Handling Transformers

Removable lifting lugs are provided with the transformer and should be utilized in conjunction with spreader bars and/or non-metallic slings when moving the transformer to prevent damage to paint or other parts. Lift only by appropriate lifting lugs. After checking the nameplate for proper voltages and kVA size, install the transformer on the foundation and remove the lifting lugs. Secure the transformer to the foundation as depicted on drawing 45-125.

45.19.50 Primary Connection

Install loadbreak bushing inserts in bushing wells using torque limited tools and properly bond the bushing well to the ground (see Page 45-126). Primary cable shall be brought into the pad, maintaining a 4 inch clearance between the top of the cable and pad flange for direct buried applications. Train the primary cable, being careful to meet or exceed the allowable cable bending radius (see Section 35 – Cables), so that the cable can be extended 3 feet above the top surface of the vault pad.. Install loadbreak connector elbow such that the cable is located in its final assembled position. This position should contain enough slack to provide adequate clearance for removing the elbow and preventing any strain. Since the cable jacket cutbacks are sealed at the elbows, it is important to pull-in enough cable to allow approximately 2 feet of twisted concentric neutral wire length between the elbow and the ground connection. Connect the ground grid to transformer tank and concentric neutral wires to ground before energizing the transformer. Bond to ground grid feed-thru devices and parking stands if permanently left in a switch enclosure or transformer. Bond to ground dead end insulated caps.

Tag all primary cables in accordance with Section 45.15 to identify phase and destination of cables.

45.19.60 Secondary Connection

Train secondary cables and connect to the transformer as shown in Section 45.20. The secondary cables must not interfere with the primary cable movement when operating primary loadbreak elbows.

Tag all secondary cables in accordance with Section 45.15.

45.19.70 Fuse Check

Check position of dual voltage switch, if present. Verify accessible fuse size for correct current and voltage rating from Section 39 – Fuses and install fuse.

The single phase pad-mounted transformer is equipped with two fuses, an expulsion fuse and a partial range current limiting fuse, installed in series; see Pages 45-120 and 45-121. The partial range current limiting fuse is installed internal to the tank and is not accessible for replacement. The partial range current limiting fuse is sized to coordinate with the expulsion fuse and should only operate for internal winding faults.

45.19.80 Installation Identification

Identify transformer location by placing 2 × 3 self adhesive decals (Std. Item P21) on the cover of the padmount. Install decals so as to be easily visible from the street.

45.19.90 Transformer Security

After tightening the captive pentahead bolt provided with the unit, install a standard short shank padlock (Std. Item UL20S).

Supersedes 7/16 Issue – Updated text in 45.19.50

45.20 SINGLE-PHASE PAD-MOUNTED TRANSFORMER SECONDARY CONNECTIONS

45.20.10 General

Low voltage bushings (Std. Item UR21) for transformer sizes 25 – 75 kVA are ⅝ inch threaded studs, transformer sizes 100 – 167 kVA have 1 inch threaded studs. The lowest bushing (X2) is the neutral and has a ground strap connected to the transformer tank wall.

45.20.20 Connectors

Secondary connectors are the slip fit type containing 6 positions covering a range of conductor sizes from #2 stranded to 500 kcmil and are constructed from an aluminum alloy making them suitable for both copper and aluminum conductors. A connector kit contains three bus connectors, two with protective covers for use on the live leg connections, and one bare bus connector for the neutral connection.

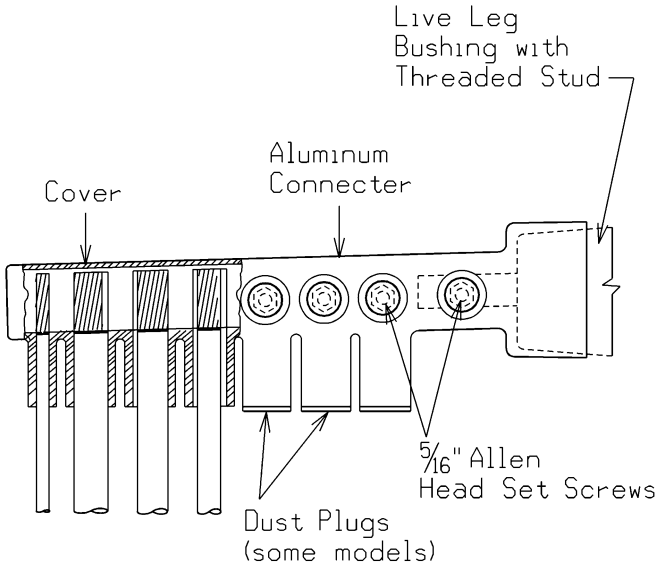


Figure 15
Live Leg Connection

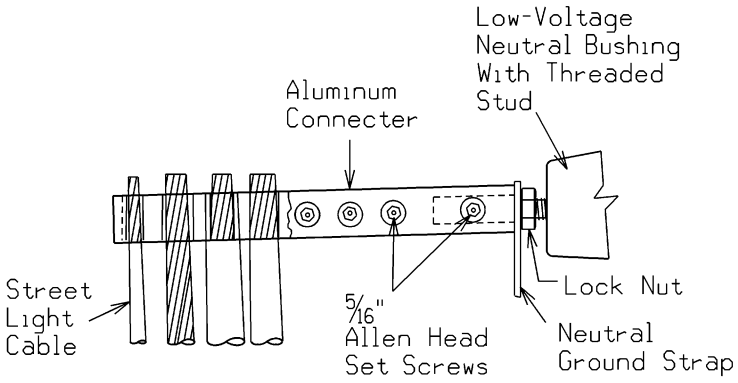


Figure 16
Neutral Connection

45.20.30 Connector Installation

A. Live Legs

Some transformers may be shipped with a nut screwed onto the threaded stud. This nut is not required and should be removed as it may inhibit the proper insertion of the secondary bus connector. With an insulated Allen wrench, loosen the stud mounting set screw and slip the bus connector over the threaded stud until it bottoms in the connector. Position the connector such that the cable ports are in a 7 o'clock orientation (to facilitated cable connections) and tighten the set screw securely. See Figure 15 for details. Note install all bus connectors with Allen connections on the left side facing toward the left exterior of the minpad.

B. Neutral Leg

Transformers are shipped with a grounding strap attached to the neutral bushing sandwiched between two nuts on the threaded stud. It will be necessary to remove the outside nut to allow the bus connector to slip deep enough onto the threaded stud to properly engage the set screw. After removing this nut, install the neutral bus connector in the same manner as the live leg connectors. After the stud set screw has been tightened, tighten the nut on the back side of the ground strap against the bus connector to provide a solid ground strap contact, see Figure 16.

45.20.40 Cable Installation

Train cable to proper position. Loosen the cable port set screw using an insulated Allen wrench. Carefully remove an amount of cable insulation equal to the width of the connector. Do not pencil. Wire brush the bare conductor and insert it fully into the inhibitor pre loaded port of the connector. Hold cable in place and tighten the set screw. No bare conductor shall be exposed below the port. Cover any open port with protective cap. Do not cut live leg protective covers.

45.20.50 Streetlight Connection

The end position of the bus connector (furthest away from transformer) is reserved for the street light cable. To install #6 street light cable, remove an amount of cable insulation equal to twice the width of the bus connector. Double the conductor size by folding the exposed conductor in half. Wire brush the conductor and insert it fully into end position of the connector. Hold cable in place and tighten the set screw.

45.21 SUBSURFACE TO PADMOUNT CONVERSION ADAPTER

Supersedes 7/15 Issue – Update Section 45.21. Added paragraph 4.

Subsurface and submersible equipment are no longer standard items for URD construction. When field conditions and/or problems warrant working on existing subsurface equipment, these installations should be converted to pad-mount installations.

The submersible to pad-mount conversion adapter assemblies (Std. Item UR12) allow conversion of existing submersible junction enclosures to pad-mounted junction enclosures and single phase submersible transformer enclosures to single phase pad-mounted transformers.

A universal adapter is available (Std Item UR11U) for installations where specific adapters will not work. The adapter is 48” x48” x 15” high. Flange of the base of the adapter to be buried 8 to 12” below finished grade.

Ground grids for converted submersible to pad-mount installations shall conform to the single phase transformer ground grid standard page number 45-120.

45.21.10 Precast Concrete Transformer Vault Conversions

Attach converter pad to existing subsurface vault using either combination of 39 inch spaced holes. Use two ⅜ inch x 1¼ inch stainless steel pentahead bolts. Attach single phase pad-mount transformer using ⅜ inch x 1¼ inch stainless steel pentahead bolts.

45.21.20 36 Inch Submersible to Padmount Conversion Adapter Assembly (Maintenance)

1. Prepare the existing junction or transformer enclosure for conversion, including removing the frame and cover from the enclosure.

2. Remove a sufficient amount of earth from around the upper portion of the enclosure to permit the installation of the conversion adapter and the installation of the ground

rods and ground grid as required. For grounding plan refer to Pages 45-120 and 45-121 for a single phase pad-mounted transformer and Section 38 – Switches / Switchgear for a single phase pad-mounted junction enclosure.Bolt the four angle brackets to the bottom of the top cap in the positions shown on Page 45-130. Do not completely tighten the bolts at this time.

3. Position the top cap onto the enclosure so that the angle brackets are located inside the enclosure as shown on Page 45-130.

4. Mark the location of the angle brackets; remove the top cap and notch out the top edge of the enclosure to accommodate the angle bracket so that the top cap will set flush with the top of the existing enclosure.

5. Replace the top cap on the enclosure and fasten the angle brackets flush to the inside of the enclosure.

6. After all brackets are fastened to the enclosure, tighten all the bolts to the top cap.

7. Backfill or grade around top cap, if required, to finish grade.

8. Place the cover onto the top cap and secure as shown on Page 45-131.

9. Install the pad-mounted junction enclosure or the single phase pad-mounted transformer, as required.

45.21.30 <u>48 Inch Submersible to Padmount Conversion Adapter Assembly (Maintenance)</u>

1. Prepare the existing junction or transformer enclosure for conversion, including removing the frame and cover from the enclosure.

2. Remove a sufficient amount of earth from around the upper portion of the enclosure to permit the installation of the conversion adapter and the installation of the ground rods and ground grid as required. For grounding plan refer to Pages 45-120 and 45-121 for a single phase pad-mounted transformer and Section 38 – Switches / Switchgear for a single phase pad-mounted junction enclosure.

3. Bolt the four angle brackets to the bottom of the adapter ring in the positions shown on Page 45-132. Do not completely tighten the bolts at this time.

4. Position the adapter ring onto the enclosure so that the angle brackets are located inside the enclosure and in the position as shown on Page 45-132. Fasten the angle brackets flush to the inside of the enclosure as shown on Page 45-132. After all brackets are fastened to the enclosure, tighten all the bolts to the adapter ring.

5. With the adapter ring fastened in place, position the top cap on the adapter ring and line up the four bolt holes in the top cap with those in the adapter ring and secure the top cap as shown on Page 45-133.

6. Backfill or grade around top cap, if required, to finish grade.

7. Place the cover onto the top cap and secure as shown on Page 45-134.

8. Install the pad-mounted junction enclosure or the single phase pad-mounted transformer, as required.

45.22 SINGLE PHASE SUBSURFACE TRANSFORMERS (FOR MAINTENANCE ONLY)

1. General

Single-phase subsurface transformers are no longer standard items for URD construction. When field conditions and/or problems warrant working on existing subsurface equipment, consideration should be given to converting these installations to pad-mount installations.

Single phase, submersible transformers (URD type, Std. Item UT20B) upon receipt should be visually inspected for any external damage that may have occurred during shipment and for parts that may have become loose in handling. Storage can be either indoors or outdoors provided care is used to insure against damage to the special corrosion preventive coating or the unit itself. Lifting lugs are provided with the transformer and should be used in conjunction with spreader bars and non-metallic slings as necessary to prevent any damage to the coating or other parts. Do not lift the unit by way of the cover or the radiators, if present; but only by the appropriate lifting lugs.

Every unit shall be visually inspected for any external damage and for parts that may have become loose in handling before placing the unit into service. In addition, the coating of every unit shall, where practical, be carefully checked with a high voltage “Jeep” tester. Any breaks or voids in the coating shall be repaired in accordance with the manufacturer’s recommendations to achieve a coating with uniform integrity.

Install single phase submersible transformer (Std. Item UT20B) in the enclosure on the three 8 inch × 16 inch × 8 inch concrete blocks or equivalent footing. Use additional blocks, if required, to bring the transformer to the appropriate height.

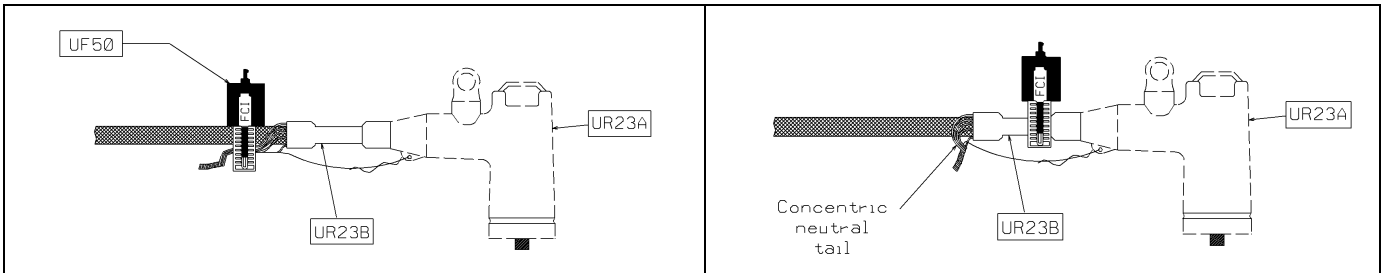
Cable terminated in single-phase, submersible transformers should be of the same phase. If field conditions necessitate cables of different phases a “NOT IN PHASE” sign (Std. Item P22P) must be used in conjunction with the installation for identification purposes.

Supersedes 7/07 Issue – Corrected Figure Reference in 45.23

45.23 FAULT INDICATORS

Fault indicators can be used in underground residential distribution. The indicators can be installed in switching modules/enclosures and padmounts at the cable termination points. Figure 17 shows how to install the indicator on a loadbreak elbow. To minimize outage restoration times a fiber optic lead (Std Item UF50__) can be installed to provide a visible external display of the indictor flashing. The fiber optic lead plugs in to the end of the indicator and the display light is mounted thru the switching module/enclosure or padmount. Distribution Field Engineering can provide recommendations on where the indicators shall be used.

Figure 17



Indicator installed thru all neutrals over cable	Indicator installed thru cable only, no neutrals

45.24 SIDE TAP SECTIONALIZING

Large URD's with radial side taps can be sectionalized with a fused switch pad. The fused switch pad has one source input with three bay-o-net style fused taps. Typical installation of this would be at a street intersection. The switch pad shall be installed on the standard mini-pad foundation. Note: due to the dimensions of the switch pad, it must be installed sideways to properly fit over the opening. See figure 18 below for one line. All bushings are 200 amp style for Load Break Elbows.

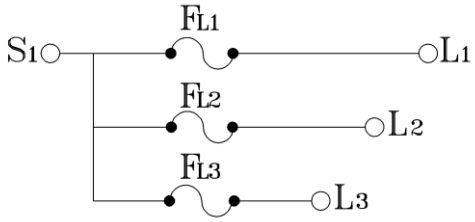


Figure 18

45.25 CUSTOMER LOAD AND VOLTAGE DROP CALCULATION

This section gives a step by step direction on how to properly size transformers as well as estimate voltage drop at any place on a secondary crib. It is important to design a URD as efficiently as possible so that maximum utilization of company assets and customer reliability is achieved.

1) Determine transformer size:

Use Table 2 below to determine the correct sized transformer for your particular application. Cross reference the '# of houses' column with the 'transformer needed' column to determine the appropriate transformer for each application. Table 1 below shows the approximate loading per dwelling for small, medium and large sized homes. This information is extrapolated and diversified in Table 2 from 2 to 15+ customers.

Table 1

Small House 0-1700 sq. ft.			
Base Load (kW)	**AC Load (kW)**	**Total (kW)**	**Total (kVA)**
4	3.5	7.5	7.89

Medium House 1800-2600 sq. ft.			
Base Load (kW)	**AC Load (kW)**	**Total (kW)**	**Total (kVA)**
4.5	5.5	10	10.53

Large House 2700-3000 sq. ft.			
Base Load (kW)	**AC Load (kW)**	**Total (kW)**	**Total (kVA)**
5	6.5	11.5	12.11

Supersedes 7/07 Issue – Added section 45.24 and Customer Load and Voltage Drop Calculation

Table 2

House Size		Small 0-1700 sq. ft.		Medium 1800-2600 sq. ft.		Large 2700-3000 sq. ft.	
Total AC # of houses	Diversity Factors	Typical Diversified Load (kVA)	Transformer Needed (kVA)	Typical Diversified Load (kVA)	Transformer Needed (kVA)	Typical Diversified Load (kVA)	Transformer Needed (kVA)
1	1	8	25	11	25	12	25
2	0.92	15	25	19	25	22	25
3	0.81	19	25	26	25	29	50
4	0.73	23	25	31	50	35	50
5	0.71	28	50	37	50	43	50
6	0.7	33	50	44	50	51	75
7	0.69	38	50	51	75	58	75
8	0.68	43	50	57	75	66	75
9	0.67	48	50	63	75	73	75
10	0.66	52	75	69	75	80	100
11	0.65	56	75	75	75	87	100
12	0.64	61	75	81	100	93	100
13	0.63	65	75	86	100	99	100
14	0.63	70	75	93	100	107	na
15	0.63	75	75	99	100	114	na

2) Voltage Drop

Once the correct transformer size has been determined for the job it is important to calculate the voltage drop that the customer may experience.

There are three voltage drop factors that need to be taken into account while determining the overall voltage drop at the customer's service entrance. They are as follows:

- **Diversity Factor:** The diversity factor (listed in Table 2) is a factor that can be applied to a connected transformer load to determine how much of the load is likely going to be active at one time.

Example - If there were 5 customers and 40kVA of connected load, according to Table 2 the diversity factor for 5 customers is .71. Therefore you would size the transformer for (.71)(40)=28kVA.

- **Transformer (T) Factor**: The T factor is the voltage drop that occurs naturally in the transformer itself depending on impedance and load. Table 3 below shows approximate T factors that are associated with certain transformers.

Table 3

Transformer size	T Factor
25kVA	0.0796
50kVA	0.0367
75kVA	0.0212
100kVA	0.0212

Supersedes 7/07 Issue – Added Customer Load and Voltage Drop Calculation

- **Cable (S) Factor**: The S factor is for calculating voltage drop that is a result of cable impedance alone. Each type of cable has a per foot S factor. Table 4 below shows S Factors for different types of cable.

Table 4

Cable Size	S Factor
4/0 Al	0.0332
350 Al	0.0219
2/0 Cu	0.0329
4/0 Cu	0.0225
250 Cu	0.0199

.

Voltage Drop Calculation (Three step process)

I) Calculate voltage drop through transformer.

Transformer Voltage Drop = (Diversity Factor)(T Factor)(Connected load on Transformer.)/100 = □%

Note – For connected load use entire load on transformer. Not just the load in the direction you are calculating voltage drop.

II) Calculate voltage drop through secondary

Secondary Voltage Drop = (Diversity Factor)(S Factor)(Cable Length)(Connected Load)/100=□%

Note – Only use # of customers and load down stream of the leg of cable you are calculating for. Also, add 10 feet per hand hole to the cable length.

III) Calculate secondary service voltage drop

Secondary Voltage drop = (S factor)(Cable Length)(Customer Connected load)/100=□%

Note – For calculating a single customer's service voltage drop use the connected load of their house because there is no diversity factor for a single customer. Also, note that the customer cable may be different from the PPL secondary cable in the street in which case it would have a different S Factor.

IV) Calculate TOTAL voltage drop at customer's service entrance

Total Voltage Drop = (Transformer Voltage Drop)+(Secondary Cable Voltage Drop)+(Service Cable Voltage Drop)

Supersedes 7/07 Issue – Added Customer Load and Voltage Drop Calculation

45.26 CABLE REHABILITATION / REPLACEMENT GUIDELINES

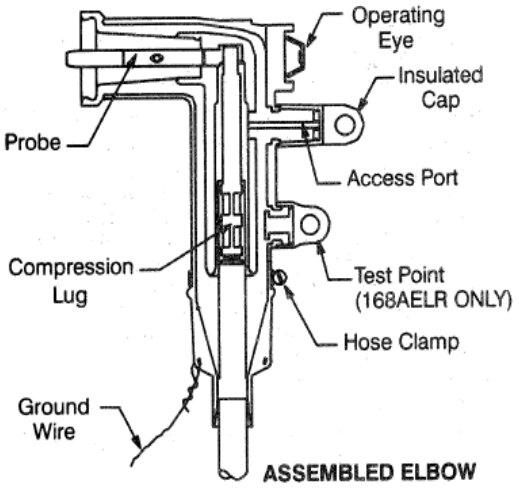
Direct buried solid dielectric cables installed from the late 1960's to the late 1980's have shown the susceptibility for failure. These cables were built with XLPE, PE or EPR insulations. Failure mechanisms have ranged from improper backfill material during initial installation, damage from third party installations, corrosion of the neutral shield and failure of the XLPE or PE insulation form water and electrical trees. Older URD cables that are subject to multiple failures shall be considered for rehabilitation or replacement. Engineering Planning has developed lists of URD's that are candidates for these programs.

45.26.10 Cable Rehabilitation

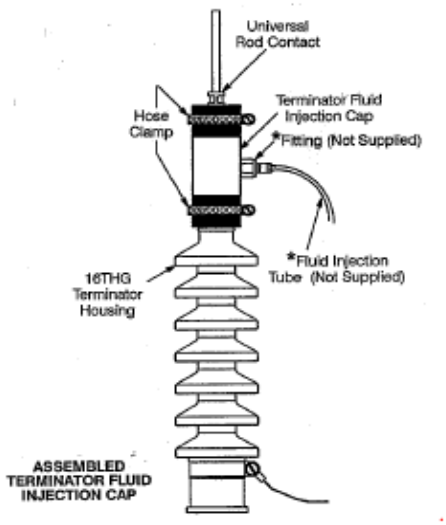
Cables are rehabilitated by the method of cable injection that will extend the life of the asset. The method involves introducing silicon fluid into the power cable strands. This fluid migrates into the conductor shield and the insulation filling any voids and modifying the chemistry of the insulation. This method can only be applied to cables that have no strand-fill conductors and splices with connectors that don't have oil stops to allow the fluid to travel down the system. The URD system is tested first to make sure it is a good candidate for cable injection. A Time-Domain Reflectometer (TDR) test can determine the condition of the neutrals, length of section, approximate location and number of splices. The following steps are used to perform the cable injection method:

a. De-energize, test and ground cable
b. Perform TDR test to locate splices and collect data
c. Remove terminations/elbows and connectors
d. Install new connectors and termination/elbow adaptors with injection ports
e. Connect fluid tanks to ports and inject segment at moderate pressure
f. Complete injection process after a pre-determined time (7 days usually)
g. Replace termination/elbows
h. Re-energize URD cable

The cable injection companies claim that a rehabilitated cable has the same reliability of a new cable.



200A Deadbreak Elbow with Injection Port
Figure 19



200A Terminator with Injection Port
Figure 20

7/19 – New Page

45.26.20 Cable Replacement

Direct buried cables are to be replaced requiring their installation in conduits and pullboxes following URD standards. The preferred method is Cable In Conduit (CIC) installed by Horizontal Directional Drilling (HDD). This technology is able to penetrate under parking lots, roadways, driveways and lawns without damaging the surface area. Open trench excavation technology becomes the second option when HDD cannot be performed because of soil conditions. Rocky soils are not adept for HDD technology.

1. Technology:

The HDD equipment consists of a drill rig that is steerable by means of an electronic directional system which includes a trackable drill head that can be closely monitored within 12 inches of its actual position. A mix of water and bentonite clay (slurry) is used to reinforce the bored holes and to lubricate the drilling operation. The HDD equipment has sufficient strength to drill the pilot hole, reams the hole to adequate diameter, and pulls the conduit through the hole for the length and pipe diameter indicated (Figure 21). The length of CIC section shall be 500 feet

Figure 21

2. Material:

The Cable in Conduit consists of #2 AL 15 kV URD cable already pulled inside a 2” Schedule 80 high density polyethylene (HDPE) smooth wall conduit. This conduit is flexible enough to fit on a reel. SAP Item ID# 9391788 has been established for this material (Figure 22).

Available spare duct is 2” Schedule 80 HDPE smooth wall coilable conduit according to NEMA TC7. Conduit shall be black with three red stripes 120 degrees apart. This material comes in 500-foot coils and SAP Item ID # 939289 has been established. Other sizes will may be set up in the future (Figure 23).

Figure 22

Figure 23

7/19 – New Page

3. Design:

Jobs can be designed in STORMS and CUs have been set up for the installation of Cable-In-Conduit (CCIC-BYCONTRACTOR2 and CCIC-WITHMATERIAL2) and for the empty 2" HDPE conduit (CCIC-SPARECONDUIT-2IN and CCIC-SPARECONDUIT-2INCONTR). The following standards shall be followed when performing a design:

a) Standard URD practices and equipment shall be used in designing cable replacement projects using CIC
b) The maximum installed span shall not exceed 500 feet because of drilling equipment limitations. Consult with Standards Engineering for longer spans.
c) Installation of a pullbox is recommended between the first section of conduit and the riser pole. The pullbox shall be located within 10 to 50 feet (plus or minus) from the riser pole.
d) Standard 3" PVC DB conduit and fittings will be installed between the riser pole and the first pullbox. Standard #2 AL 15 kV URD cable will be installed in this conduit.
e) Sufficient CIC slack shall be left in pullboxes and boxpads for cable splicing and terminating.

4. Permitting:

Dig Safe must be called in first to identify utilities in the proposed area and to ensure a clear path. Use of Ground Penetrating Radar (GPR) is recommended to locate utilities in private property. Review of utility plans must be performed as a minimum clearance of 30 inches from other utilities has to be maintained. Other permits may be required for projects such as street opening, water hydrant usage, waste disposal and environmental. Check with the local authorities prior to project kick off.

5. Process:

These steps shall be followed to perform installation of CIC in a cable replacement project:

a) Utilize Dig Safe and GPR (Ground Penetrating Radar) services to locate subsurface utilities in order to lay out the CIC route
b) Perform test pit excavation in congested areas to verify utility location
c) Access pits are dug out where the drilling equipment will begin operation
d) Directional drilling is performed and monitored by personnel that follows the route of the drill above ground
e) CIC reel is place next to the target pit where the drill head is replaced with a pulling eye and the CIC and or empty conduit is attached and pulled back towards the rig. The target and access pits are usually replaced by a pullbox
f) Install connecting conduit form pullboxes to riser poles and boxpad foundations

6. Restoration:

After completion of all directional drilling work, the entry and exit pits shall be restored to their initial conditions. Crews shall clean up and restore to pre-construction conditions any public or private property disturbed or damaged during construction. Restoration shall include paved and un-paved surfaces, shrubbery, landscaping, trees, structures and all else encountered.

7/19 – New Page

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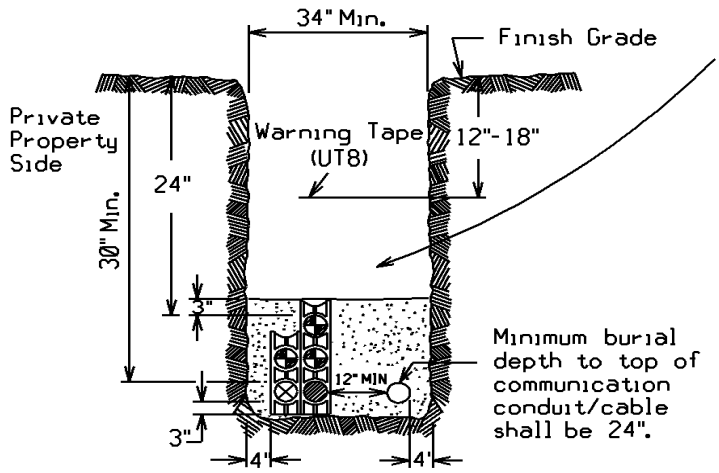
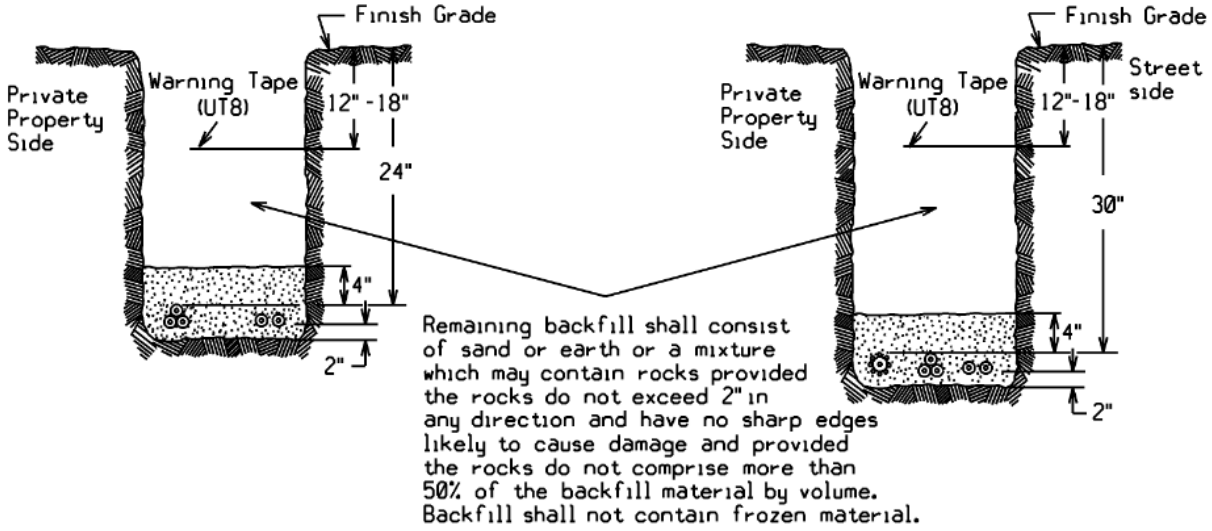


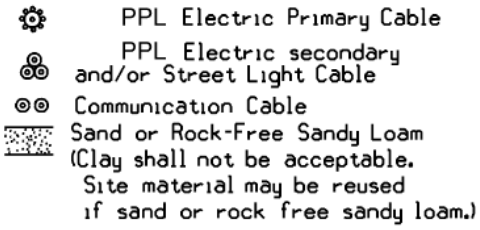
Remaining backfill shall consist of sand or earth or a mixture which may contain rocks provided the rocks do not exceed 2 inches in any direction and have no sharp edges likely to cause damage and provided the rocks do not comprise more than 50% of the backfill material by volume. Backfill shall not contain frozen material.

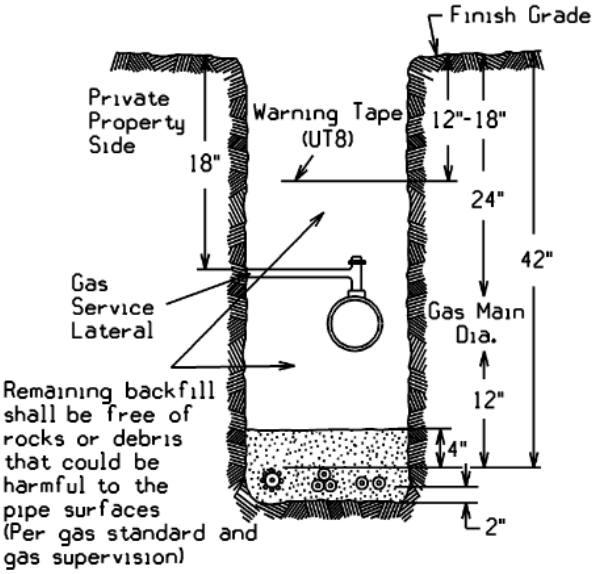
LEGEND

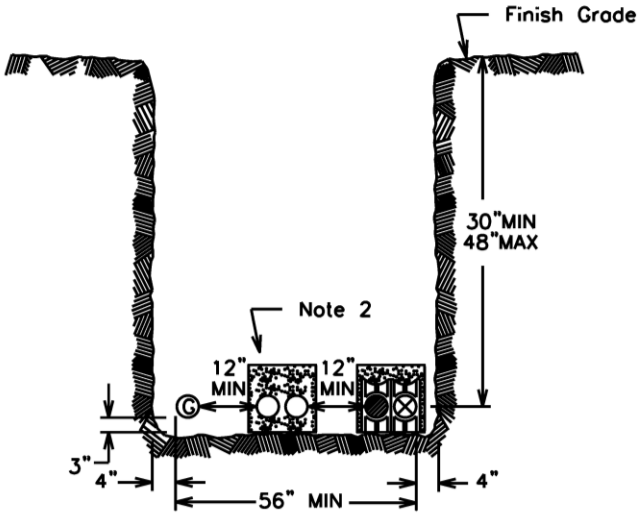
- Base Spacer
- Intermediate Spacer
- Secondary Electric Duct
- Primary Electric Duct
- Communication Duct or Cable
- Spare Duct

Supersedes 2/06 Issue – Added Text

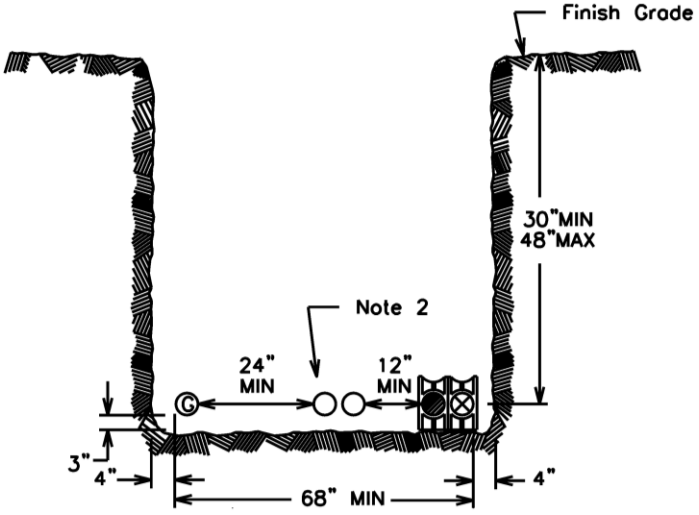








HORIZONTAL TRENCH SEPERATION
CONDUIT IN CONCRETE



HORIZONTAL TRENCH SEPERATION
DIRECT BURIED CONDUIT

LEGEND

- Base Spacer
- Intermediate Spacer
- Secondary Electric Duct
- Primary Electric Duct
- Communication Duct or Cable
- Spare Duct

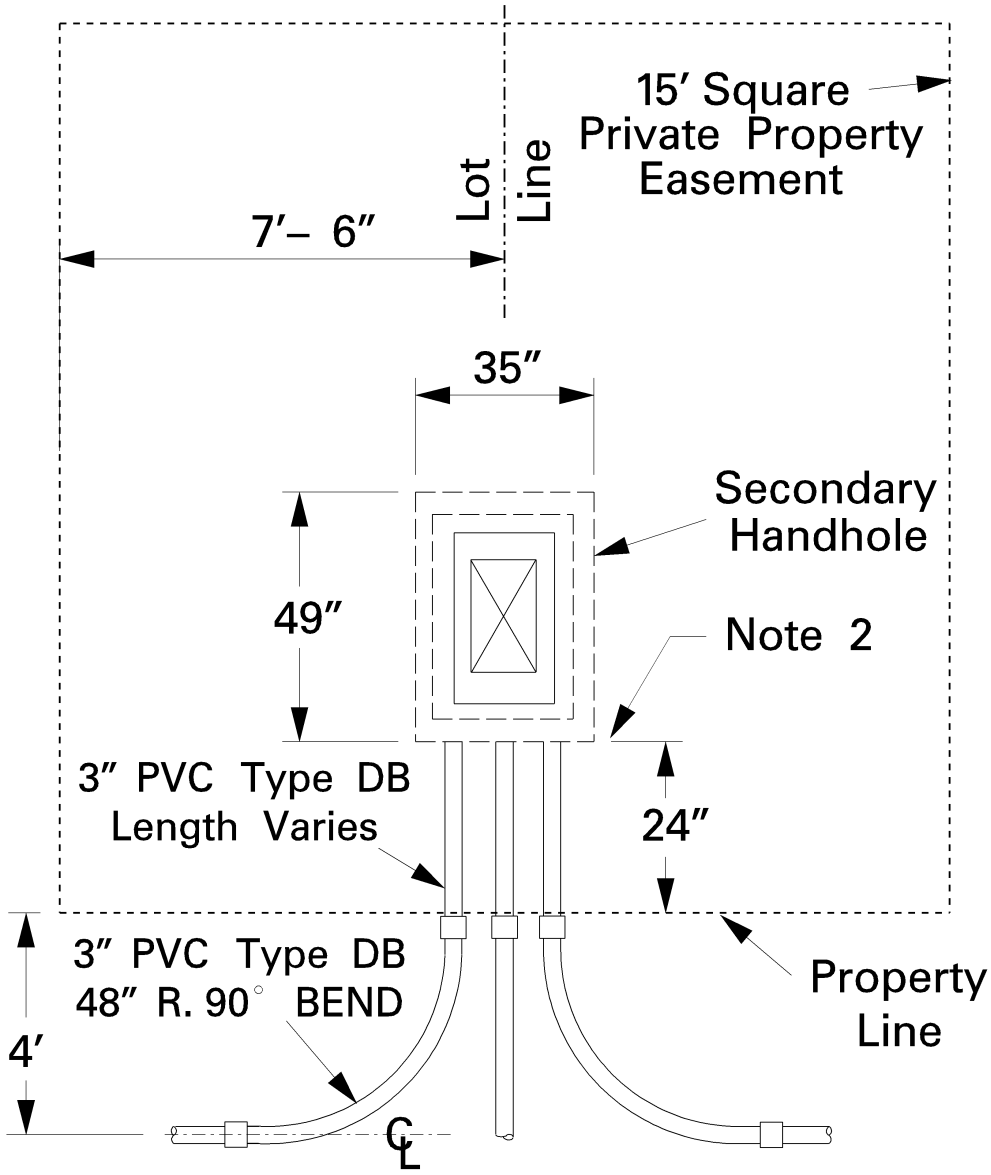
NOTE

1. Detail is only to be utilized when drainage pipe or other municipal mandated obstructions prevent vertical separation from being accomplished.
2. If communications is not in the trench National Grid requires 36" minimum separation between Electrical and Gas.

TYPICAL TRENCH DETAILS – TYPICAL ROAD CROSSING

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	45-102	7/18

Location Plan



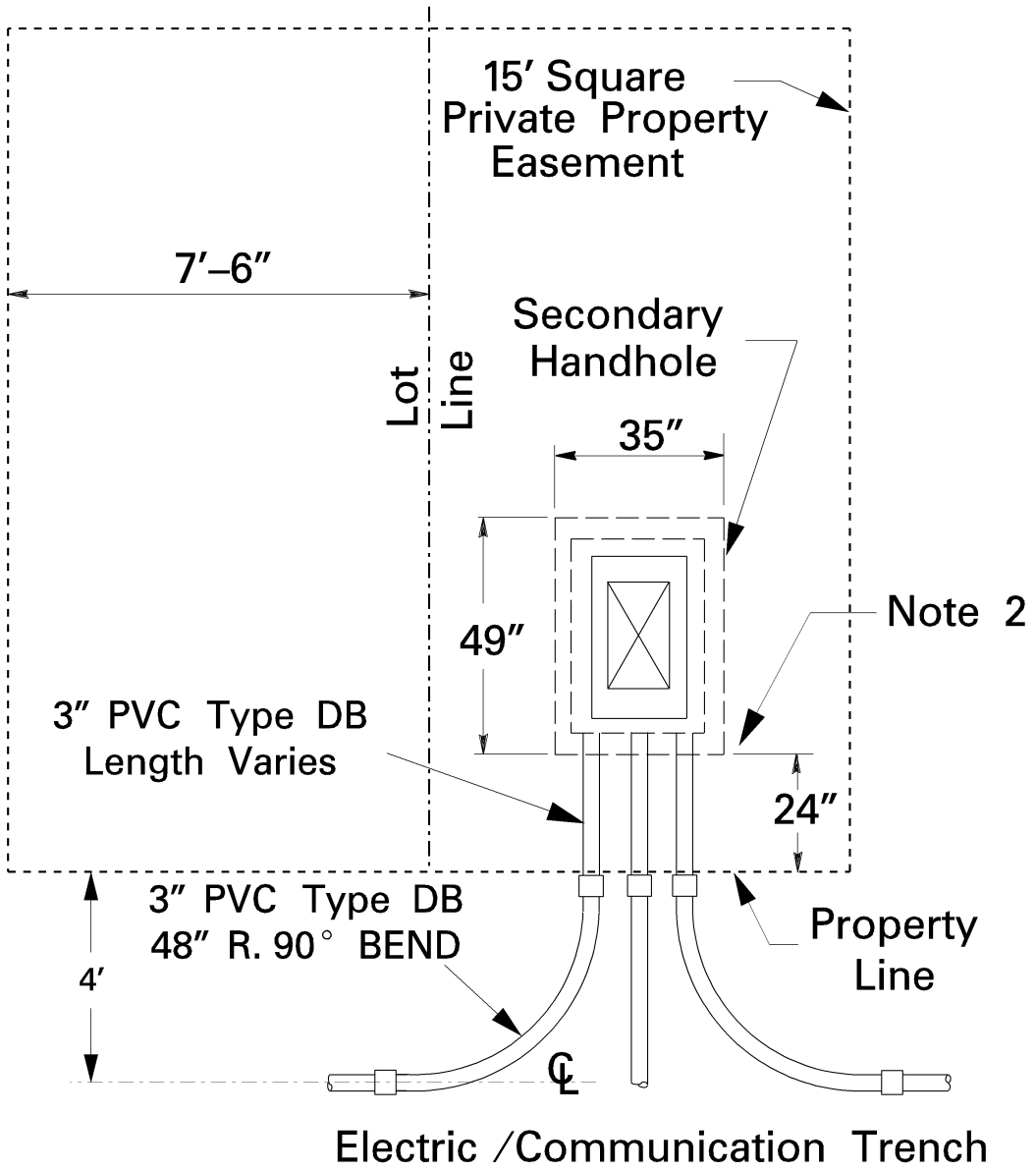
Electric /Communication Trench

Notes:

1. Refer to URD Design Guide, for layout & design.
2. Secondary handhole to be placed as shown in location plan or alternate location plan with three conduit holes facing the electric/communication trench.
3. Secondary handhole to be placed on level undisturbed or well tamped solid earth covered with 4 inch minimum of crushed stone. Maximum stone size is ¾ inch.
4. All secondary handholes shall have their covers installed and secured after initial installation.
5. Secondary handhole cover shall be flush with finish grade.
6. Handhole shall be installed to maintain 24 inch burial depth from finish grade to top of conduit knockouts.
7. Use washed, screened sand.
8. Clean fill, free of stones greater than 2 inches and not containing shell, ash, cinder, or frozen material.
9. All unused conduit knockout holes shall be sealed with conduit plugs.

SECONDARY HANDHOLES – CONDUIT SYSTEM LAYOUT			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
2/06	**45-104**		

Alternate Location Plan



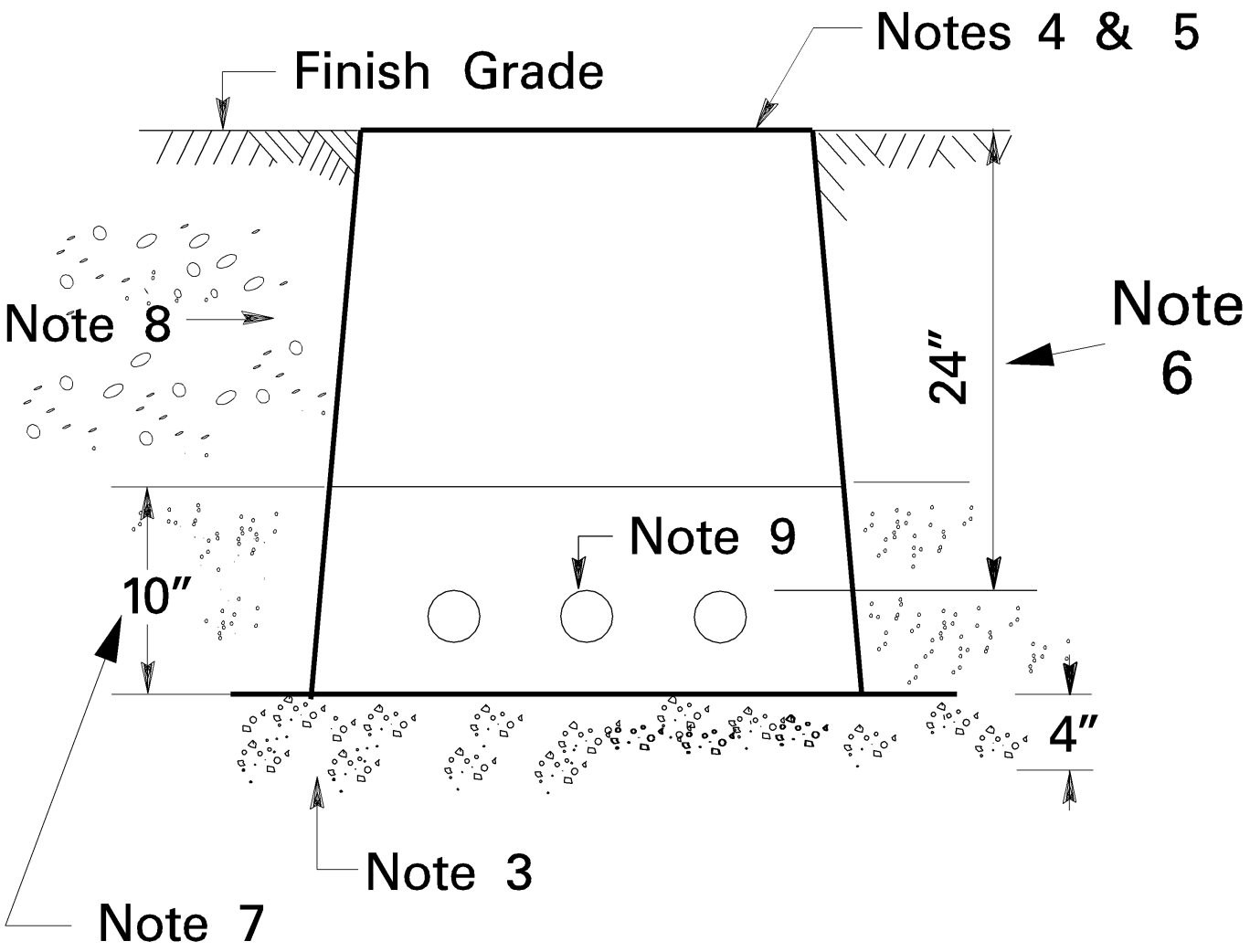
Electric /Communication Trench

Notes:

1. Refer to URD Design Guide, for layout & design.
2. Secondary handhole to be placed as shown in location plan or alternate location plan with three conduit holes facing the electric/communication trench.
3. Secondary handhole to be placed on level undisturbed or well tamped solid earth covered with 4 inch minimum of crushed stone. Maximum stone size is ¾ inch.
4. All secondary handholes shall have their covers installed and secured after initial installation.
5. Secondary handhole cover shall be flush with finish grade.
6. Handhole shall be installed to maintain 24 inch burial depth from finish grade to top of conduit knockouts.
7. Use washed, screened sand.
8. Clean fill, free of stones greater than 2 inches and not containing shell, ash, cinder, or frozen material.
9. All unused conduit knockout holes shall be sealed with conduit plugs.

SECONDARY HANDHOLES – CONDUIT SYSTEM ALTERNATE LAYOUT			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		45-105	2/06

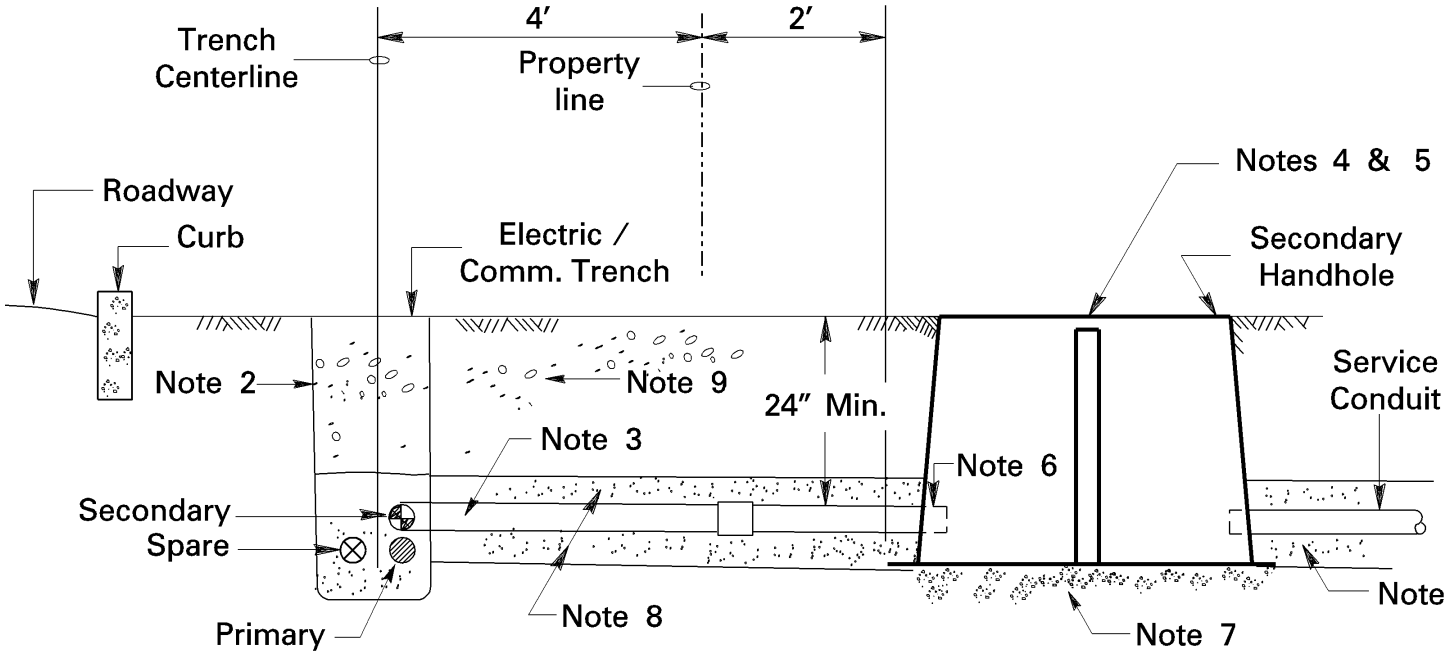
Front View



Notes:

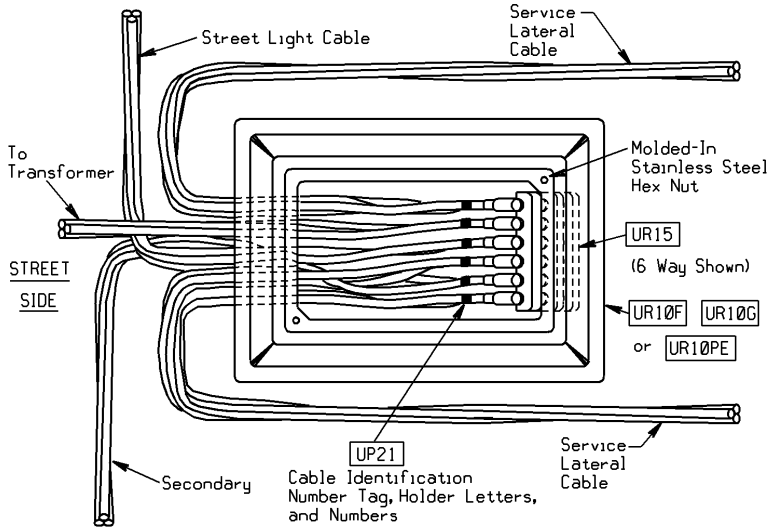
1. Refer to URD Design Guide, for layout & design.
2. Secondary handhole to be placed as shown in location plan or alternate location plan with three conduit holes facing the electric/communication trench.
3. Secondary handhole to be placed on level undisturbed or well tamped solid earth covered with 4 inch minimum of crushed stone. Maximum stone size is ¾ inch.
4. All secondary handholes shall have their covers installed and secured after initial installation.
5. Secondary handhole cover shall be flush with finish grade.
6. Handhole shall be installed to maintain 24 inch burial depth from finish grade to top of conduit knockouts.
7. Use washed, screened sand.
8. Clean fill, free of stones greater than 2 inches and not containing shell, ash, cinder, or frozen material.
9. All unused conduit knockout holes shall be sealed with conduit plugs.

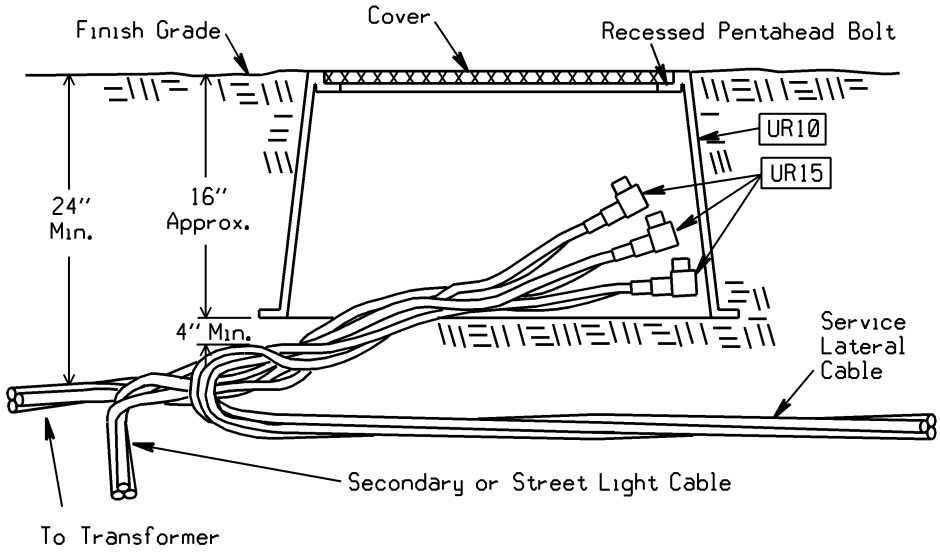
SECONDARY HANDHOLES – CONDUIT SYSTEM FRONT VIEW			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
2/06	**45-106**		



Notes:

1. Refer to URD Design Guide for layout & design.
2. Refer to Section 45.10 for trench specifications.
3. Refer to location plans for conduit details.
4. All secondary handholes shall have their covers installed and secured after initial installation.
5. Secondary handhole cover shall be flush with finished grade.
6. Extend PVC conduits into handhole by a maximum of 3 inches.
7. 4 inch minimum of crushed stone (maximum stone size ¾ inch) on solid earth.
8. Washed, screened sand, 4 inches above and below all conduits.
9. Clean fill, free of stones greater than 2 inches in diameter and not containing shell, ash cinder or frozen material.

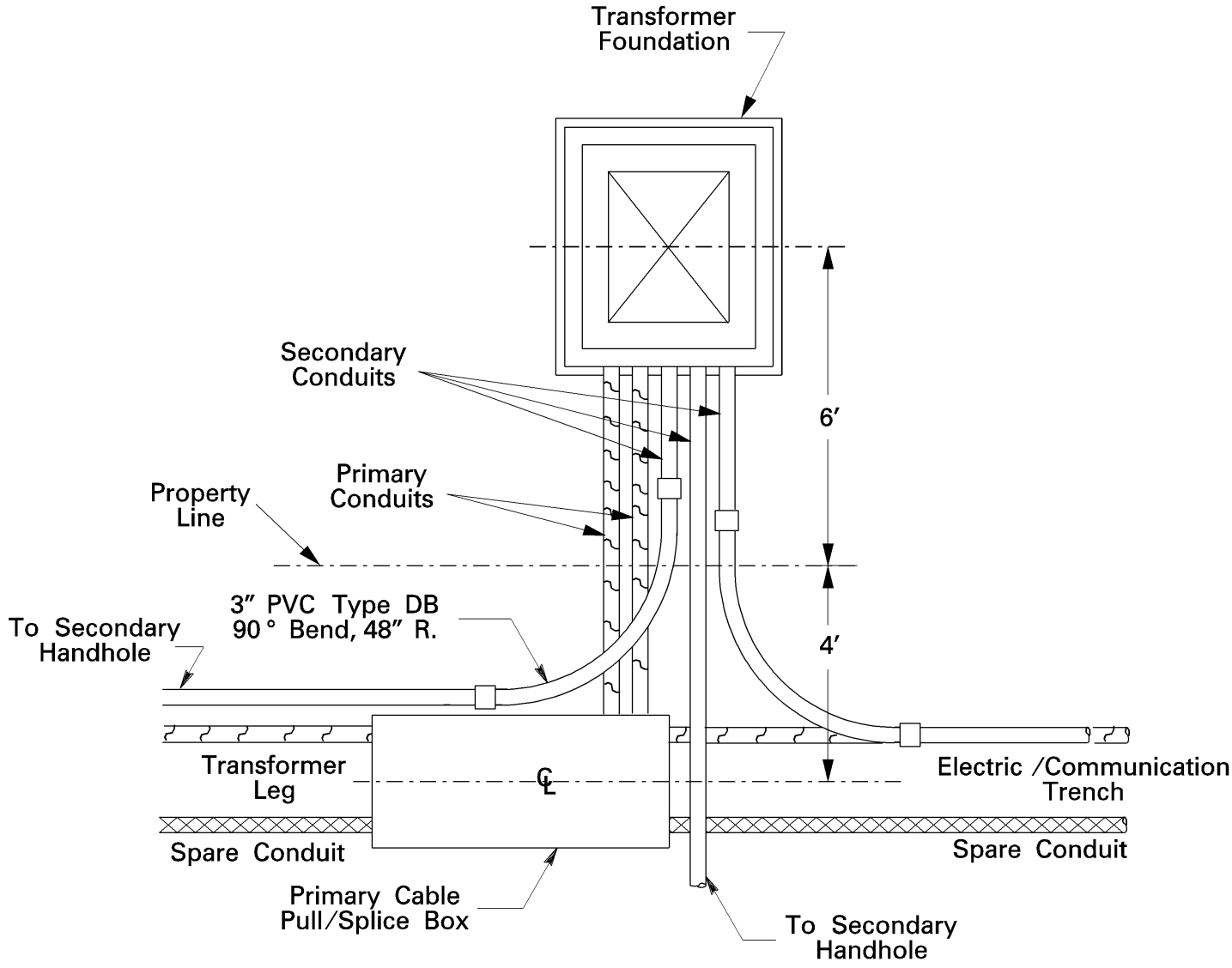




Notes:

1. Refer to URD Design Guide, for layout & design.
2. Secondary handhole to be placed on level undisturbed or well tamped solid earth.
3. Secondary handhole cover shall be flush with finish grade.
4. All secondary handholes shall have their covers installed and secured after initial installation.
5. All secondary service cables, shall be brought into the handhole, allowing a minimum of 4 inches of clearance between the cable and the base of the handhole.
6. Washed, screened sand, 4 inches above and below all secondary cables.
7. Remaining fill to be free of stones greater than 2 inches in diameter and not containing shell, ash cinder or frozen material.

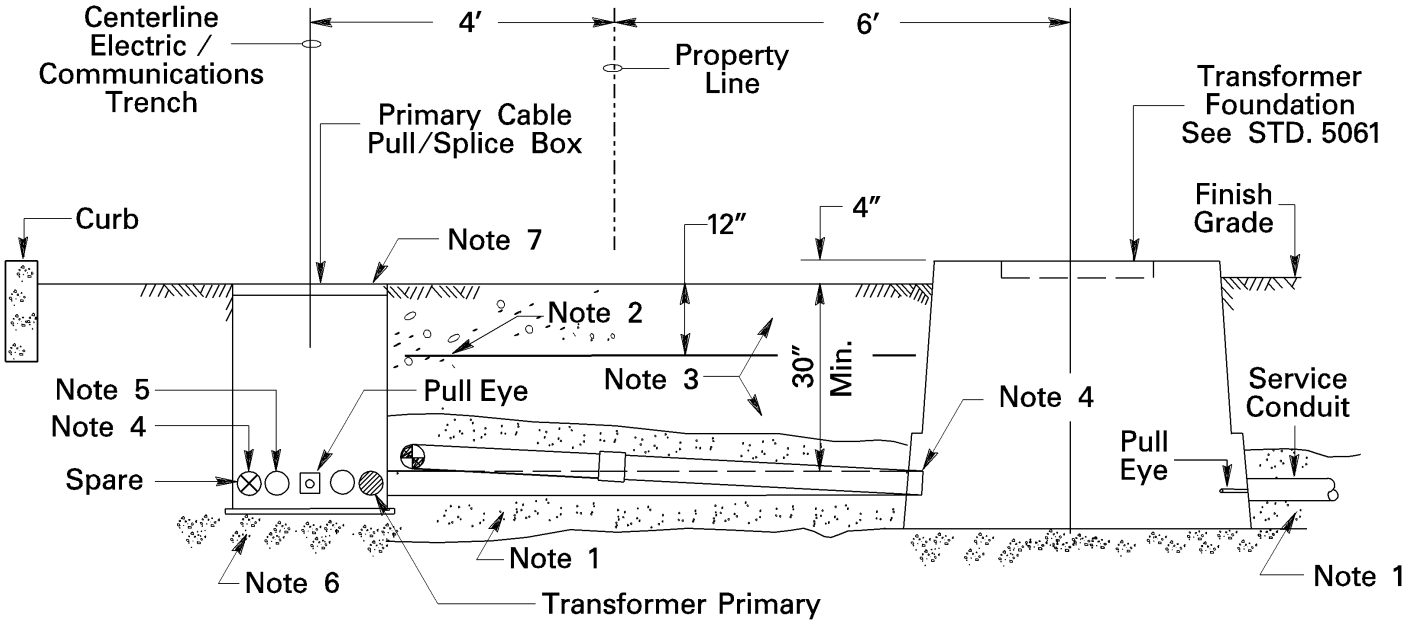
Supersedes 2/06 Issue – Add Note 3



Notes:

1. Maintain minimum cable bending radius on all primary cables.
2. Spare conduit not looped in and out of transformer foundation.
3. The maximum number of cables in a pull/splice box is two sets of 3-1/C #2

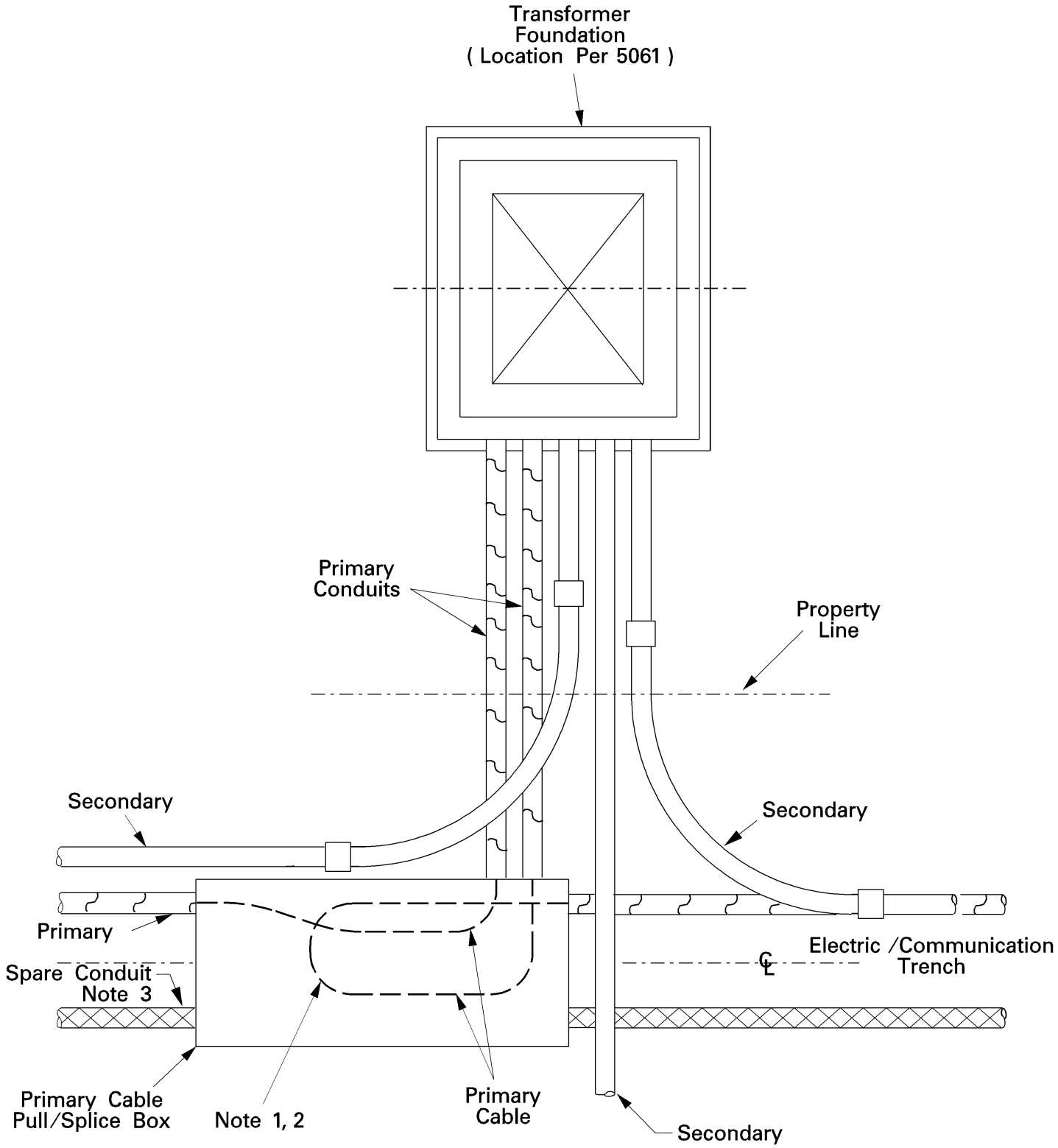
PRIMARY CABLE PULL / SPLICE BOX LOCATION			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		45-109	7/15



Notes:

1. 4 inches of washed screened sand above and below all conduits.
2. Warning tape to be placed above conduits, approximately 12 – 18 inches below finish grade.
3. Clean fill, free of stones greater than 2 inches in diameter and not containing shell, ash, cinder or frozen material.
4. Conduit to penetrate inside walls of primary cable pull / splice box and transformer foundation by a maximum of 3 inches.
5. All unused conduit knockout holes shall be sealed with conduit plugs.
6. Primary cable pull / splice box shall be placed on level undisturbed or well tamped solid earth covered with 4 inches minimum of crushed stone. Maximum stone size is ¾ inch.
7. Top of primary cable pull / splice box to be flush with finished grade. Cover to be left secured to box when unattended.

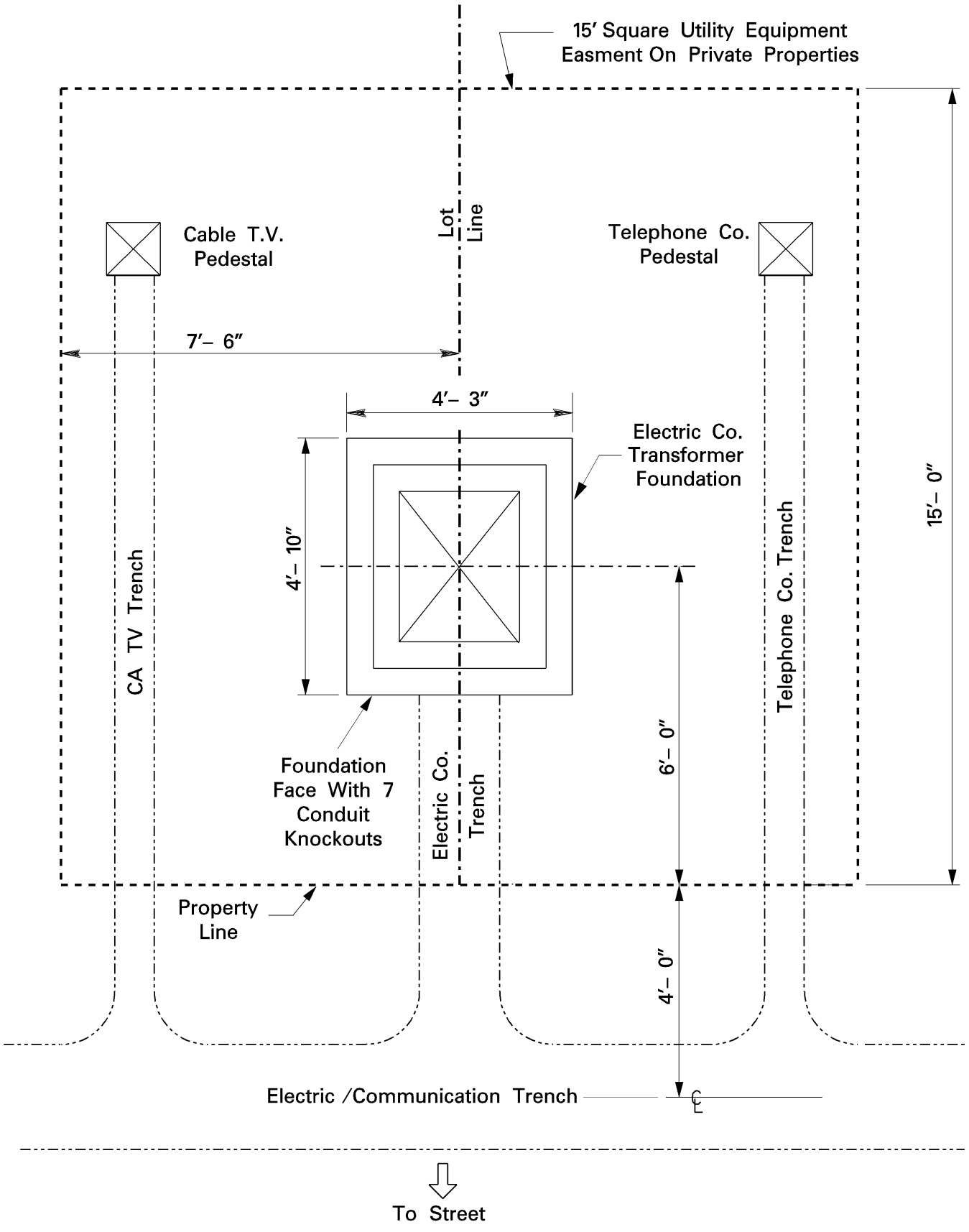
PRIMARY CABLE PULL / SPLICE BOX LOCATION – SIDE VIEW			
ISSUE	**PAGE NUMBER**		
2/06	**45-110**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl



Notes:

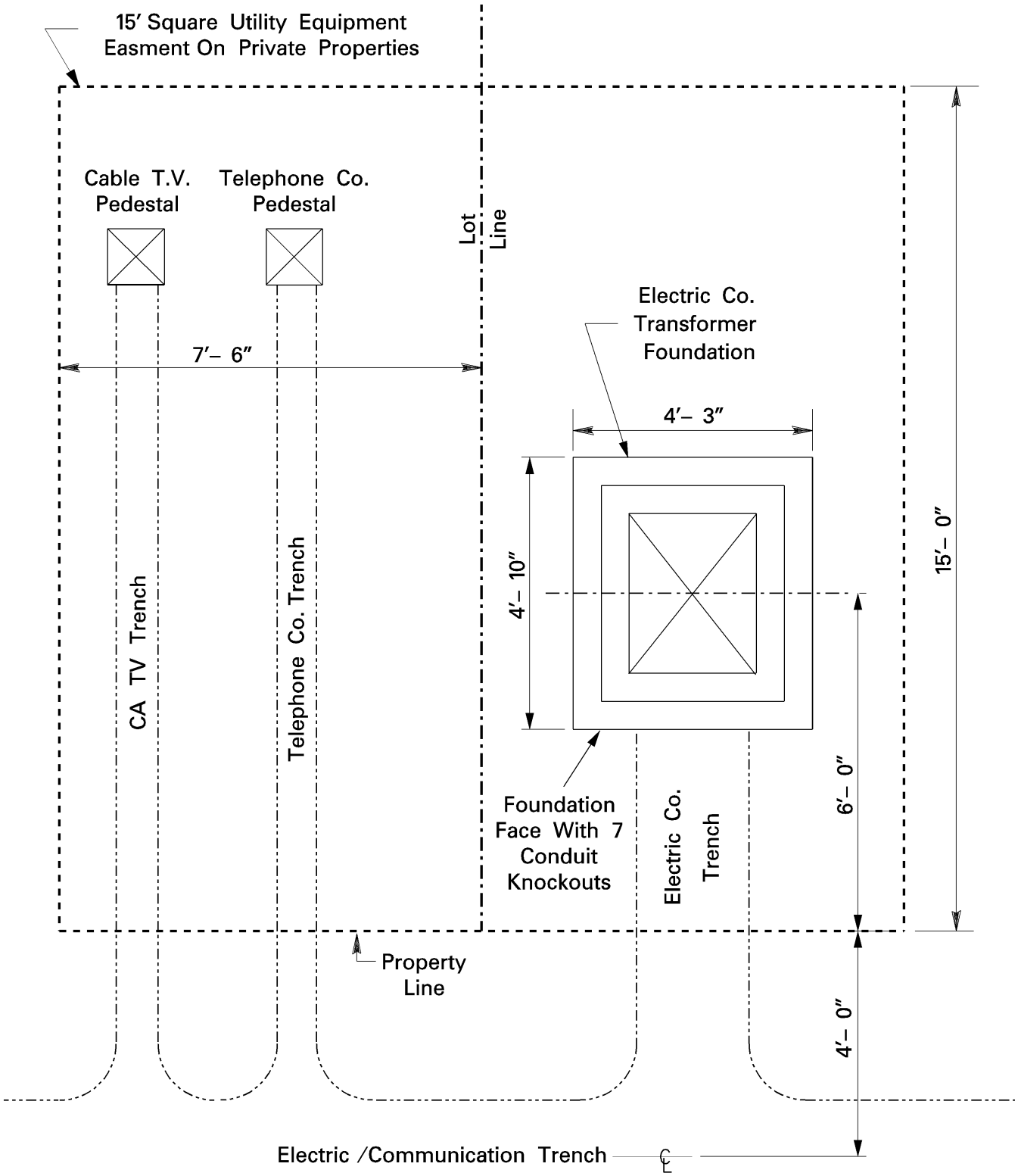
1. Maintain minimum cable bending radius on all primary cables.
2. Modular splice shall be covered with cold shrink splice jacket per Standard Section 36.
3. Spare conduit not looped in and out of transformer foundation.

PRIMARY CABLE PULL / SPLICE BOX			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		45-111	2/06



PREFERRED LOCATION OF EQUIPMENT IN EASEMENT AREA

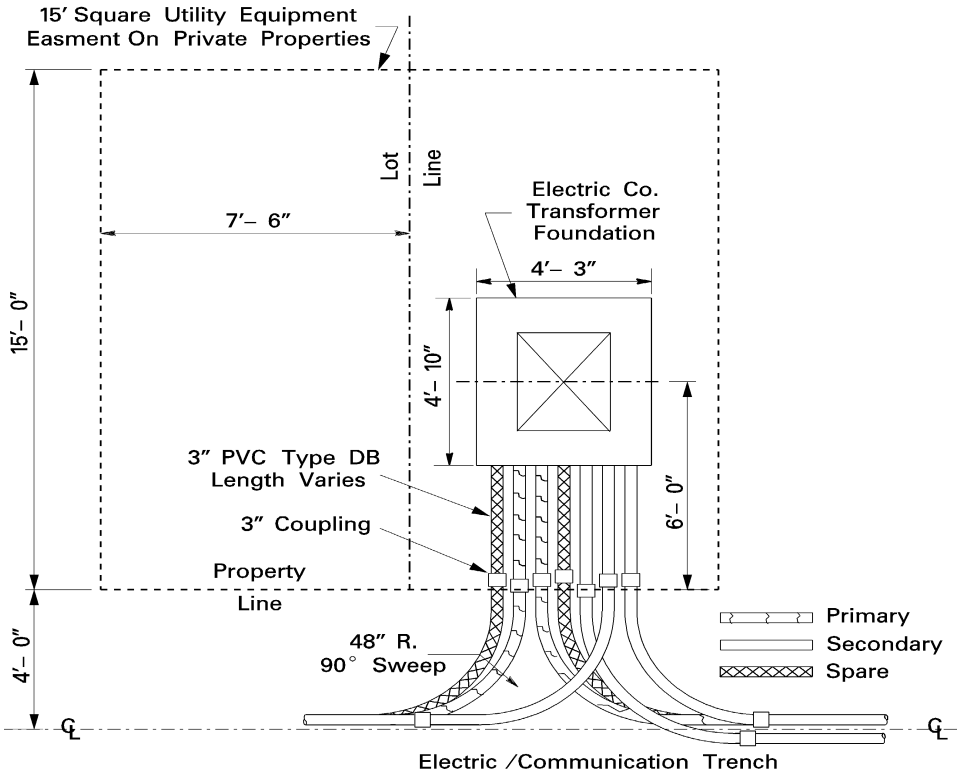
ISSUE	PAGE NUMBER		
2/06	45-114	UNDERGROUND CONSTRUCTION STANDARD	ppl



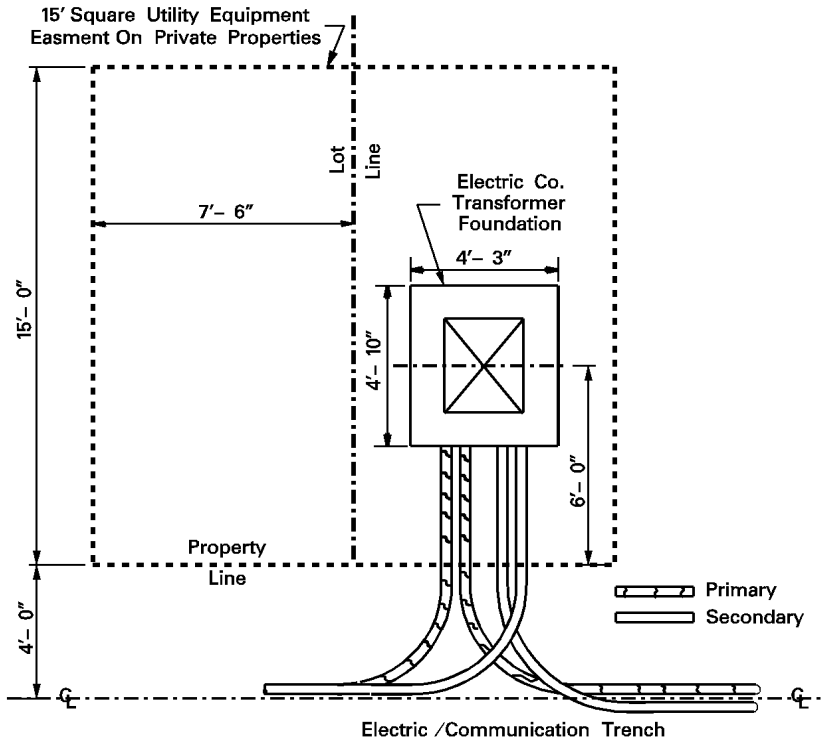
ALTERNATE LOCATION OF EQUIPMENT IN EASEMENT AREA

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	45-115	2/06

Conduit Layout

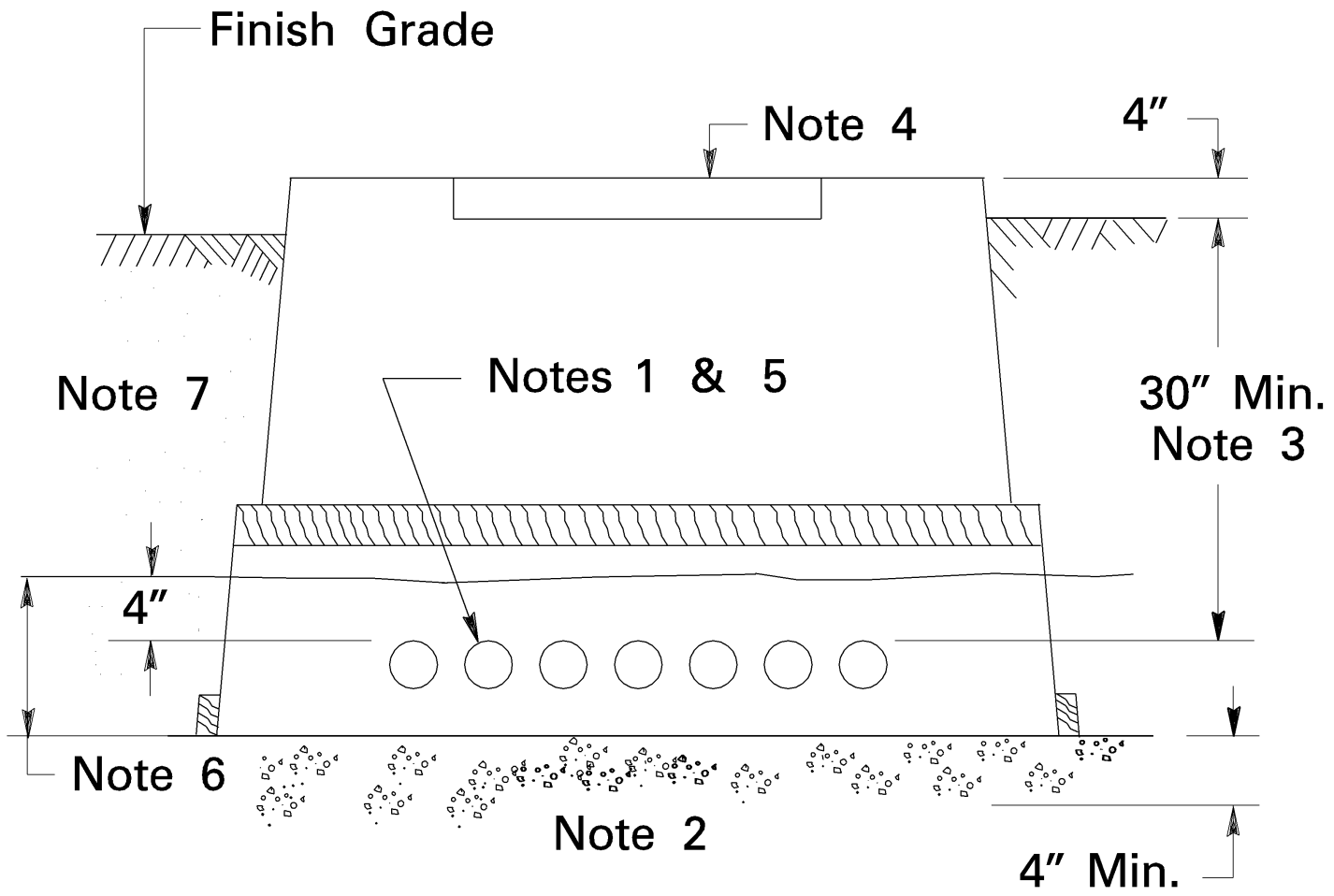


Direct Burial Layout



Supersedes 2/06 Issue – Add Direct Burial Layout

SINGLE PHASE PADMOUNT TRANSFORMER – TYPICAL LAYOUT			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/07	**45-116**		

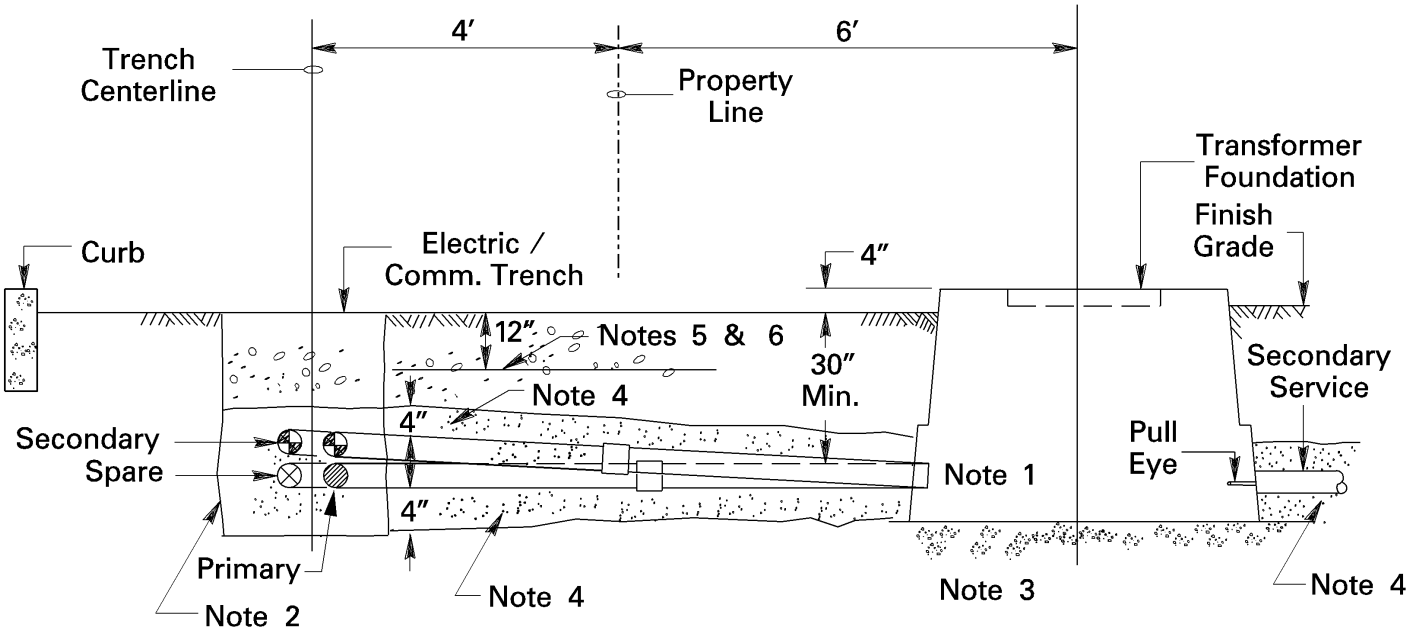


Supersedes 2/06 Issue – Page update

Notes:

1. Foundation to be placed as shown on pages 45-114 thru 45-116 with seven hole knockouts facing toward electric trench.
2. Foundation to be placed on level undisturbed or well tamped earth covered with 4 inches minimum well tamped crushed stone.
3. Top of conduit knockouts shall be 30 inches minimum below finish grade.
4. All foundations shall have covers installed and locked when transformer not in place.
5. All unused conduit knockout holes and conduits shall be plugged with conduit plugs.
6. Washed, screened sand.
7. Clean fill free of stones greater than 2 inches and not containing shell, ash, cinder or frozen material.

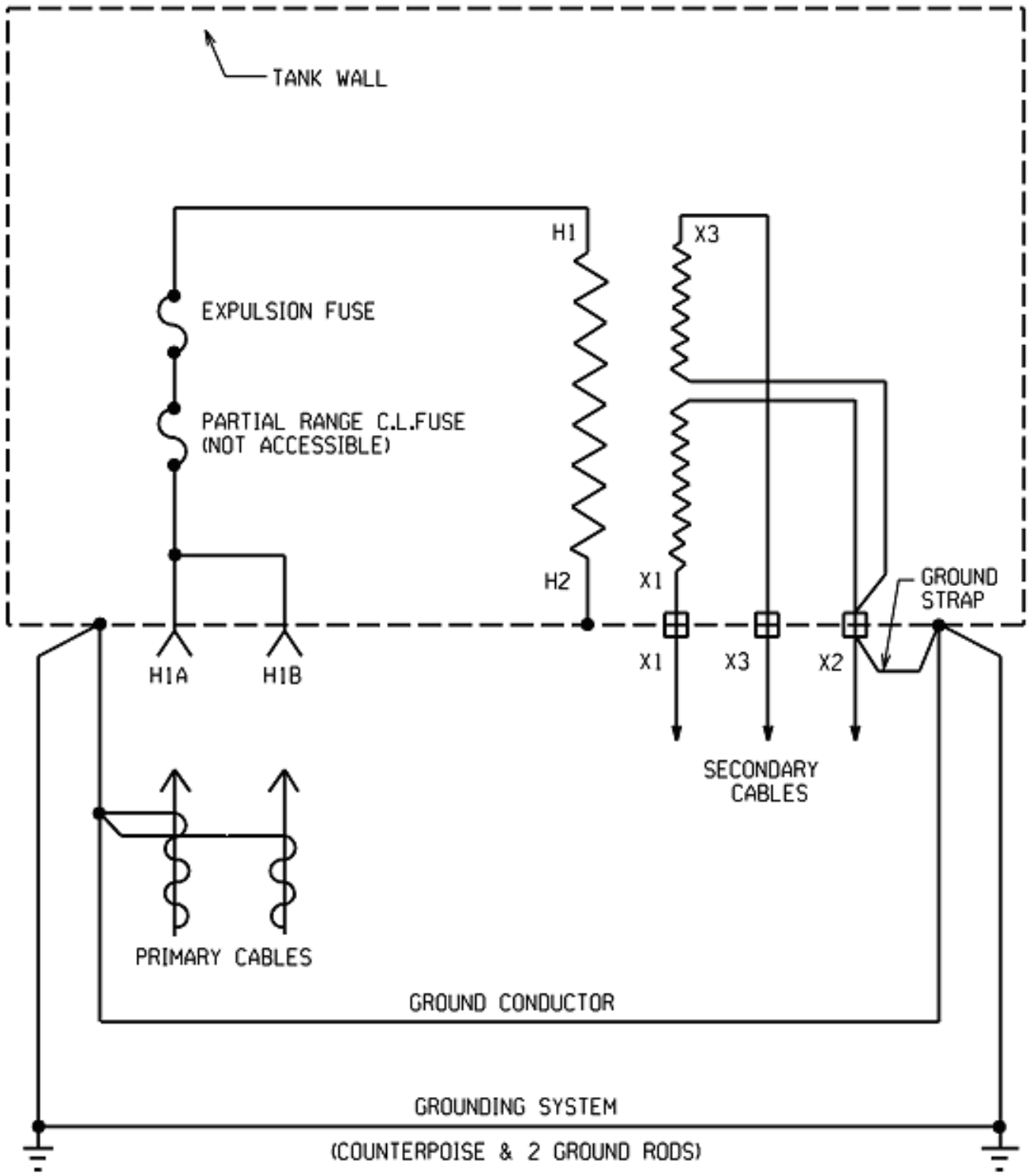
SINGLE PHASE PADMOUNT TRANSFORMER – CONDUIT SYSTEM TYPICAL LAYOUT			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		45-117	7/07



Notes:

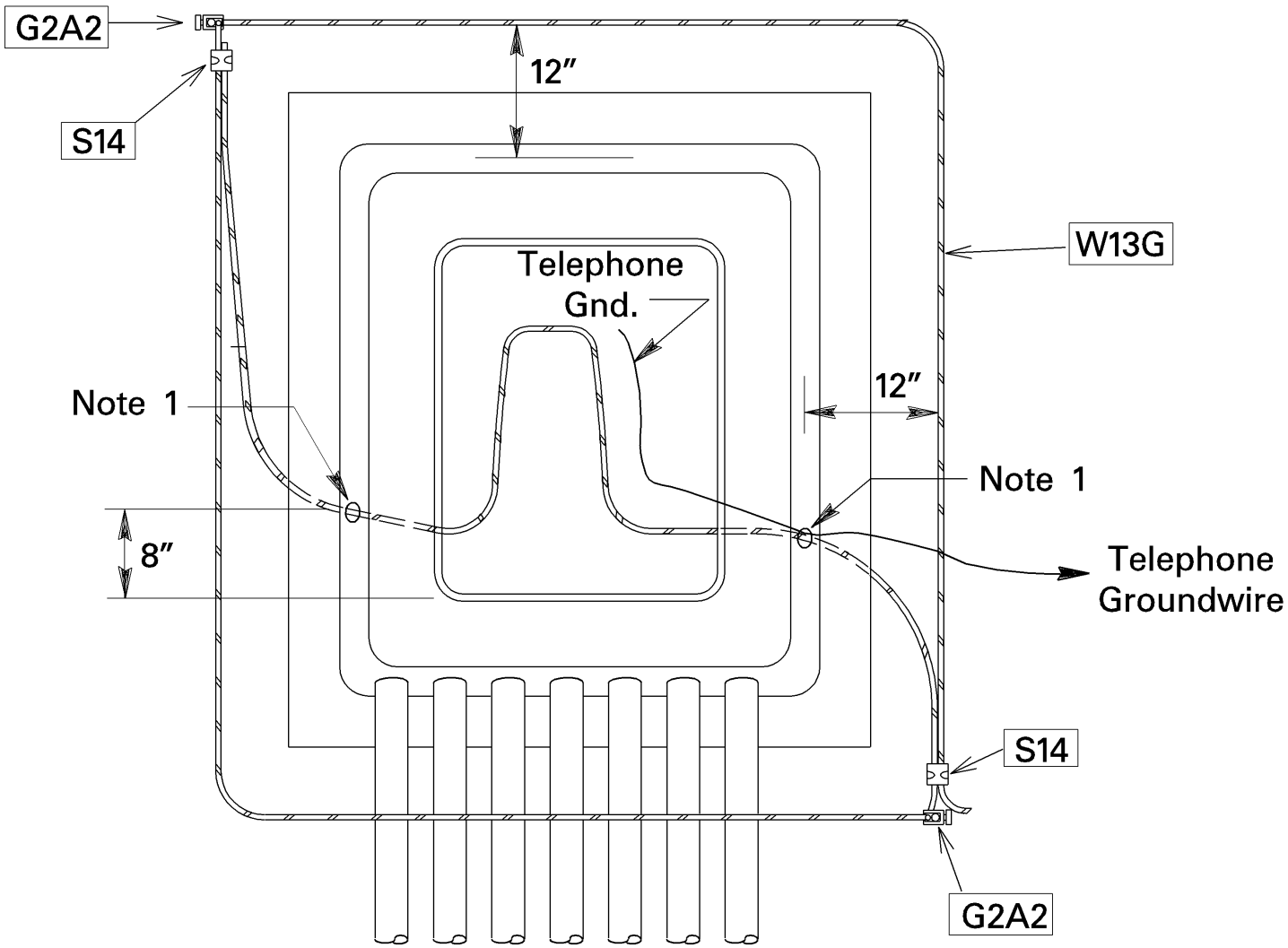
1. Extend PVC conduits through transformer foundation by 3 inch maximum.
2. Refer to Section 45.10 for trench specifications.
3. Foundation to be placed on level, undisturbed or well tamped earth covered with 4 inches minimum of crushed stone.
4. Washed, screened sand – 4 inches minimum above and below all conduit.
5. Clean fill, free of stones greater than 2 inches, and not containing shell, ash, cinder, or frozen material.
6. Install plastic warning tape above all conduit runs, approximately 12 – 18 inches below finish grade.

SINGLE PHASE PADMOUNT TRANSFORMER – CONDUIT SYSTEM SIDE VIEW			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
2/06	**45-118**		



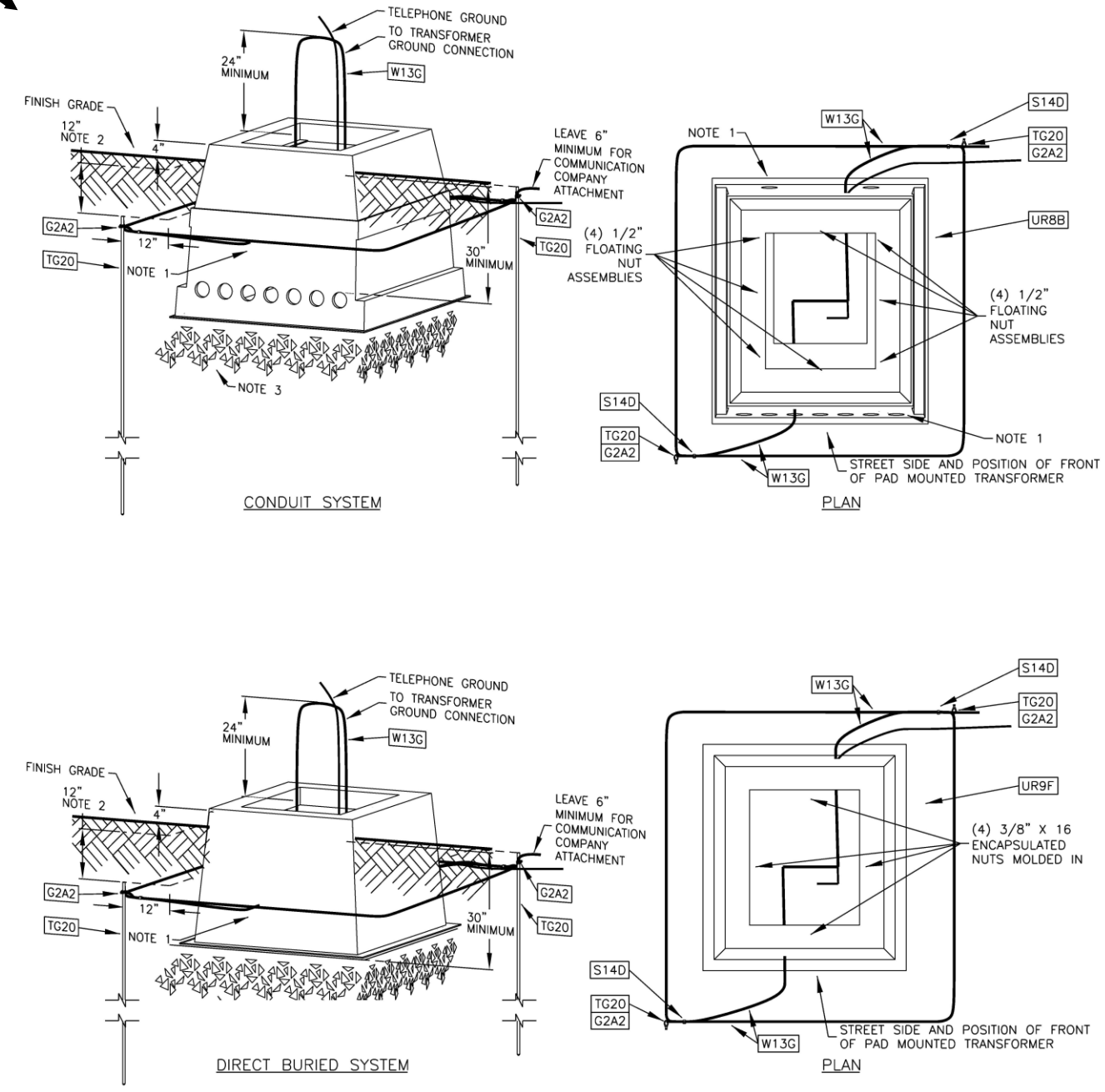
Notes:

1. Partial range current limiting fuse is not accessible for replacement.



Notes:

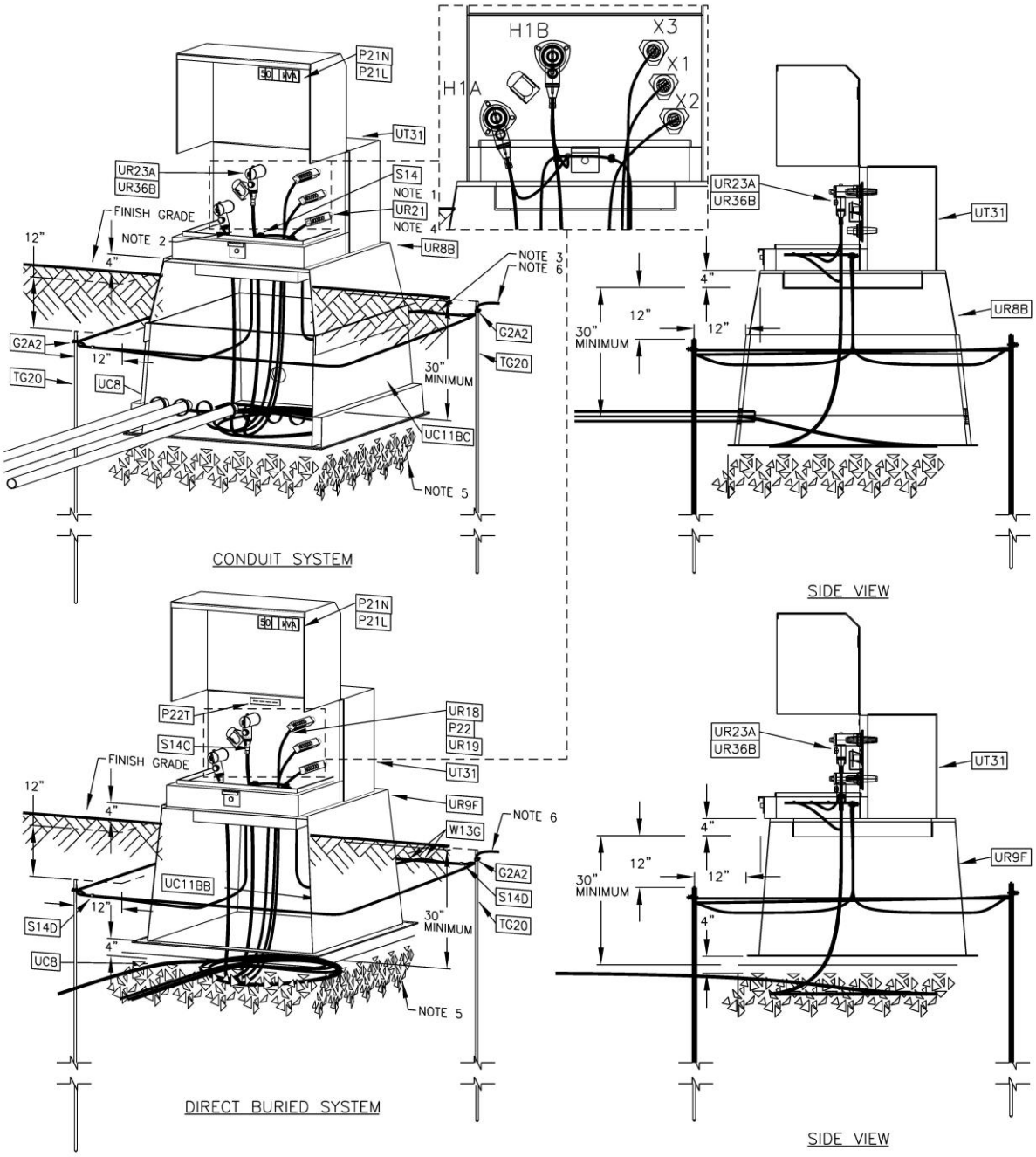
1. Drill ⅝ inch diameter holes as shown in sides of foundation if not provided by foundation manufacturer.
2. Ground loop around foundation to be buried 12 inches below finish grade.
3. Although conduit system is shown, direct buried systems shall incorporate the same ground grid.



Supersedes 2/06 Issue – Updated to 3-D drawing

Notes:

1. Drill ⅝ inch diameter holes as shown in sides of foundation if not provided by foundation manufacturer.
2. Ground loop around foundation to be buried 12 inches below finish grade.
3. Although conduit system is shown, direct buried systems shall incorporate the same ground grid.



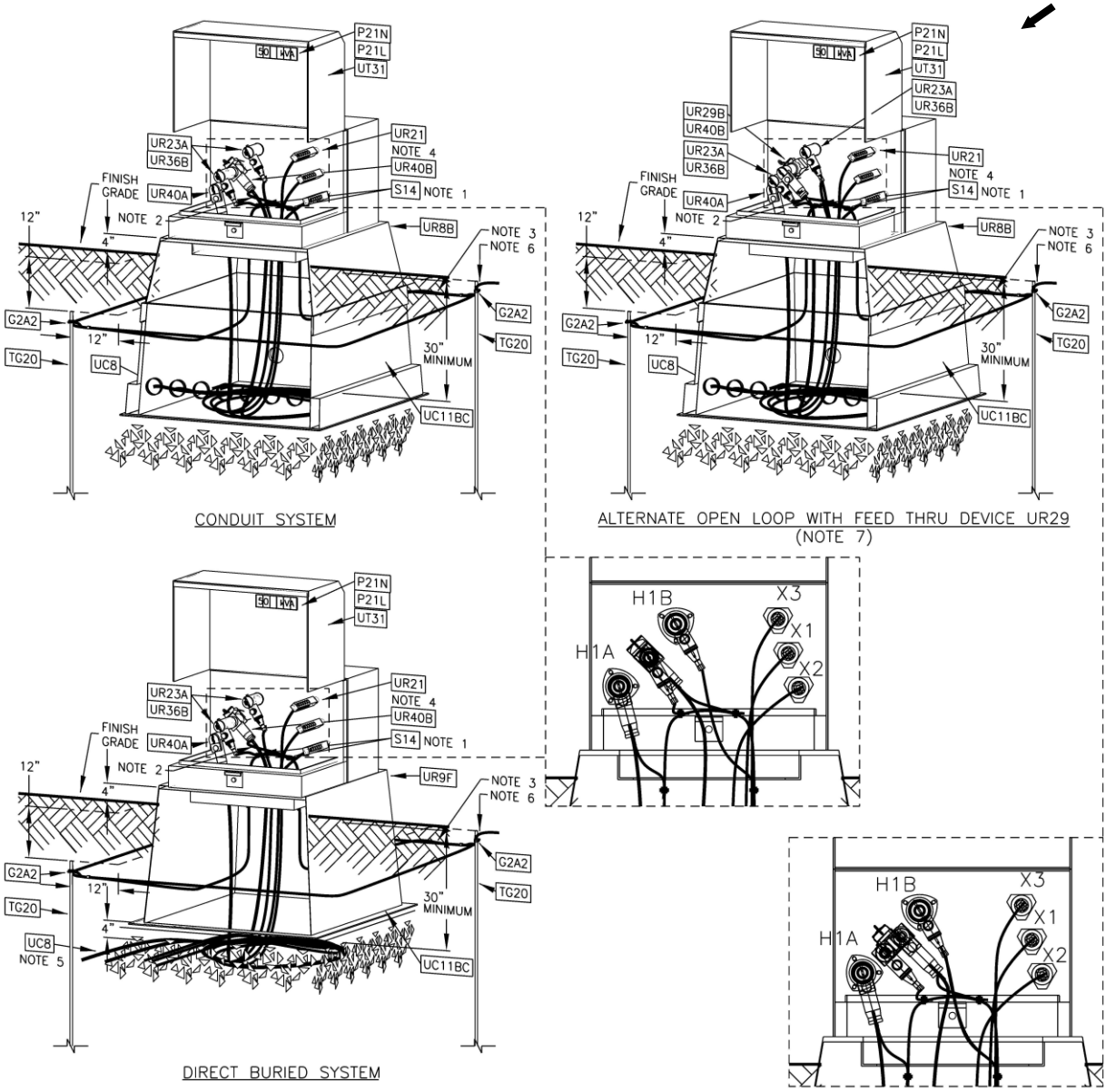
Notes:

1. Install #2 copper ground wire loop through both transformer tank split-bolt stud connectors.
2. Use 2 foot length of twisted concentric neutral wires from the primary cable for connection to #2 copper ground wire loop.
3. Install foundation and ground grid in accordance with Section 45.120 and Section 45.121.
4. Install secondary busses per Section 45.20.20.
5. For direct buried systems, loop cables around base of foundation before terminating
6. Leave 6 inches minimum for communication company attachment.
7. Install short shank padlock (UL20S) after tightening captive pentahead bolt.

Supersedes 7/15 Issue – Updated to 3-D Drawing

PADMOUNT TRANSFORMER INSTALLATION – TYPICAL LOOP FEED			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/17	**45-122**		

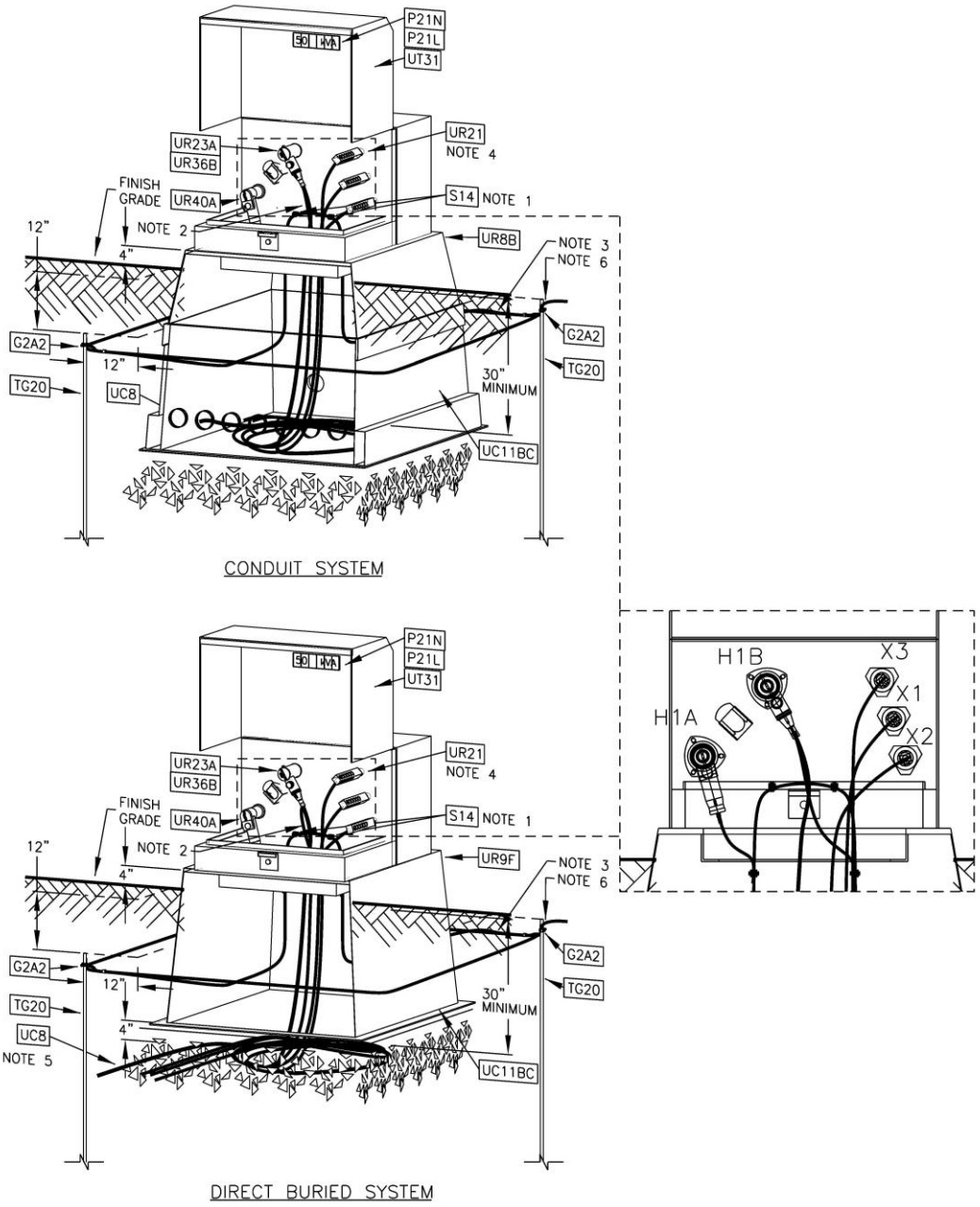
Supersedes 7/15 Issue – Updated to 3-D Drawing



Notes:

1. Install #2 copper ground wire loop through both transformer tank split-bolt stud connectors.
2. Use 2 foot length of twisted concentric neutral wires from the primary cable for connection to #2 copper ground wire loop.
3. Install foundation and ground grid in accordance with Section 45.120 and Section 45.121.
4. Install secondary busses per Section 45.20.20.
5. For direct buried systems, loop cables around base of foundation before terminating.
6. Leave 6 inches minimum for communication company attachment.
7. Install short shank padlock (UL20S) after tightening captive pentahead bolt.

PADMOUNT TRANSFORMER INSTALLATION – TYPICAL LOOP FEED OPEN POINT WITH ARRESTERS INSTALLED ON A FEED THRU OR PARKING STAND			
ppl	**UNDERGROUND CONSTRUCTION STANDARD**	**PAGE NUMBER**	**ISSUE**
		45-123	**7/17**



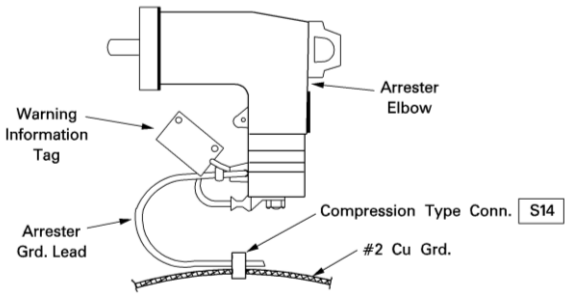
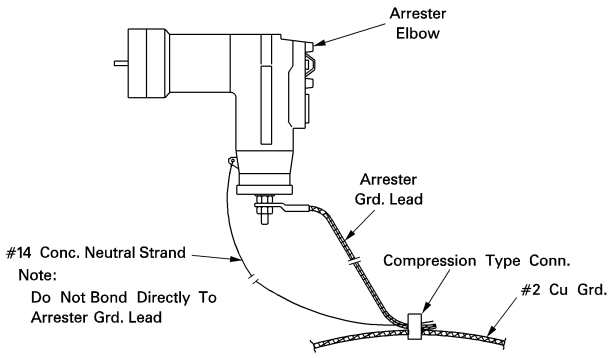
Notes:

1. Install #2 copper ground wire loop through both transformer tank split-duct stud connectors.
2. Use 2 foot length of twisted concentric neutral wires from the primary cable for connection to #2 copper ground wire loop.
3. Install foundation and ground grid in accordance with Section 45.120 and Section 45.121.
4. Install secondary busses per Section 45.20.20.
5. For direct buried systems, loop cables around base of foundation before terminating.
6. Leave 6” minimum for communication company attachment.
7. Install short shank padlock (UL20S) after tightening captive pentahead bolt.

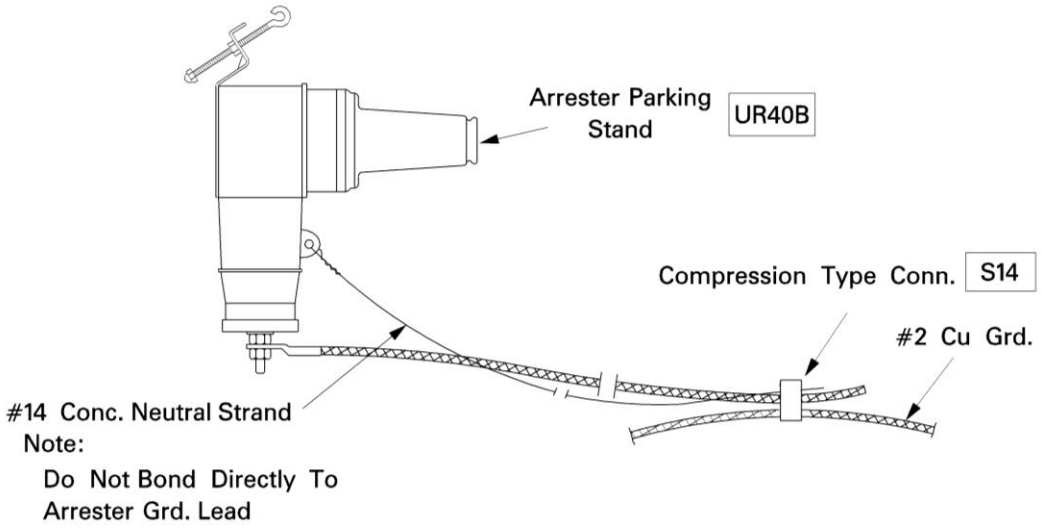
Supersedes 7/15 Issue – Updated to 3-D Drawing

PADMOUNT TRANSFORMER INSTALLATION – FRONT VIEW TYPICAL ARRESTER ELBOWS END OF RADIAL CIRCUIT			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/17	**45-124**		

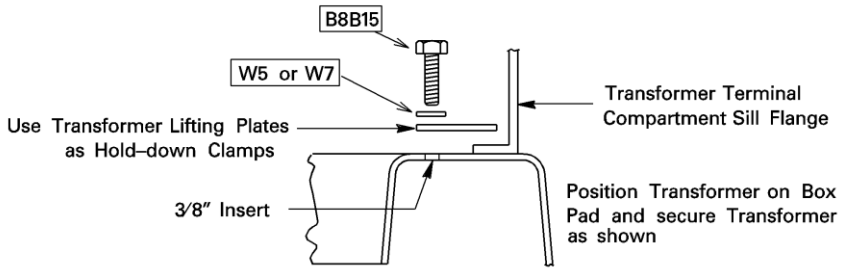
Supersedes 1/07 Issue – Replace Bolt B8B15 in Detail Drawing

	
Elbow Arrester with braided ground attached to housing.	Elbow Arrester without ground attached to housing, install #14 concentric neutral or equivalent from housing to # 2 Cu. system ground in a URD.

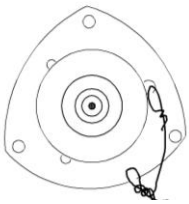
Arrester Elbow Grounding Detail

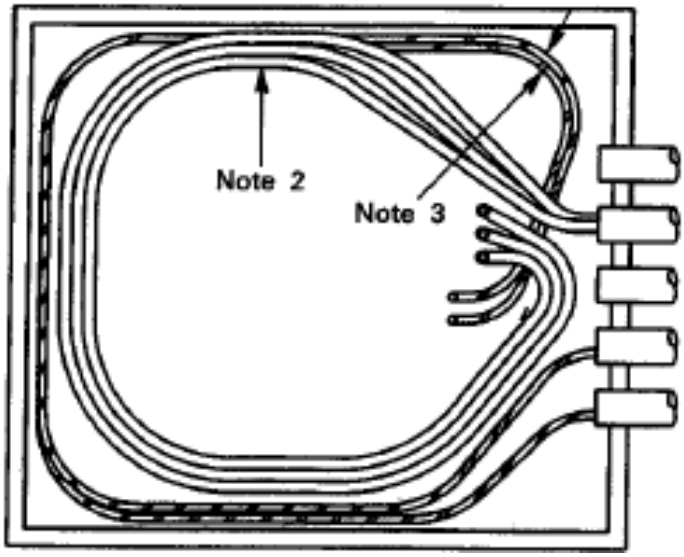


Arrester Parking Stand Grounding Detail



Transformer to Vault Pad Fastening Detail

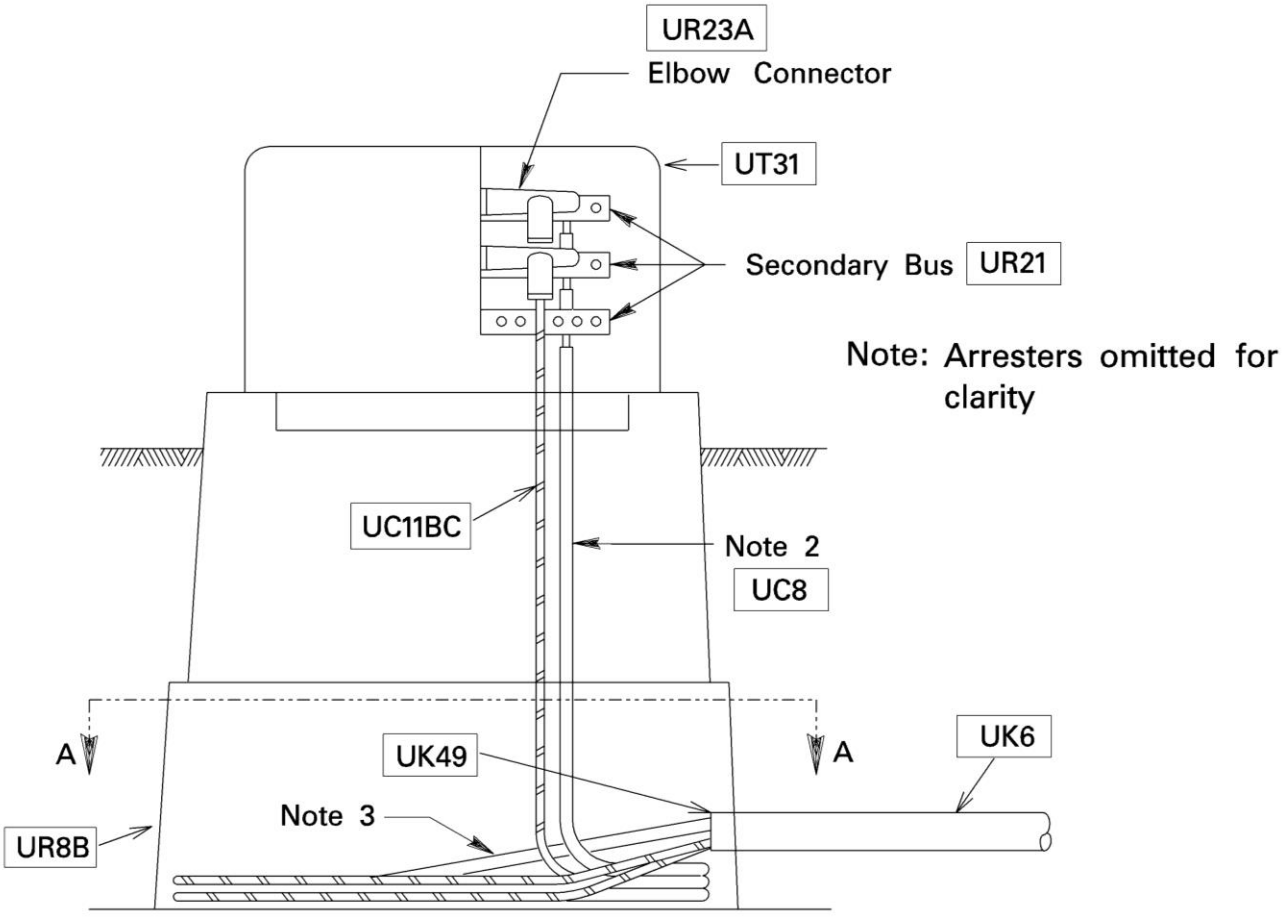




Note: Use a minimum of #14 solid copper or equivalent to bond bushing insert to mounting plate.

Transformer Bushing Well Grounding Connection

Section A – A



Single Phase Padmount Transformer – Installation

Notes:

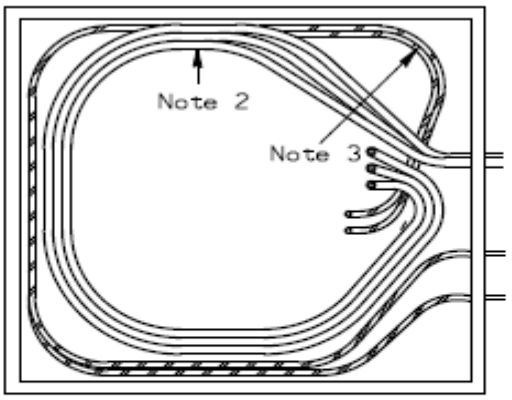
1. Grounding not shown.
2. Only one Triplexed Secondary Cable shown.
3. Do not exceed minimum cable bending radii when training cables.

Supersedes 1/07 Issue – Removed Note 4

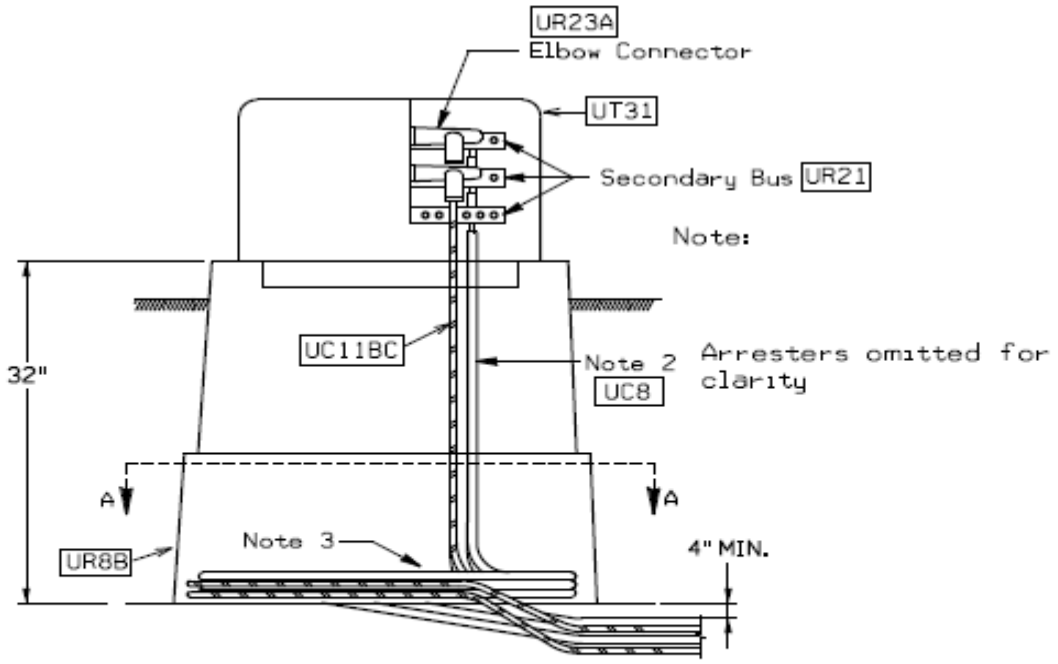
TRANSFORMER BUSHING WELL GROUNDING CONNECTION SINGLE PHASE TRANSFORMER CONDUIT INSTALLATION – SIDE VIEW			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/07	**45-126**		

NOTE: USE A MINIMUM OF #14 SOLID COPPER OR EQUIPMENT TO BOND BUSHING INSERT TO MOUNTING PLATE

Transformer Bushing Well Grounding Connection



SECTION A-A



SINGLE PHASE PADMOUNT TRANSFORMER-INSTALLATION SIDE VIEW

Notes:

1. Grounding not shown.
2. Only one Triplexed Secondary Cable shown.
3. Do not exceed minimum cable bending radii when training cables.

Supersedes 7/07 Issue – New Drawing

TRANSFORMER BUSHING WELL GROUNDING CONNECTION SINGLE PHASE TRANSFORMER DIRECT BURIAL INSTALLATION – SIDE VIEW			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		45-127	7/16

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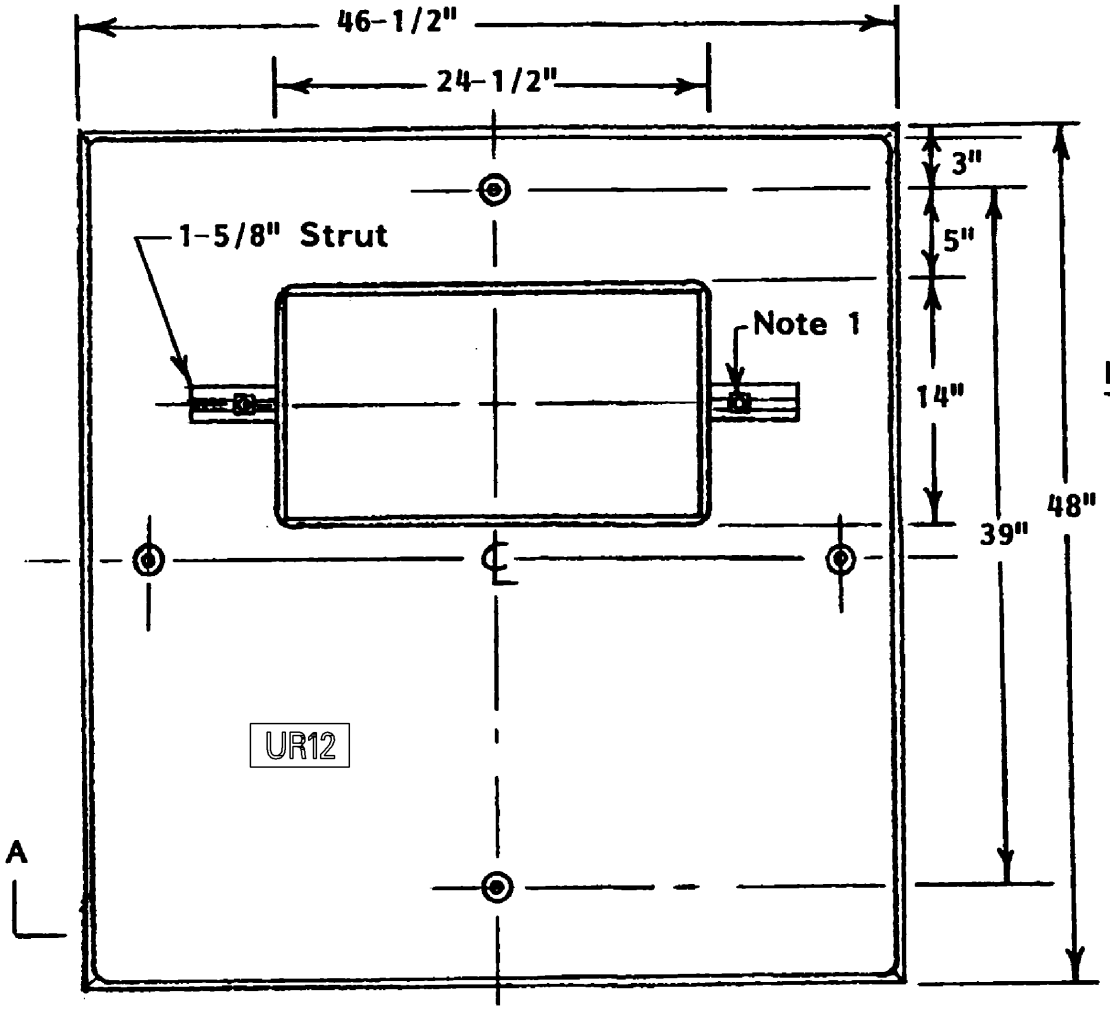


FIGURE 1
PLAN

Note 1 - Captive nut for 3/8" x 1-1/4" transformer mounting bolt.

B19

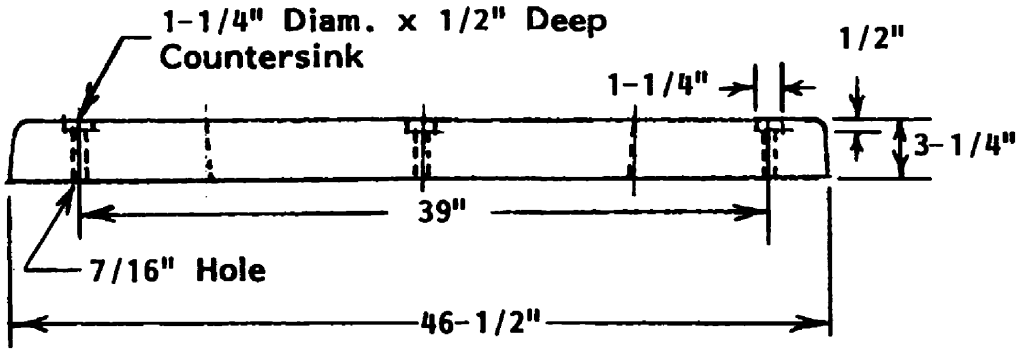
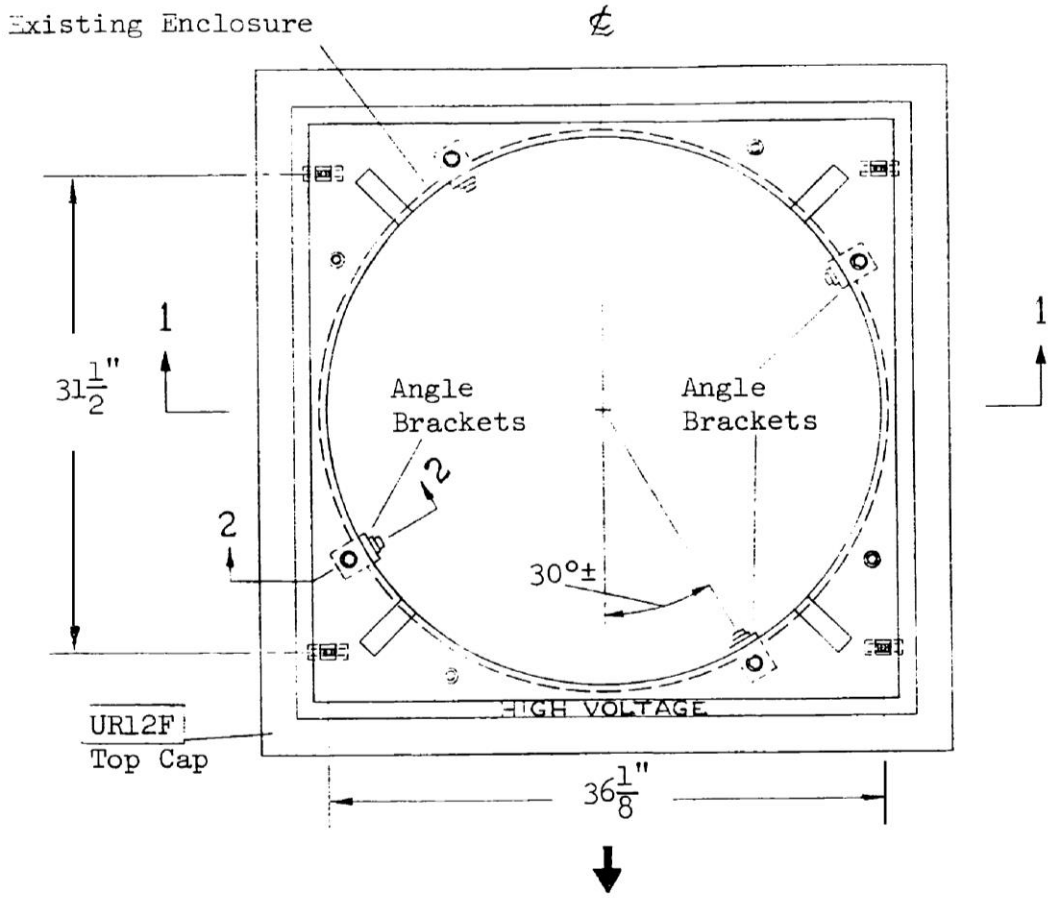
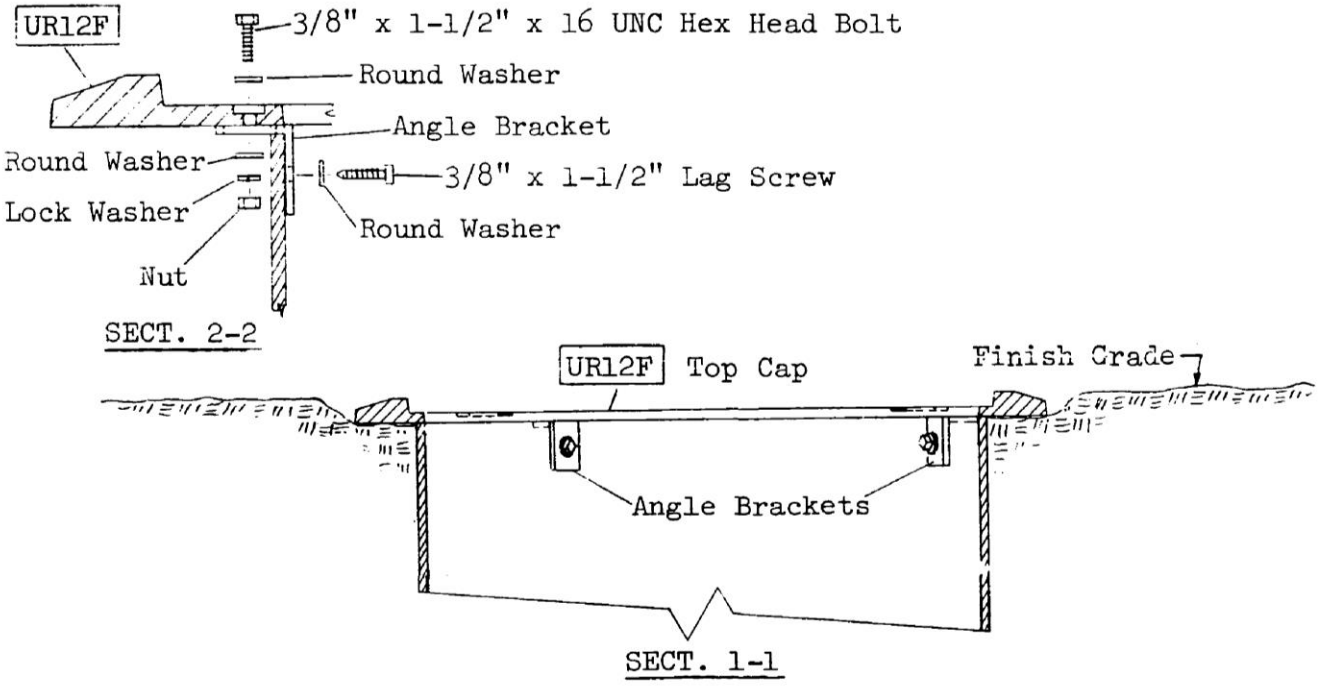


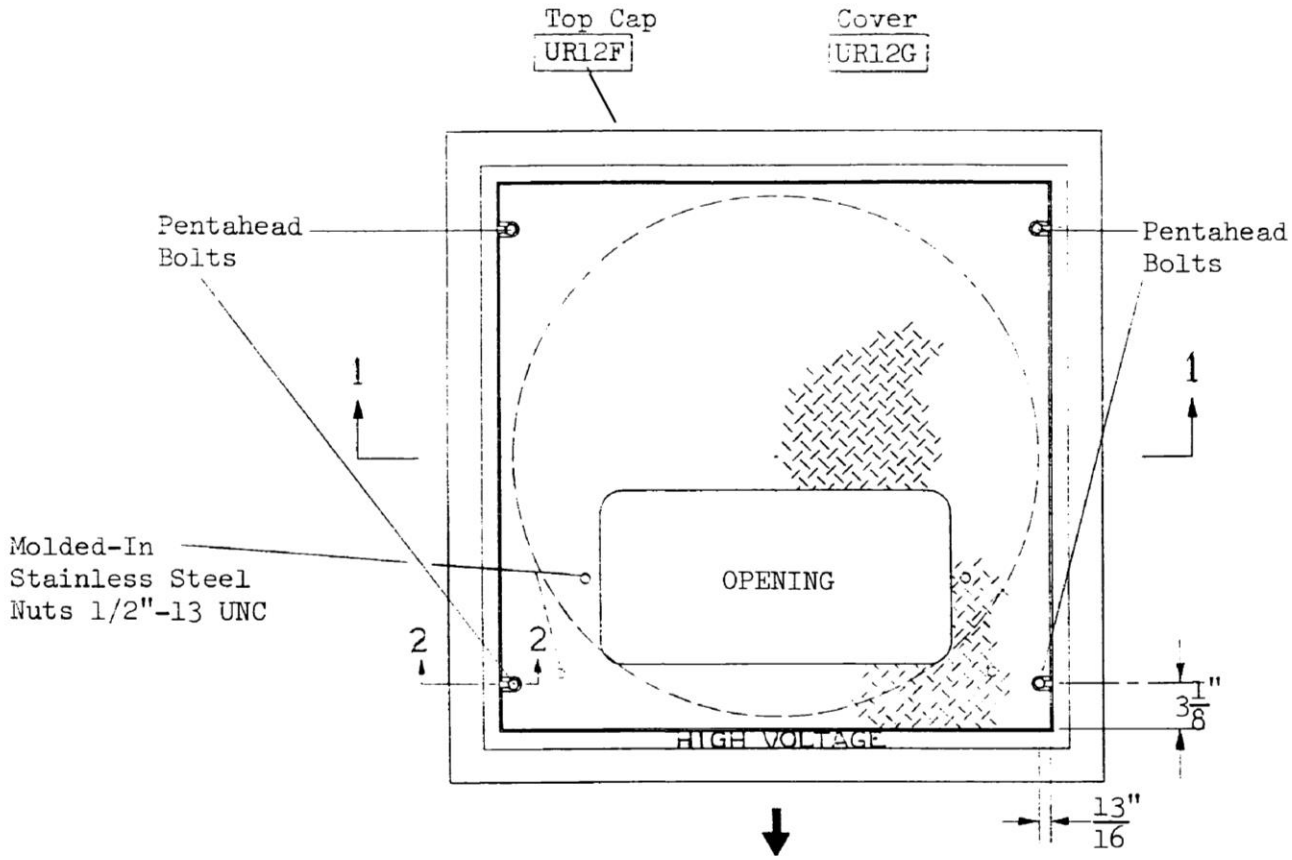
FIGURE 2
SECTION A-A



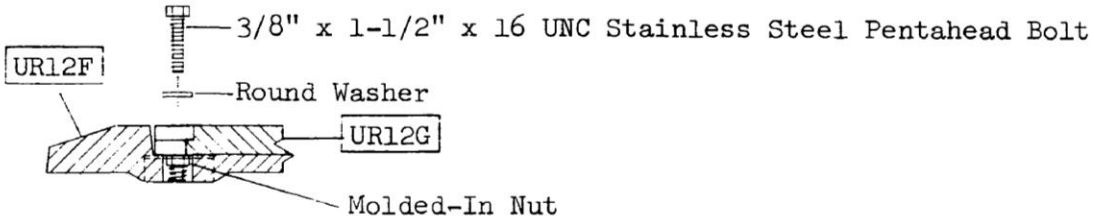
STREET SIDE AND POSITION OF FRONT
OF PADMOUNTED JUNCTION OR TRANSFORMER



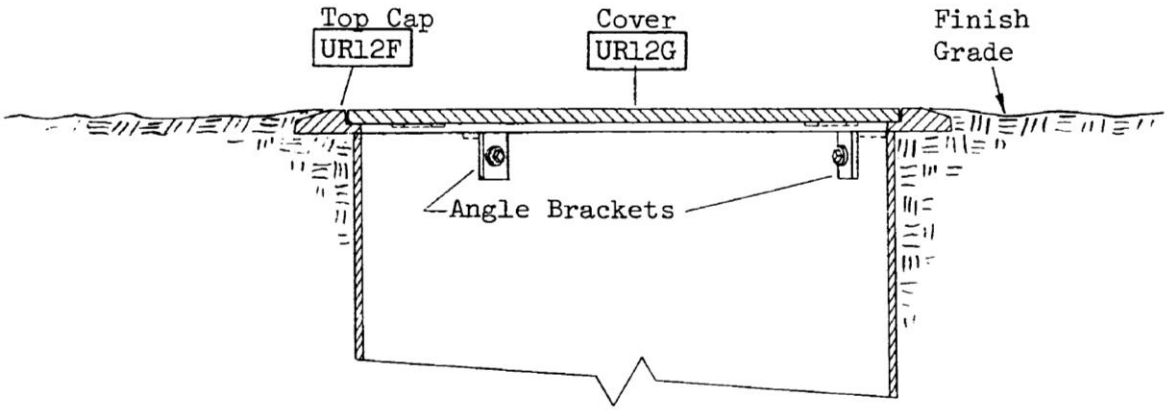
SUBMERSIBLE TO PADMOUNT CONVERSION –APPLICATIONS 36 INCH SUBMERSIBLE ENCLOSURES			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
2/06	**45-130**		



STREET SIDE AND POSITION OF FRONT
OF PADMOUNTED JUNCTION OR TRANSFORMER

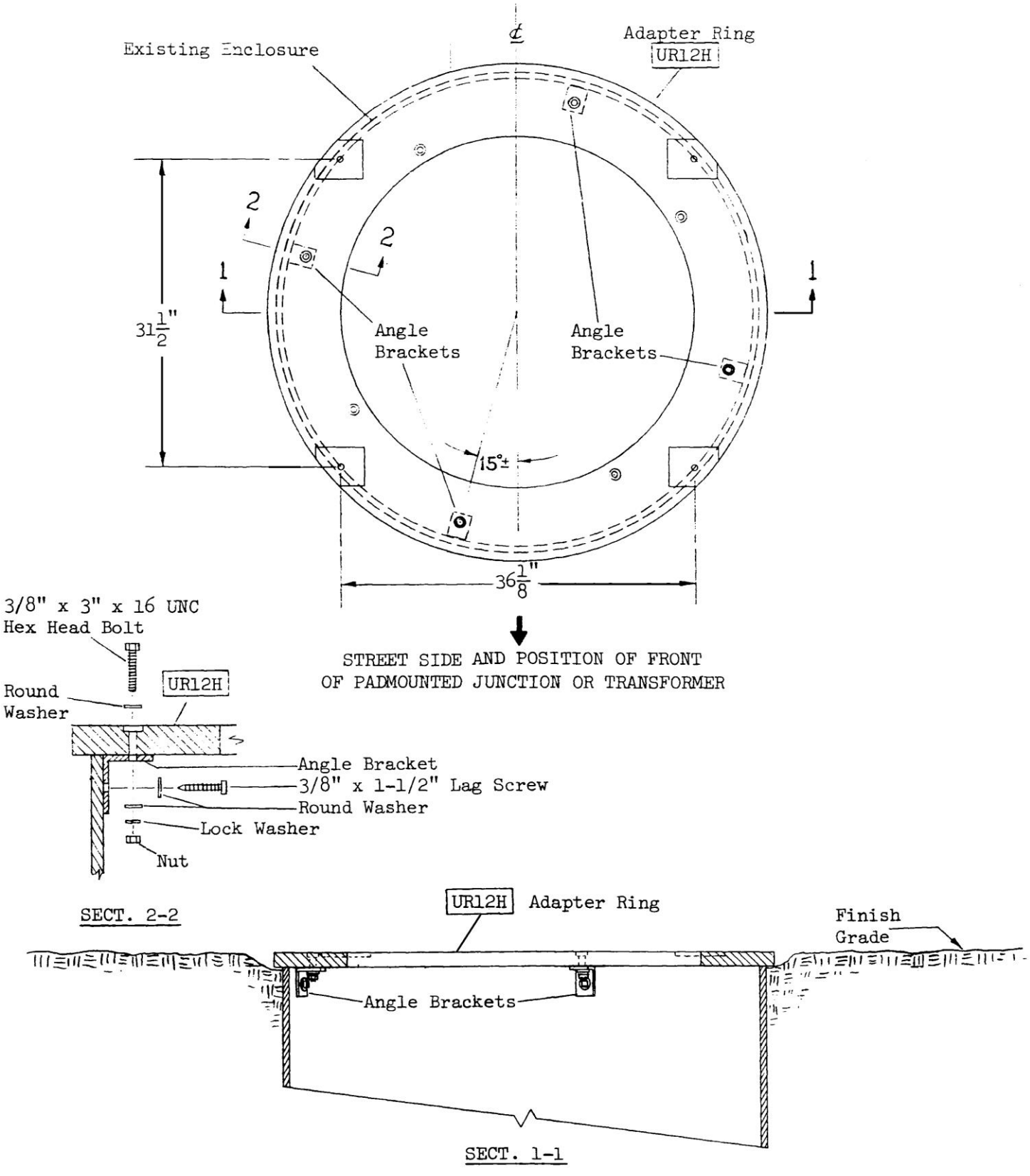


SECT. 2-2

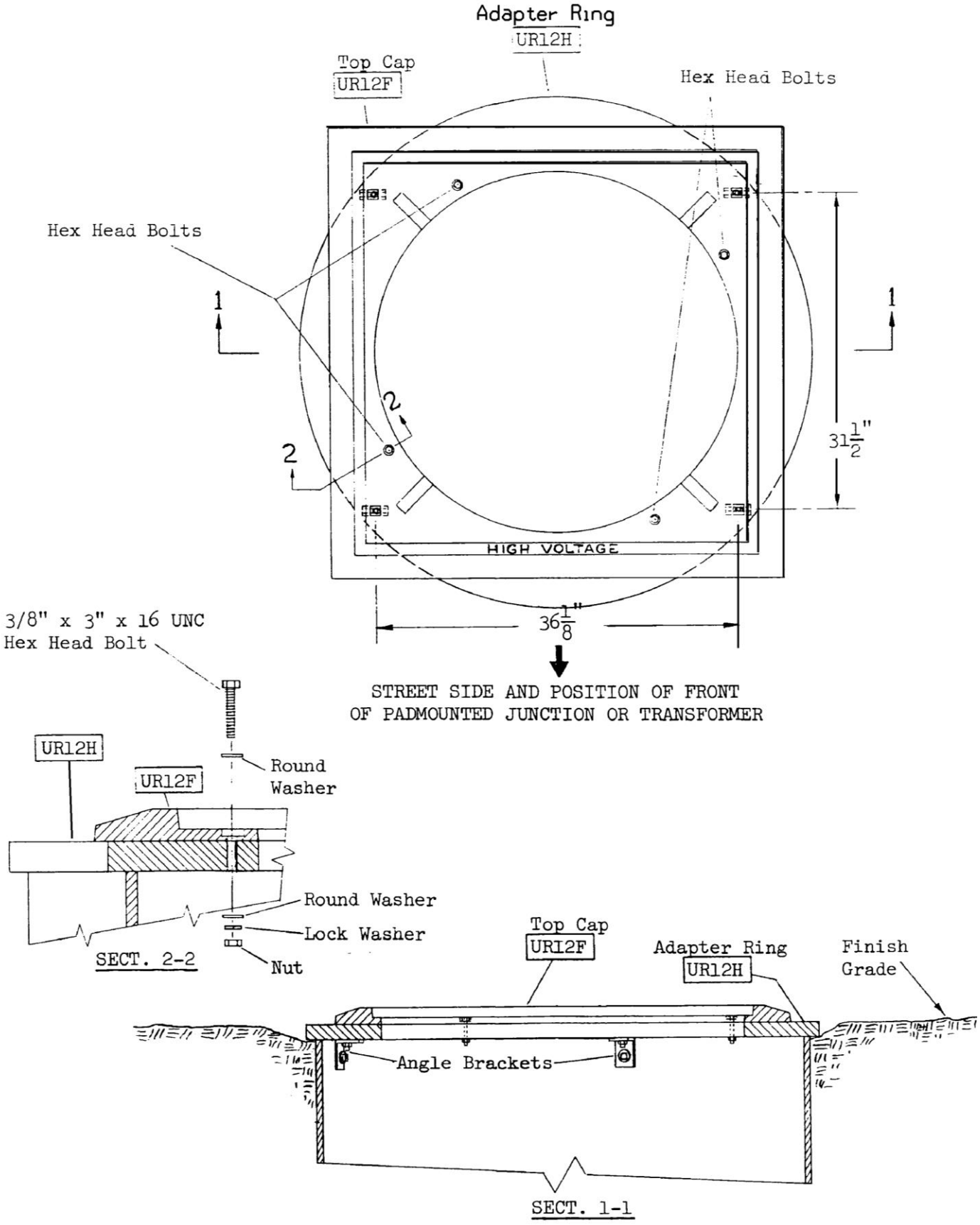


SECT. 1-1

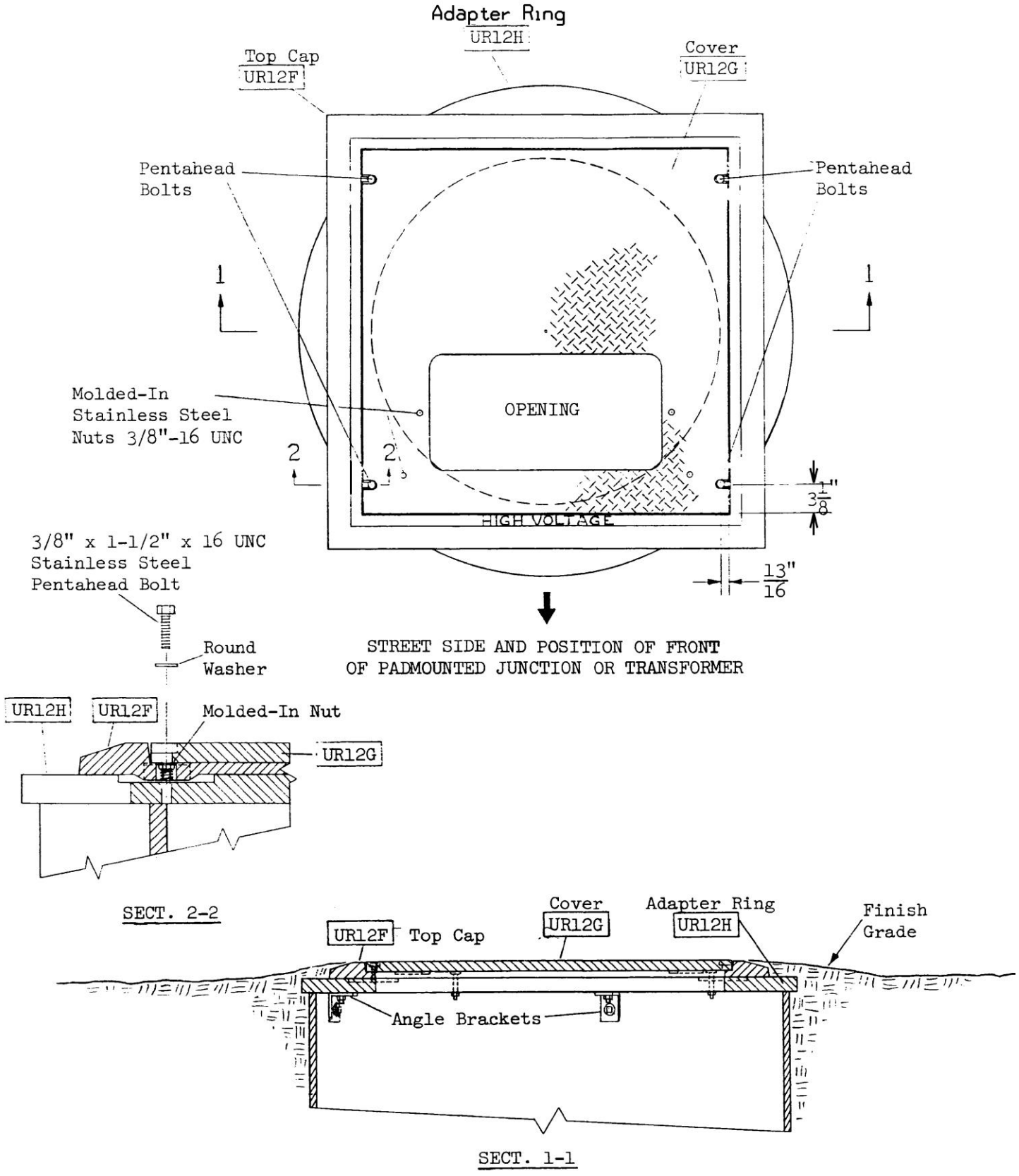
SUBSURFACE TO PADMOUNT CONVERSION
36 INCH SUBMERSIBLE ENCLOSURES



SUBMERSIBLE TO PADMOUNT CONVERSION – NEW YORK APPLICATIONS 48 INCH SUBMERSIBLE ENCLOSURES			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
2/06	**45-132**		

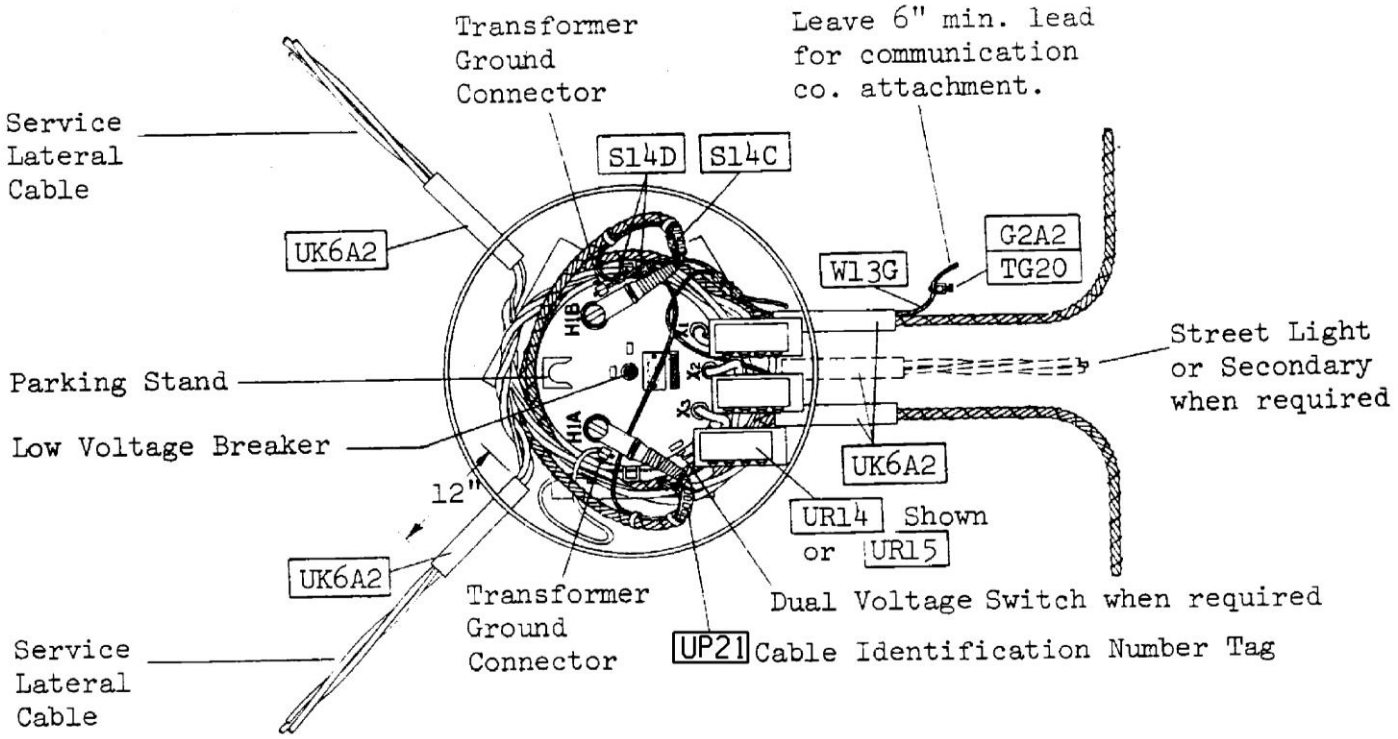


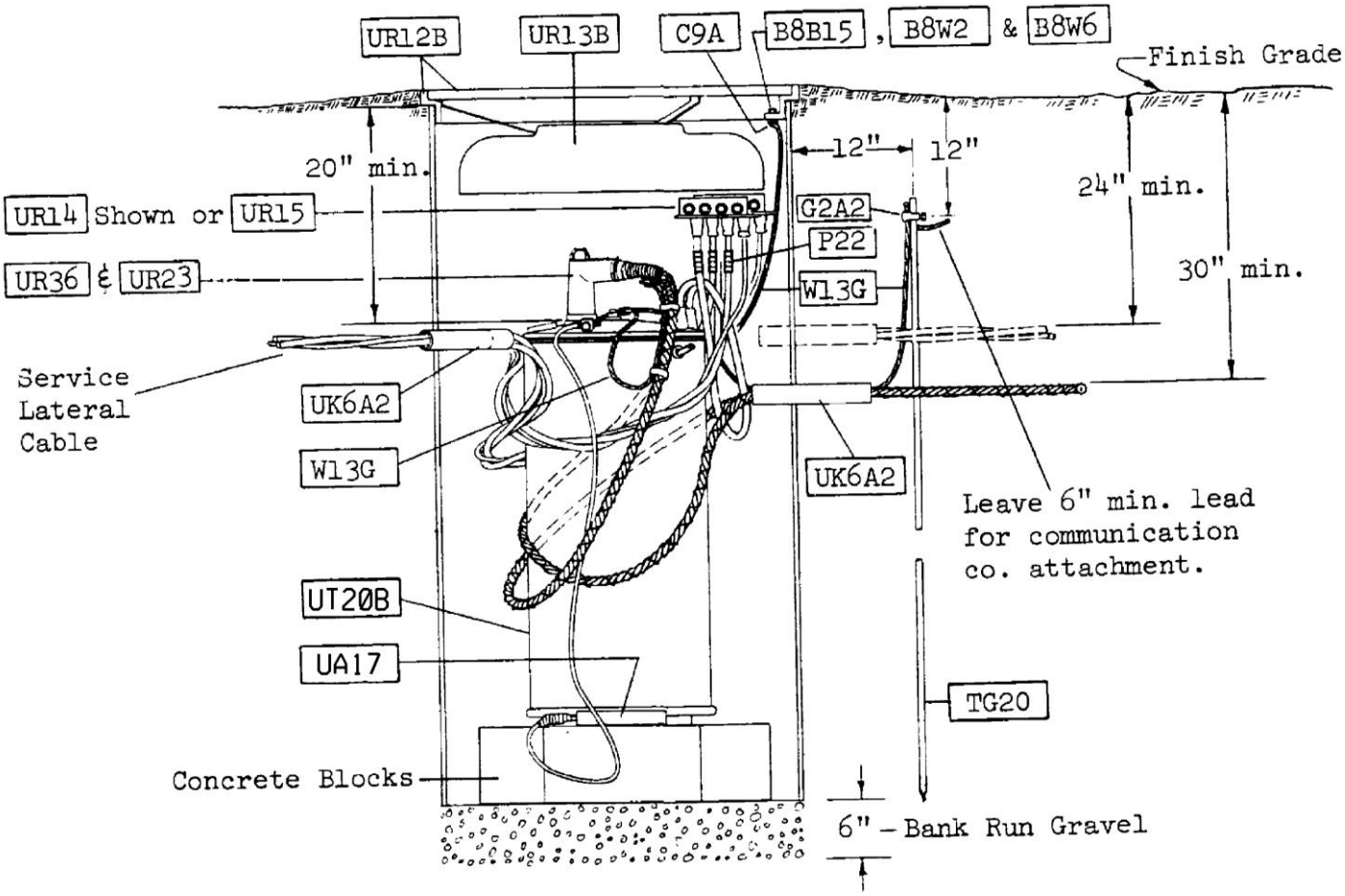
SUBMERSIBLE TO PADMOUNT CONVERSION – NEW YORK APPLICATIONS 48 INCH SUBMERSIBLE ENCLOSURES			
ppl	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
		45-133	2/06



SUBMERSIBLE TO PADMOUNT CONVERSION – NEW YORK APPLICATIONS 48 INCH SUBMERSIBLE ENCLOSURES			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
2/06	**45-134**		

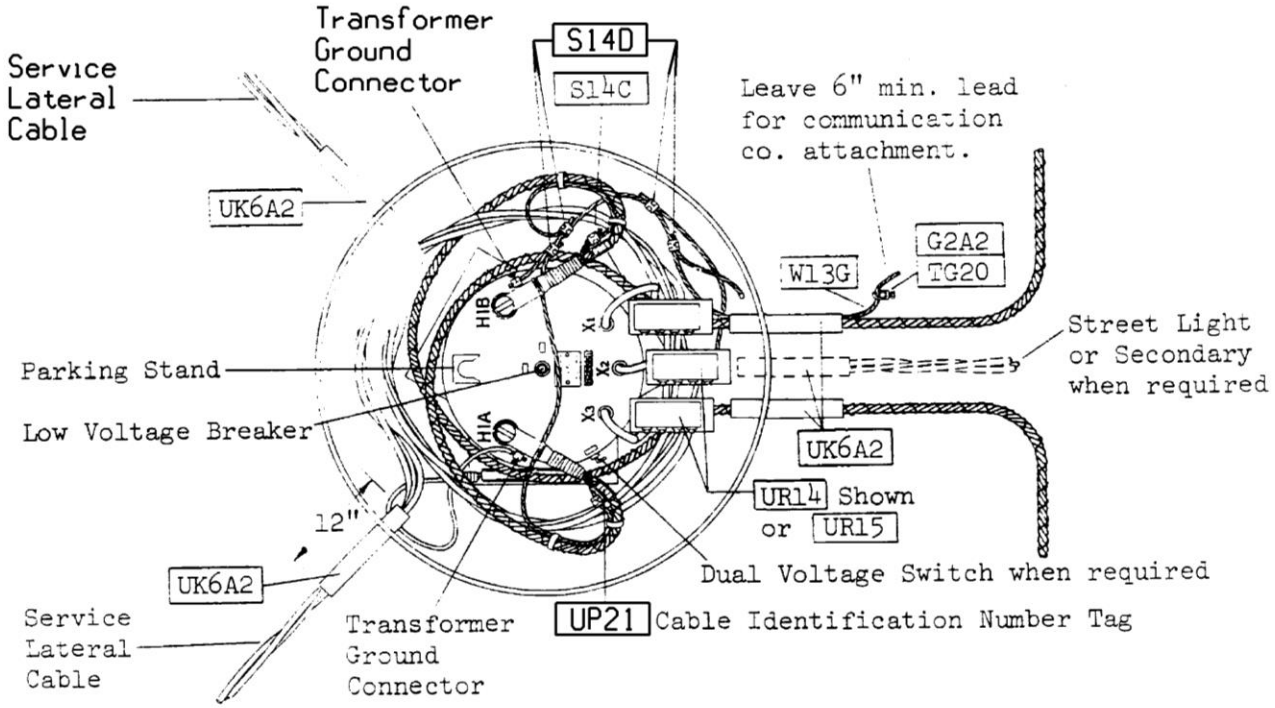
FOR MAINTENANCE PURPOSES ONLY

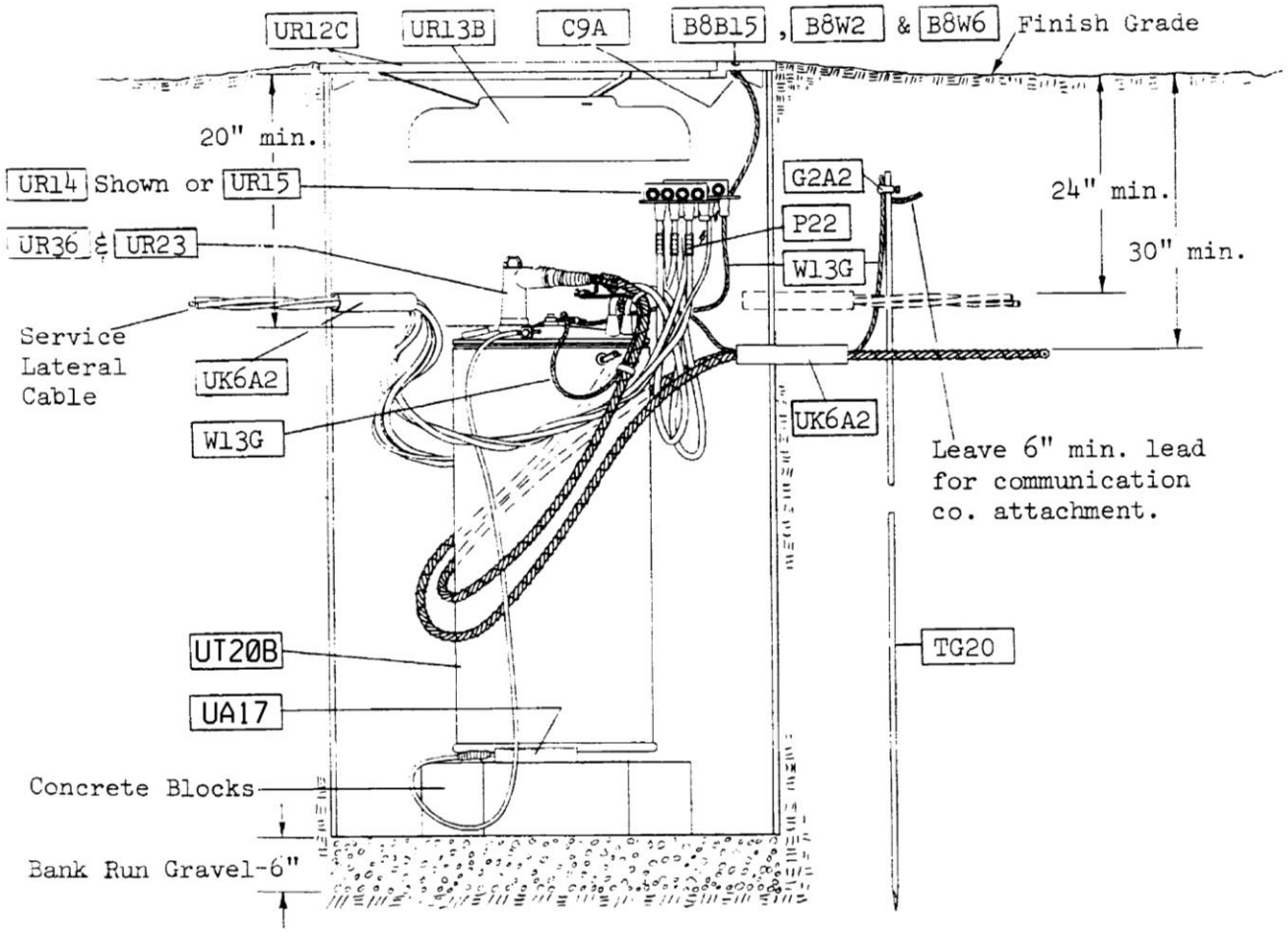




TOP AND FRONT ELEVATION – SINGLE PHASE SUBMERSIBLE TRANSFORMER
25 kVA IN A 36 INCH DIAMETER X 72 INCH DEEP ENCLOSURE

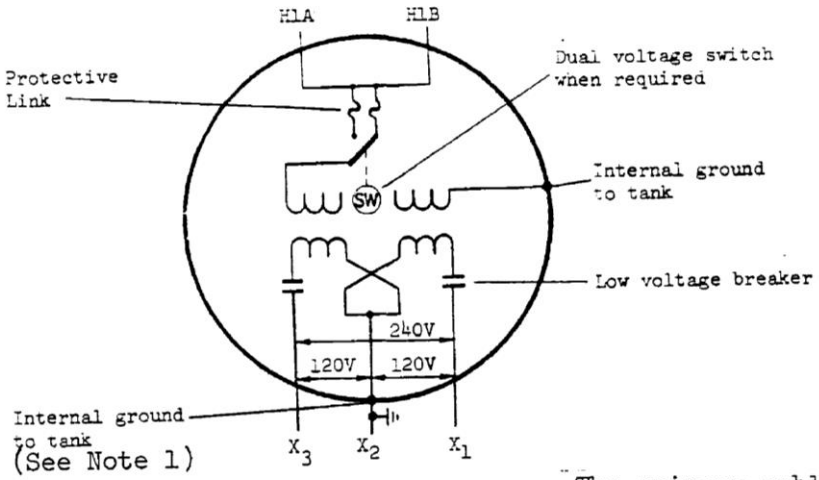
FOR MAINTENANCE PURPOSES ONLY



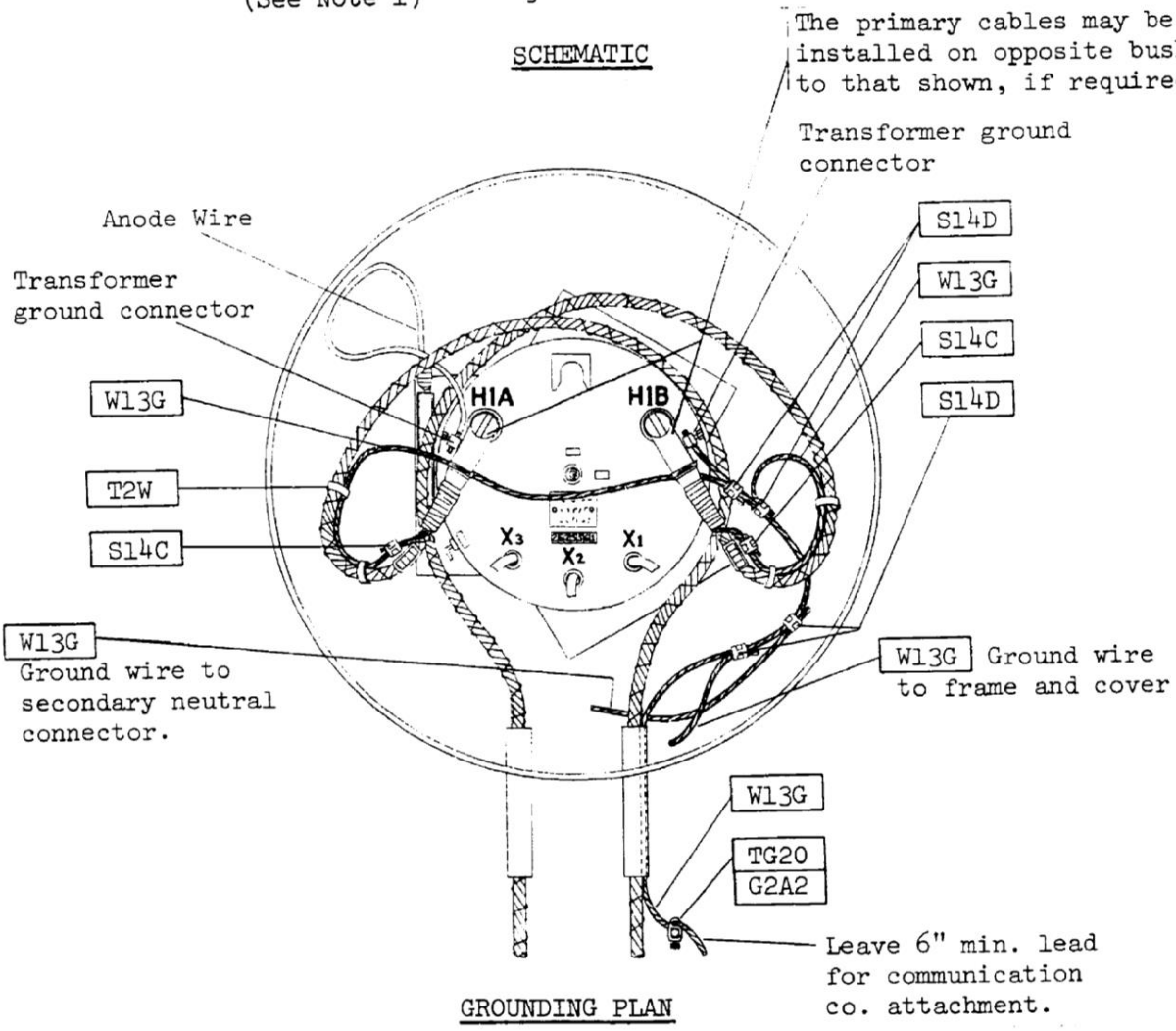


TOP AND FRONT ELEVATION – SINGLE PHASE SUBMERSIBLE TRANSFORMER 50, 75 OR 100 kVA IN A 48 INCH DIAMETER X 84 INCH DEEP ENCLOSURE

FOR MAINTENANCE PURPOSES ONLY



SCHEMATIC

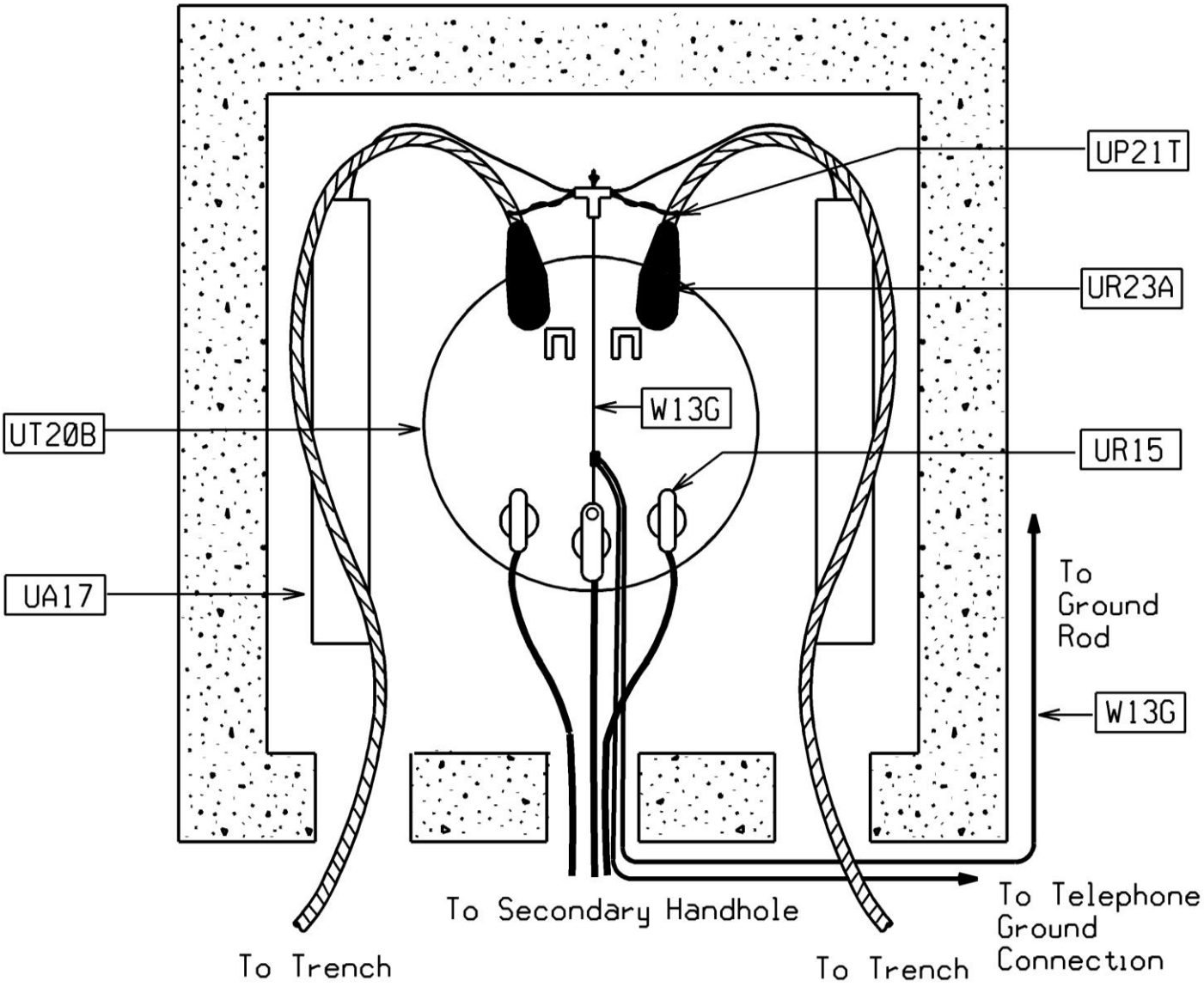


GROUNDING PLAN

Notes:

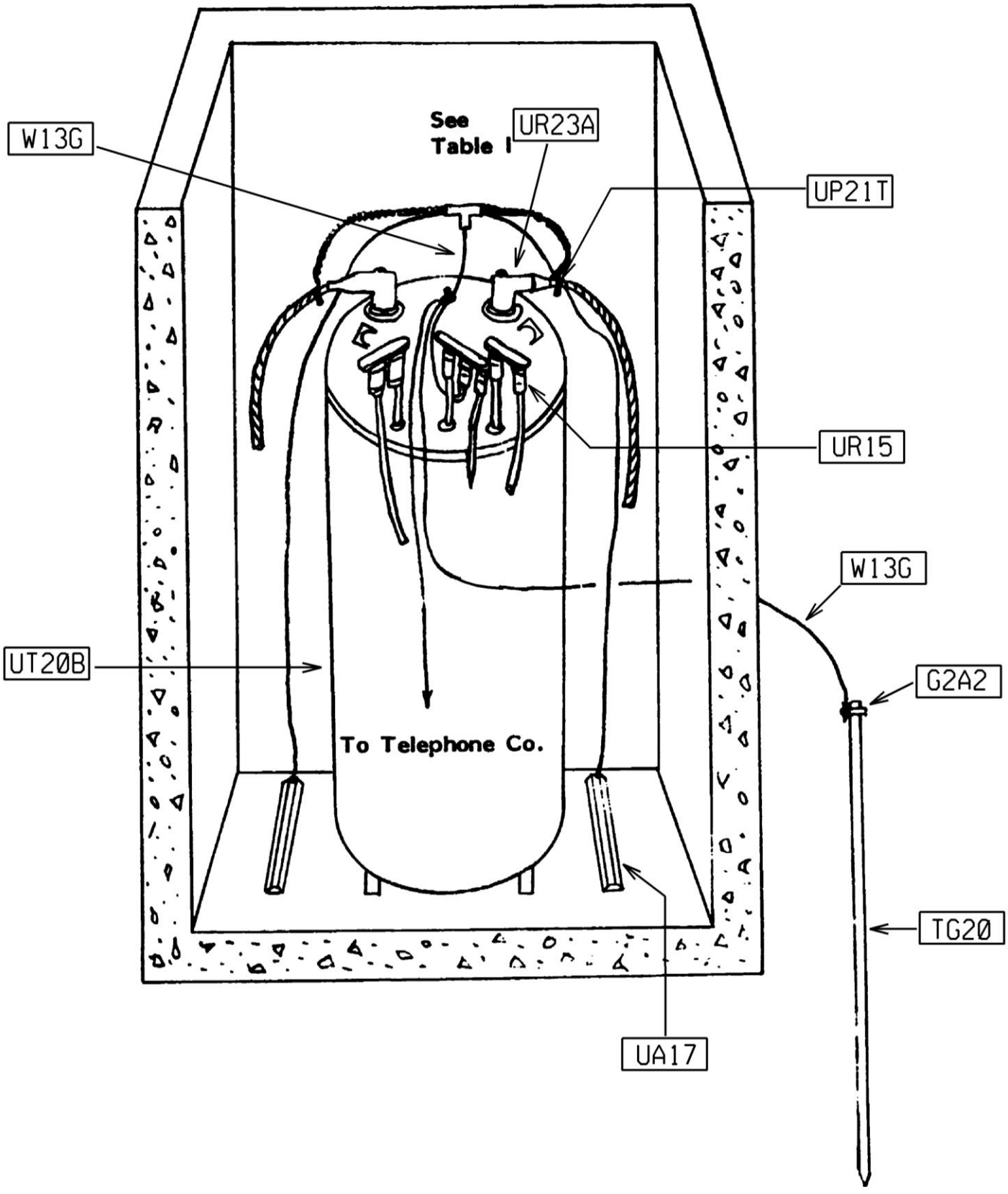
1. Some of the earlier single-phase submersible transformers on the system may not have had the secondary neutral internally grounded. Therefore, on all installations, the secondary neutral shall be externally grounded. The transformer shall be de-energized if this external secondary neutral ground connection is to be disconnected for any reason.
2. Secondary, service and street light cable and connectors not shown for clarity.

SCHEMATIC AND GROUNDING PLAN SINGLE PHASE SUBMERSIBLE TRANSFORMER			
ppl	**UNDERGROUND CONSTRUCTION STANDARD**	**PAGE NUMBER**	**ISSUE**
		45-139	**2/06**



Transformer Size	Transformer Lead Size	Secondary To First Handhole	
		Size	Material Specification No.
15 & 25 kVA	2/0 Cu.	2-350 kcmil AL & 1-4/0 AL Neutral	5011
37.5 & 50 kVA	4/0 Cu.		
75 & 100 kVA	500 kcmil Cu.	2-500 kcmil AL & 1-4/0 AL Neutral	4154

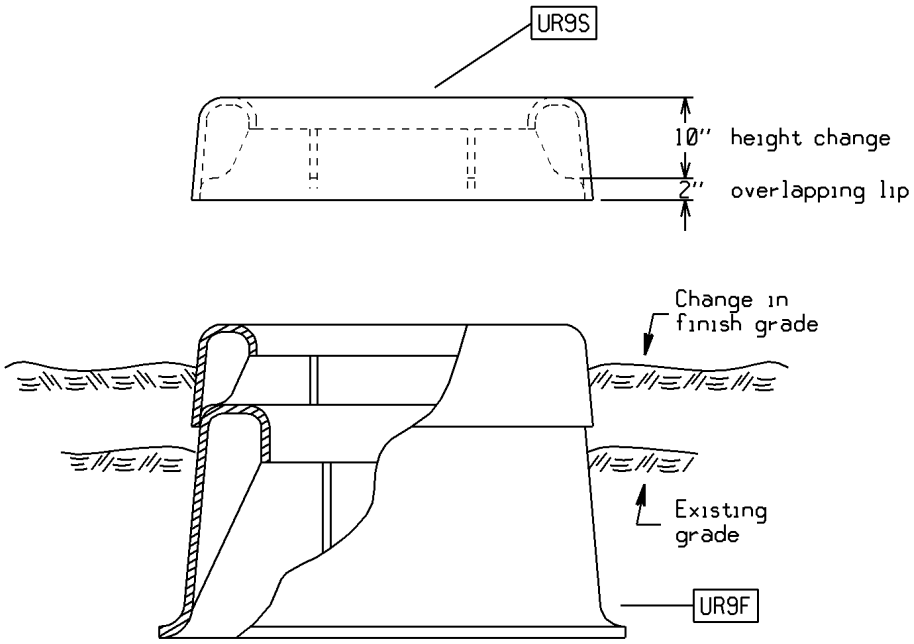
Allow adequate slack in all cables and neutrals to permit removal of transformer.



SCHEMATIC AND GROUNDING PLAN
SINGLE PHASE SUBMERSIBLE TRANSFORMER

	UNDERGROUND CONSTRUCTION STANDARD	PAGE NUMBER	ISSUE
ppl		45-141	2/06

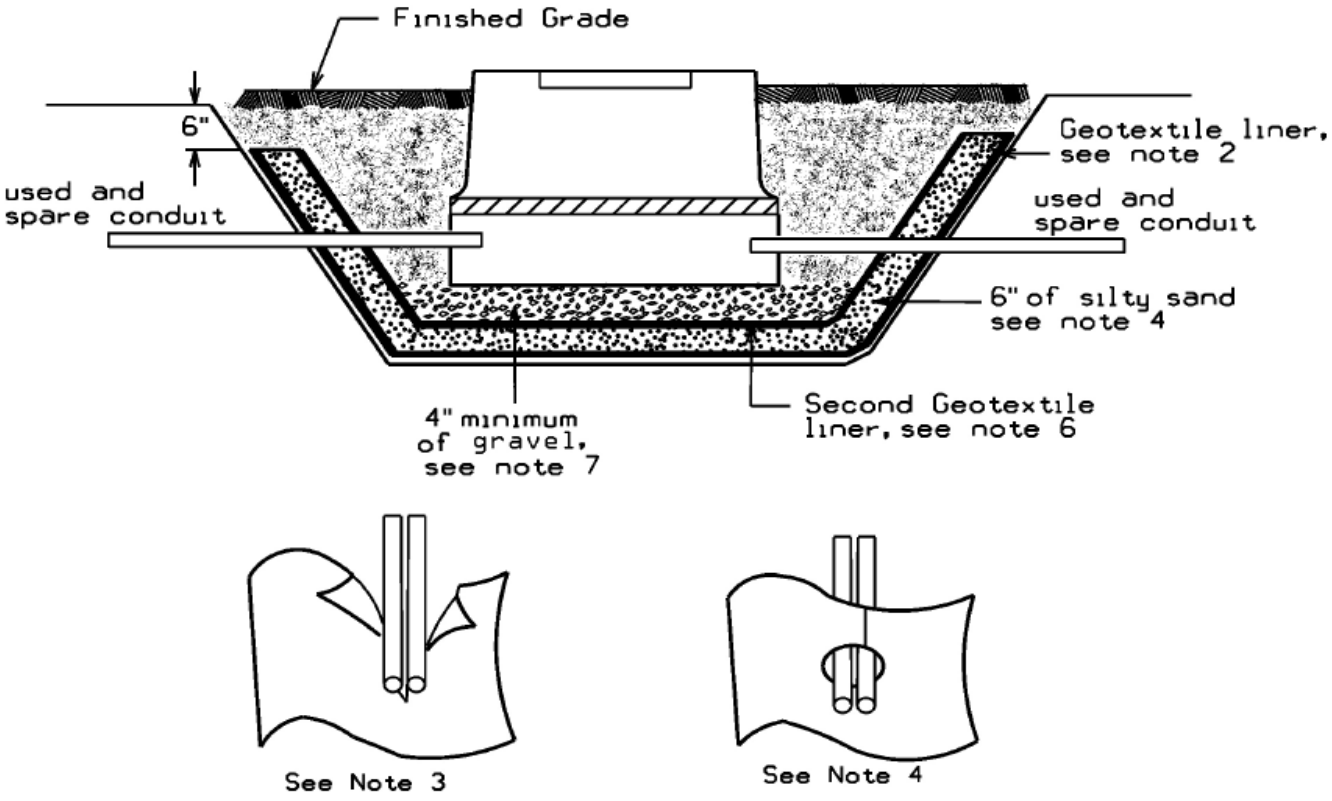
FOR MAINTENANCE PURPOSES ONLY



Notes:

1. When unexpected grade changes require a deeper vault pad, item UR9S will increase the height of the existing pad by 10 inches.

2. Item UR9S is designed to slip over the existing item UR9F and has a 2 inch overlapping lip to prevent slippage and assure a tight fit with the vault pad. No fasteners are required.

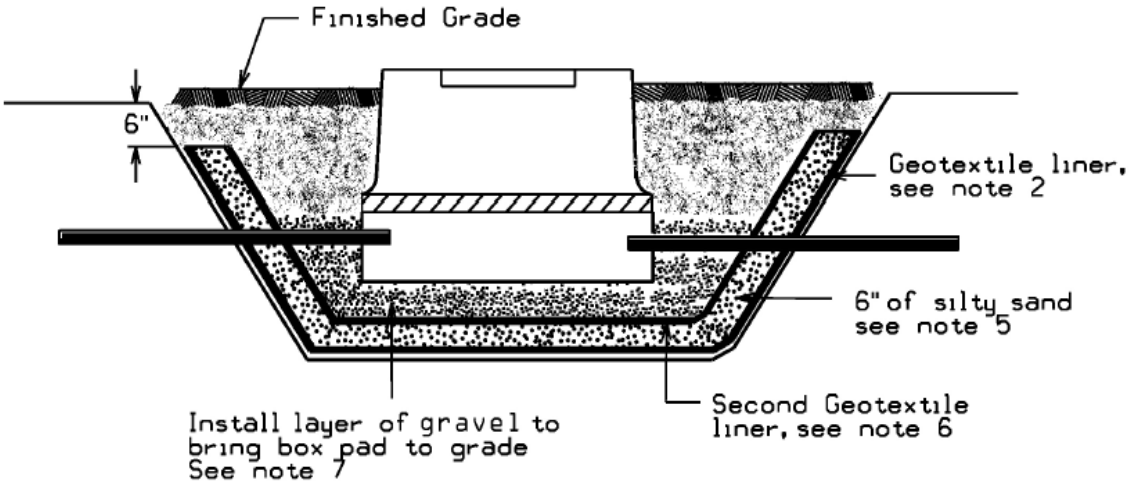


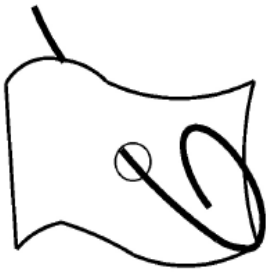
New Standard

Reference drawing taken from the Electric System Bulletin No 759A, page 24 (Figure 19.0-1)

Notes:

1. Dig out at least an additional foot on the bottom and sides of the boxpad area and stub out conduits out into the pit.
2. Install geo-textile liner (Item ID# F70) inside pit along the bottom and sides up to 6” from finish grade.
3. Make vertical cuts in the liner to accommodate conduits.
4. Overlap the liner flaps around the conduit and seal the liner seam and in between conduits with expanding foam (Item ID# UF10).
5. Fill in area with 6” of compacted silty sand.
6. Install second layer of geo-textile liner by repeating steps 2 and 3.
7. Install a minimum of 4” of gravel base for boxpad to be at proper grade.
8. Set boxpad and make up conduits into it.
9. Install secondary handhole (Item ID# UR10G) and connecting conduit(s) behind transformer boxpad, outside of oil containment.
10. Install ground grid and backfill after company inspection.





New Standard

Reference drawing taken from the Electric System Bulletin No 759A, page 25 (Figure 19.0-2)

Notes:

1. Dig out at least an additional foot on the bottom and sides of the boxpad area and stub out conduits out into the pit.
2. Install geo-textile liner (Item ID# F70) inside pit along the bottom and sides up to 6” from finish grade.
3. Make small holes in the liner and feed primary and secondary cables through holes into pit.
4. Once cables are pulled, seal the liner around the cables with expanding foam (Item ID# UF10).
5. Fill in area with 6” of compacted silty sand.
6. Install second layer of geo-textile liner and cut holes for cables as noted in step 3.
7. Install layer of gravel for cable routing and for boxpad base to be at proper grade.
8. Set boxpad, train cables into boxpad and backfill on top of cables with sand.
9. Install secondary handhole (Item ID# UR10G) and secondary cables behind transformer boxpad, outside of oil containment.
10. Install ground grid and backfill after company inspection.

Version	Date	Modification	Author(s)	Approval by (Name/Title)
8	7/20	• Updated Section 45.17 – Secondary Handhole Enclosure • Updated Section 45.18 – Secondary cable Straight Splice		
7	7/19	• Added Section 45.26 – Cable Rehabilitation / Replacement Guidelines		
6	7/18	• Added 45-102 – Typical Road Crossing Detail • Page Shift eliminated 45-21 and shifted 45-100 THRU 101		
5	7/17	• Updated 45.19.50 • Corrected figure reference in 45.23 • Updated 45-121, 122, 123, and 124 to 3-D • Added 45-102		
4	7/16	• Updated Section 45.15.20 B,C,D and E • Updated 45.19.40 • Updated 45-21 • Updated drawing 45-127		
3	7/15	• Revised Text – Section 45.8.10 • Revised Text – Section 45.1.50 • Revised Text – Section 45.20.40 • Added Note 3 – Page 45-109 • Updated Pages 45-122, 45-123 & 45-124		
2	7/12	• Added Section 45-19.35 – Transformer Oil Containment • Added New Construction Standards 45-143, Single Phase Oil Containment – Conduit System • Added New Construction Standards 45-144, Single Phase Oil Containment – Direct Buried System		
1	7/11	• Added Section 45.25 - CUSTOMER LOAD AND VOLTAGE DROP CALCULATION		

46.0 GENERAL

This Section provides an overview of outdoor lighting utilized throughout the Company service territory. The intent is to provide the user with a basic knowledge of the limitations and capabilities of the luminaires offered by the Company that can be passed on to customers as an aid in selecting the luminaire that will best meet their lighting need. This is not intended to be a substitute for a formal lighting layout.

46.0.10 Light Sources

All of the Company's luminaires use the following lamp sources.

Table 1
Lamp Sources

Light Source	Color Output	Comment
Mercury Vapor (MV)	Blue / White	Obsolete light source. Luminaires can no longer be purchased. Lamps are available for maintenance of existing installations.
High Pressure Sodium Vapor (HPS)	Orange	Most efficient light source used for all general illumination requirements.
Probe Start Metal Halide (MH)	White	Obsolete light source. Luminaires can no longer be purchased. Lamps are available for maintenance of existing installations.
Pulse Start Metal Halide (PSMH)	White	Used where light output color is a primary concern.
Light-Emitting Diode (LED)	White	Approved for use in roadway applications only in towns with tariff agreements. This source will eventually become predominant luminaire.

Supersedes 7/09 Issue – Revised Table 1.

46.0.20 Lighting Control

Company luminaires are designed for dusk to dawn operation using photoelectric controls. Photoelectric controls are factory calibrated to "turn on" the luminaire when the natural light level falls to 1.5 foot-candles. This occurs at approximately 16 minutes after sunset and results in approximately 4,175 luminaire burning hours per year.

46.0.30 Horizontal Roadway Luminaires

Horizontal roadway luminaires are designed for roadway illumination applications. A horizontal roadway luminaire will produce an oval shaped light pattern designed to throw the light output up and down the roadway a greater distance than across the roadway. The area a horizontal roadway luminaire can cover is directly dependent on the mounting height of the luminaire.

46.0.40 Floodlight Luminaires

Floodlight luminaires are designed to meet the needs of non-roadway illumination applications. They are designed to focus a high level of illumination on a specific area. Their primary application is commercial and industrial security lighting.

46.0.50 Private Area Luminaires

Private area luminaires are general purpose luminaires designed for non-roadway illumination applications. They produce a circular light pattern in a small concentrated area. These luminaires are primarily designed for residential security applications.

46.0.60 Post Top Luminaires

Post top luminaires are historic or contemporary style decorative luminaires designed to be mounted on metal or fiberglass posts, at a mounting height of 16 feet or less. Most post top luminaires produce an oval shaped light pattern identical to horizontal roadway luminaires. Because of the lower mounting heights, luminaire spacing needs to be much closer than that of horizontal roadway luminaires to produce an equivalent illumination level. Specific poles are available to complement the decorative style of post top luminaire offerings.

46.0.70 Teardrop Luminaires

Teardrop luminaires are decorative luminaires designed for roadway illumination applications. They are mounted at a nominal 25 foot height and produce an oval shaped light pattern identical to horizontal roadway luminaires. Specific decorative poles are available to complement the historic teardrop luminaire style.

46.0.80 Architectural Luminaires

Architectural luminaires (also known as “shoebox” luminaires) are a contemporary style decorative luminaire used in general illumination applications. They are mounted only on square shaft, architectural style, poles.

Supersedes 1/07 Issue – Revised mounting height dimension in paragraph 46.0.60.

46.1 DEFINITIONS

Table 2
Commonly Used Outdoor Lighting Terms Defined

TERM	DEFINITION
Air Lamp:	A failure mode for a high intensity discharge lamp where the vacuum is lost within the glass bulb and the lamp becomes filled with air.
Anchor Base:	A type of outdoor lighting pole base that is bolted to a precast concrete or other type foundation.
Anchor Bolt:	A galvanized steel bolt embedded in concrete that is used to secure an anchor base pole.
Anchor Bolt Projection:	The length of anchor bolt that projects above the top of a precast concrete lighting foundation.
Arc Tube:	A gas filled glass tube within a high intensity discharge lamp that gives off illumination when energized with an electric current.
Architectural Luminaire:	A contemporary style decorative luminaire with a rectangular shaped housing. Also commonly called a “shoebox” or “rectilinear” luminaire.
Architectural Pole:	A square shaft pole designed for use with an architectural luminaire.
Arm:	A device utilized on metal or fiberglass pole to extend and hold the luminaire out over a roadway surface.
Ballast Transformer:	An auxiliary device used with a high intensity discharge lamp to obtain necessary circuit conditions for starting and operating the lamp. Reactor Ballast = A single winding ballast transformer. CWA Ballast **= C**onstant-**W**attage **A**utotransformer. = A two winding ballast transformer.
Base:	A precast or poured concrete device used to mount an anchor base type pole. Also commonly called a “foundation”.
Bird Guard:	A device in a horizontal roadway luminaire used to prevent birds and squirrels from entering the luminaire housing.
Bolt Circle: (BC)	A measurement to describe the positioning of anchor bolts on a precast concrete lighting foundation.
Bracket:	A device installed on a wooden distribution pole which is used to extend and hold a luminaire out over a roadway surface.
Break-Away:	A safety device used to enable an anchor base pole to break away from its foundation in the event the pole is struck by a motor vehicle.
Bulb:	The glass envelope component of a lamp.
Button Control:	A photoelectric control used in a decorative luminaire where only the light sensing device is visible from the outside of the luminaire.
Cobra-Head:	Another name for a horizontal roadway luminaire.
Cutoff: • *(non-cutoff)* • *(semi-cutoff)* • *(cutoff)* • *(full cutoff)*	An IES term used to describe how much illumination an outdoor luminaire allows to go skyward.
Cycling:	A failure mode of a high pressure sodium vapor lamp where the lamp continuously cycles “on” and “off”.
Davit Pole:	A lighting pole whose arm forms a 90 degree sweep.
Effective Projected Area: (EPA)	A measurement in square feet to describe the area of a luminaire with respect to wind displacement.

TERM	DEFINITION
Embedded:	A term used to identify a lighting pole that is installed by direct burial of the bottom portion of the pole shaft in the ground.
Festoon Outlet:	An electrical receptacle located on an outdoor lighting pole.
Finial:	A decorative ornament affixed to the top of a luminaire.
Floodlight Luminaire:	An outdoor luminaire used to flood an area with a concentrated large quantity of illumination.
Foot-candle: (FC)	A standard measurement of illumination. One foot-candle = the light intensity on a 1 square foot surface located one foot away from a 1 lumen light source.
Foundation:	A supporting structure for an anchor base pole – usually precast concrete.
Getter Flash:	A device within a high intensity discharge lamp used as a cleaning agent to maintain a pure vacuum within the lamp bulb.
Glare:	Light output that is offensive or blinding to the viewer.
Grounding Conductor:	An electrical conductor used to connect a metal pole or luminaire housing to earth potential.
High Intensity Discharge: (HID)	A method of producing illumination by passing an electric current through a gas filled arc tube.
High Pressure Sodium Vapor (HPS):	A type of high intensity discharge light source that emits an orange colored light output.
Horizontal Roadway Luminaire:	A type of outdoor luminaire used for roadway illumination where the lamp is operated in a horizontal position.
IES:	Illuminating Engineering Society
Igniter:	An auxiliary device used to start a high intensity discharge lamp.
Incandescent:	A type of light source where an electric current is passed through a filament wire.
Lamp:	A device that transforms electrical energy into light usually consisting of a base, bulb and light emitting device.
Lens:	A glass or plastic device in a luminaire that redirects and controls the distribution of light by refraction.
Light-Emitting Diode (LED)	A method of producing illumination by utilizing diodes that emit light when connected in a circuit.
Light Trespass:	The distribution of illumination output into unwanted areas.
Lumen:	A measure of illumination output.
Luminaire:	A complete lighting unit consisting of a housing, terminal board, auxiliary electrical components, reflector/refractor and lamp socket. The luminaire is designed to distribute the illumination output and to position and protect the lamp.
Mercury Vapor: (MV)	A type of high intensity discharge light source that emits a blue/white colored light output.
Metal Halide: (MH)	A type of high intensity discharge light source that emits a white colored light output.
Mounting Height: (MH)	The vertical distance measured from ground level to a luminaire.
Multiple Circuit:	A street lighting circuit where multiple luminaires are electrically connected in parallel and operate on a nominal secondary voltage.
Multiple Control Relay:	A device used to group control a multiple number of luminaires

TERM	DEFINITION
NEMA:	**N**ational **E**lectrical **M**anufacturers **A**ssociation.
NEMA Luminaire:	A type of luminaire commonly used in rural or residential security lighting installations.
Optical Assembly:	The refractor and reflector components of a luminaire that control the illumination output.
PECR:	**P**hoto-**E**lectric **C**ontrol **R**eceptacle.
Photoelectric control: (PEC)	A device that switches luminaires on or off in response to natural light levels.
Photometrics:	A description of illumination output qualities and characteristics of a luminaire.
Pole Access Handhole:	An opening near the base of an outdoor lighting pole to provide access to the electrical wiring connections.
Post Top Luminaire:	A type of decorative luminaire that is installed directly on the top of a pole.
Powerbracket:	A type of luminaire commonly used in rural or residential security lighting installations.
Rectilinear Luminaire:	A contemporary style decorative luminaire with a rectangular shaped housing. Also commonly called a “shoebox” or “architectural” luminaire.
Red Cap:	A device used in place of a twistlock photoelectric control to leave the lamp load permanently “off”.
Reflector:	A surface of polished or painted metal, mirrored glass, or plastic, shaped to control and re-direct the illumination output.
Restrike Time:	The amount of time needed for an HID lamp source to restart after a momentary interruption in electrical power.
Series Circuit:	A street lighting circuit where the luminaires are electrically connected in series to one another.
Shoebox Luminaire:	A contemporary style decorative luminaire with a rectangular shaped housing. Also commonly called a “rectilinear” or “architectural” luminaire.
Shorting Receptacle Cap:	A device used in place of a twistlock photoelectric control to leave the lamp load permanently “on”.
Shroud:	A device used at the base on an anchor base pole to cover the anchor bolts.
Slipfitter:	The portion of a luminaire whose purpose is to attach the luminaire to an arm or bracket.
Starter:	An electronic device utilized to provide voltage and current for initial illumination of an HID lamp.
Teardrop Luminaire:	A decorative style pendant luminaire that is shaped like a teardrop.
Tenon:	A device on a pole designed to accept the luminaire slipfitter.
Transformer Base: (T-Base)	An enclosure installed at the base of an anchor base pole that is used to house the luminaires ballast transformer or other electrical equipment.
Underpass Luminaire:	A specialty luminaire that is designed to provide illumination under a highway bridge or in a tunnel.
Vandal Shield:	An accessory device used on an outdoor luminaire to provide protection from vandalism.
Visor:	An accessory device used on an outdoor luminaire to restrict and limit the outer limits of the illumination output.

46.2 IES LIGHT DISTRIBUTION PATTERNS

The Illuminating Engineering Society (IES) has a three part system to define the light output pattern of horizontal roadway, post top, and other luminaires commonly used in roadway lighting service.

46.2.10 Spacing Classification

This defines how far up and down the length of the roadway the luminaire can cover. This distance is expressed as a factor of the mounting height (MH) of the luminaire.

Table 3

Spacing Classification	Length of Main Beam	Maximum Pole Spacing
SHORT	1.0 to 2.25 MH	4.5 MH
MEDIUM	2.25 to 3.75 MH	7.5 MH
LONG	3.75 to 6.0 MH	12.0 MH

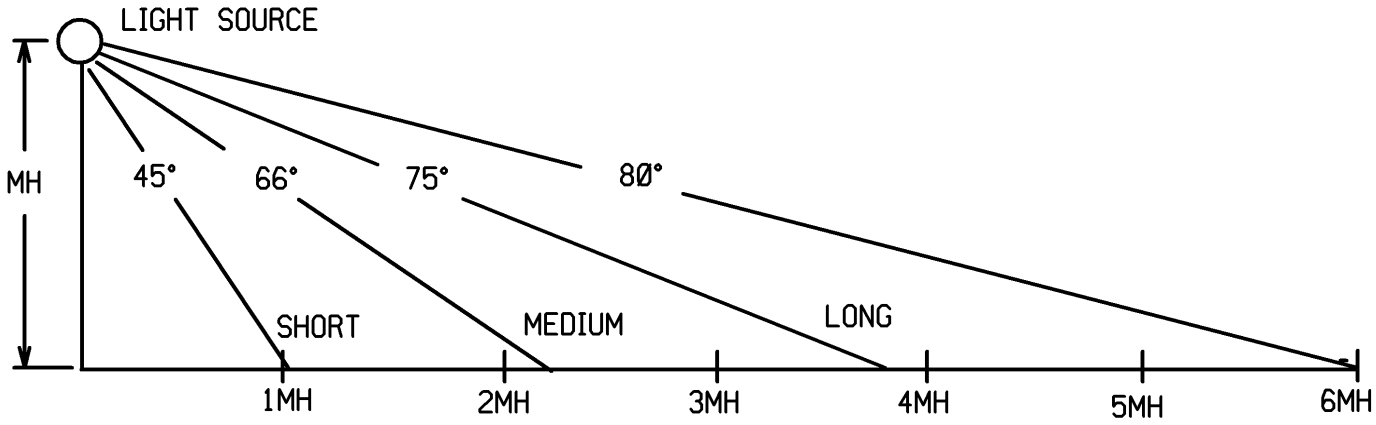


Figure 1
IES Spacing Classification

46.2.20 Glare Control Classification

The glare control classification defines how much of the light output is allowed to go above the 80 degree and 90 degree horizontal plane (skyward) of the luminaire.

Table 4

Glare Classification	Allowable Illumination Between The 80° and 90° Plane	Allowable Illumination Above the 90° Plane
FULL CUTOFF	< = 10 %	0 %
CUTOFF	< = 10 %	< = 2.5 %
SEMI-CUTOFF	< = 20 %	< = 5.0 %
NON-CUTOFF	no limitation	no limitation

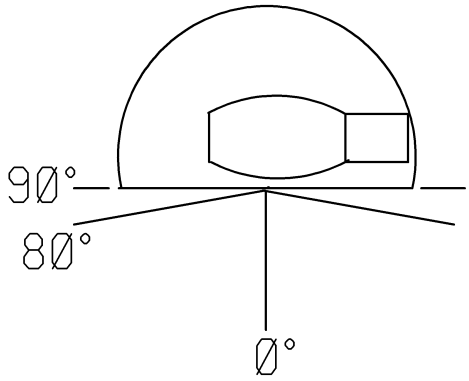


Figure 2
Glare Control Classification

46.2.30 Width Classification

This defines how far across the width of the roadway the main beam will shine. This distance is expressed as a factor of the mounting height (MH) of the luminaire.

Table 5

Width Classification	Definition
Type I	Intended to be located over the center of relatively narrow residential roadways.
Type II	Intended to be located near the side of a roadway not exceeding 1.75 MH in width.
Type III	Intended to be located near the side of a roadway not exceeding 2.75 MH in width.
Type IV	Intended to be located near the side of a roadway greater than 2.75 MH in width.
Type V	Provides a circular light pattern of equal intensity in all directions.

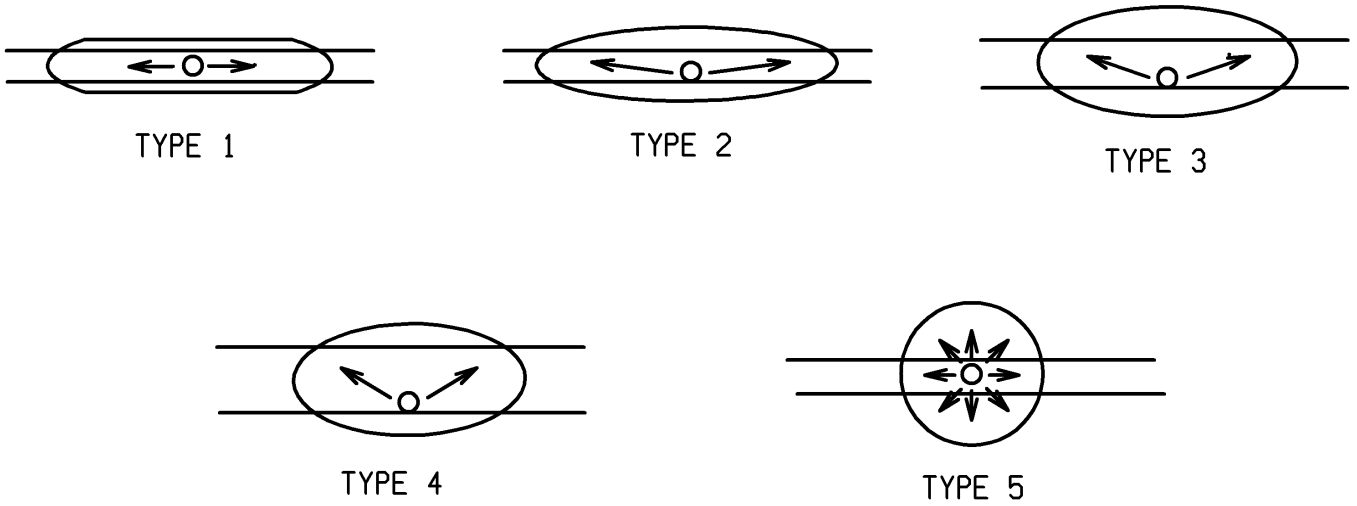


Figure 3
Width Classification

46.2.40 Company Luminaires

The IES Classification information for all luminaires used by the Company is found in STANDARDS Section 49 – Materials Index – Outdoor Lighting.

46.3 ROADWAY LUMINAIRES

This Section provides information for the proper application of horizontal roadway luminaires and other decorative pendant style luminaires with an IES type II or III distribution.

46.3.10 Mounting Height

Roadway luminaires must be installed at a sufficient height to minimize the glare to approaching traffic and at the same time provide an acceptable level of illumination at the roadway surface. The mounting height of a light source will affect the intensity of illumination, uniformity of brightness, area covered, and relative glare produced by the luminaire. Higher mounting heights will provide greater area coverage, more uniformity, and a reduction of glare, but a lower overall illumination level.

46.3.20 Overhead Supplied Installations

For lighting installations on wood distribution poles, the actual luminaire mounting height will be affected by other distribution equipment on the pole. In every case, adequate clearances, as specified in the Overhead Construction Standards Manual – Section 19, must be maintained. The roadway bracket rise will typically add 30 inches (±) to the luminaire mounting height as measured from the bracket through bolt height.

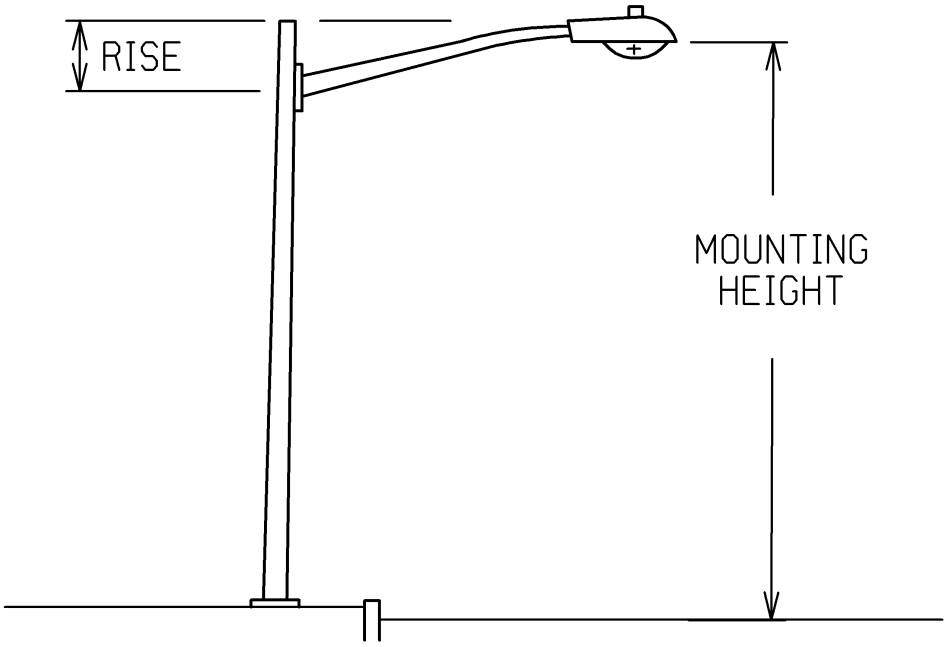


Figure 4
Luminaire Mounting Height

46.3.30 Recommended Minimum Roadway Luminaire Mounting Heights

Table 6

Luminaire Wattage	Minimum Mounting Height
50 Watt – 250 Watt	20 Feet
400 Watt	30 Feet
1,000 Watt	35 Feet

Supersedes 1/07 Issue – Minor text revision to paragraph 46.3.20.

46.3.40 Arm / Bracket Length

The luminaire arm / bracket must have sufficient length to properly place the luminaire over the roadway surface in order to take best advantage of the luminaire light distribution pattern. Roadway luminaires with IES type II or III light distribution are designed to be mounted over the roadway surface near one side and still project useful light output across the entire roadway width. Common practice is to have the luminaire's refractor overhang the roadway surface by four feet.

46.3.50 To Determine Arm / Bracket Length

Add setback distance (determined by field measurement) to arm / bracket overhang distance (always 3 feet). The result will be the minimum arm / bracket length required. Installation of the luminaire will provide the additional distance needed to create a four foot overhang.

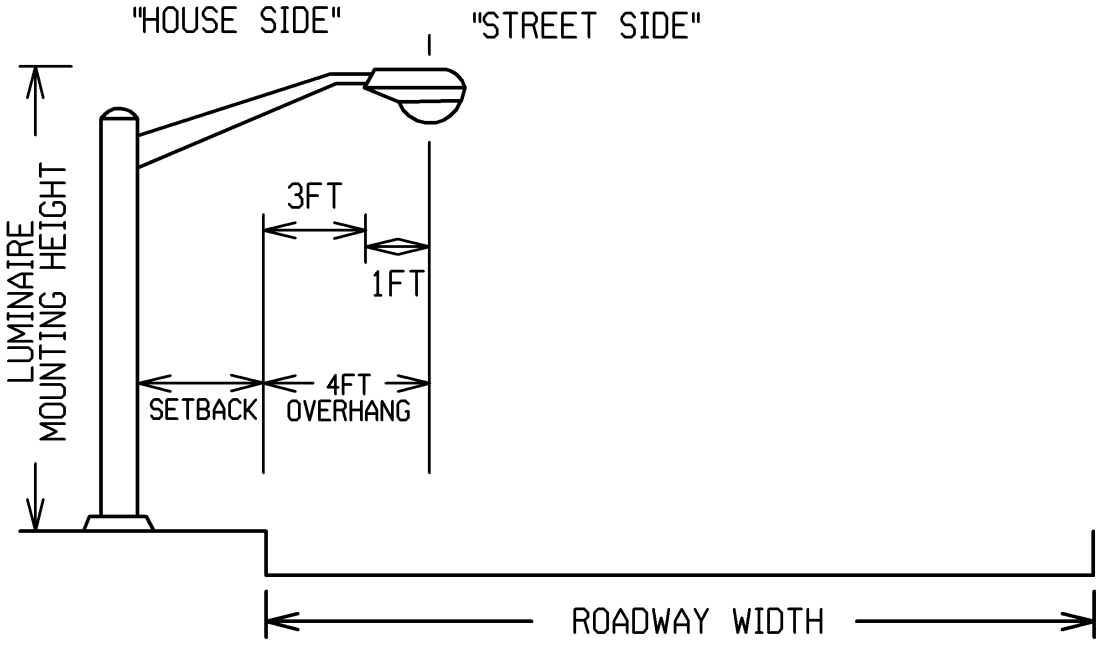


Figure 5
Arm / Bracket Length

46.3.60 Roadway Width

Roadway luminaires with an IES type II light distribution pattern are designed for roadways where the width does not exceed 1.75 times the luminaire mounting height. IES type III roadway luminaires are designed for roadway widths up to 2.75 times the luminaire mounting height.

If the roadway has multiple travel lanes or is divided, a roadway luminaire with Type II or Type III distribution will not be able to adequately illuminate the entire roadway width. A possible solution is to install luminaires on both sides of the roadway opposite one another.

46.3.70 Luminaire Adjustment

Tilting the luminaire five degrees upward will increase the "street side" illumination (and decrease the "house side" illumination). This may be a solution when a shorter arm / bracket must be used because of insufficient pole space or clearances.

46.3.80 Exceptions

Field conditions, such as trees, may necessitate using a different arm / bracket length than would normally be called for.

46.3.90 Luminaire Spacing

Luminaires should be spaced to allow the light output between adjacent luminaires to overlap. This will eliminate dark spots midway between two luminaires and contribute uniformity to the overall lighting installation.

46.3.100 Roadway Luminaire Selection

PPL offers horizontal roadway luminaires with semi-cutoff distribution (globe) and full cutoff distribution (flat glass). In the absence of specific direction from the customer, the default luminaire choice for horizontal roadway luminaires shall be the cutoff / full cutoff (flat glass) units.

Supersedes 1/07 Issue – Added paragraph 46.3.100.

46.4 FLOODLIGHT LUMINAIRES

This Section provides information for proper application of floodlight luminaires.

46.4.10 Mounting Height

Floodlight luminaires must be installed at a sufficient height in order to maximize the efficiency of the illumination output and at the same time control glare. The recommended mounting height for a floodlight luminaire is one half the distance across the area to be illuminated.

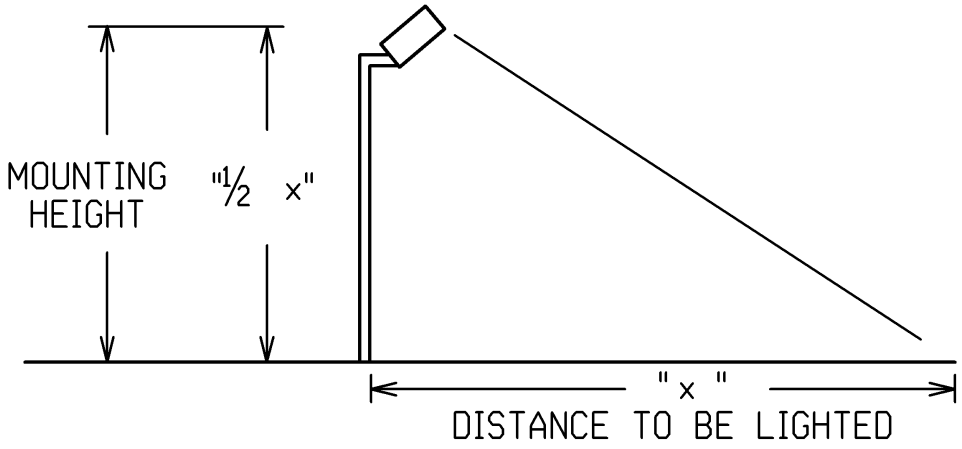


Figure 6
Floodlight Mounting Height

46.4.20 Clearance To Overhead Conductors

For floodlight installations mounted on wood distribution poles, the actual floodlight mounting height may be limited by other distribution equipment on the pole. In every case, adequate clearances, as specified in the Overhead Construction Standards Manual Section 19, must be maintained.

46.4.30 Aluminum Pendant Pole Installations

Aluminum pendant poles are rated capable of supporting one floodlight luminaire along with one arm and roadway luminaire or two floodlight luminaires with no roadway luminaire. Ratings are based on a sustained 90 mph wind. Consult Standards Engineering if additional loading is required.

46.4.40 Floodlight Aiming

Floodlight luminaires must be properly aimed in order to obtain the desired illumination. Some floodlight luminaires have a sight aiming guide molded into the top of the housing. Follow the manufacturer's instructions.

46.4.50 Vertical Aiming

Vertical floodlight aiming affects the distance a floodlight luminaire can cover. To maximize the useful light output, the floodlight should be aimed ⅔ across the distance to be lighted, or approximately two times the mounting height, whichever value is lower. To minimize glare, a floodlight's vertical aiming point distance should never exceed twice the mounting height. See Figure 7 for details.

Supersedes 1/07 Issue – Minor text revision to paragraph 46.4.20.

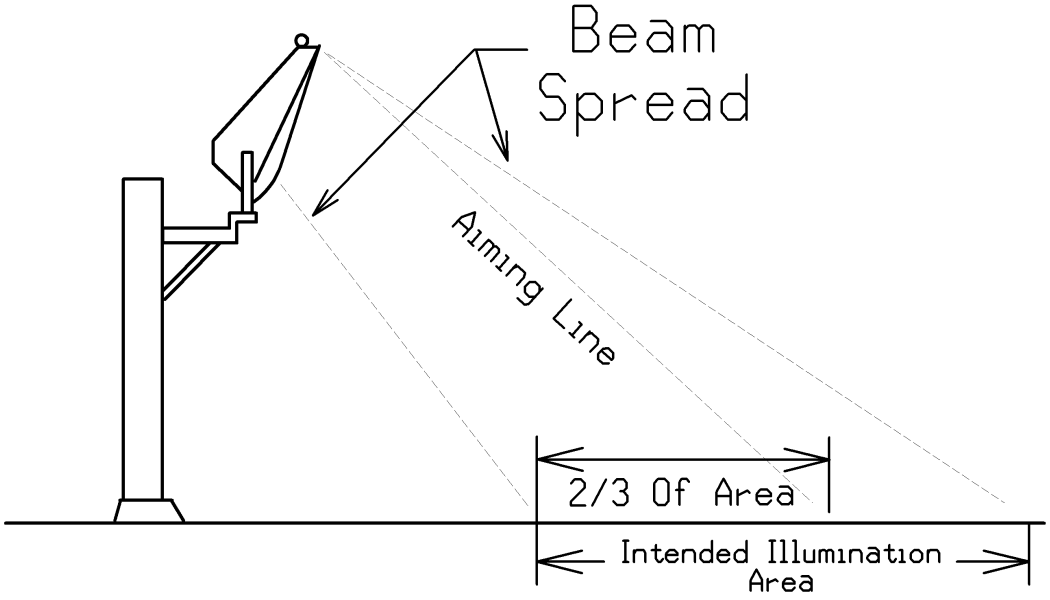


Figure 7
Floodlight Aiming – Vertical

46.4.60 **Horizontal Aiming**

Horizontal aiming must be considered when more than one floodlight is contributing to the illumination output. A floodlight's horizontal beam spread will extend 45 degrees on either side of the aiming line. Floodlight luminaires should be horizontally aimed to allow the light output between adjacent luminaires to overlap. This will contribute to overall uniformity to the overall lighting installation.

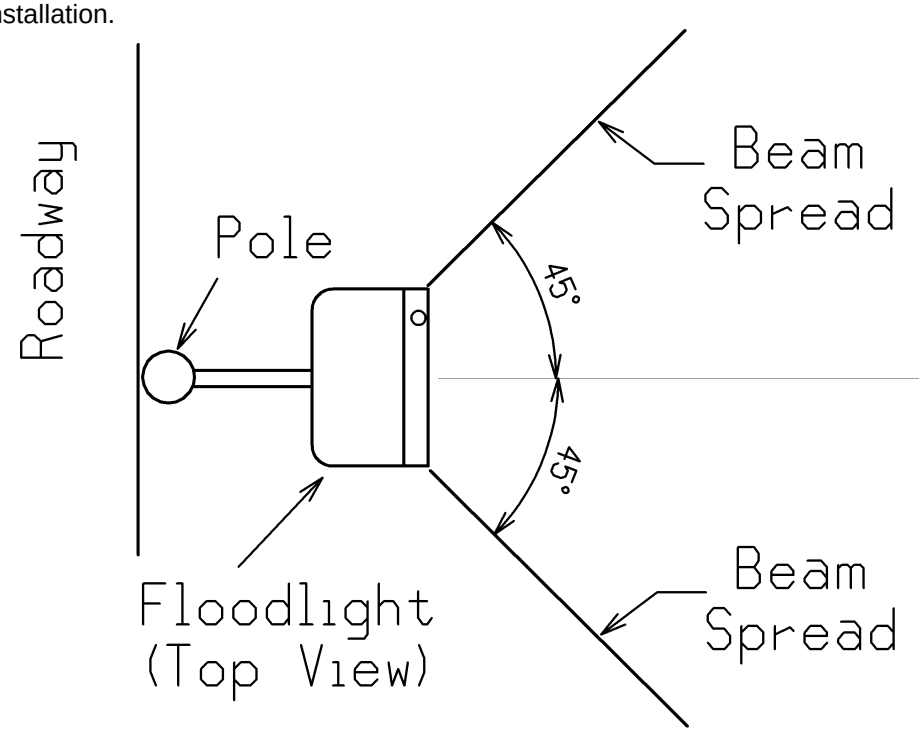


Figure 8
Floodlight Aiming – Horizontal

46.4.70 Pole Spacing

When a floodlighting installation consists of multiple luminaires mounted on different poles, pole spacing needs to be considered. In general, the spacing between adjacent floodlight poles should equal 4 times the luminaire mounting height.

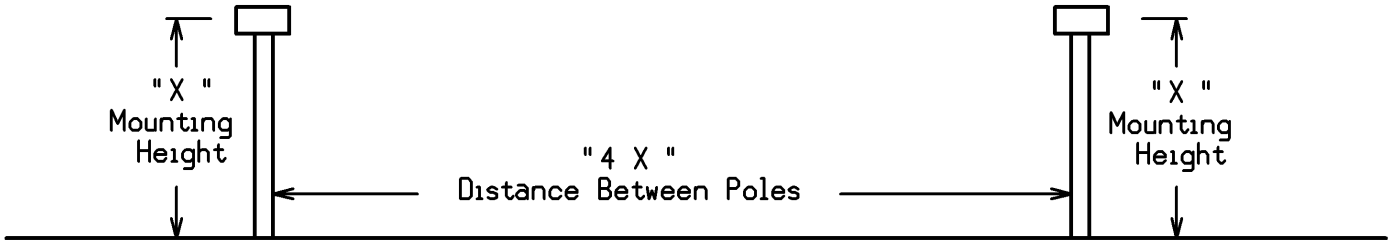


Figure 9
Floodlight Pole Spacing

46.4.80 Light Pollution

Use care in the aiming of floodlights. Never allow a floodlight's light output to extend onto an adjacent roadway into the face of oncoming traffic. Never install a floodlight across a roadway from the intended illumination area. Always be sensitive to the spilling of unwanted light onto adjacent properties. For tighter control of the light output, consider installing a floodlight visor

46.5 POST TOP LUMINAIRES

This Section provides information for proper application of post top style luminaires.

46.5.10 Mounting Height

Post top luminaires must be mounted at a sufficient height to take best advantage of the luminaire's light output and at the same time minimize glare to approaching traffic. The preferred luminaire mounting height for all new post top installations is 14 feet above grade for roadway installations or 10 feet above grade for pedestrian (town park) applications. In Rhode Island service territories, all post top luminaires shall be mounted at a height of 10 feet or 14 feet as applicable.

46.5.20 Luminaire Orientation

Most post top luminaires that are commonly used throughout the entire Company service territory produce an IES Type III light distribution pattern (oval shaped light output pattern) and are provided with "street side" and "house side" orientation markings to facilitate proper installation. Follow the manufacturer's instructions, supplied with every luminaire, to properly direct the light output pattern.

46.5.30 Luminaire Spacing

Because of their lower mounting height, post top luminaires require a relatively close spacing between adjacent luminaires in order to produce a uniform illumination pattern without dark spots between luminaires. As a general rule, the spacing between adjacent post top luminaires should not exceed 5 times the luminaire mounting height.

46.5.40 Twin Luminaire Installations

Because of their relatively low mounting height, glare to approaching traffic is a primary concern in post top luminaire installations. For this reason, post top luminaires greater than 175 Watts are not offered by the Company. For illumination requirements requiring a light output greater than that available from a 175 Watt luminaire, decorative twin arms are available to enable two post top luminaires to be side-by-side, mounted on the same pole.

46.5.50 Pole Application

Post top style poles are available in either aluminum or fiberglass. As a general rule, metal poles are preferred in "downtown" type applications typically subject to physical abuse from motor vehicle doors, snow plowing, etc. Fiberglass poles are preferred in underground residential developments, town parks, and other areas somewhat protected from such physical abuse.

Supersedes 1/07 Issue – Revised paragraph 46.5.10 – luminaire mounting heights and paragraph 46.5.50 – deleted steel and cast iron.

46.6 ELECTRICAL DESIGN

This Section provides information to aid in the design of underground circuits supplying outdoor luminaires.

46.6.10 Series Circuits

No new series street lighting circuits shall be installed. Existing series circuits shall be converted to multiple operation any time there is a major component failure, additional load to be added, or substantial maintenance is required.

46.6.20 Multiple Circuits

All new underground lighting circuits shall be a multiple design where each individual luminaire is operating on a standard system secondary voltage (120 Volts preferred) and each individual luminaire is controlled by its own individual photoelectric control.

46.6.30 Preferred Underground Supply

The preferred underground supply design is to tap existing secondary mains with an individual radial feed supply to each single street light pole location.

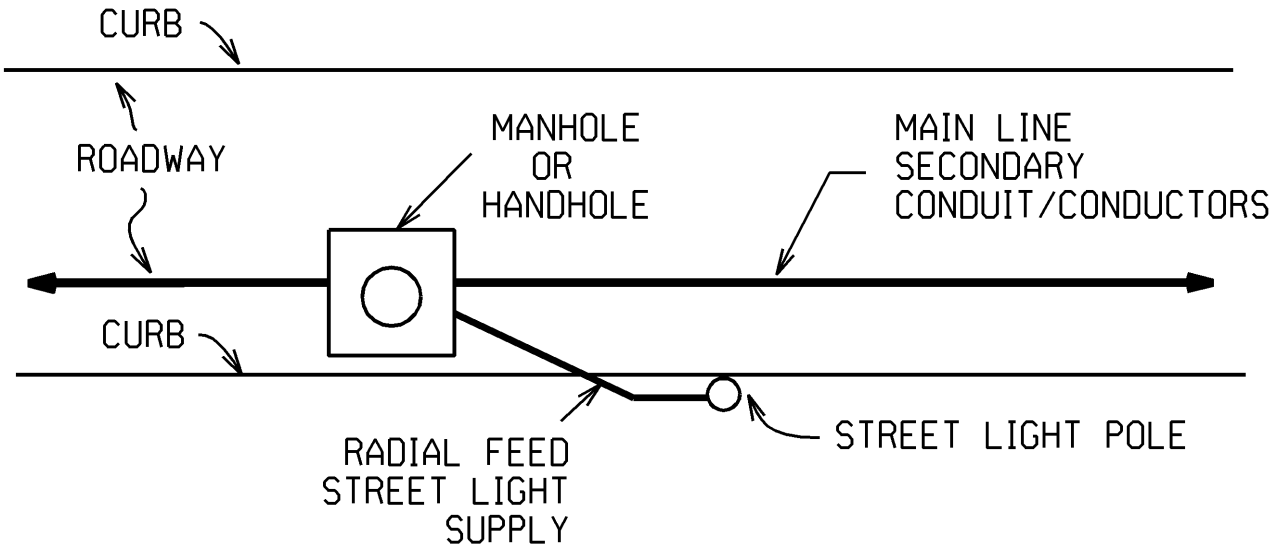


Figure 10
Street Light Supply from Existing Secondary Mains

46.6.40 Alternate Underground Supply

An alternate underground supply design is to provide a dedicated secondary main exclusively for outdoor lighting use and tap multiple luminaires onto this supply circuit at multiple locations. Always install an in ground handhole (STD Item SG10) adjacent to each pole.

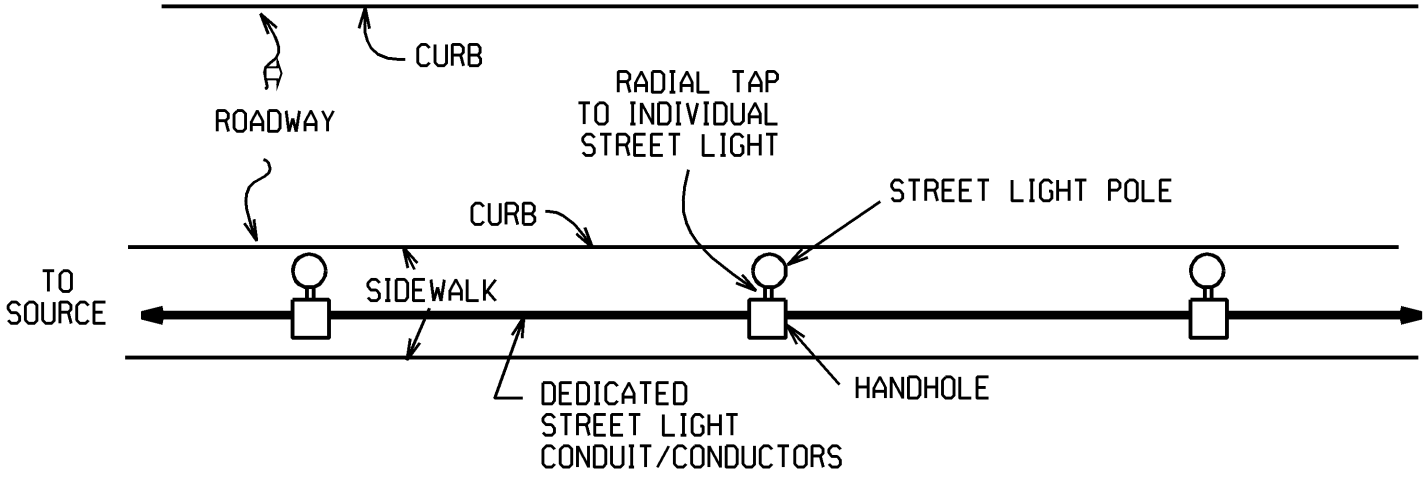


Figure 11
Street Light Supply from Dedicated Secondary Mains

46.6.50 Underground Supply Conductors

The standard underground conductor supplying a single radial fed street light pole location shall be #6 stranded copper. This conductor is available as (2) conductor - BLACK-WHITE – (STD Item SY6A2), or (3) conductor - BLACK-WHITE-RED – (STD Item SY6A3) and is suitable for both direct burial and conduit applications.

Conductor assignment shall conform to the following color code:

BLACK	=	Hot Lead
RED	=	2nd Hot Lead
WHITE	=	Neutral

The underground supply conductors for a dedicated street light supply circuit shall be sized to supply the lighting load with respect to voltage drop. For applications where #6 AWG copper is not adequate, use #2 AWG stranded copper conductors – BLACK-WHITE-RED – (STD Item SY8A3). Underground taps to individual street light pole locations shall always use #6 copper (STD Item SY6A2) between the in-ground handhole and the pole access handhole.

46.6.60 Luminaire Supply Conductors

Use #10 AWG stranded copper conductors – BLACK-WHITE twisted pair - (STD Item SY4A2) in all outdoor lighting installations to connect the luminaire. In underground supplied installations, (on aluminum or fiberglass poles) use #10 AWG conductors from the pole access handhole – up the pole - to the luminaire. For non-metallic poles, also install a #10 AWG stranded copper GREEN conductor (STD Item SY4AG) to ground the metal luminaire housing.

Use #10 conductors on all wood pole, overhead supplied installations to connect the luminaire to the secondary supply.

Supersedes 07/09 Issue – Updated STD Item Numbers.

Conductor assignment shall conform to the following color code:

BLACK = Hot Lead
WHITE = Neutral
GREEN = Luminaire Housing Ground

Prior to the adoption of the standard SY4 street lighting conductors, many luminaire installations in Rhode Island were wired with #12 AWG conductors with THHN insulation.

With the exception of lamp and photocontrol maintenance, whenever the need arises to work on a luminaire wired with the older #12-THHN or #10-XHHW conductors, or when the existing conductor insulation is found to be cracked or deteriorated, the luminaire shall be completely rewired using STD Item SY4 conductors.

In no cases shall luminaire conductors be spliced by any method for any reason.

46.6.70 Electrical Connections

A. Black Lead (hot) **–** Use an in-line fuse holder (STD. Item SZ04A) to connect the underground supply conductors to the luminaire supply conductors. The in-line fuse holder is supplied with a solid copper link. A cartridge type fuse can be substituted when fusing is desired. The in-line fuse holder is designed to pull apart, in the event of a pole knockdown, and leave no exposed energized wires.

B. Neutral Lead – Use a gel-wrap connector (STD. Item SZ07) to connect the underground supply conductors to the luminaire supply conductors.

46.6.80 Fusing

A. Radial Supplied Pole Locations **–** A 10 A midget cartridge fuse (STD. Item SZ05B), installed in the in-line fuse holder, is recommended to provide elevated voltage protection in the event of a short circuit in the luminaire supply conductors.

B. Dedicated Underground Supply Circuits **–** Cartridge style fuses in watertight housings may be installed at strategic circuit locations in dedicated underground lighting supply circuits as a sectionalizing device to add in finding underground faults. Fuses shall be sized with respect to the conductor size.

C. Standard Fuses - Refer to Standards page 49-SZ06 for details on cartridge fuses approved for use in outdoor lighting applications.

Supersedes 07/13 Issue – Added information on maintenance of fixture conductors and information on standard fuses for lighting circuits.

46.7 LUMINAIRES

This Section provides general requirements for all luminaires used throughout the Company service territory.

46.7.10 Utility Grade

All luminaires shall be designed for long term reliable use in street and area lighting applications. Replacement parts are stocked for all HID luminaires including starters, ballasts and lamps. LED luminaires have no replaceable parts.

46.7.20 Voltage Rating

The standard Company luminaire is designed to operate from a 120 VAC, 2 wire source. Luminaires with other voltage ratings are available as non-standard luminaires to meet specific application needs.

46.7.30 Ballast Selection

All Company luminaires using high intensity discharge lamp sources require an internally mounted ballast transformer. LED's do not require ballasts. Two types of ballast transformers are available for use.

Table 7
Ballast Selection

Ballast Type	Ballast Features
Reactor Ballast	● Single coil ballast wired in series with the lamp. ● Non-regulating – normal power factor ballast. ● Lowest ballast losses = least wasted energy. ● Tolerates line voltage variations to within + or – 5%. ● Standard ballast used in HPS luminaires below 250 Watts. ● Most economical purchase cost.
Regulated (CWA) Ballast	● Two coil ballast. – Constant Wattage Autotransformer ● Regulating – high power factor ballast ● Higher ballast losses than reactor ballast. ● Tolerates line voltage variations to within + or – 10%. ● Standard ballast used in HPS luminaires 250 Watts & above. ● Standard ballast used in all mercury vapor and metal halide luminaires. ● Higher purchase cost than reactor ballast.

Note: The lamp wattage and light source of any HID lamp must match the lamp wattage and light source rating of the HID luminaire it is to be used in. Lamps and luminaires with different wattage ratings or different light sources are not interchangeable.

46.7.40 Starting Aids

All high pressure sodium vapor luminaires require a separate starter to ignite the lamp. The Company Standard is to require a field replaceable plug-in starting aid whenever possible.

46.7.50 Terminal Block

Whenever possible, all Company luminaires shall have a terminal connection block for attachment of the source wiring.

Standard 2 wire, 120 Volt luminaires shall have a three terminal block with the middle terminal connected to the luminaire metal housing with a green housing ground wire.

Non-standard voltage luminaires shall have a two terminal connection block or three terminal connection block as needed.

Supersedes 1/07 Issue – Revised 46.7.10 to include LED.

46.7.60 Luminaire Electrical Load Data

Table 8
HID Luminaire Data

Luminaire Description			Luminaire Component Loads				
Wattage & Light Source	**Ballast Type**	**Source Voltage**	**Rated Lamp Wattage**	**Ballast Wattage**	**Photo Control Wattage**	**Total Wattage Load**	**Maximum Input * Amperage**
100 Watt – MV *ANSI H-38*	Regulated	120 VAC	100 Watts	29 Watts	1 Watt	130 Watts	1.1 A
175 Watt – MV *ANSI H-39*	Regulated	120 VAC	175 Watts	35 Watts	1 Watt	211 Watts	1.7 A
250 Watt – MV *ANSI H-37*	Regulated	120 VAC	250 Watts	56 Watts	1 Watt	307 Watts	2.8 A
400 Watt – MV *ANSI H-33*	Regulated	120 VAC	400 Watts	76 Watts	1 Watt	477 Watts	4.0 A
1,000 Watt – MV *ANSI H-36*	Regulated	120 VAC	1,000 Watts	94 Watts	1 Watt	1,095 Watts	2.5 A
50 Watt - HPS *ANSI S-68*	Reactor	120 VAC	50 Watts	10 Watts	1 Watt	61 Watts	1.5 A
70 Watt - HPS *ANSI S-62*	Reactor	120 VAC	70 Watts	15 Watts	1 Watt	86 Watts	2.0 A
70 Watt - HPS *ANSI S-62*	Regulated	120 VAC	70 Watts	19 Watts	1 Watt	90 Watts	0.8 A
100 Watt - HPS *ANSI S-54*	Reactor	120 VAC	100 Watts	17 Watts	1 Watt	118 Watts	3.2 A
100 Watt - HPS *ANSI S-54*	Regulated	120 VAC	100 Watts	23 Watts	1 Watt	124 Watts	1.2 A
150 Watt - HPS *ANSI S-55*	Reactor	120 VAC	150 Watts	22 Watts	1 Watt	173 Watts	4.4 A
150 Watt - HPS *ANSI S-55*	Regulated	120 VAC	150 Watts	36 Watts	1 Watt	187 Watts	1.6 A
250 Watt - HPS *ANSI S-50*	Regulated	120 VAC	250 Watts	53 Watts	1 Watt	304 Watts	2.5 A
400 Watt - HPS *ANSI S-51*	Regulated	120 VAC	400 Watts	69 Watts	1 Watt	470 Watts	3.9 A
1,000 Watt - HPS *ANSI S-52*	Regulated	120 VAC	1,000 Watts	105 Watts	1 Watt	1,106 Watts	9.7 A
175 Watt – MH *ANSI M-57*	Regulated	120 VAC	175 Watts	31 Watts	1 Watt	207 Watts	1.8 A
250 Watt – MH *ANSI M-58*	Regulated	120 VAC	250 Watts	44 Watts	1 Watt	295 Watts	2.6 A
400 Watt – MH *ANSI M-59*	Regulated	120 VAC	400 Watts	50 Watts	1 Watt	451 Watts	4.0 A
1,000 Watt – MH *ANSI M-47*	Regulated	120 VAC	1,000 Watts	77 Watts	1 Watt	1,078 Watts	9.0 A
175 Watt – PSMH *ANSI M-152E*	Regulated	120 VAC	175 Watts	23 Watts	1 Watt	199 Watts	1.78 A
250 Watt – PSMH *ANSI M-153E*	Regulated	120 VAC	250 Watts	30 Watts	1 Watt	281 Watts	2.5 A
400 Watt – PSMH *ANSI M-155E*	Regulated	120 VAC	400 Watts	48 Watts	1 Watt	449 Watts	4.0 A

* = Maximum input amperage = Starting amperage. Operating amperage will be lower.

Supersedes 7/09 Issue – Renamed Table 8 to " HID" Luminaire Data.

Supersedes 7/19 Issue – Updated Table with new material items

Table 8A

LED Luminaire Data

Standard ID	Description	Source Voltage*	Lumens**	Wattage**
SK06A1	"Local" Roadway Luminaire	120 - 277 VAC	≤ 2000	20
SK06A	"Local" Roadway Luminaire	120 - 277 VAC	2,001 - 4,000	25
SK06C	“Collector” Roadway Luminaire	120 - 277 VAC	4,001 – 8,000	48
SK06G	“Major” Roadway Luminaire	120 - 277 VAC	8,000 – 14,000	96
SK06H	“Expressway” Roadway Luminaire	120 - 277 VAC	20,000 – 30,000	210
SJ06E	"Standard Area" Floodlight	120 - 277 VAC	14,000 – 20,000	150
SJ06F	"Large Area" Floodlight	120 - 277 VAC	28,000 – 30,000	199
SL76A	"Carriage"- B Post Top	120 - 277 VAC	2,001 – 4,000	35
SL76B	"Carriage”- C Post Top	120 - 277 VAC	4,001 – 8,000	66
SJL76C	"Carriage" – RI Only Post Top	120 - 277 VAC	5,000	50
SL80AB SL80AG	“Highland Park”-B Post Top	120 - 277 VAC	2,001 – 4,000	30
SL80BB SL80BG	“Highland Park”-C Post Top	120 - 277 VAC	4,001 – 8,000	65
SL85AB SL85AG	“Princeton” – B Post Top	120 - 277 VAC	2,001 – 4,000	30
SL85BB SL85BG	“Princeton” – C Post Top	120 - 277 VAC	4,001 – 8,000	65
SL90AB SL90AG	“Oxford” – B Post Top	120 - 277 VAC	2,001 – 4,000	30
SL90BB SL90BG	“Oxford” – C Post Top	120 - 277 VAC	4,001 – 8,000	57
SM05B	“Arbordale (Shoebox)”- B Area	120 - 277 VAC	4,001 – 8,000	53
SM05C	“Arbordale (Shoebox)”- C Area	120 - 277 VAC	8,000 – 14,000	91
SM05D	“Arbordale (Shoebox)”- D Area	120 - 277 VAC	14,001 – 20,000	132
SM05E	“Arbordale (Shoebox)”- E Area	120 - 277 VAC	20,001 – 30,000	177
SP30CB SP30CG	“Westminster” – D Tear Drop	120 - 277 VAC	8,000 – 14,000	84
SP30DB SP30DG	“Westminster” – E Tear Drop	120 - 277 VAC	14,001 – 20,000	141
SP30GB SP30GG	“Westminster” – F Tear Drop	120 - 277 VAC	20,001 – 30,000	243
SP35GB SP35GG	“Westminster Pedestrian” – B Tear Drop	120 - 277 VAC	2,001 – 4,000	28
SP35BB SP35BG	“Westminster Pedestrian” – C Tear Drop	120 - 277 VAC	4,001 – 8,000	52

* = Luminaires accept both 120 and 277 VAC with no adjustments

** = Actual lumens and wattages may vary between manufacturers but will be compliant with the applicable tariffs.

Table 8B
HID to LED Roadway Equivalent Conversion Table
(Note: LED luminaires shall only be installed in cities/towns with established rate agreements. Contact Outdoor Lighting if uncertain.)

HID Luminaire					LED Equivalent		
Standard Item	**SAP Item ID**	**Type**	**Description**	**Line Voltage**	**Standard Item**	**SAP Item ID**	**Description**
SK03A	9309606	HPS	50 Watt	120 VAC	SK06A1 SK06A	9390299	LED, Horizontal Roadway, 20 watts ±, ≤ 2000 delivered lumens, 120-277 VAC, IES
SK03A1	9309717	HPS	50 Watt				
SK03B	9314688	HPS	70 Watt			9389768	LED, Horizontal Roadway, 25 watts ±, 2,001 – 4,000 delivered lumens ±, 120-277 VAC, IES full cutoff, type II.
SK03B1	9315139	HPS	70 Watt				
SK03B2	9300855	HPS	70 Watt				
SK03C	9314705	HPS	100 Watt	120 VAC	SK06C	9389795	LED, Horizontal Roadway, 48 watts ±, 4,001 – 8,000 delivered lumens ±, 120-277 VAC, IES full cutoff, type II.
SK03C1	9314656	HPS	100 Watt				
SK03C2	9311847	HPS	100 Watt				
SK03D	9314704	HPS	150 Watt				
SK03D1	9314687	HPS	150 Watt				
SK03D2	9312004	HPS	150 Watt				
SK03G	9314703	HPS	250 Watt	120 VAC	SK06G	9389786	LED, 96 watts ±, 8,000 – 14,000 Delivered Lumens ±, 120-277 VAC, IES full cutoff, type III.
SK03G1	9314706	HPS	250 Watt				
SK03H	9313589	HPS	400 Watt	120 VAC	SK06H	9389785	LED, 210 watts ±, 20,000 – 30,000 Delivered Lumens ±, 120-277 VAC, IES full cutoff, type III.
SK03H1	9314700	HPS	400 Watt				
SK03K	9314701	HPS	1,000 Watt				
SK05H	9306796	PSMH	400 Watt	120 VAC	SK06H	9389785	LED, 210 watts ±, 20,000 – 30,000 Delivered Lumens ±, 120-277 VAC, IES full cutoff, type III.
SK20C	9317388	HPS	100 Watt	277 VAC	SK06C	9389795	LED, Horizontal Roadway, 48 watts ±, 4,001 – 8,000 delivered lumens ±, 120-277 VAC, IES full cutoff, type II.
SK20D	9317387	HPS	150 Watt				
SK20G	9317386	HPS	250 Watt	277 VAC	SK06G	9389786	LED, 96 watts ±, 8,000 – 14,000 Delivered Lumens ±, 120-277 VAC, IES full cutoff, type III.
SK20H	9309716	HPS	400 Watt	277 VAC	SK06H	9389785	LED, 210 watts ±, 20,000 – 30,000 Delivered Lumens ±, 120-277 VAC, IES full cutoff, type III.

Supersedes 7/16 Issue – Renamed table to include " Roadway" only and revised table data.

Table 8C
HID to LED Floodlight Equivalent Conversion Table
(Note: LED luminaires shall only be installed in cities/towns with established rate agreements. Contact Outdoor Lighting if uncertain.)

New Issue

HID Luminaire					LED Equivalent		
Standard Item	**SAP Item ID**	**Type**	**Description**	**Line Voltage**	**Standard Item**	**SAP Item ID**	**Description**
SJ03B	9314705	HPS	70 Watt	120 VAC	SJ06E	9393538	LED, "Standard Area" Floodlight, 150 watts ±, 14,000 – 20,000 delivered lumens ±, 120-277 VAC, IES NEMA 6x6 or 7x6.
SJ03D	9305870	HPS	150 Watt	120 VAC			
SJ03G	9314672	HPS	250 Watt	120 VAC			
SJ03H	9314671	HPS	400 Watt	120 VAC	SJ06F	9393537	LED, "Large Area" Floodlight, 199 watts ±, 28,000 – 30,000 delivered lumens ±, 120-277 VAC, IES NEMA 6x6 or 7x6.
SJ03H1	9306198	HPS	400 Watt	277 VAC			
SJ03K	9314670	HPS	1,000 Watt	120 VAC			
SJ05H	9306795	PSMH	400 Watt	120 VAC			
SJ04K	9314669	PSMH	1,000 Watt	120 VAC			

46.8 LUMINAIRE HID LAMP IDENTIFICATION

This section covers the labeling systems used on all mercury vapor, high pressure sodium vapor, metal halide and LED luminaires for field identification of the lamp wattage, light source and LED type.

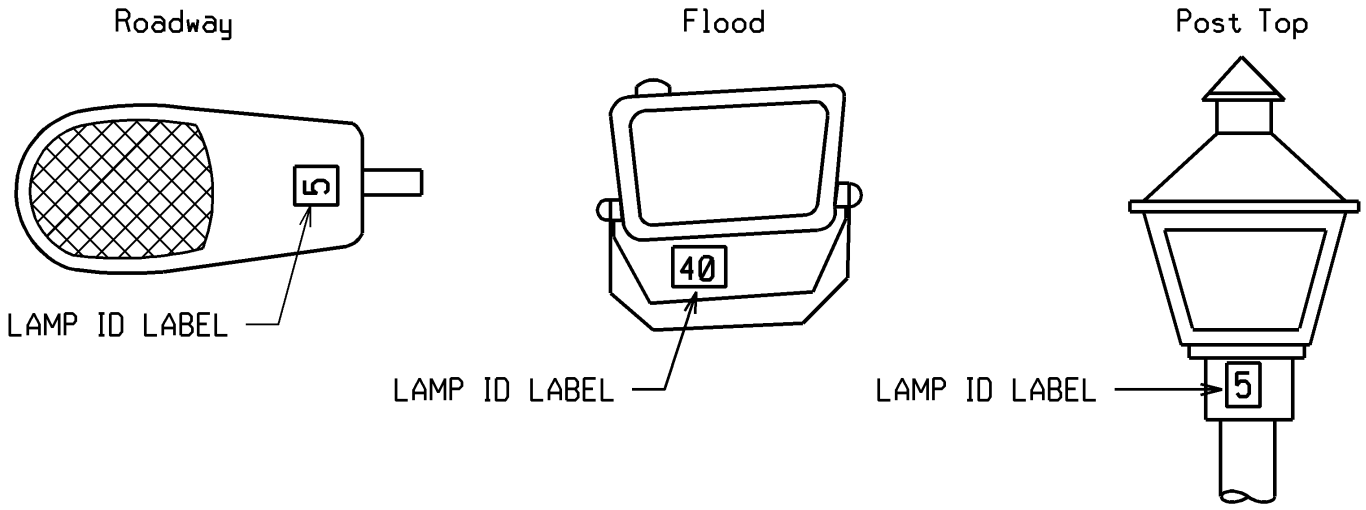


Figure 12
Typical Label Placement on Common Luminaires

46.8.10 Lamp Identification (HID)

A number / color code label system is used to identify the wattage and light source of all HID luminaires. All roadway and floodlight HID luminaires use a 3 inch square label. All post top HID luminaires use a 1 inch square label. New HID luminaires come with factory installed labels. Replacement labels are available from Stores for maintenance. See Figure 12 for typical label locations on commonly used luminaires.

Table 9
Wattage Code Numbers

Wattage	Wattage Code Number
50	"5"
70	"7"
100	"10"
150	"15"
175	"17"
250	"25"
400	"40"
1,000	"X1"

Table 10
Light Source Color Code

Light Source	Label Background Color
Mercury Vapor	Blue
High Pressure Sodium Vapor	Yellow
Metal Halide – Probe Start	Red
Metal Halide – Pulse Start	Red / White

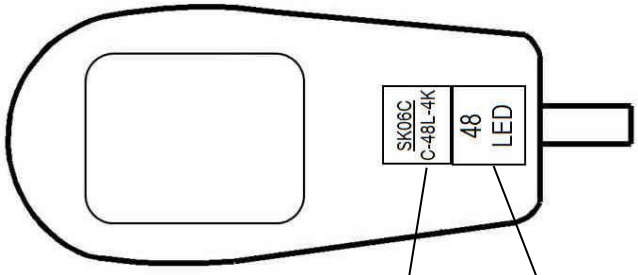
Supersedes 07/13 Issue – Revised 46.8.10 10. Applies to HID luminaires only.

46.8.20 LED Luminaire Identification

LED roadway luminaires, area lights, floodlights and decorative post tops are approved for use at PPL. It is anticipated that tariff agreements will be reached for floodlights in Rhode Island and decorative post tops in the near term.

46.8.30 LED Roadway Luminaire Identification

Two external labels shall be affixed to the underside of the LED roadway luminaire. The first label shall be a 3-inch by 3-inch, black letter on white background wattage label in accordance with ANSI C136.15, latest issue. The second external identification label is for the purpose of PPL to associate the installed luminaire with its internal Item ID number. The font shall be 1-1/4-inch in height. (See table 10A for label code).



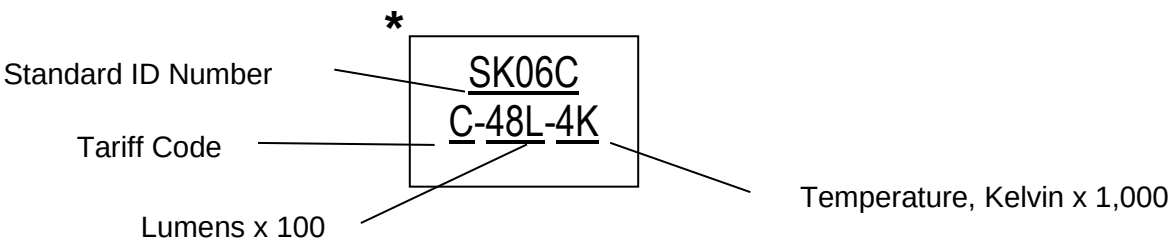
PPL Label Code

LED Wattage Label*

*Note: LED Wattages vary by manufacturer as much as +/- 10%.

Table 10A
LED Roadway Luminaire Label Codes

Standard ID Number	Description	Item ID Number	Lumens	Wattage	PPL Label Code*
SK06A1	"Local" Roadway Luminaire	9390299	1 - 2,000	20	SK06A1 A-20L-4K
SK06A	"Local" Roadway Luminaire	9389768	2,001 – 4,000	25	SK06A B-26L-4K
SK06C	"Collector" Roadway Luminaire	9389795	4,001 – 8,000	48	SK06C C-48L-4K
SK06G	"Major" Roadway Luminaire	9389786	8,000 – 14,000	96	SK06G D-116L-4K
SK06H	"Expressway" Roadway Luminaire	9389785	20,000 – 30,000	210	SK06H F-250L-4K



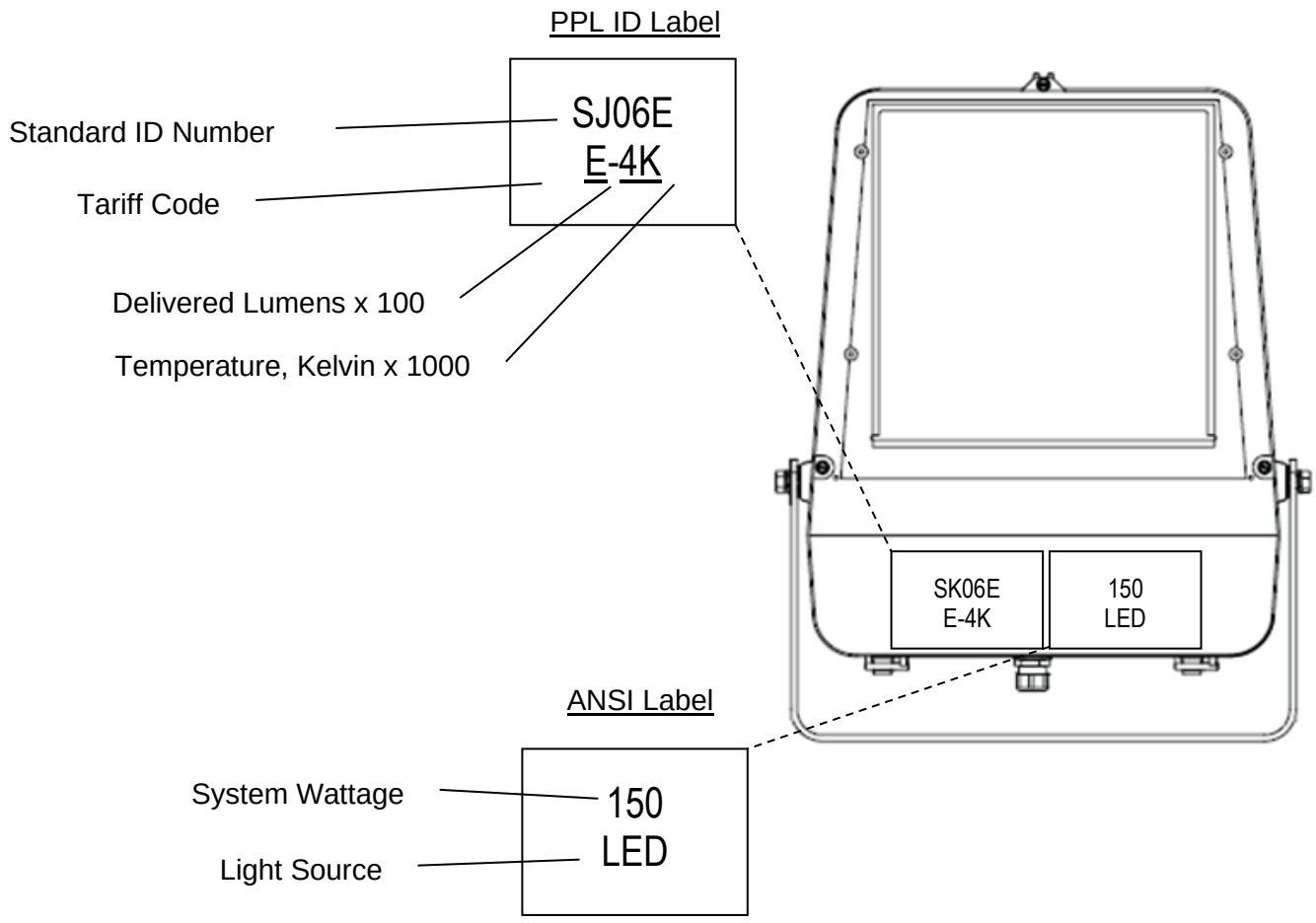
Supersedes 07/17 Issue – Update text for new LED offerings .

46.8.40 LED Floodlight Luminaire Identification

Two external labels shall be affixed to the underside of the LED roadway luminaire. The first label shall be a 3-inch by 3-inch, black letter on white background wattage label in accordance with ANSI C136.15, latest issue. The second external identification label is for the purpose of PPL to associate the installed luminaire with its internal Item ID number. The font shall be 1-1/4-inch in height. See table 10B for label code. (Note: tariff rates have not been established yet, so wattage and lumen values are not available. Tariff rates are anticipated to be completed by 2018.

Table 10B
LED Floodlight Luminaire Label Codes

Standard Item ID	PPL Item ID Number	Description	Maximum System Wattage	Delivered Lumen Range, Lumens	PPL ID Label	ANSI Label
SJ06E	9393538	"Standard Area" Floodlight	150W	14,000-20,000	SJ06E E-4K	150 LED
SJ06F	9393537	"Large Area" Floodlight	199W	20,001-30,000	SJ06B F-4K	200 LED



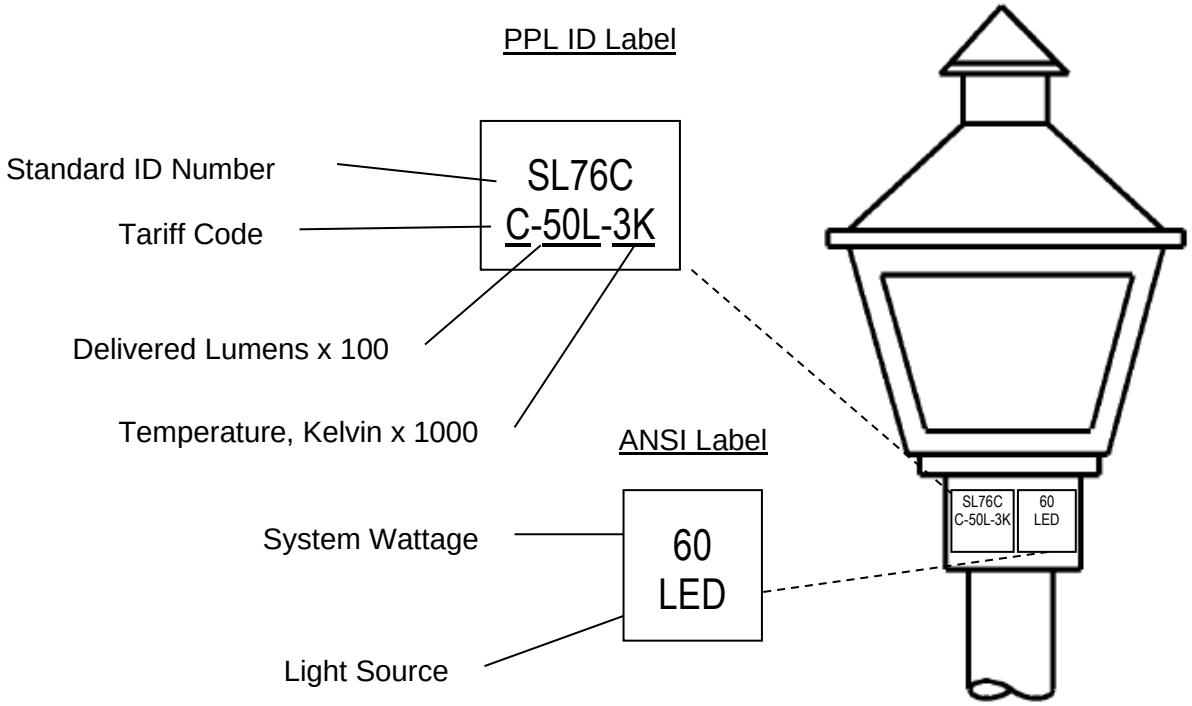
Supersedes 7/19 Issue – Updated Table 10B

46.8.50 LED Post Top Luminaire Identification

Two external identification labels with 1-inch by 1-inch black letter on white background shall be affixed to the underside of the luminaire. The first label shall be in accordance with ANSI C136.15, latest issue. The second label is for the purpose of PPL to associate the installed luminaire with its internal Item ID number, tariff billing code, delivered lumens and LED temperature. (See table 10C for sample label code - refer to material specifications for detailed information).

Table 10C
LED Post Top Luminaire Label Code

Standard Item ID	PPL Item ID Number	Description	IES Distribution Type	Maximum System Wattage	Delivered Lumen Range, Lumens	PPL ID Label	ANSI Label
SL76A	9393099	"Carriage" LED Post Top	III	35	2,001 – 4,000	SL76A A-33L-3K	35 LED
SL76B	9393100	"Carriage" LED Post Top	III	66	4,001 – 8,000	SL76B A-63L-3K	65 LED
SL76C	9390330	"Carriage" LED Post Top	III	60	5,000	SL76C C-50L-3K	60 LED



Supersedes 7/19 Issue – Updated Table.

46.9 LUMINAIRE OWNERSHIP IDENTIFICATION

This Section covers the labeling system used on all luminaires to identify the luminaire owner and / or party responsible for maintenance.

46.9.10 Customer Owned & Maintained Luminaires

Customer owned and maintained luminaires that are installed on Company poles are identified by two customer supplied labels detailed as follows:

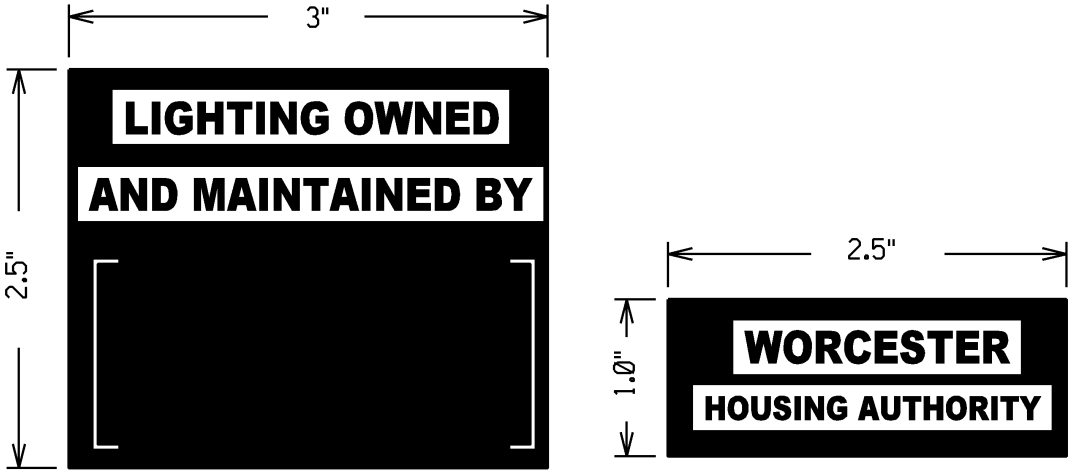


Figure 13
Customer Owned & Maintained Luminaire Label Example

Both labels shall have a black background and reflective silver legend. The label identifying the owner shall be applied within the brackets of the larger label.

46.10 LAMPS

This Section provides technical information on incandescent and high intensity discharge (HID) lamps available for use in all Company outdoor lighting installations.

46.10.10 Incandescent Lamps

Incandescent lamps are available for maintenance of existing multiple incandescent street lighting installations only.

46.10.20 High Intensity Discharge Lamps

High pressure sodium vapor and pulse start metal halide, high intensity discharge lamps are the standard lamps available for use in all new outdoor lighting installations. Mercury vapor lamps are available until January 1, 2016 for maintenance of existing mercury vapor installations only.

46.10.30 Theory Of Operation

All high intensity discharge (HID) lamps have a sealed, gas filled, arc tube with electrodes at each end. Once energized, an electric arc is created between these two electrodes. This caused gasses and metals within the arc tube to vaporize, giving off energy as illumination.

Because HID lamps have negative resistance characteristics, they must be used with a ballast transformer rated for the specific lamp type and lamp wattage.

Note: The lamp wattage and light source of any HID lamp must match the lamp wattage and light source rating of the HID luminaire it is to be used in. Lamps and luminaires with different wattage ratings or different light sources are not interchangeable.

Table 11
HID Lamp Characteristics

Lamp Type	Color Output	Efficiency (Initial Lumens/Watt)	Restrike Time	Most Common Failure Mode
Mercury Vapor	Blue / White	34 - 63	3 – 6 minutes	Gradually Dims
High Pressure Sodium Vapor	Orange	51 - 140	1 minute	Cycles
Metal Halide	White	68 - 120	10 – 15 minutes	Extinguishes

46.10.40 Lamp Safety

All HID lamps run very ***HOT***. Use Extreme Caution!

WARNING: An HID lamp with a broken outer glass bulb will give off ultraviolet radiation. Always de-energize lamp before attempting replacement.

Supersedes 1/07 Issue – Revised paragraphs 46.10.20 - Mercury Vapor lamp usage.

46.11 MULTIPLE CONTROL RELAYS

This Section covers application details for multiple control relays. A multiple control relay allows group control of a quantity of luminaires. This type of control is most often used when the circuit is designed exclusively for outdoor lighting and individual photoelectric controls cannot achieve desired operational results. Examples would be underpass lighting where adequate daylight may never reach the photocontrol, or areas where artificial light sources prevent the photoelectric control from operating. The number of luminaires a multiple control relay can control is limited by voltage drop and relay capacity.

46.11.10 Multiple Control Relay Operation

A standard twistlock photocontrol is used as the daylight sensing device and controls the multiple control relay, which in turn, energizes or de-energizes the dedicated lighting circuit.

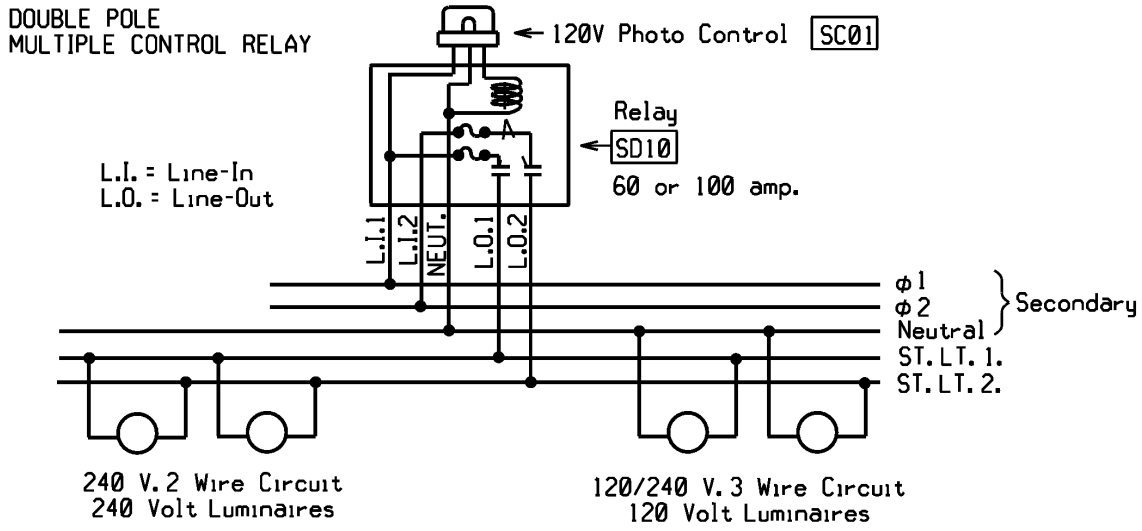


Figure 15
Multiple Control Relay Wiring Diagram

Notes:

1. Bond all neutrals, circuit grounds and pole or bracket grounds to secondary neutral.
2. Internal relay contacts shown are normally open (coil de-energized).

46.12 TWISTLOCK PHOTOELECTRIC CONTROLS

This Section provides instructions for installation and field testing twistlock photoelectric outdoor lighting controls (photocontrols).

Twistlock photocontrols are used for dusk to dawn control of nearly all outdoor lighting installations. Select the proper photocontrol to use based on the operating voltage of the luminaire. The operating voltage of the photocontrol is identified on the base of the photocontrol and can also be determined by the color of the photocontrol housing.

Table 12
Housing Color Code for Twistlock Photocontrols

Housing Color	Voltage Rating	Use
GRAY	105-130 VAC	Use on all new and existing 120 Volt luminaires.
BLUE	105-300 VAC	May be used on 120 Volt luminaires. ***MUST*** be used on 2 wire 240 Volt and 277 Volt luminaires ***MUST*** be used on all LED luminaires
GREEN	105-130 VAC	Part Night Control – Allows partial night operation of luminaire. Use only upon specific request.

46.12.10 Installation

Install photocontrol with the control window facing NORTH, however, reposition as necessary to avoid pointing the window towards artificial light which could cause unwanted photocontrol operation. See luminaire instruction sheet for information on adjusting the photocontrol receptacle. Upon installation, twist the photocontrol clockwise to lock it in position.

46.12.20 Field Testing

Cover and uncover the photocontrol window and check for luminaire “turn on” and “turn off”. If the photocontrol exhibits any chatter noise when switching, DO NOT USE. Turn in the photocontrol as defective and replace with another photocontrol. At night, test operation by aiming a flashlight into the photocontrol window.

Note: Some photocontrols have a short time delay on “turn on” and/or “turn off”. Allow time for the control to operate.

46.12.30 Warranty Information

All photocontrols are under warranty for 6 years from the date of manufacture. Twistlock photocontrols have the year of manufacture molded into the top of the housing. Photocontrols which fail in service within the 6 year warranty shall be saved for return to the manufacturer for warranty replacement.

46.12.40 Photocontrol Maintenance

A. Electro-Mechanical Photocontrols – Twistlock photocontrols purchased prior to 1996 are electro-mechanical units. These controls can be identified by the date code on the top of the housing. As this type of control ages, its light level setting will drift, causing an undesirable increase in the number of luminaire burning hours. When performing any type of maintenance on a luminaire with this type of photocontrol, replace the photocontrol with a new electronic control.

Supersedes 1/07 Issue – Revised Table 12. Redefined use of BLUE and GREEN photocontrols.

B. Electronic Photocontrols – Twistlock photocontrols purchased by the Company since 1996 are electronic controls. This type of photocontrol will hold the proper light level setting throughout its life and will not drift the way an electro-mechanical control will. When performing any type of maintenance on a luminaire with an electronic photocontrol, replace the photocontrol only if it has failed, or is greater than 10 years old.

Table 13
Twistlock Photocontrol Accessories

Description	Housing Color	Use
"OPEN" Receptacle Cap	RED	Used in place of a twistlock photocontrol to leave the lamp load permanently "OFF".
"SHORTING" Receptacle Cap	BLACK	Used in place of a twistlock photocontrol to leave the lamp load permanently "ON".
Twistlock Photocontrol Receptacle with Mounting Bracket.	N/A	Use when a twistlock photocontrol must be pole or crossarm mounted. The mounting bracket may be adapted for ½ inch conduit or knockout mounting.

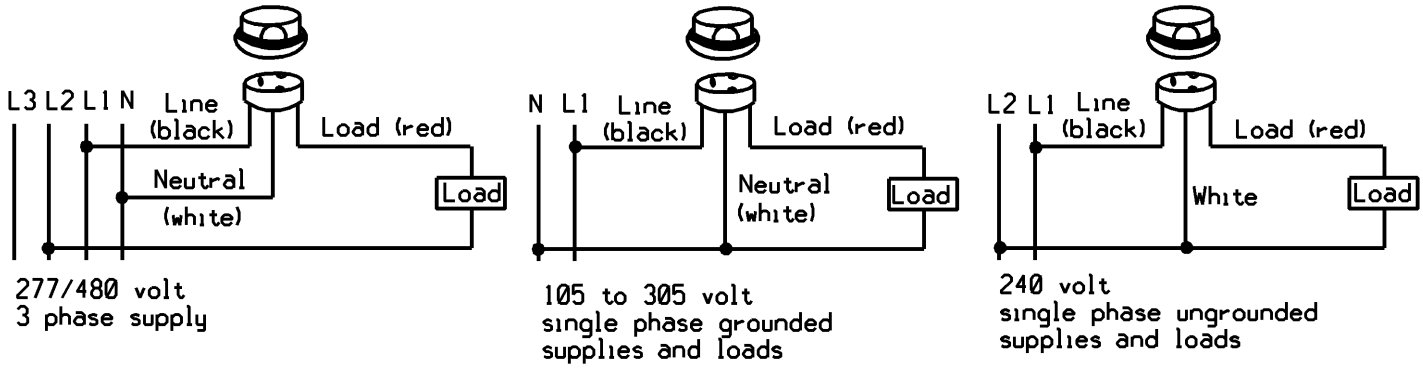


Figure 16
Wiring Diagrams for Photocontrol Receptacle Mounting Bracket

46.13 BUTTON PHOTOELECTRIC CONTROLS

This Section provides instructions for installation and field testing button style photoelectric outdoor lighting controls (photocontrols).

Button photocontrols are available for dusk to dawn control of certain decorative luminaires. They are used only when space on the luminaire is not available for a standard twistlock photocontrol or when use of a twistlock photocontrol would detract from the luminaires appearance.

46.13.10 Installation

Mount the button photocontrol inside the luminaire housing using the plastic locknuts provided. Mount the rubber "O-ring" to the outside of the luminaire housing under the plastic locknut to provide a weatherproof seal. See Figure 17 for details.

Note: Only the window and threaded nipple are rain tight. The body of the button photocontrol is not rain tight. Orient the photocontrol body with the leads facing downward and form a drip loop with the wiring to direct water away from the photocontrol.

Adjust the luminaire housing if the button photocontrol window is pointing towards artificial light which could cause an unwanted photocontrol operation. Be aware that this adjustment may require a subsequent adjustment of the luminaire's optical assembly to maintain the proper roadway light distribution pattern. See instructions supplied with the luminaire.

Electrically connect the button photocontrol using wire nuts.

BLACK wire = Source wire (hot) – **WHITE** wire = Neutral wire. – **RED** wire = Load wire (hot)

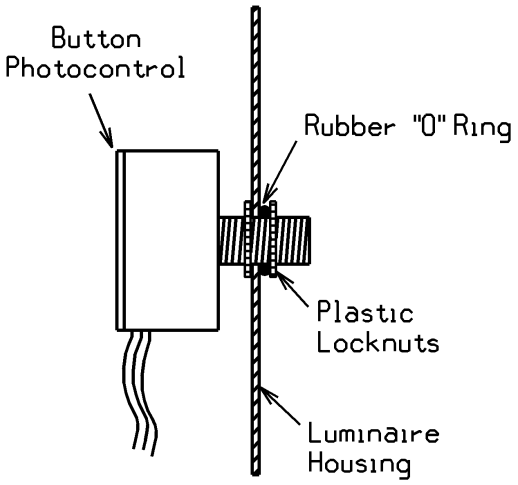


Figure 17
Button Photocontrol Mounting

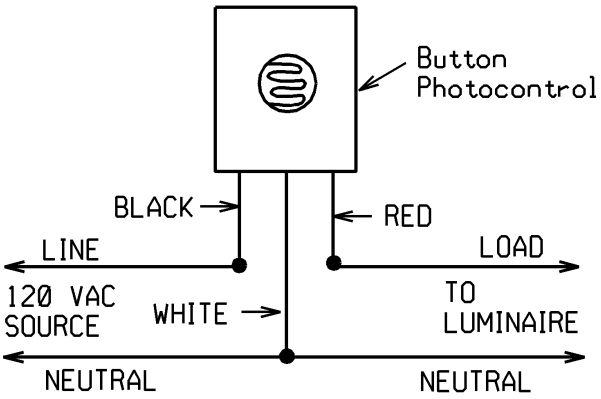


Figure 18
Button Photocontrol Wiring Diagram

46.13.20 Field Testing Button Photocontrols

Cover and uncover the photocontrol window and check for luminaire "turn on" and "turn off". If the photocontrol exhibits any chatter noise when switching, DO NOT USE. Turn in the photocontrol as defective and replace with another photocontrol. At night, test operation by aiming a flashlight into the photocontrol window.

Note: Button photocontrols have a 1 minute (±) time delay on "turn on" and/or "turn off". Allow time for the control to operate.

46.13.30 Warranty Information

All photocontrols are under warranty for 6 years from the date of manufacture. Button photocontrols have the date of manufacture identified on the side of the housing. Photocontrols which fail in service within the 6 year warranty shall be saved for return to the manufacturer for warranty replacement.

46.13.40 Photocontrol Maintenance

Button photocontrols should be replaced only when the unit has failed.

46.14 POLES

This Section provides general requirements and application information for all anchor base and embedded poles used for street lighting service.

46.14.10 Loading

In general, all poles have been engineered to support the expected loading imposed by the luminaire(s) and supporting arm(s). Loading details specific to any particular pole style are included in the construction standard for that pole style. All ratings are based on a sustained 90 mph wind.

MUNICIPAL ATTACHMENTS – BANNERS, FLOWERPOTS, SIGNS, ETC. – In general, poles do not have sufficient spare strength to support the additional loading imposed by municipal attachments. These attachments, particularly banners, can often far exceed the pole's wind loading capacity. In some cases, however, limited additional loading may be possible. Each request must be evaluated on a case-by-case basis. In every case, the customer must furnish the following information:

A. Effective Projected Area, (EPA) of the proposed attachment (this is a square foot measurement describing the wind displacement requirements of the attachment).

B. Weight of the proposed attachment.

C. Exact attachment location on the pole.

D. Pole height and pole manufacturer.

E. Proposed method of attachment to the pole. (In no cases shall any pole ever be field drilled to accommodate any municipal attachment).

With this information, Standards Engineering will then consult the pole manufacturer to determine if the municipal attachment can be safely supported.

46.14.20 Installation Notes

Poles shall never be installed without the luminaire(s). The luminaire(s) contribute to dampen wind induced vibration forces which could lead to pole failure.

46.14.30 Embedded Poles

In general, embedded poles are designed to be used with direct buried supply conductors. In cases where an embedded pole must be installed with conduit enclosed supply conductors, install a handhole (Std. Item SG10) adjacent to the pole. See STANDARDS Section 46.17 for handhole installation details. Direct buried conductors can then be installed between the handhole and the embedded pole.

46.14.40 Anchor Base Poles

Anchor base poles are designed to be used with precast concrete foundations. Although conduit enclosed supply conductors are preferred, direct buried supply conductors can be installed directly into the conduit slot in precast concrete foundations. See STANDARDS Section 46.18 for information on the bolt circle patterns required by the Company's standard pole offerings.

46.15 POLE NUMBER AND REFLECTOR INSTALLATION

This Section covers requirements for installing pole number decals and pole reflectors on all metal and fiberglass lighting poles.

46.15.10 Pole Numbers

Every pole shall be numbered in accordance with Figure 19. Pole surface must be clean and dry. Install pole number decals on the roadway side of the pole, 6 feet above finished grade.

Always use 1¾ inch x 3 inch, high intensity WHITE, reflective pole number decals. (STD Item SX20). *Do NOT use yellow reflective number decals.*

Always install pole number decals HORIZONTAL to each other as shown in Figure 19. – *not vertical.*

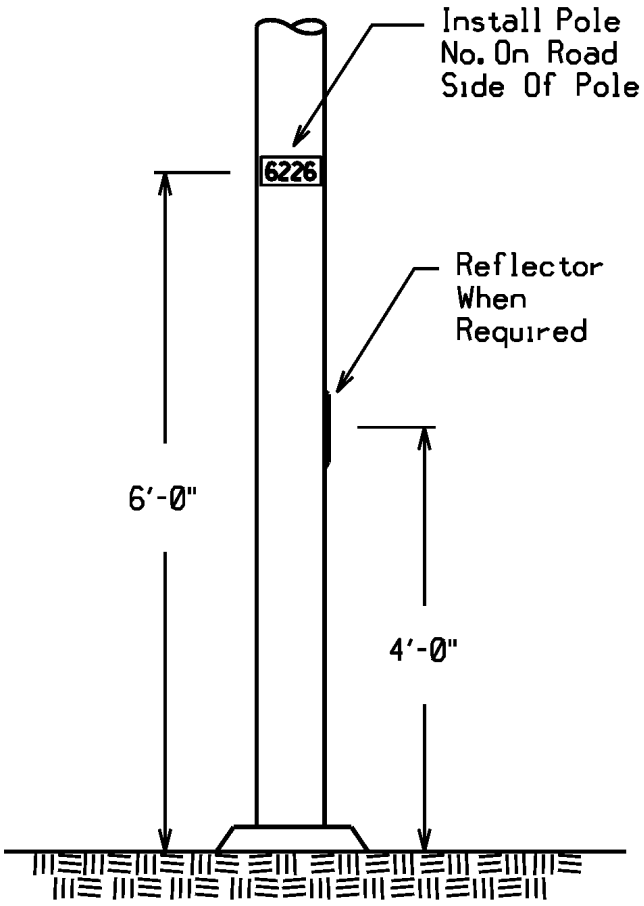


Figure 19
Pole Number Installation

Supersedes 1/07 Issue – Changed mounting height to 6 feet. Revised paragraph 46.15.10.

46.15.20 Pole Reflectors

The pole surface shall be clean and dry. Install 3 inch x 10 inch adhesive high intensity pole reflectors, vertically, facing traffic, centered 4 feet above grade

A. Reflector Color

On ramps, freeways, divided highways, and one way streets, reflective material shall face oncoming traffic and shall be colored white on the right side of the roadway and yellow on the left side of the roadway. On two way undivided roadways, reflective material shall be colored white and shall be placed on poles to the right of, and facing, oncoming traffic on each side of the road.

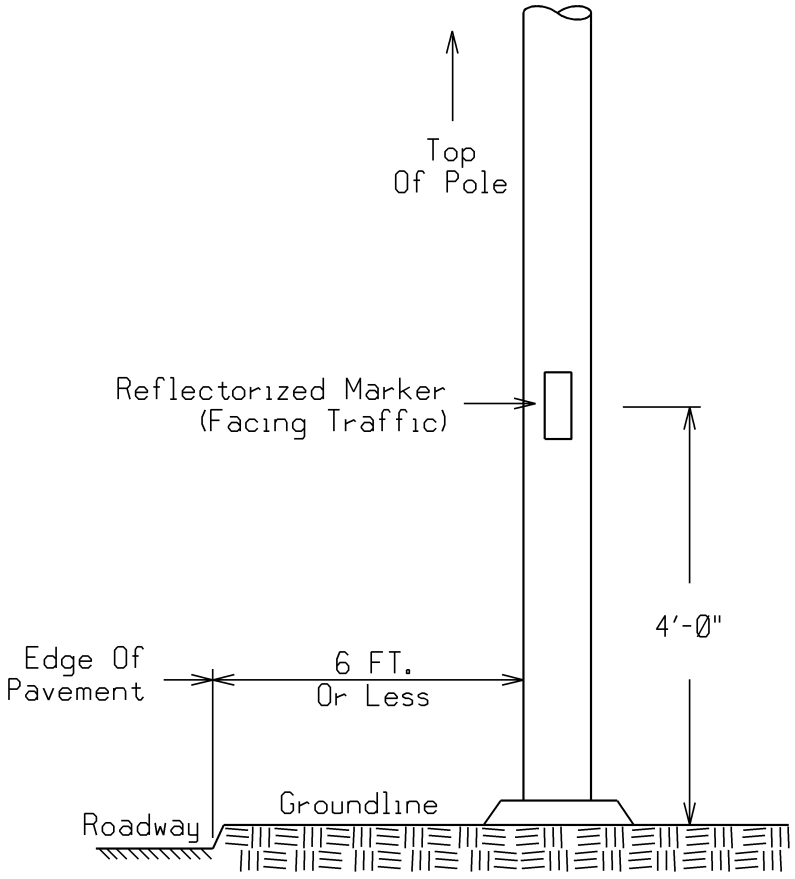


Figure 20
Pole Reflector Installation

Supersedes 1/07 Issue – Deleted Table 16. Revised paragraph 46.15.20.

46.16 PRECAST CONCRETE STREET LIGHTING FOUNDATION

This Section provides details for installation of a precast concrete lighting foundation.

46.16.10 Foundation Design

All precast concrete lighting foundations have a built-in slotted opening to facilitate conduit or direct buried supply conductors.

46.16.20 Anchor Bolt Size

Precast concrete foundations with ¾ inch diameter anchor bolts are designed for use with post top poles 16 feet and under in height. They shall not be used to support taller poles.
Precast concrete foundations with 1 inch diameter anchor bolts are available for use with 25 foot and taller poles.

46.16.30 Foundation Location

The precast foundation should be placed within the area between the sidewalk and edge of the roadway. Utilize the utility corridor or grass strip when available. When possible, place pole 6 to 12 inches away from the roadway edge to provide protection from vehicles and snowplows, etc. When installed within the sidewalk area, be sensitive to wheelchair access.

46.16.40 Bollards

Poles installed adjacent to parking lots or other locations with direct exposure to backing motor vehicles shall be protected by bollard(s). Use a 3 inch galvanized steel pipe filled with concrete and painted yellow.

46.16.50 Excavation

Excavate hole to required depth. Foundation should rest on undisturbed earth.

46.16.60 Backfill

Backfill material should consist of good compactable materials such as approved native soils, sand or select backfill material. Backfill in 6 inch segments and tamp thoroughly. Avoid large rocks.

46.16.70 Conduit System

All foundations have a square vertical center opening designed to accept (1) two inch diameter conduit. When more than one conduit is needed, install an in-ground handhole (STD Item SG10) behind or adjacent to the precast foundation. Terminate all conduits in this handhole and install one 2” conduit to the precast foundation. See Standards section 46.17 for details.

46.16.80 Grounding

Install ground rod and grounding conductor at each pole location. Always connect grounding conductor to all metal conduits.

46.16.90 Protection

Install temporary foundation cover (Std. Item SF40) if pole is to be installed at a later date.

Supersedes 1/07 Issue – Revised paragraph 46.16.70.

Table 14
Precast Concrete Foundations

Std. Item	Description	
SF01	**Precast Concrete Foundation - 8½" Bolt Circle with (4) ¾" anchor bolts** 24" x 24" x 48" depth - conduit opening = 3½ "x 3½" square - weight = 2,225 pounds	
	For use with Std. Item poles:	
	SW01C1	14' "Suburban" fiberglass post top pole.
	SW06	14' "Essex" aluminum post top pole.
	SW07	10', & 14' "Villager" aluminum post top poles.
	SW09	14' "Washington" aluminum post top pole.
SF02	**Precast Concrete Foundation - 11½" Bolt Circle with (4)- ¾" anchor bolts** 24" x 24" x 48" depth - conduit opening = 5"x 5" square - weight = 2,025 pounds	
	For use with Std. Item poles:	
	SW01	10', 12', 14', & 16' "Suburban" fiberglass post top poles (all except SW01C1)
	SU01D	16' "Architectural" aluminum pole.
	SW12	12' "Winter Park" post top pole.
SF03	**Precast Concrete Foundation - 15" Bolt Circle with (4) ¾" anchor bolts** 24" x 24" x 48" depth - conduit opening = 5"x 5" square - weight = 2,025 pounds	
	For use with Std. Item poles:	
	SW05	12' & 16' "Armory Square" aluminum post top poles.
	SW08	12' & 16' "Presidential" fiberglass post top poles.
	SW10	12' "Little Falls" aluminum teardrop pole.
	SW11	12' "Little Falls" aluminum post top pole.
SF10	**Precast Concrete Foundation - 11½" Bolt Circle with (4)-1" anchor bolts** 24" x 24" x 60" depth - conduit opening = 5"x 5" square - weight = 2,500 pounds	
	For use with Std. Item poles:	
	ST01	25', 30', & 35' "Pendant" aluminum roadway poles.
	ST02	25' "Pendant" fiberglass roadway pole.
	ST04	19' & 24' "Davit" aluminum roadway pole.
	ST08	25' "Niagara" aluminum roadway pole.
SF11	**Precast Concrete Foundation - 15" Bolt Circle with (4)-1" anchor bolts** 24" x 24" x 60" depth - conduit opening = 5"x 5" square - weight = 2,500 pounds	
	For use with Std. Item poles:	
	SU01F	25' "Architectural" aluminum pole.
	SX80	Transformer bases – aluminum.

46.16.100 **All Precast Foundations**
Anchor bolt projection above the top of the concrete = 2¾ inches.

46.16.110 **Roadway Class Poles – (> 16' Mounting Height)**
Never install these poles on a precast foundation with ¾" anchor bolts.

46.16.120 **Post Top Class Poles – (10' - 16' Mounting Height)**
Some post top poles have slotted anchor bolt holes which may allow installation on more than one size foundation.

Supersedes 1/07 Issue – Revised Table 14 and added paragraphs 46.16.110 and 46.16.120.

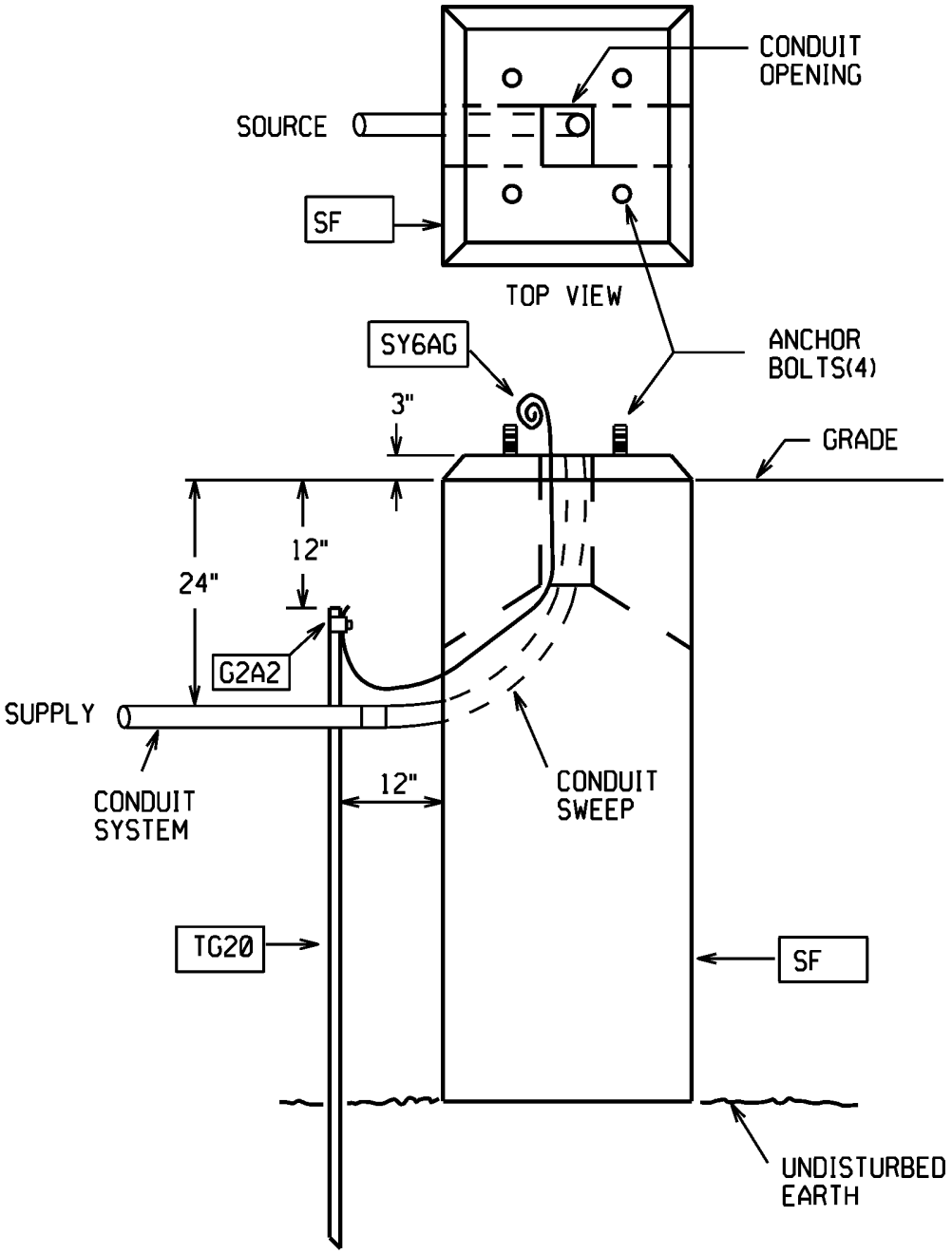


Figure 21
Precast Concrete Foundation – Single Source

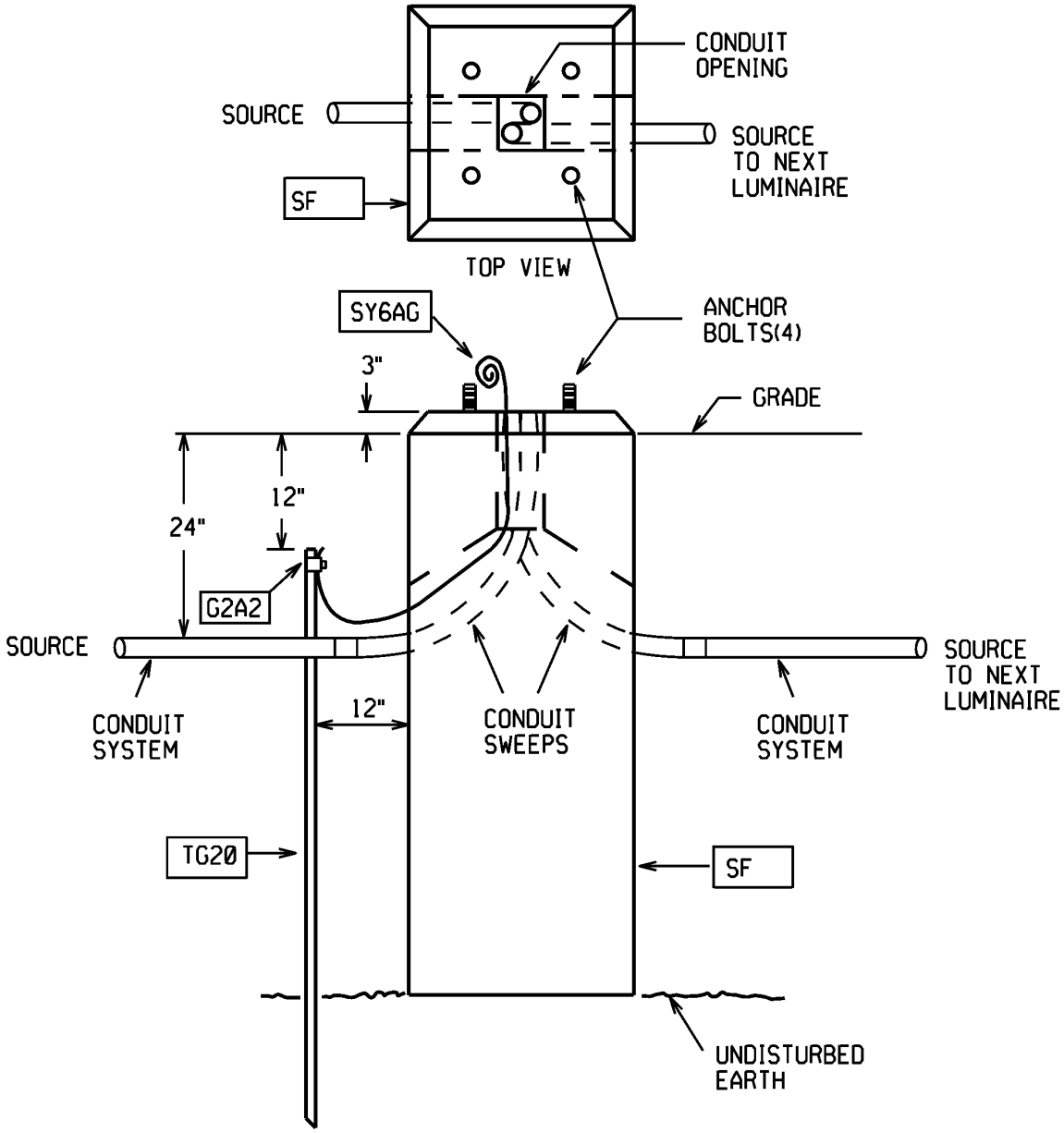


Figure 22
Precast Concrete Foundation – Twin Source

1. For **MAINTENANCE ONLY** of existing installations. Do not use for new construction. For new construction requiring more than one conduit, install an in-ground handhole behind or adjacent to the precast foundation. See Standards Section 46.17 for details.

Supersedes 1/07 Issue – Updated STD Item numbers. Added Note 1 - " Maintenance Only" restriction.

46.17 HANDHOLE INSTALLATION ADJACENT TO PRECAST STREET LIGHTING FOUNDATION

This Section provides details for installation of a polymer concrete handhole adjacent to a precast concrete lighting foundation.

46.17.10 Application

Install a polymer concrete handhole (STD Item SG10) any time it is necessary to have more than one conduit at a precast concrete foundation. Terminate all conduits in the in-ground handhole and install one conduit to the precast foundation.

46.17.20 Location

Install the polymer concrete handhole behind or adjacent to a precast concrete foundation such that the conduit going to the precast foundation can sweep directly into the conduit slot in the foundation.

46.17.30 Restrictions

Polymer concrete handholes are rated for use in grass areas, sidewalks, driveways, and parking lots. They are not rated for use in roadways or in any location subject to heavy traffic.

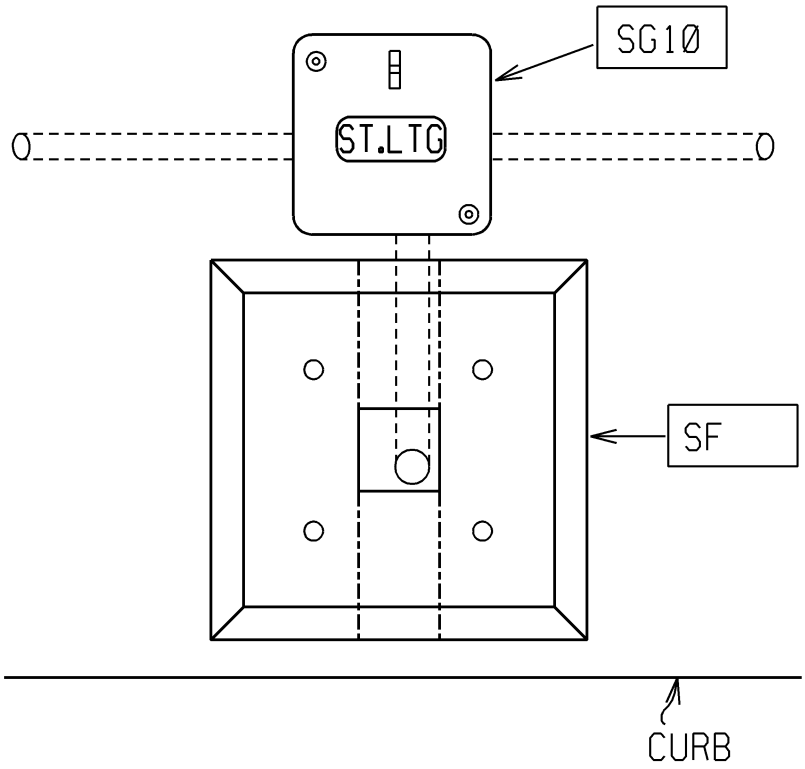


Figure 23
Handhole Installation Adjacent to Precast Concrete Lighting Foundation – Top View

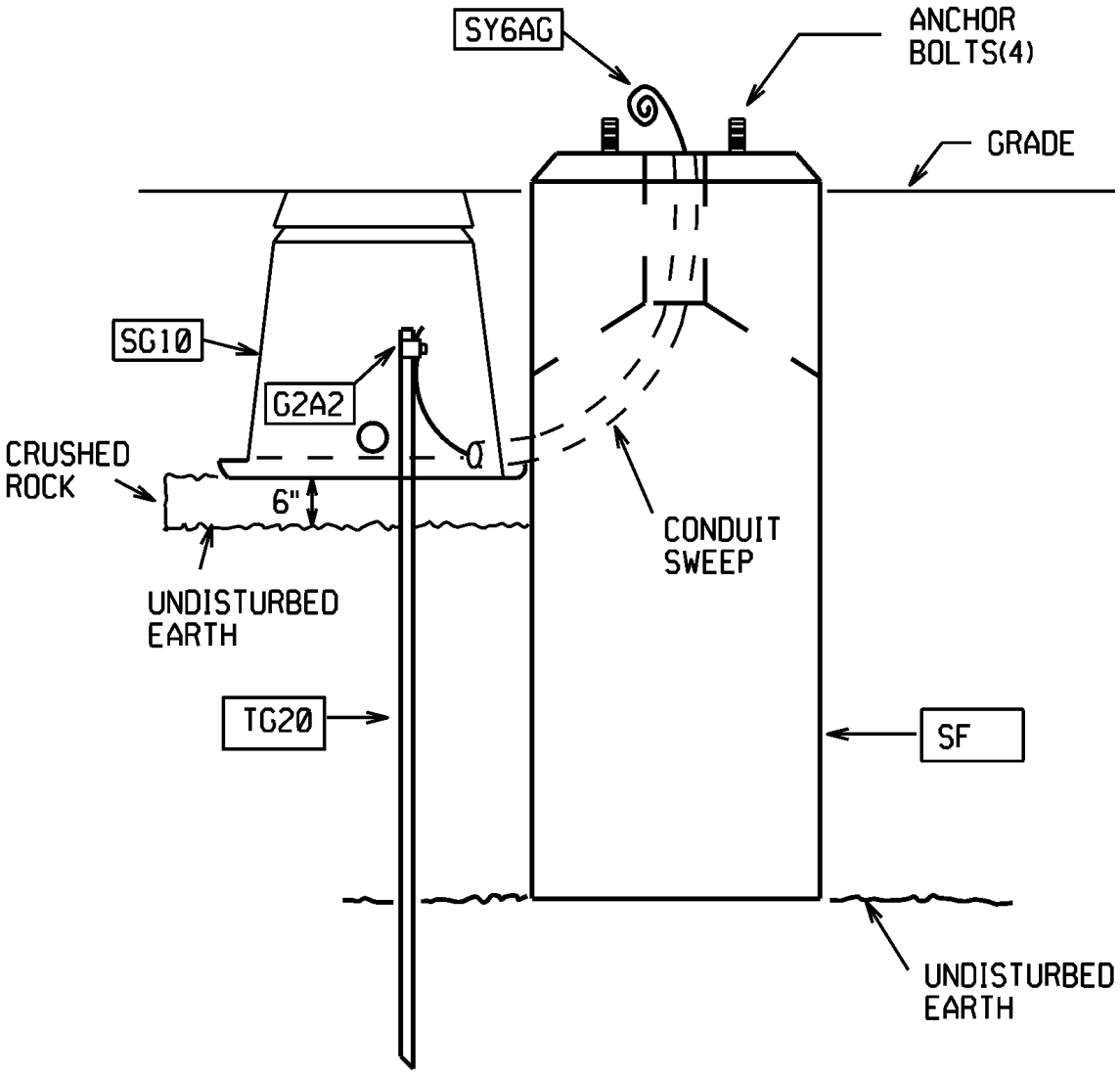


Figure 24
Handhole Installation Adjacent to Precast Concrete Lighting Foundation – Side View

Supersedes 1/07 Issue – Updated STD Item numbers.

46.18 POURED CONCRETE FOUNDATIONS – ANCHOR BOLT CIRCLE REQUIREMENTS

The Company Standard is to use precast concrete foundations for all underground supplied outdoor lighting applications. In those rare cases where field conditions prohibit the use of a precast concrete foundation, a poured in place concrete foundation may be used. This Section provides general guidance to aid in foundation design and anchor bolt circle requirements for standard Company lighting poles.

46.18.10 Poured In Place Concrete Foundations

Poured in place concrete foundations shall be field designed so as to duplicate the equivalent precast concrete foundation with respect to physical size and materials. Each foundation requires (4) anchor bolts (STD Item SF30 or SF31). Foundation conduit sweeps shall be a minimum 24 inch radius using 2 inch conduit. See STANDARDS Section 46.16 for precast concrete foundation dimensions and Company Material Specification Standards for detailed drawings.

Figure 25
Anchor Bolt for Poured-In-Place Concrete Foundations

46.18.20 Anchor Bolt Circle Requirements

All anchor base poles require a concrete foundation with four galvanized steel anchor bolts arranged in accordance with Figure 26 and Tables 15 or 16, as applicable.

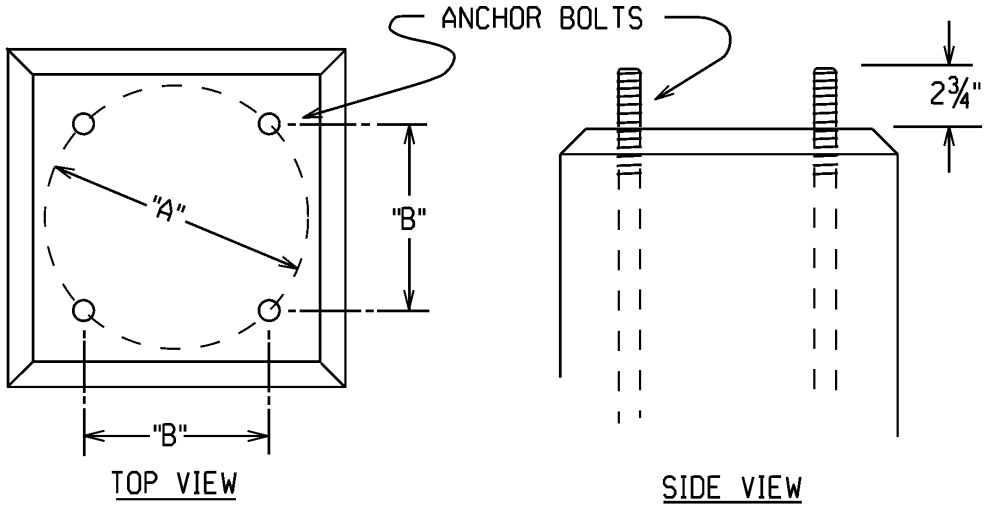


Figure 1 - Anchor Bolt Circle Requirements

Figure 26
Anchor Bolt Circle Requirements

Supersedes 07/09 Issue – Minor revision to Figure 26.

Table 15
Roadway Poles

Std. Item	Description	Anchor Bolt Circle Diameter (Dimension "A")	Anchor Bolt Distance (Dimension "B")	Anchor Bolt Diameter
ST01	*"Pendant"* Pole - Aluminum	11½ Inch	8⅛ Inch	1"
ST02	*"Pendant"* Pole - Fiberglass	11½ Inch	8⅛ Inch	1"
ST04	*"Davit"* Pole - Aluminum	11½ Inch	8⅛ Inch	1"
ST08	*"Niagara"* Pole - Aluminum	11½ Inch	8⅛ Inch	1"
SU01F	*"Architectural"* Pole – Aluminum 25 Foot	15-Inch	10⅝ Inch	1"
SX80	Transformer Base	15-Inch	10⅝ Inch	1"

Table 16
Post Top Poles

Std. Item	Description	Anchor Bolt Circle Diameter (Dimension "A")	Anchor Bolt Distance (Dimension "B")	Anchor Bolt Diameter
SW01	*"Suburban"* Post Top Pole Fiberglass	11½ Inch	8⅛ Inch	¾"
SW01C1	*"Suburban"* Post Top Pole Fiberglass	8½ Inch	6 Inch	¾"
SW05	*"Armory Square"* Post Top Pole Aluminum	15 Inch	10⅝ Inch	¾"
SW06	*"Essex"* Post Top Pole Aluminum	8½ Inch	6 Inch	¾"
SW07	*"Villager"* Post Top Pole Aluminum	8½ Inch	6 Inch	¾"
SW08	*"Presidential"* Post Top Pole Fiberglass	15 Inch	10⅝ Inch	¾"
SW09	*"Washington"* Post Top Pole Aluminum	8½ Inch	6 Inch	¾"
SW10	*"Little Falls"* Teardrop Pole Aluminum	15 Inch	10⅝ Inch	¾"
SW11	*"Little Falls"* Post Top Pole Aluminum	15 Inch	10⅝ Inch	¾"
SW12	*"Winter Park"* Post Top Pole Aluminum	11½ Inch	8⅛ Inch	¾"
SU01D	*"Architectural"* Pole – Aluminum 16 Foot	11½ Inch	8⅛ Inch	¾"

Supersedes 1/07 Issue – Updated Tables 15 and 16.

46.19 CONNECTIONS AND GROUNDING FOR UNDERGROUND SUPPLIED LIGHTING

This Section provides connections and grounding details for all underground supplied lighting installations where connections are made inside the pole access handhole.

46.19.10 Connection Rules

Figures 27 – 32 provide details on the most common connection and grounding combinations. The following connection and grounding rules apply to all pole installations, and shall be applied in cases where the connection combination required is not shown in Figures 27 – 32.

A. Ground Rod: Every pole installation requires a driven ground rod and # 6 AWG grounding connection. The #6 AWG grounding conductor shall always be connected to the system neutral conductor inside the pole access handhole.

B. Metal Poles: Every metal pole shall be grounded by connecting the #6 AWG grounding conductor to the metal pole shaft. This connection shall be made inside the pole access handhole, or inside the transformer base, as applicable.

C. Non-Metallic Poles: The metal housing on every luminaire installed on a non-metallic pole shall be grounded. Always install a separate # 10 AWG GREEN conductor inside the pole shaft for each luminaire. Whenever possible, luminaires are supplied with a three terminal connection block with the middle terminal factory connected to the luminaire housing by a green grounding conductor. Use this middle terminal for the housing grounding connection when available. Otherwise, connect the #10 AWG Green conductor directly to the luminaire housing. Follow manufacturers instructions supplied with every luminaire.

D. Cable Identification: Always install a cable tagging kit (STD Item SZ02) on each underground conductor set to identify the destination of the conductors.

Supersedes 1/07 Issue – Added note " D" – Cable Identification.

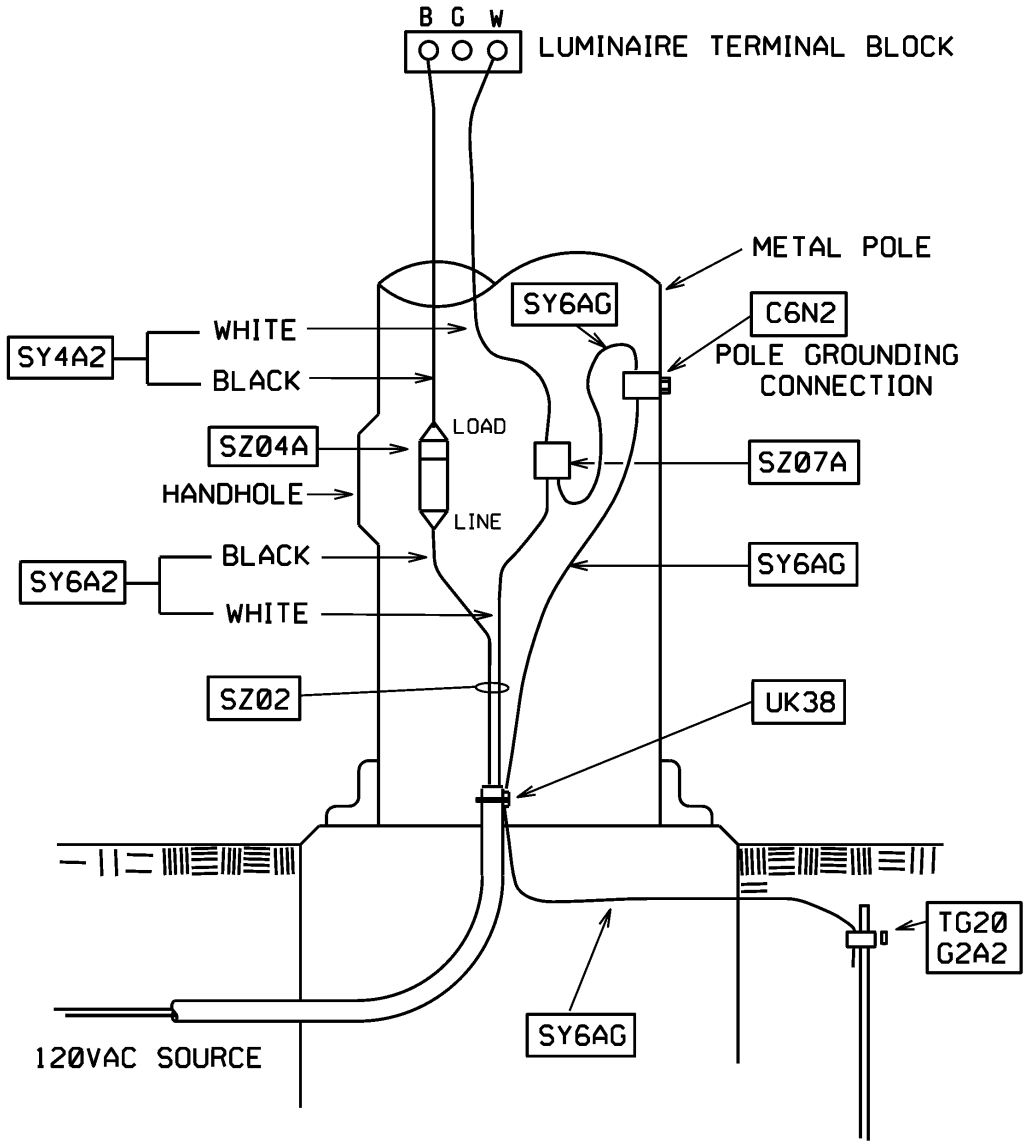


Figure 27

Notes:

1. Always use an in-line fuse holder as the connection between the #6 source wiring and the #10 luminaire wiring. In-line fuse holders are designed to separate when the pole is broken by a motor vehicle and leave no exposed energize wiring. The in-line fuse holder housing must be installed properly with respect to “Line End” and Load End” as marked on the rubber housing. Follow manufacturers instructions packaged with every fuse holder.

2. Always pull conductors outside of the pole access handhole to make connections. Allow sufficient slack for future maintenance. Push completed connections and slack conductors back inside handhole and secure cover with tamper resistant hardware.

3. Connect equipment grounding conductor to metal conduit sweep, when available, and then to a driven ground rod. For direct buried cable installations or when conduit sweep is non-metallic, install grounding conductor direct to the driven ground rod.

Supersedes 07/09 Issue – Revised STD Item numbers and added STD Item SZ02 – Cable tagging kit.

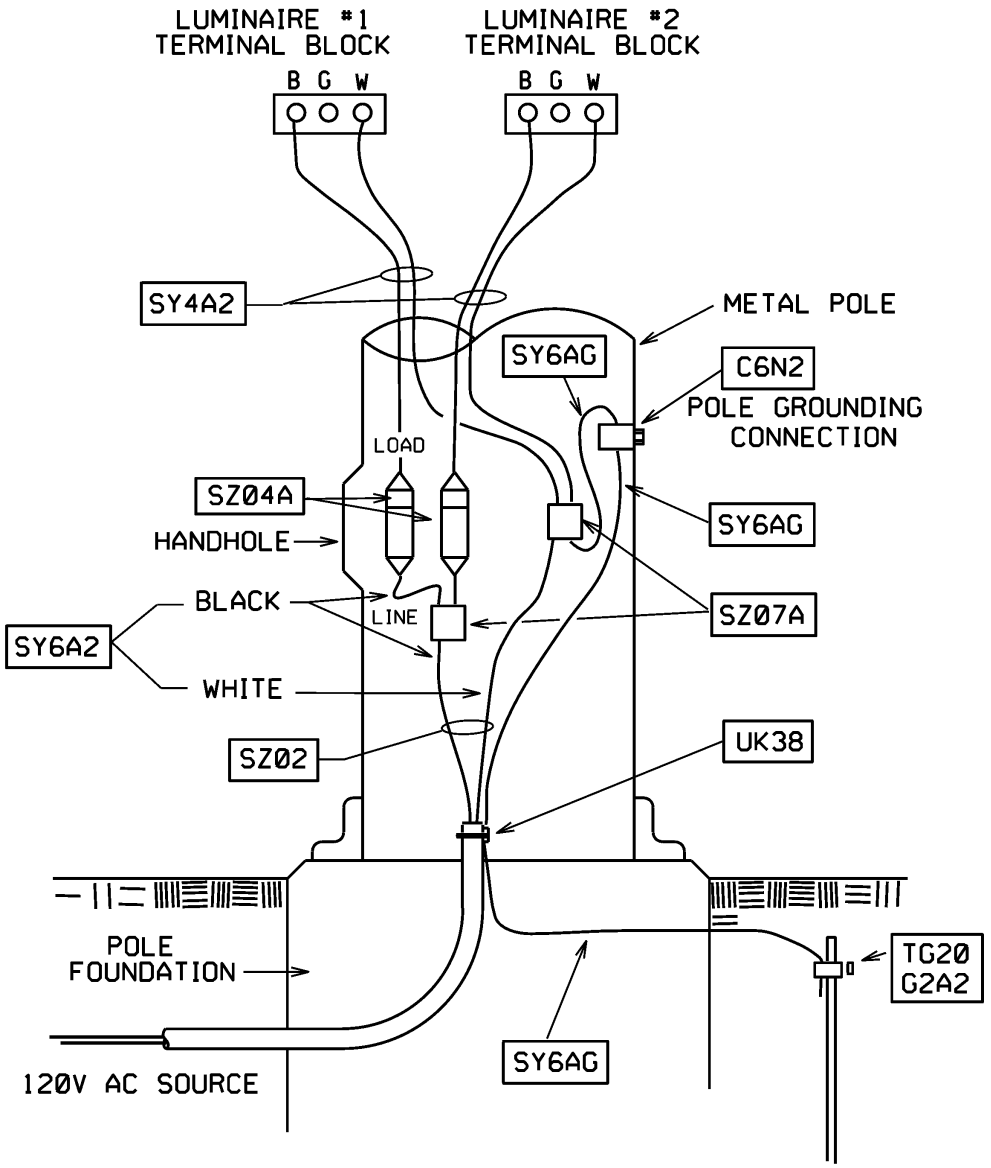


Figure 28

Notes:

1. Always use an in-line fuse holder as the connection between the #6 source wiring and the #10 luminaire wiring. In-line fuse holders are designed to separate when the pole is broken by a motor vehicle and leave no exposed energize wiring. The in-line fuse holder housing must be installed properly with respect to “Line End” and Load End” as marked on the rubber housing. Follow manufacturers instructions packaged with every fuse holder.

2. Always pull conductors outside of the pole access handhole to make connections. Allow sufficient slack for future maintenance. Push completed connections and slack conductors back inside handhole and secure cover with tamper resistant hardware.

3. Connect equipment grounding conductor to metal conduit sweep, when available, and then to a driven ground rod. For direct buried cable installations or when conduit sweep is non-metallic, install grounding conductor direct to the driven ground rod.

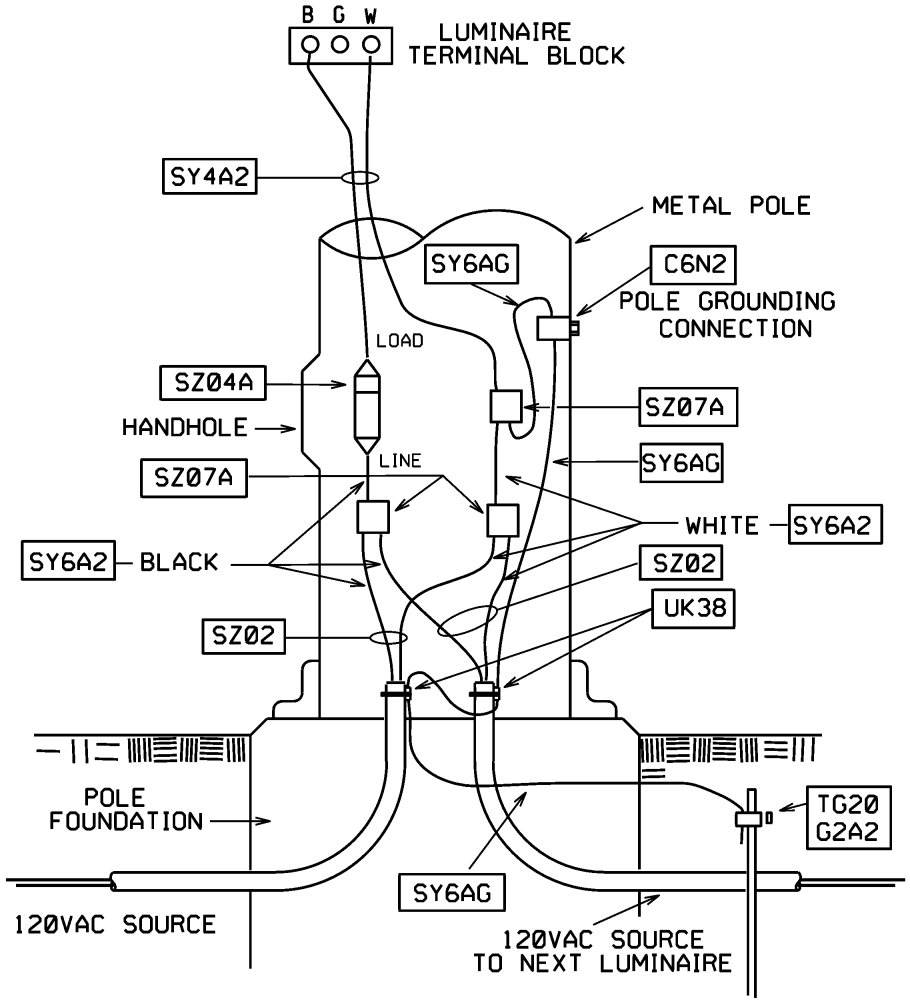


Figure 29

Notes:

1. For **MAINTENANCE ONLY** of existing installations. Do not use for new construction. See Standards Section 46-17 for details.

2. Always use an in-line fuse holder as the connection between the #6 source wiring and the #10 luminaire wiring. Separable connectors are designed to separate when the pole is broken by a motor vehicle and leave no exposed energize wiring. The in-line fuse holder housing must be installed properly with respect to “Line End” and Load End” as marked on the rubber housing. Follow manufacturers instructions packaged with every fuse holder.

3. Always pull conductors outside of the pole access handhole to make connections. Allow sufficient slack for future maintenance. Push completed connections and slack conductors back inside handhole and secure cover with tamper resistant hardware.

4. Connect equipment grounding conductor to metal conduit sweep, when available, and then to a driven ground rod. For direct buried cable installations or when conduit sweep is non-metallic, install grounding conductor direct to the driven ground rod.

Supersedes 07/09 Issue – Revised STD Item numbers and added STD Item SZ02 – Cable tagging kit. Added “ For Maintenance Only” .

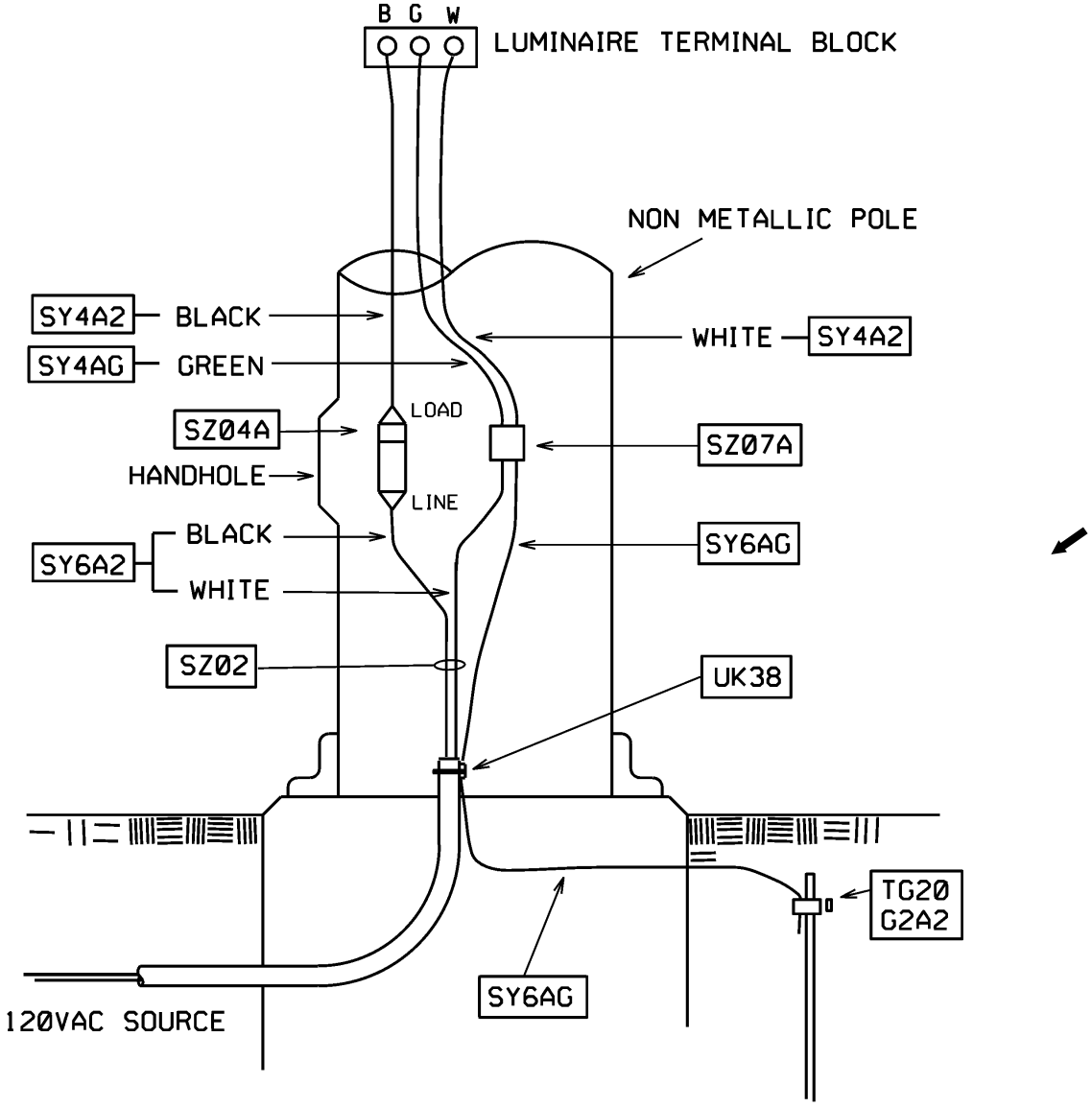


Figure 30

Notes:

1. Always use an in-line fuse holder as the connection between the #6 source wiring and the #10 luminaire wiring. In-line fuse holders are designed to separate when the pole is broken by a motor vehicle and leave no exposed energize wiring. The in-line fuse holder housing must be installed properly with respect to “Line End” and Load End” as marked on the rubber housing. Follow manufacturers instructions packaged with every fuse holder.

2. Always pull conductors outside of the pole access handhole to make connections. Allow sufficient slack for future maintenance. Push completed connections and slack conductors back inside handhole and secure cover with tamper resistant hardware.

3. Connect equipment grounding conductor to metal conduit sweep, when available, and then to a driven ground rod. For direct buried cable installations or when conduit sweep is non-metallic, install grounding conductor direct to the driven ground rod.

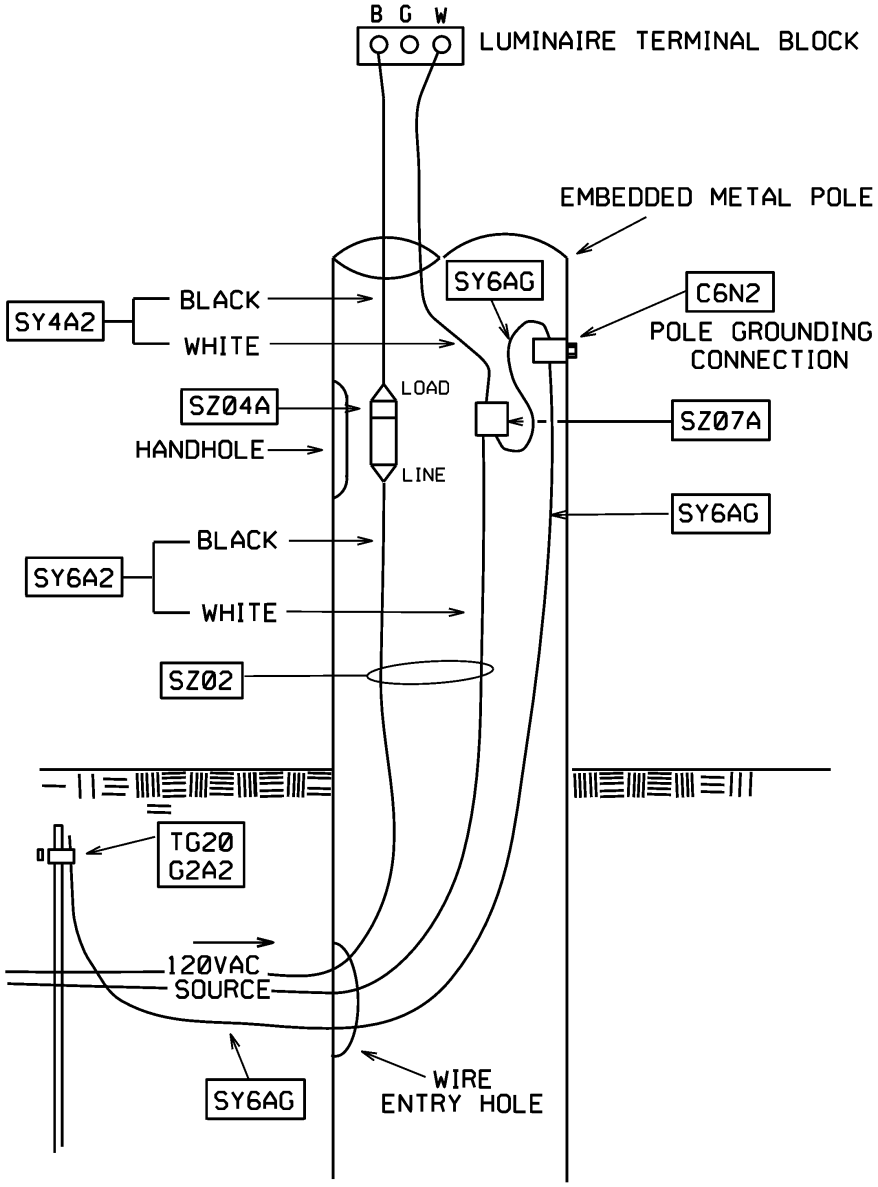


Figure 31

Notes:

1. Always use an in-line fuse holder as the connection between the #6 source wiring and the #10 luminaire wiring. In-line fuse holders are designed to separate when the pole is broken by a motor vehicle and leave no exposed energize wiring. The in-line fuse holder housing must be installed properly with respect to “Line End” and Load End” as marked on the rubber housing. Follow manufacturers instructions packaged with every fuse holder.

2. Always pull conductors outside of the pole access handhole to make connections. Allow sufficient slack for future maintenance. Push completed connections and slack conductors back inside handhole and secure cover with tamper resistant hardware.

3. Connect equipment grounding conductor to metal conduit sweep, when available, and then to a driven ground rod. For direct buried cable installations or when conduit sweep is non-metallic, install grounding conductor direct to the driven ground rod.

Supersedes 07/09 Issue – Revised STD Item numbers and added STD Item SZ02 – Cable tagging kit.

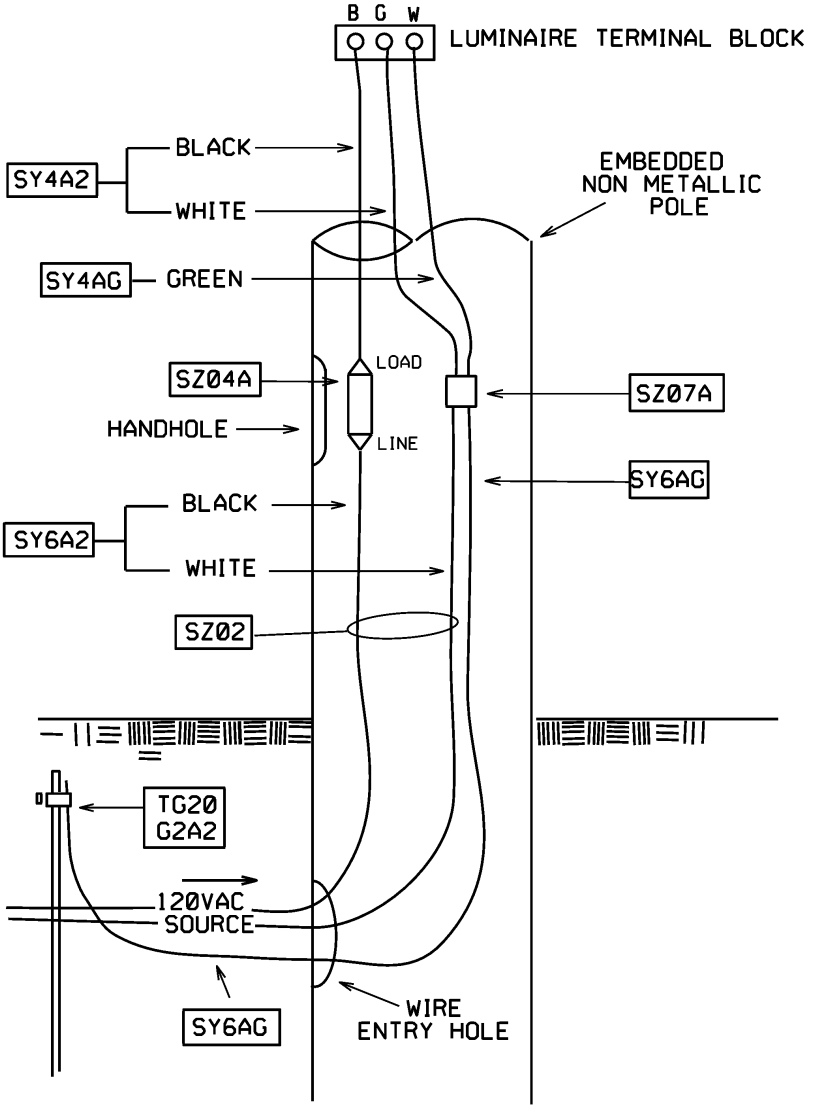


Figure 32

Notes:

1. Always use an in-line fuse holder as the connection between the #6 source wiring and the #10 luminaire wiring. In-line fuse holders are designed to separate when the pole is broken by a motor vehicle and leave no exposed energize wiring. The in-line fuse holder housing must be installed properly with respect to “Line End” and Load End” as marked on the rubber housing. Follow manufacturers instructions packaged with every fuse holder.

2. Always pull conductors outside of the pole access handhole to make connections. Allow sufficient slack for future maintenance. Push completed connections and slack conductors back inside handhole and secure cover with tamper resistant hardware.

3. Connect equipment grounding conductor to metal conduit sweep, when available, and then to a driven ground rod. For direct buried cable installations or when conduit sweep is non-metallic, install grounding conductor direct to the driven ground rod.

46.20 "PENDANT" STREET LIGHTING POLE – INSTALLATION

This Section provides details for installation of an aluminum pendant street lighting pole.

46.20.10 Loading

Pendant street lighting poles are rated capable of supporting one or two supporting arms with horizontal roadway luminaire(s) or one horizontal roadway luminaire / arm and one floodlight luminaire with arm. Ratings are based on a sustained 90 mph wind. Consult Standards Engineering if additional luminaire loading is required.

MUNICIPAL ATTACHMENTS – BANNERS, FLOWERPOTS, ETC. – In general, pendant poles have been engineered to support the arm and luminaire loading only and not the additional loading imposed by municipal attachments. In some cases, however, limited additional loading may be possible. See STANDARDS Section 46.14 for details.

46.20.20 Wiring Details

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections and slack conductors back inside pole access handhole and secure cover with tamper resistant hardware.

46.20.30 Twin Luminaire Wiring Details

Install a separate set of #10 conductors for each luminaire and terminate inside the pole access handhole. Wrap each set of luminaire conductors with three layers of PVC tape to aid in conductor identification.

46.20.40 Pendant Pole & Arm Selection

See STANDARDS Section 49-ST01 for available aluminum pendant poles and arms.

Supersedes 1/07 Issue – Deleted Table 22. Added paragraph 46.20.40.

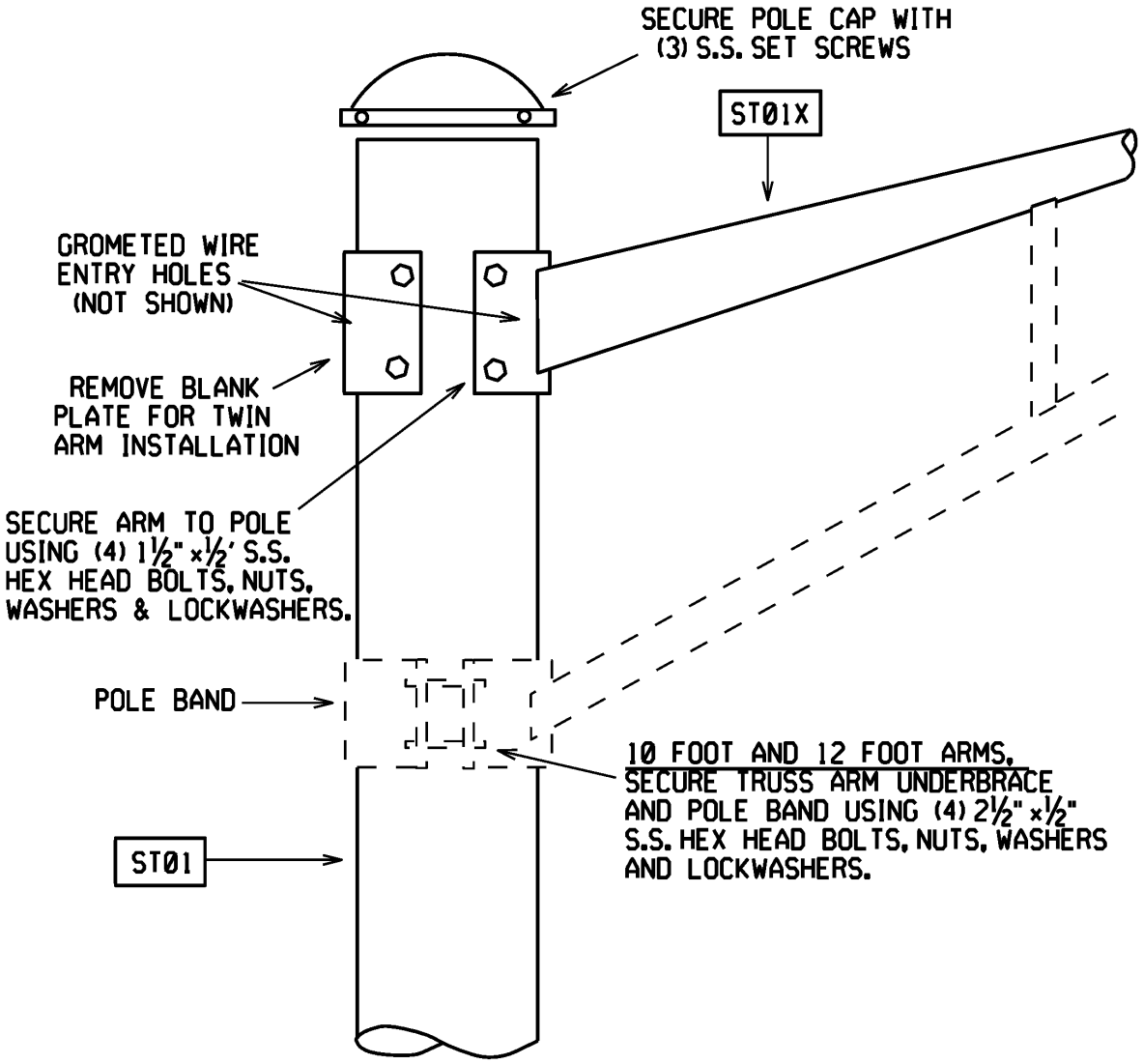


Figure 33
Arm Installation on Aluminum Pendant Pole

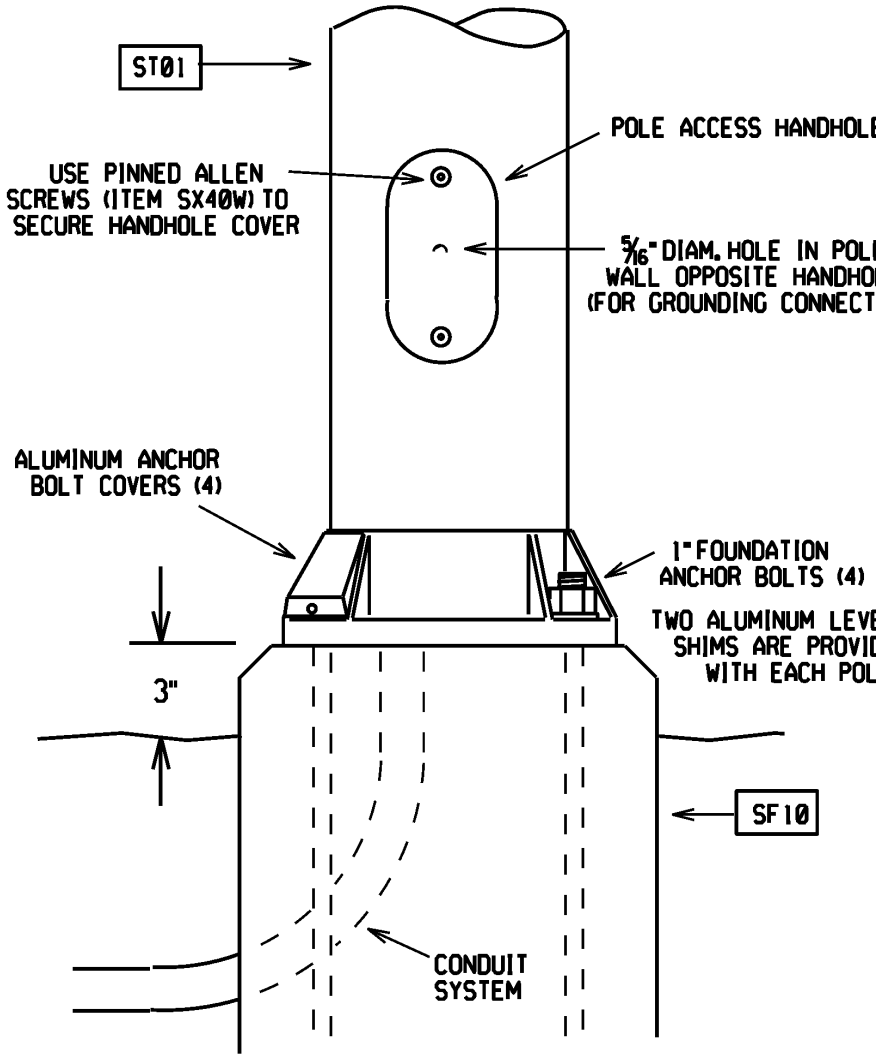


Figure 34
Aluminum Pendant Pole – Installation

CAUTION: Never install pole without arm and luminaire. The arm / luminaire combination contribute to dampen wind induced vibration forces which could lead to pole failure.

46.21 FLOODLIGHT INSTALLATION ON ALUMINUM PENDANT POLE

This Section provides instructions for installation of a floodlight luminaire on an aluminum pendant street lighting pole.

46.21.10 Loading

Aluminum pendant street lighting poles are rated capable of supporting one or two supporting arms with floodlight luminaire(s) or one floodlight arm / luminaire with one horizontal roadway luminaire with arm. Ratings are based on a sustained 90 mph wind. Consult Standards Engineering if additional loading is required.

46.21.20 Floodlight Aiming

See STANDARDS Section 46.4 for specific details on aiming floodlights.

46.21.30 Wiring Details

Install a separate set of #10 conductors for each luminaire and terminate inside the pole access handhole. Wrap each set of luminaire conductors with three layers of PVC tape to aid in conductor identification. Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19 as applicable. Push completed connections and slack conductors back inside pole access handhole and secure cover with tamper resistant hardware.

46.21.40 Floodlight Selection

See STANDARDS section 49-SJ for available floodlight luminaires and section 49-ST01 for floodlight arms.

Supersedes 1/07 Issue – Deleted Table 23. Added paragraph 46.21.40.

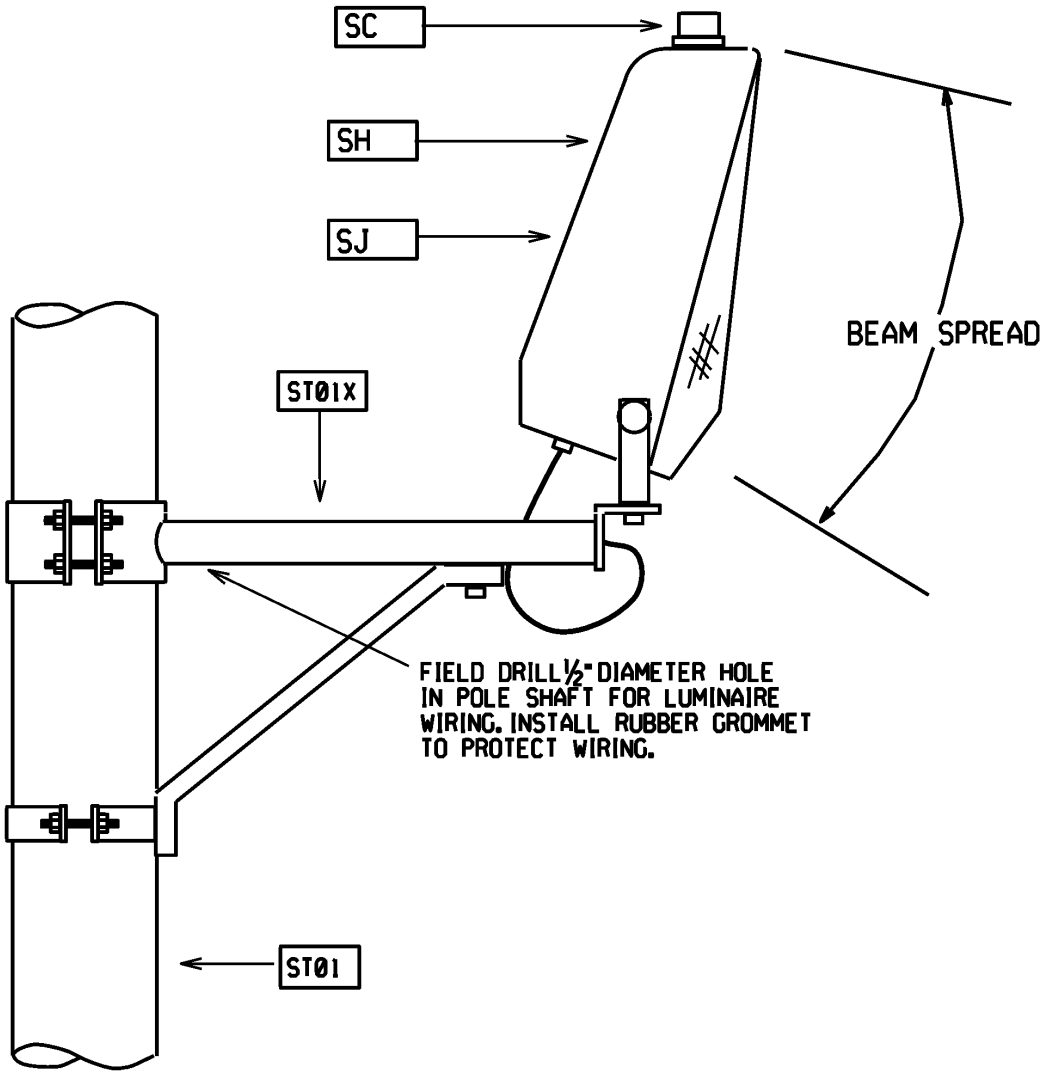


Figure 35
Floodlight Installation on Aluminum Pendant Pole

Note: For twin floodlight installations, mount two floodlight arms back-to-back and omit the back pole plates.

46.22 "DAVIT" STREET LIGHTING POLE – INSTALLATION

This Section provides details for installation of an aluminum davit style street lighting pole.

46.22.10 Loading

Aluminum davit poles are rated capable of supporting a single or twin supporting arm with horizontal roadway luminaire(s). Floodlight luminaire installations are not allowed on davit poles. Ratings are based on a sustained 90 mph wind.

MUNICIPAL ATTACHMENTS – BANNERS, FLOWERPOTS, ETC. – In general, aluminum davit poles have been engineered to support the arm and luminaire loading only and not the additional loading imposed by municipal attachments. In some cases, however, limited additional loading may be possible. See STANDARDS Section 46.14 for details.

46.22.20 Wiring Detail

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19 as applicable. Push completed connections and slack conductors back inside pole access handhole and secure cover with tamper resistant hardware.

46.22.30 Twin Luminaire Wiring Detail

Install a separate set of #10 conductors for each luminaire and terminate inside the pole access handhole or transformer base. Wrap each set of luminaire conductors with three layers of PVC tape to aid in conductor identification.

46.22.40 Davit Pole & Arm Selection

See STANDARDS Section 49-ST04 for available aluminum davit poles and arms.

Supersedes 1/07 Issue – Deleted Table 24. Added paragraph 46.22.40.

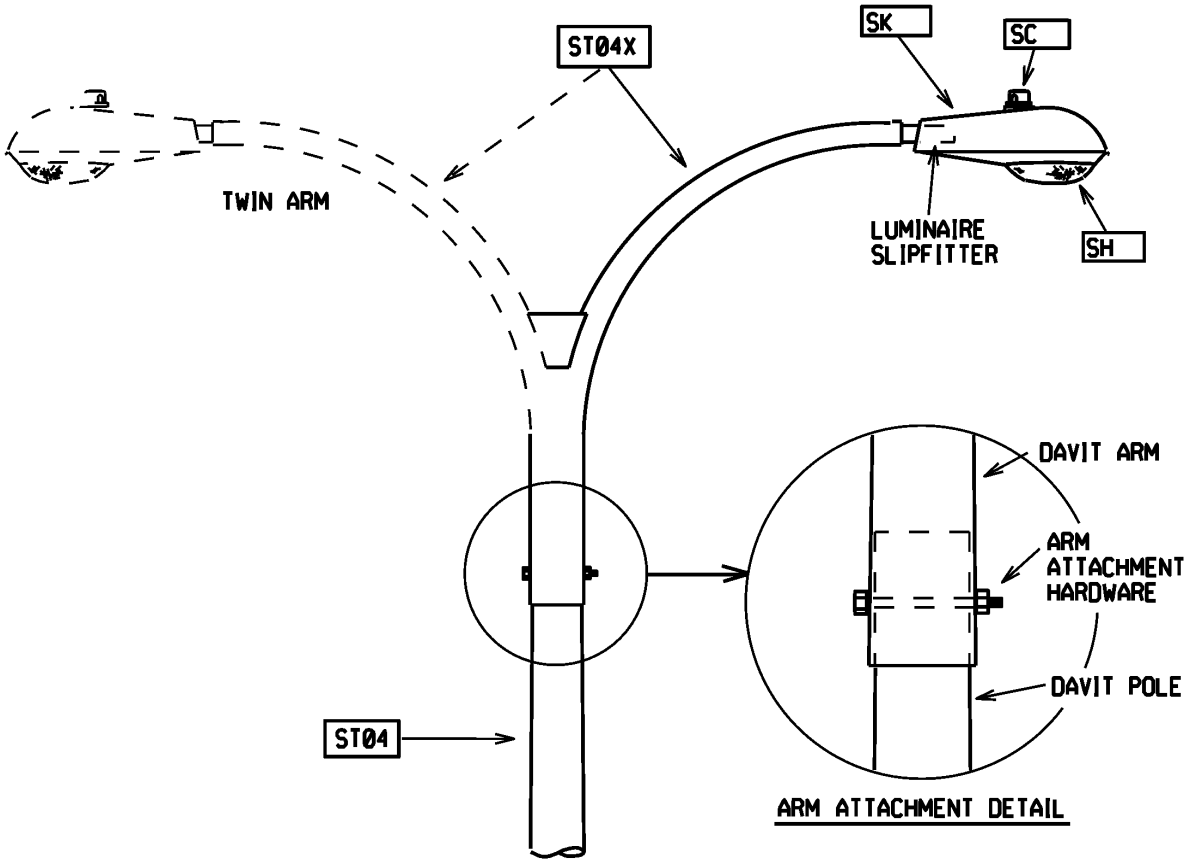


Figure 36
Arm Installation on Aluminum Davit Pole

Note: Davit arm attachment hardware consists of (1)-⅝ inch x 8 inch long aluminum studbolt, (2)-⅝" lock washers, and (2)-⅝" nuts. Attachment hardware is furnished with the davit arm.

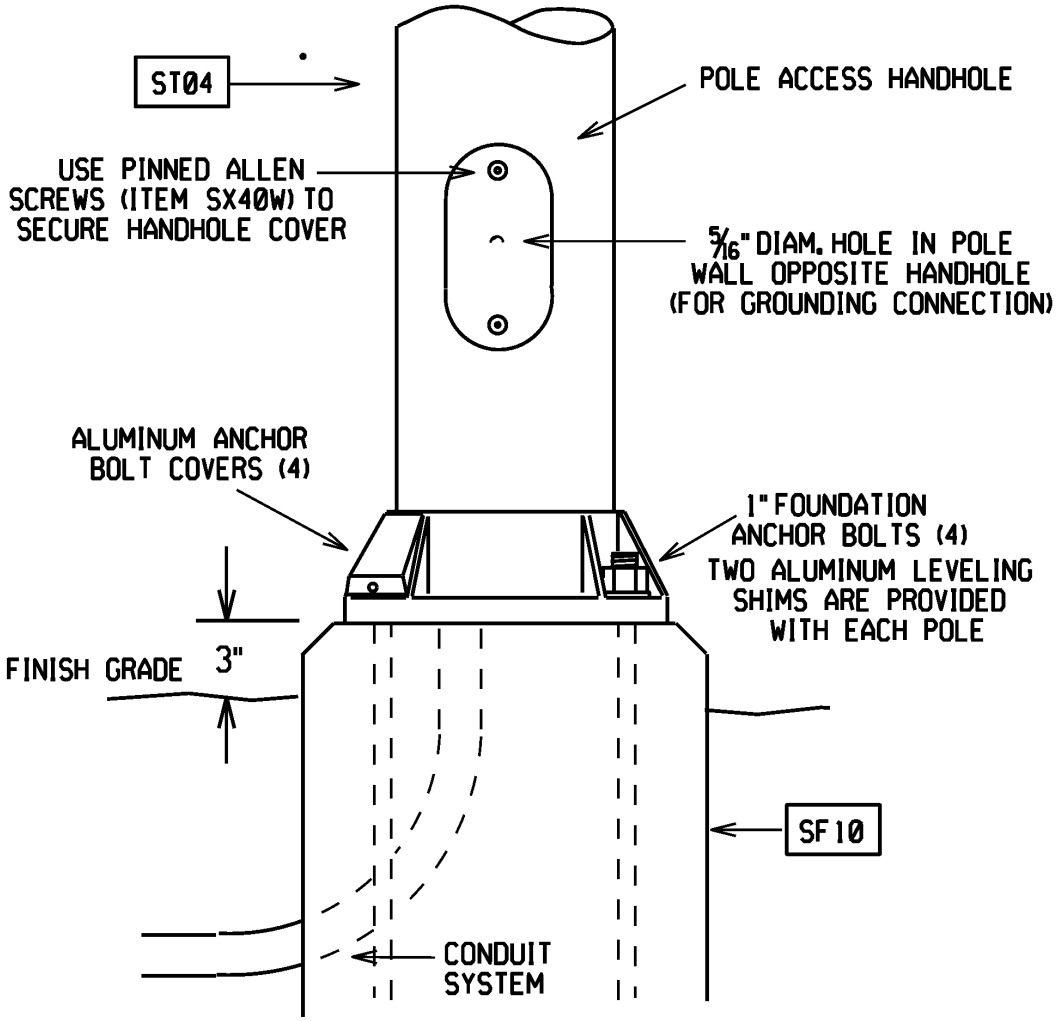


Figure 37
Aluminum Davit Pole – Installation on Precast Concrete Foundation

CAUTION: Never install pole without arm and luminaire. The arm / luminaire combination contribute to dampen wind induced vibration forces which could lead to pole failure.

Supersedes 1/07 Issue – Deleted second conduit.

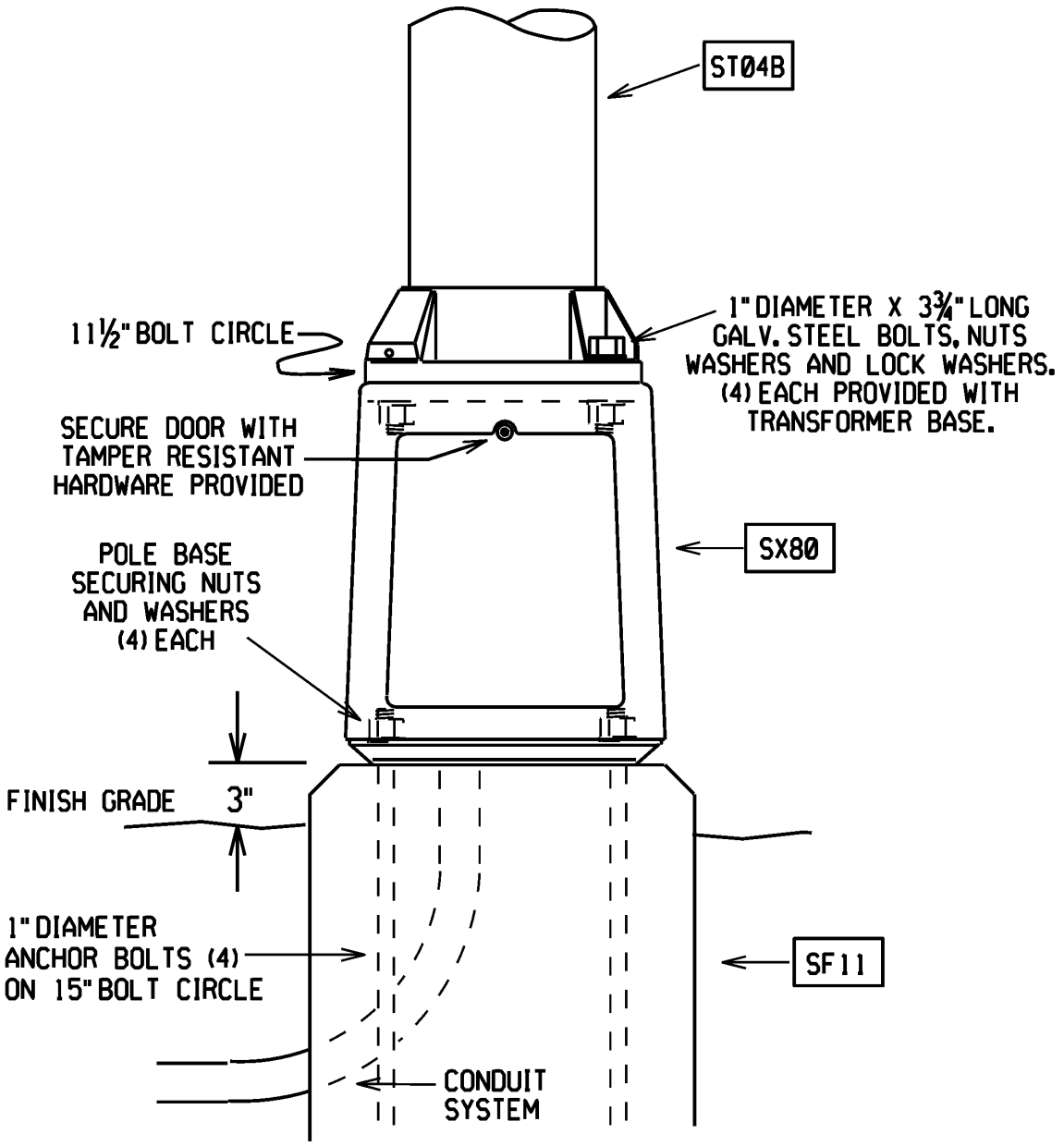


Figure 38
Aluminum Davit Pole – Installation on Aluminum Transformer Base

46.23 "ARCHITECTURAL" STREET LIGHTING POLE – ALUMINUM - INSTALLATION

This Section provides details for installation of an aluminum, square shaft, architectural style street lighting pole.

46.23.10 Loading

Aluminum architectural poles are rated capable of supporting up to four shoebox style luminaires only. Ratings are based on a sustained 90 mph wind.

46.23.20 Foundation Selection

Aluminum architectural poles are installed on precast concrete foundations. See STANDARDS Section 46.16 for precast concrete foundation selection.

46.23.30 Wiring Details

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19 as applicable. Push completed connections and slack conductors back inside pole access handhole and secure cover with tamper resistant hardware.

46.23.40 Multiple Luminaire Wiring Details

Install a separate set of #10 conductors for each luminaire and terminate inside the pole access handhole. Wrap each set of luminaire conductors with three layers of PVC tape to aid in conductor identification.

46.23.50 Luminaire Installation

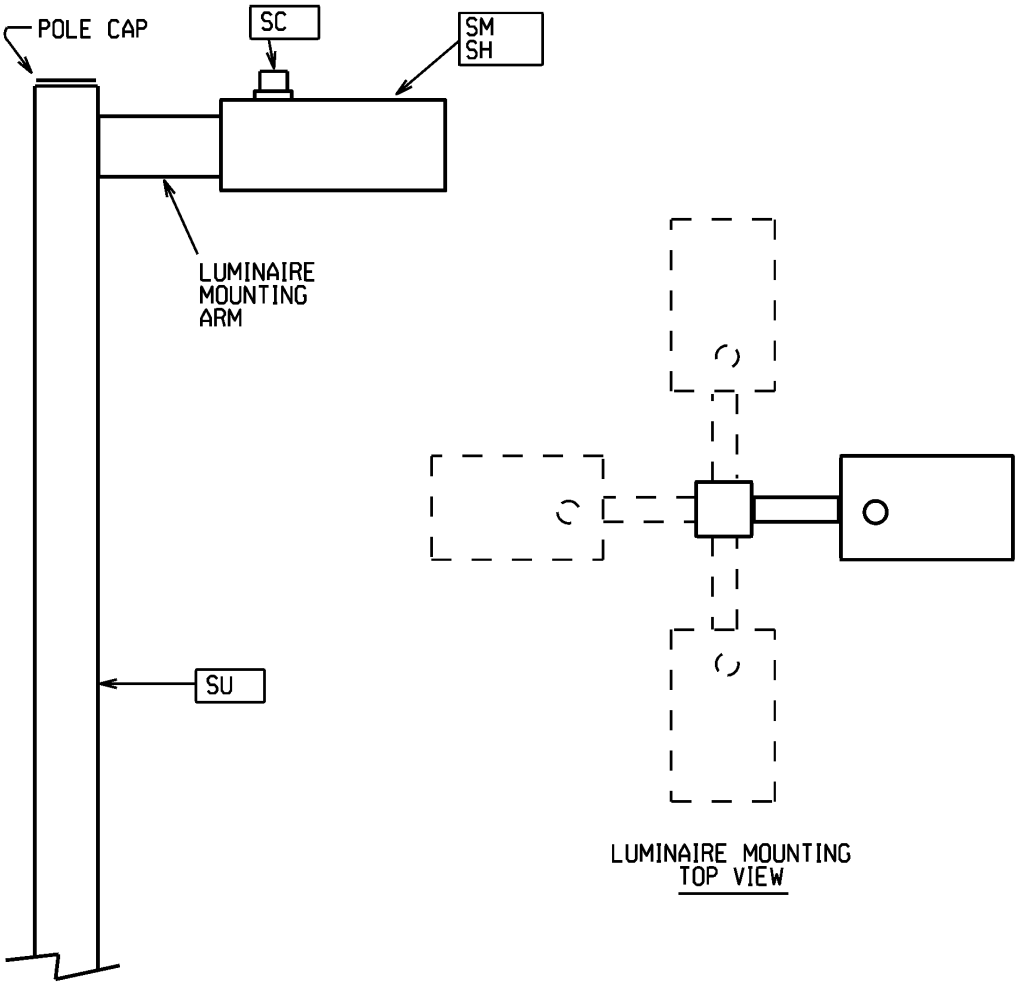
Pole must be field drilled to accept mounting arm and luminaire. See manufacturer's instructions (packaged with every luminaire) for drilling template. Follow manufacturer's instructions for arm and luminaire installation.

Luminaires may be single, double, triple, or quadruple mounted as required.

46.23.60 Architectural Pole & Shoebox Luminaire Selection

See STANDARDS section 49-SU01 for Architectural pole selection and section 49-SM03 for Shoebox luminaire selection.

Supersedes 1/07 Issue – Revised paragraph 46.23.20. Added paragraph 46.23.60.



Supersedes 1/07 Issue – Deleted Table 26.

Figure 39
Shoebox Luminaire Installation on Aluminum Architectural Pole

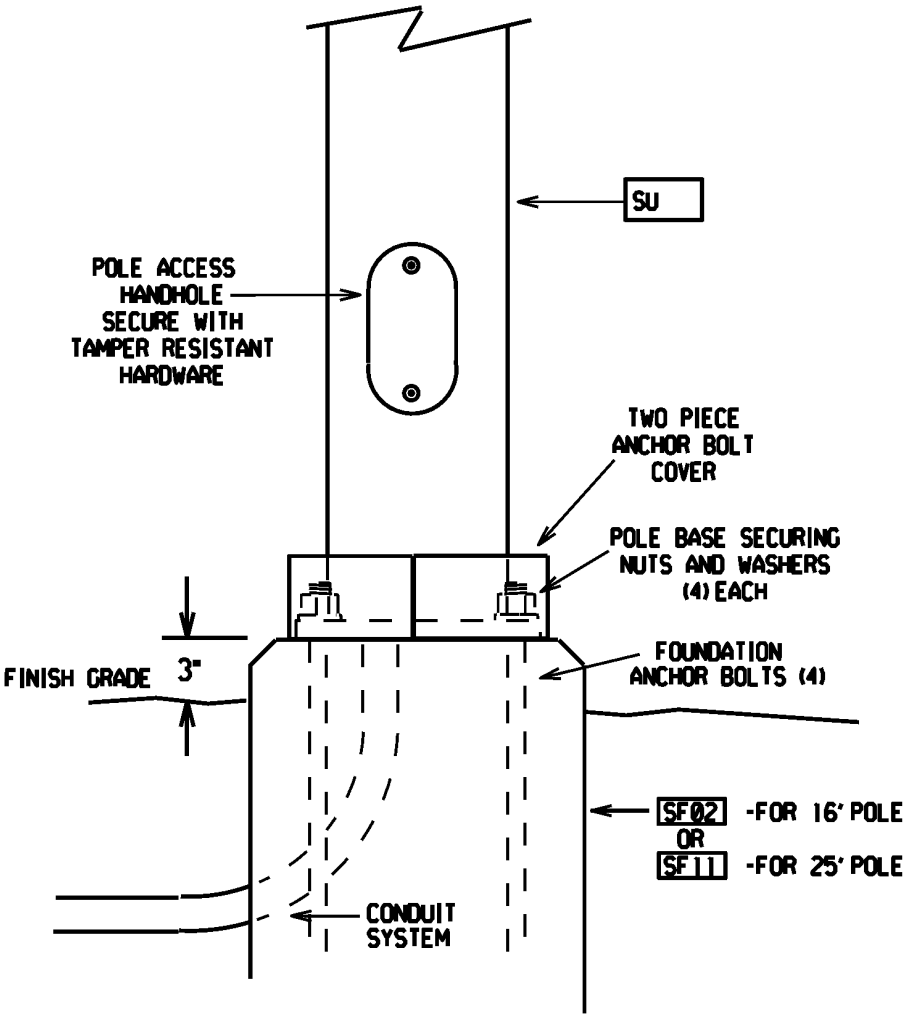


Figure 40
Architectural Pole Installation on Precast Concrete Foundation

CAUTION: Never install pole without luminaire(s). The luminaire(s) contribute to dampen wind induced vibration forces which could lead to pole failure.

Supersedes 1/07 Issue – Deleted second conduit.

46.24 "PENDANT" STREET LIGHTING POLE – FIBERGLASS – EMBEDDED - INSTALLATION

This Section provides details for installation of an embedded, fiberglass, pendant, street lighting pole. (STD Item ST02F1) Embedded, fiberglass, pendant, street lighting poles are available for use in the Rhode Island service territory only and are to be used strictly for maintenance of existing installations. They are intended for use with horizontal roadway luminaires in underground residential developments using direct buried supply conductors. New installations shall use anchor base style poles.

46.24.10 Loading

Embedded, fiberglass, pendant, poles are rated capable of supporting a single arm and horizontal roadway luminaire only. Ratings are based on a sustained 90 mph wind.

MUNICIPAL ATTACHMENTS – BANNERS, FLOWERPOTS, ETC. – Embedded, fiberglass, pendant street lighting poles have been engineered to support the arm and luminaire loading only and not the additional loading imposed by any type of municipal attachment.

46.24.20 Wiring Details

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections and slack conductors back inside pole access handhole and secure cover with tamper resistant hardware.

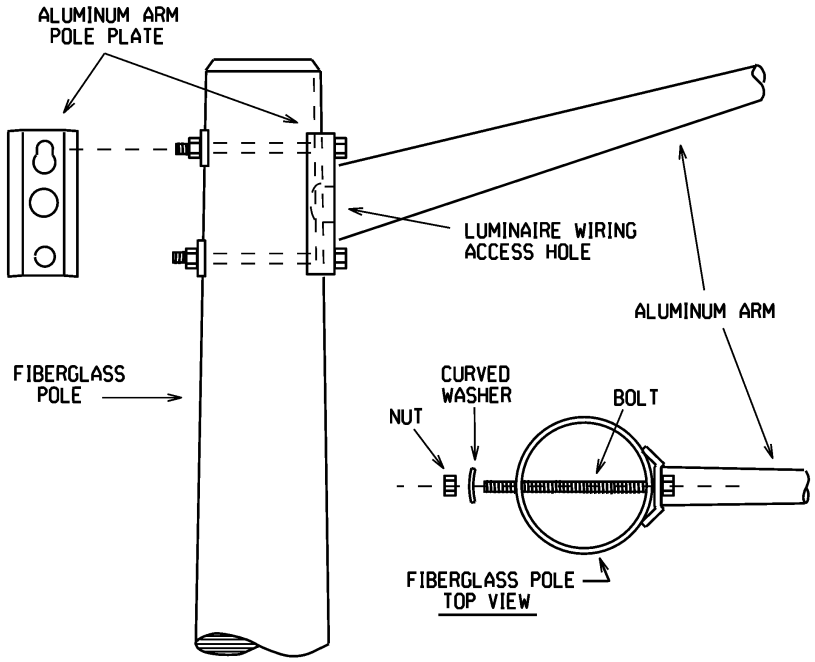


Figure 41
Arm Installation on a Pendant Fiberglass Pole

Supersedes 1/07 Issue – Deleted Table 27. Revised paragraph 46.24. Revised paragraph 46.24.

46.24.30 Pole Installation

Auger hole to required depth. Using belt slings or rope (no chain or cable), set pole plumb and hold in position on undisturbed earth. Do not remove protective pole covering during installation.

46.24.40 Backfill

Add backfill in 6 inch layers and tamp firmly. Complete filling of the hole with excavated soil to within 4 inches below grommoted wire hole and tamp firmly to eliminate voids. Avoid using stones larger than 2 inches in diameter. Next, add 8 inches of tamped sand (covering direct buried supply conductors), followed by 16 inches of tamped, excavated backfill to within 4 inches of final grade. The final 4 inches of fill shall be tamped loam.

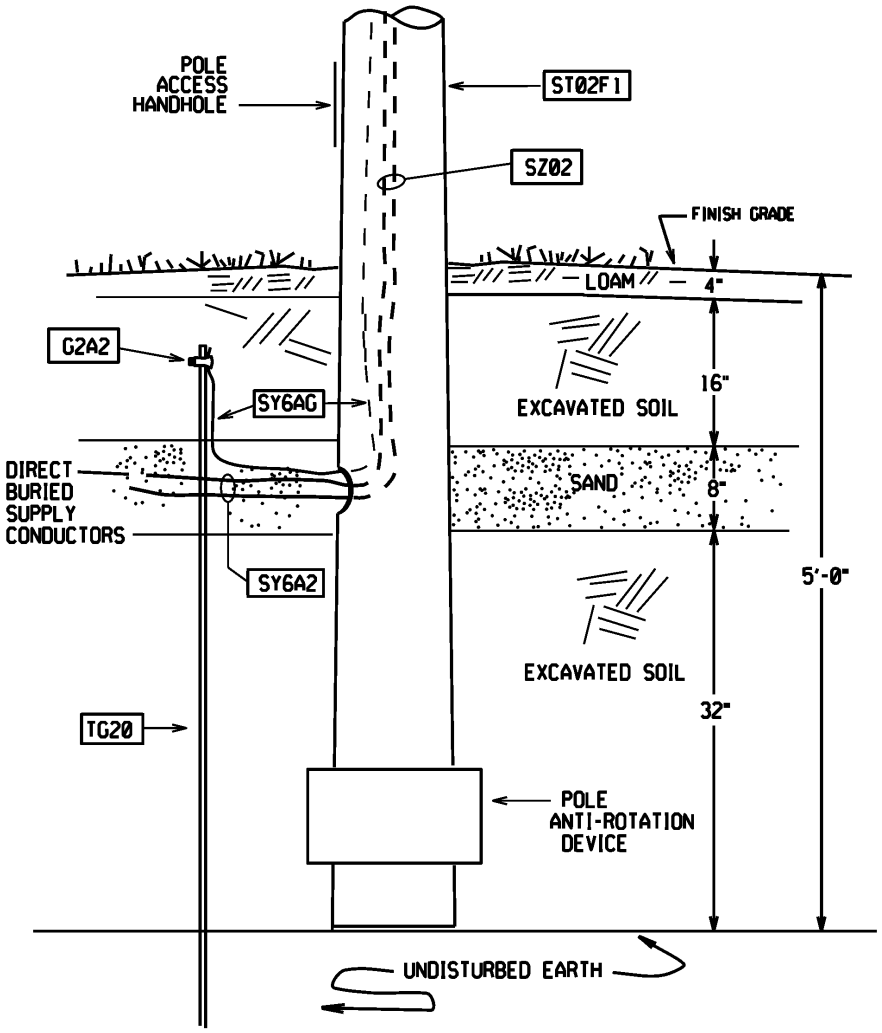


Figure 42
Embedded, Fiberglass Pendant Pole – Installation

Supersedes 07/09 Issue – Revised STD Item numbers and added STD Item SZ02 - Cable tagging kit.

46.25 "PENDANT" STREET LIGHTING POLE – ANCHOR BASE FIBERGLASS - INSTALLATION

This Section provides details for installation of an anchor base, fiberglass, pendant, street lighting pole. (STD Item ST02F). Anchor base, fiberglass, pendant, street lighting poles are intended for use with horizontal roadway luminaires in new underground residential developments using conduit installed supply conductors.

46.25.10 Loading

Anchor base, fiberglass, pendant, poles are rated capable of supporting a single arm and horizontal roadway luminaire only. Ratings are based on a sustained 90 mph wind.

MUNICIPAL ATTACHMENTS – BANNERS, FLOWERPOTS, ETC. – Anchor base, fiberglass, pendant street lighting poles have been engineered to support the arm and luminaire loading only and not the additional loading imposed by any type of municipal attachment.

46.25.20 Wiring Details

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections and slack conductors back inside pole access handhole and secure cover with tamper resistant hardware.

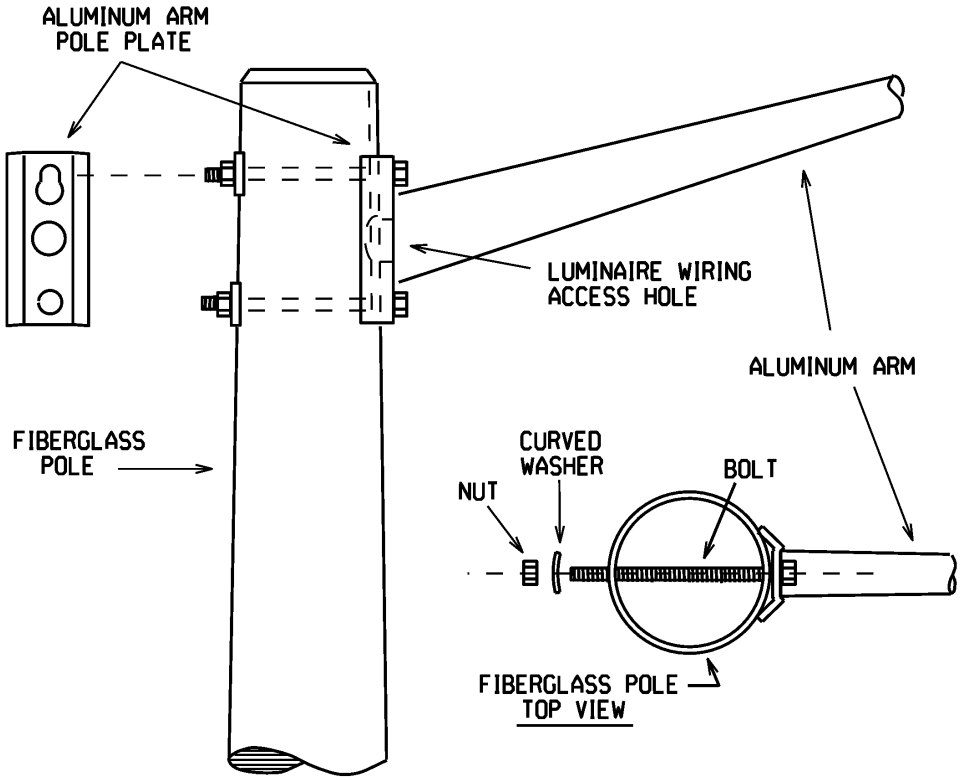


Figure 43
Arm Installation on a Pendant Fiberglass Pole

Supersedes 1/07 Issue – Deleted Table 28. Added Figure 43.

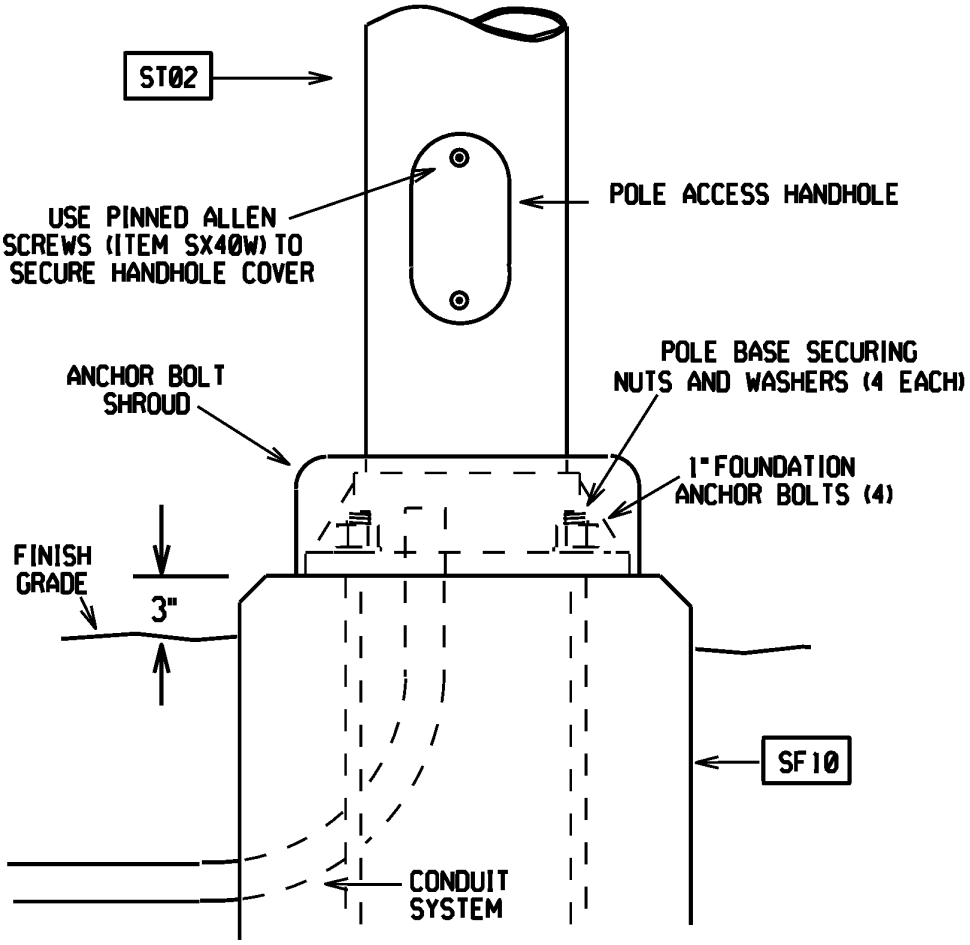


Figure 44
Anchor Base, Fiberglass, Pendant, Pole – Installation

CAUTION: Never install pole without arm and luminaire.
The arm / luminaire combination contribute to dampen wind induced vibration forces which could lead to pole failure

Supersedes 01/07 Issue – Deleted second conduit.

46.26 "SUBURBAN" POST TOP POLE - ANCHOR BASE, ROUND, FIBERGLASS – INSTALLATION

This Section provides details for installation of an anchor base, fiberglass, Suburban post top pole.

46.26.10 Foundation Installation

Anchor base, fiberglass Suburban post top poles are installed on precast concrete foundations. See STANDARDS Section 46.16 for precast concrete foundation selection and precast concrete foundation installation details.

46.26.20 Pole Installation

Attach nylon sling at a point approximately 1/3 down from pole top. Never use chain or cable. Be careful not to cut or scratch the pole surface during installation. Install anchor bolt shroud onto pole shaft before installing post top luminaire.

46.26.30 Wiring Diagram

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections and slack back inside pole access handhole and secure cover with tamper resistant hardware.

Supersedes 1/07 Issue – Deleted Table 29. Revised paragraph 46.26.10.

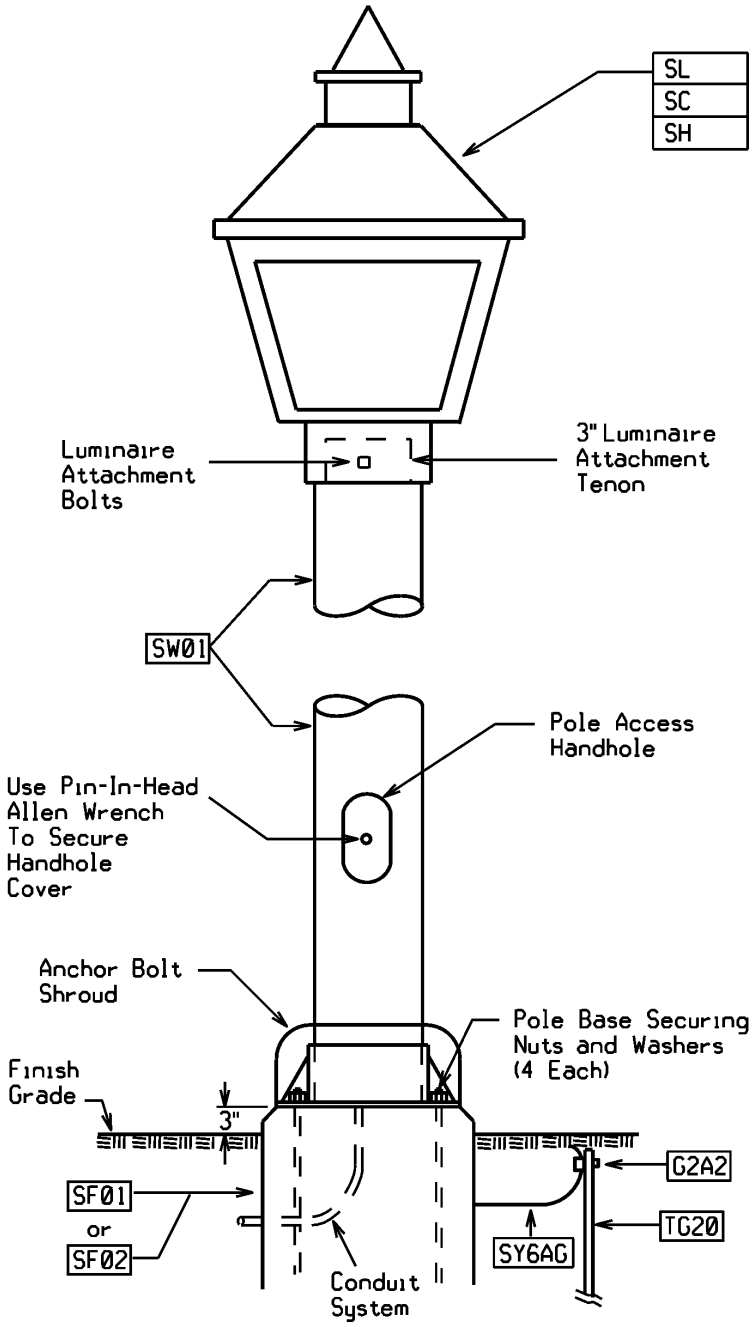


Figure 45
Suburban Post Top Pole - Anchor Base, Fiberglass, – Installation

Supersedes 1/07 Issue – Deleted second conduit and updated STD Item numbers.

46.27 "SUBURBAN" POST TOP POLE – EMBEDDED, ROUND, FIBERGLASS – INSTALLATION

This Section provides details for installation of an Suburban embedded, round, fiberglass, post top style pole. (STD Item SW02). Suburban, embedded, round fiberglass poles are intended for use with direct buried supply conductors.

46.27.10 Pole Loading

Suburban, embedded, round, fiberglass poles are rated capable of supporting one post top style luminaire. No other attachments are allowed.

46.27.20 Pole Installation

Auger hole to the required depth. Attach nylon sling at a point approximately 1/3 down from pole top. Never use chain or cable. Be careful not to cut or scratch the pole surface during installation. Set pole plumb and hold in position on undisturbed earth. As pole is set, feed underground supply cable through the conductor entrance hole up toward the pole access handhole.

46.27.30 Backfill

Add backfill in 6 inch layers and tamp firmly. Complete filling of the hole with excavated soil to within 4 inches below grommeted wire hole. Avoid stones larger than 2 inches in diameter. Next, add 8 inches of tamped sand, (covering direct buried secondary conductors), followed by 16 inches of tamped, backfill to within 4 inches of final grade. The final 4 inches of fill shall be tamped loam.

46.27.40 Luminaire Installation

Orient luminaire with respect to "street side" and "house side" markings to properly direct the light output. Securely attach the luminaire to the pole top tenon with the three attachment bolts. Lamp and photoelectric control should be the last items installed.

46.27.50 Wiring Details

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections and slack back inside pole access handhole and secure cover with tamper resistant hardware.

Supersedes 1/07 Issue – Deleted Table 30. Revised paragraph 46.27.

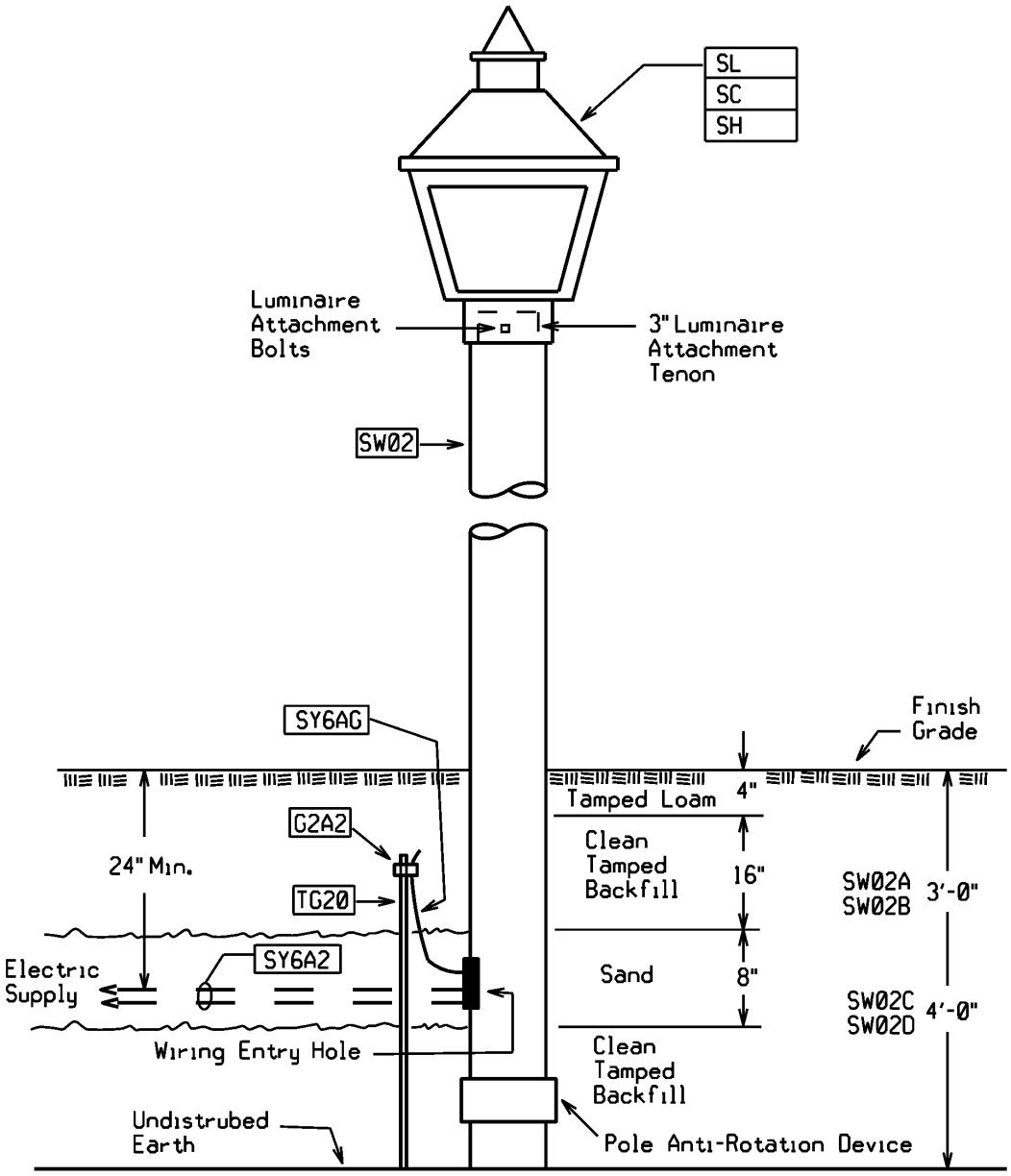


Figure 46
Suburban Post Top Pole – Embedded, Round, Fiberglass – Installation

Supersedes 1/07 Issue – Updated STD Item numbers.

46.28 "SUBURBAN" EMBEDDED, SQUARE, FIBERGLASS POLES – INSTALLATION

This Section provides details for installation of an Suburban embedded, square, fiberglass, post top style pole. Suburban embedded square fiberglass poles are intended for use with direct buried supply conductors.

46.28.10 Pole Loading

Suburban embedded, square, fiberglass poles are rated capable of supporting one luminaire. No other attachments are allowed.

46.28.20 Pole Installation

Auger hole to the required depth. Attach nylon sling at a point approximately 1/3 down from pole top. Never use chain or cable. Be careful not to cut or scratch the pole surface during installation. Set pole plumb and hold in position on undisturbed earth. As pole is set, feed underground supply cable through the conductor entrance hole up toward the pole access handhole.

46.28.30 Backfill

Add backfill in 6 inch layers and tamp firmly. Complete filling of the hole with excavated soil to within 4 inches below grommeted wire hole. Avoid stones larger than 2 inches in diameter. Next, add 8 inches of tamped sand, (covering direct buried secondary conductors), followed by 16 inches of tamped, backfill to within 4 inches of final grade. The final 4 inches of fill shall be tamped loam.

46.28.40 Luminaire Installation – 18 Foot Pole

This pole is designed for use with post top luminaires. Orient luminaire with respect to "street side" and "house side" markings to properly direct the light output. Securely attach the luminaire to the pole top tenon with the three attachment bolts. Lamp and photoelectric control should be the last items installed. See Figure 47.

46.28.50 Luminaire Installation – 24 Foot Pole

This pole is designed for use with shoebox style luminaires (Std. Items SM03B1 or SM03C1 only). A tenon adapter (Std. Item SU02X) is required to mount the shoebox luminaire to the pole top tenon. Lamp and photoelectric control should be the last items installed. See Figure 48.

46.28.60 Wiring Details

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections and slack back inside pole access handhole and secure cover with tamper resistant hardware.

46.28.70 Suburban Square Fiberglass Pole Selection

See STANDARDS sections 49-SU02 and 49-SW03 for available Suburban square fiberglass poles.

Supersedes 1/07 Issue – Deleted Table 31. Added paragraph 46.28.70.

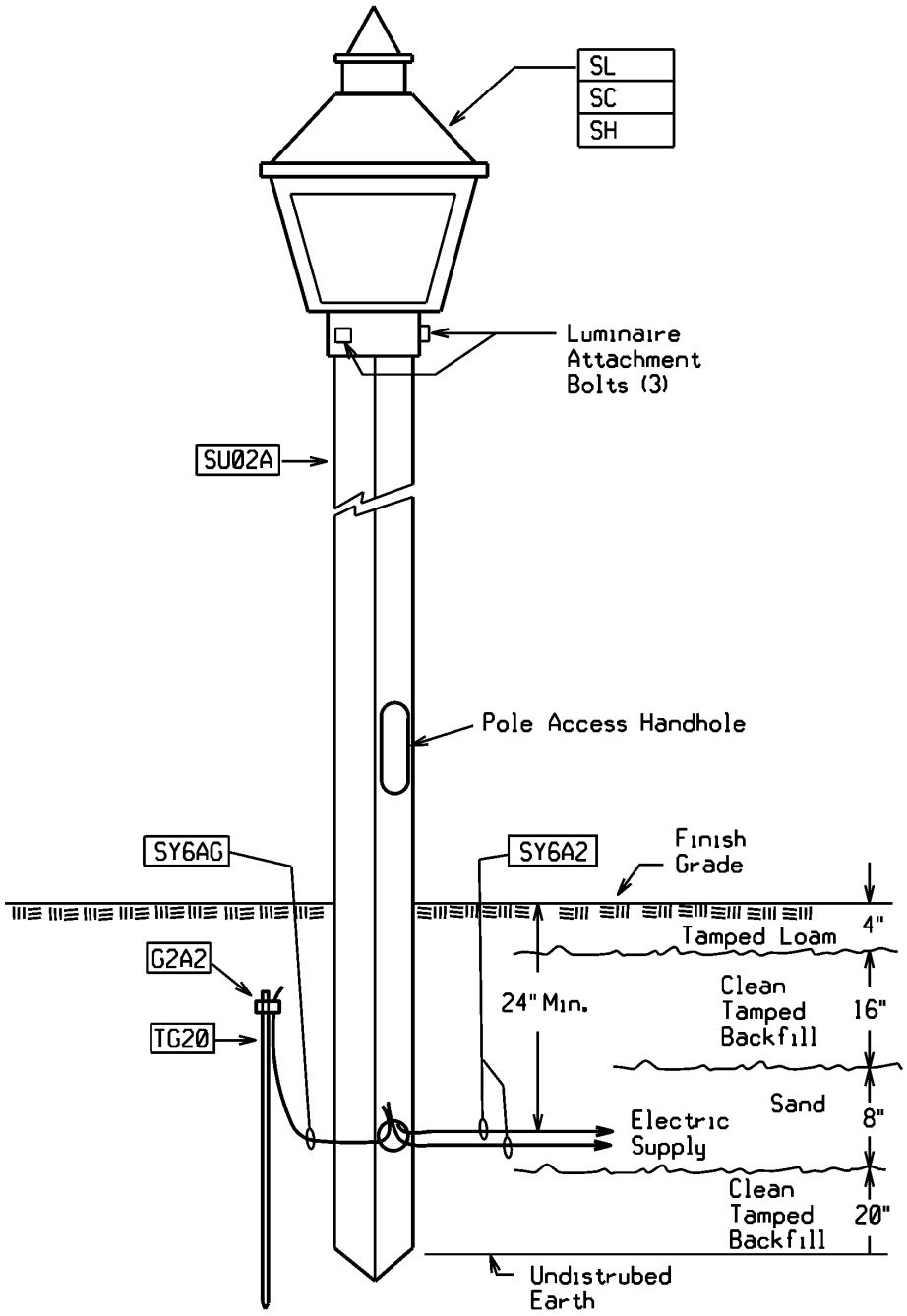


Figure 47
18-Foot Embedded "Suburban" Square Fiberglass Pole – Installation

Supersedes 07/09 Issue – Updated STD Item numbers.

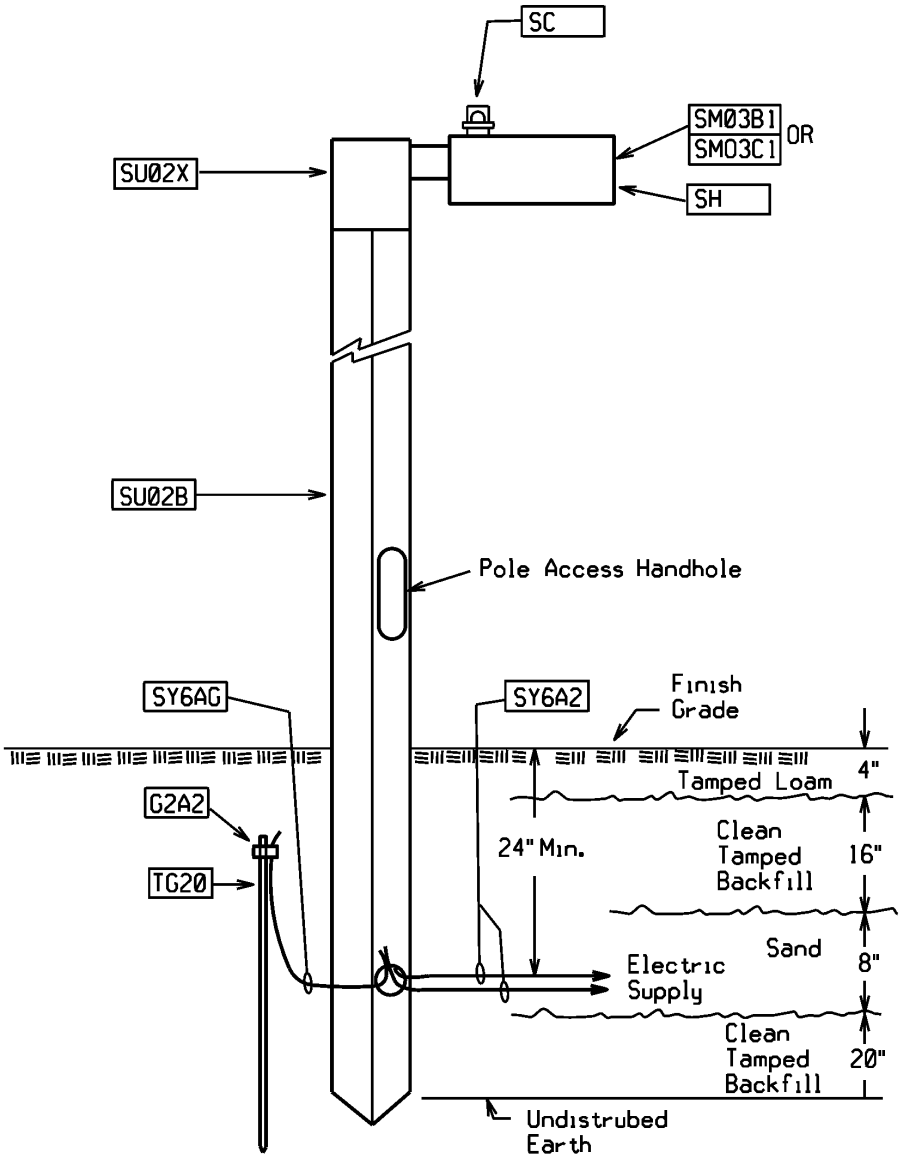


Figure 48
24-Foot "Suburban" Square Embedded Fiberglass Pole – Installation

46.29 "VILLAGER" POST TOP POLE – INSTALLATION

This Section provides details for installation of a "Villager" anchor base, aluminum, post top style pole.

46.29.10 Foundation Installation

Villager post top poles are installed on precast concrete foundations.
See STANDARDS Section 46.16 for precast concrete foundation selection and precast concrete foundation installation details.

46.29.20 Pole Installation

Attach nylon sling at a point approximately 1/3 down from pole top. Never use chain or cable. Be careful not to cut or scratch the pole surface during installation.

46.29.30 Wiring Diagram

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections and slack back inside pole access handhole and secure cover with tamper resistant hardware.

46.29.40 Villager Pole Selection

See STANDARDS Section 49-SW07 for available Villager poles.

Supersedes 1/07 Issue – General revision. Added " Villager" marketing name.

Supersedes 1/07 Issue – Revised STD Item numbers and deleted second conduit.

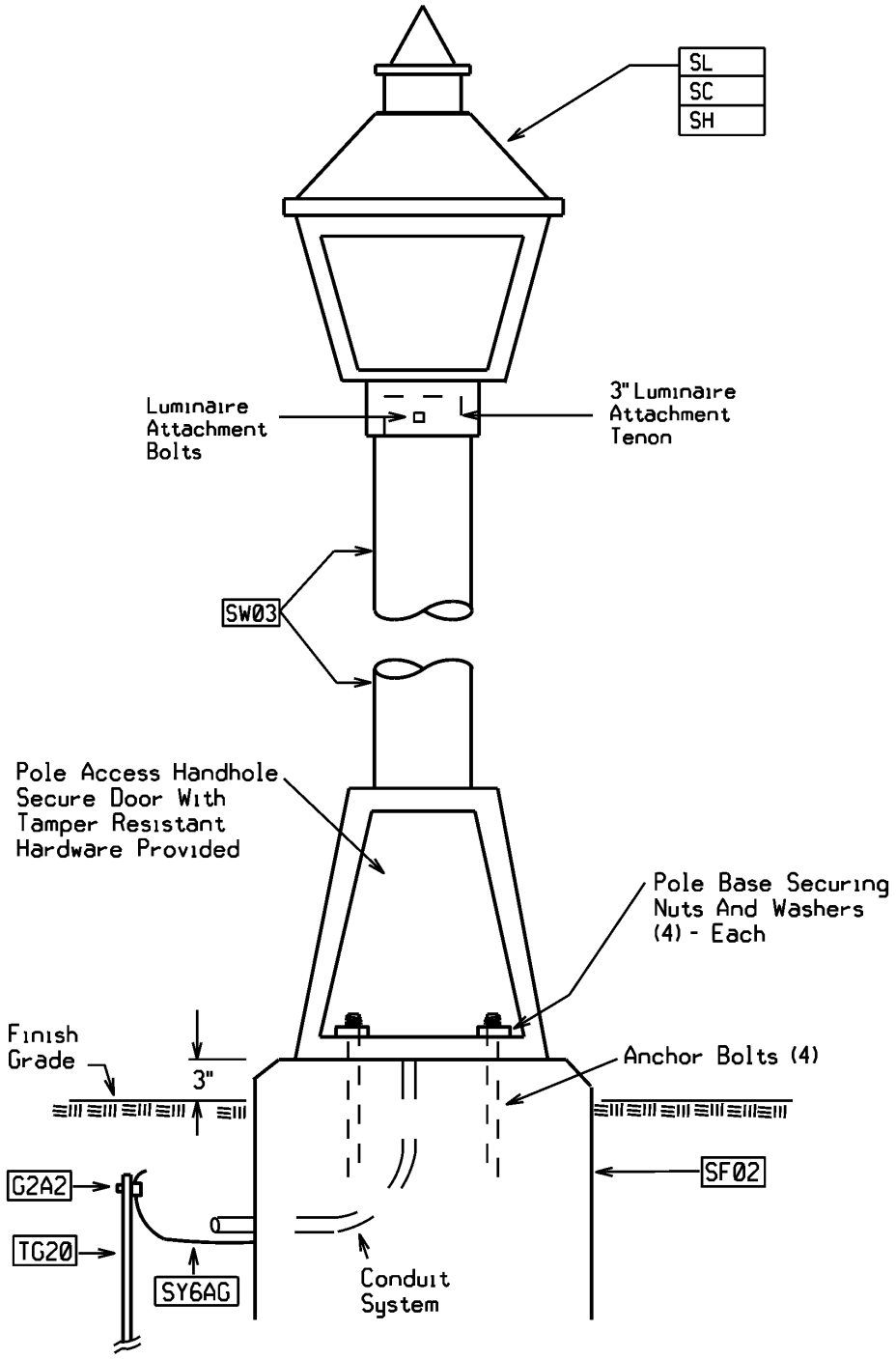


Figure 49
"Villager" Post Top Pole – Installation

46.30 TWIN POST TOPLUMINAIRE – INSTALLATION

This Section provides details for installing two post top style luminaires on the same pole using a twin arm.

46.30.10 Wiring Details

Install a separate set of #10 conductors for each luminaire and terminate inside the pole access handhole. Wrap each set of conductors with three layers of PVC tape to aid in conductor identification. Pull all conductors outside of the pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections back inside the pole access handhole and secure cover with tamper resistant hardware.

46.30.20 Twin Arms

See STANDARDS Section 49-SW50 for available selection of twin arms.

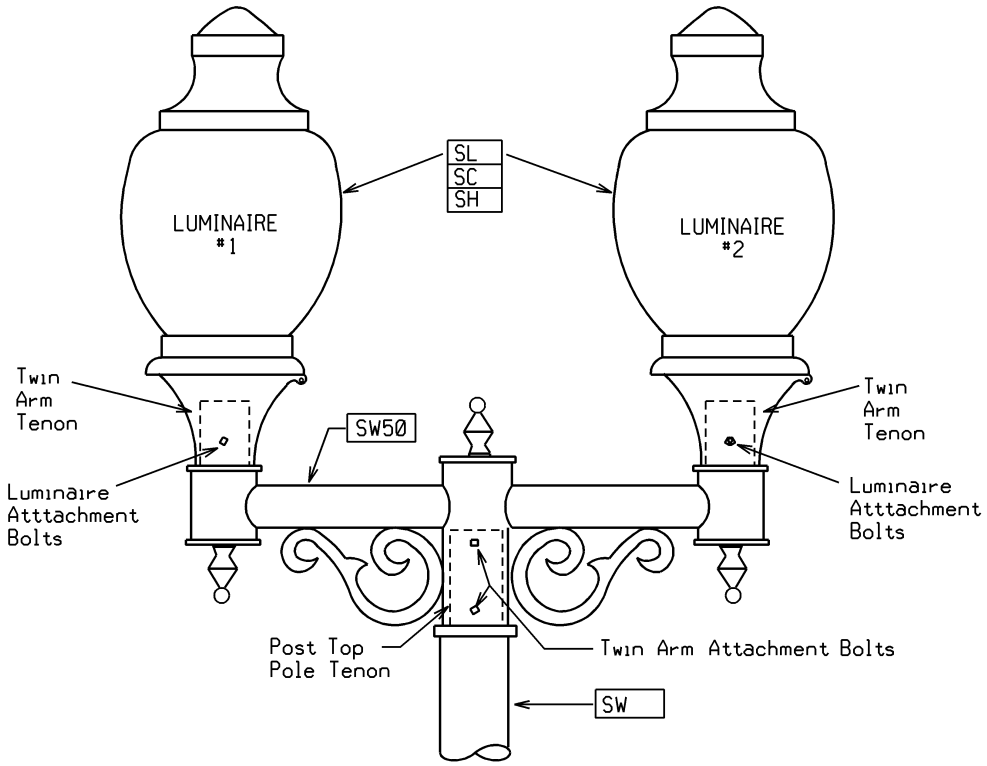


Figure 50
Twin Luminaire Arm Installation

Supersedes 1/07 Issue – Deleted Table 34. Added paragraph 46.30.20.

46.32 "ESSEX" POST TOP POLE – INSTALLATION

This Section provides details for installation of an "Essex" anchor base, aluminum, post top pole.

46.31.10 Foundation Installation

Anchor base, aluminum post top poles are installed on precast concrete foundations.
See STANDARDS Section 46.16 for precast concrete foundation selection and precast concrete foundation installation details.

46.31.20 Pole Installation

Attach nylon sling at a point approximately 1/3 down from pole top. Never use chain or cable. Be careful not to cut or scratch the pole surface during installation.

46.31.30 Wiring Diagram

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections and slack back inside pole access handhole and secure cover with tamper resistant hardware.

46.31.40 Essex Pole Selection

See STANDARDS page 49-SW06 for available Essex poles.

Supersedes 1/07 Issue – Deleted Table 35. Revised paragraph 46.31.10. Added paragraph 46.31.40.

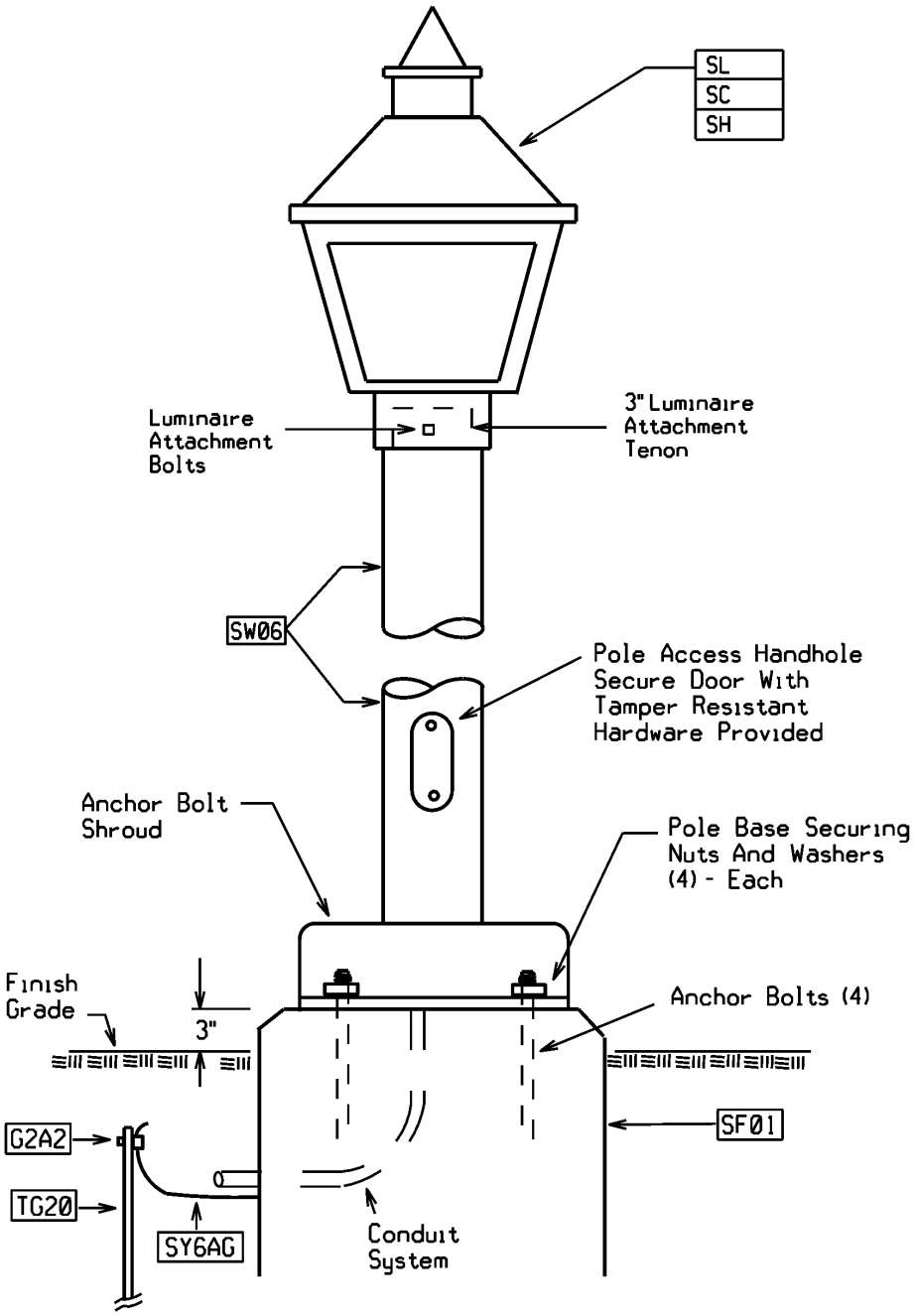


Figure 51
"Essex" Anchor Base Aluminum Post Top Pole – Installation

Supersedes 1/07 Issue – Deleted second conduit and updated STD Item numbers.

46.32 "WASHINGTON" POST TOP POLE – INSTALLATION

This Section provides details for installation of an "Washington" anchor base, aluminum, post top pole.

46.32.10 Foundation Installation

Washington anchor base, aluminum post top poles are installed on precast concrete foundations. See STANDARDS Section 46.16 for precast concrete foundation selection and precast concrete foundation installation details.

46.32.20 Pole Installation

Attach nylon sling at a point approximately 1/3 down from pole top. Never use chain or cable. Be careful not to cut or scratch the pole surface during installation.

46.32.30 Wiring Diagram

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections and slack back inside pole access handhole and secure cover with tamper resistant hardware.

46.32.40 Washington Pole Selection

See STANDARDS Section 49-SW09 for available Washington poles.

Supersedes 1/07 Issue – Deleted Table 36. Revised paragraph 46.32.10. Added paragraph 46.32.40.

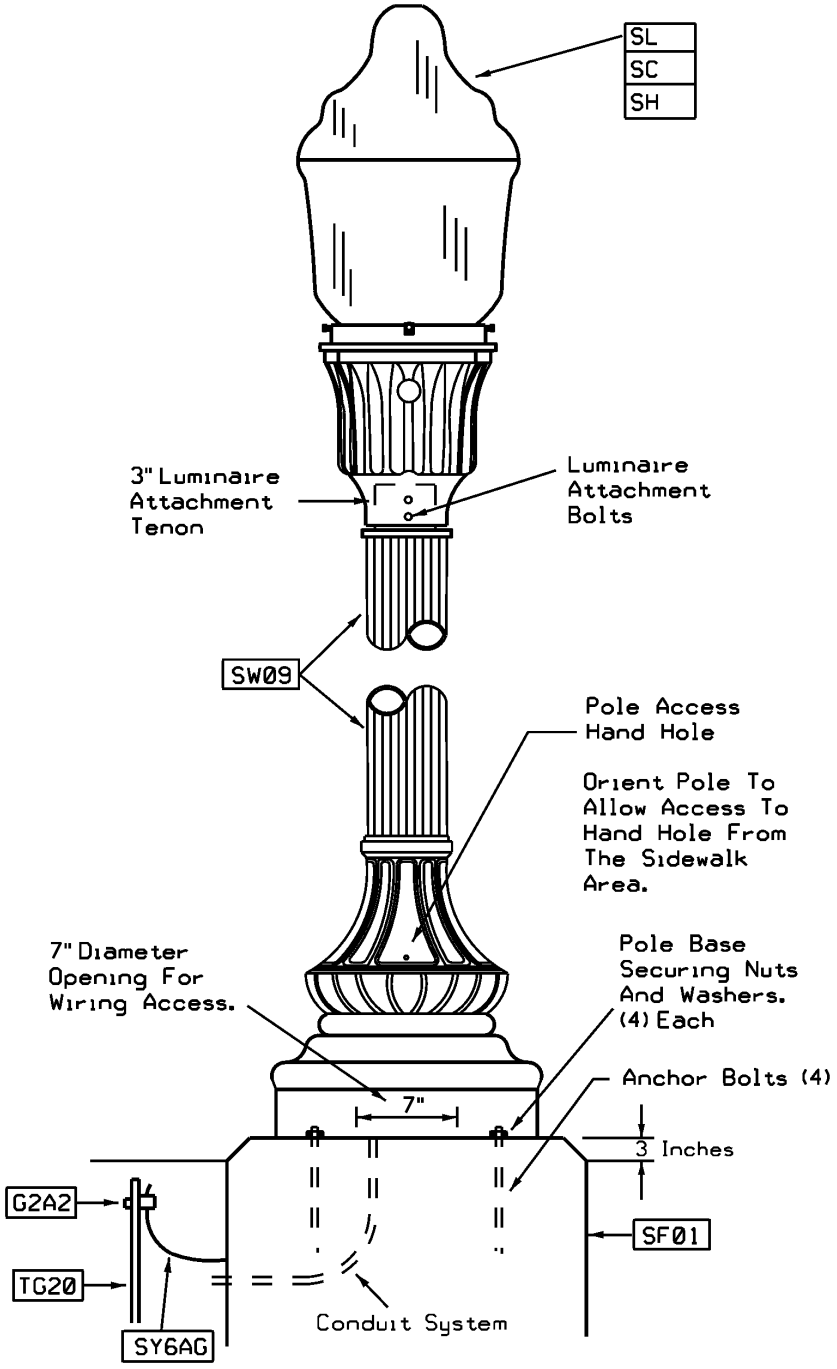


Figure 52
"Washington" Pole – Installation Details

Supersedes 1/07 Issue – Deleted second conduit and updated STD Item numbers.

46.34 "PRESIDENTIAL" POST TOP POLE – INSTALLATION

This Section provides details for installation of a "Presidential" anchor base, fiberglass, lighting pole.

46.33.10 Foundation Installation

Presidential anchor base, fiberglass post top poles are installed on precast concrete foundations. See STANDARDS Section 46.16 for precast concrete foundation selection and. precast concrete foundation installation details.

46.33.20 Pole Installation

Attach nylon sling at a point approximately 1/3 down from pole top. Never use chain or cable. Be careful not to cut or scratch the pole surface during installation.

46.33.30 Wiring Diagram

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Modify as applicable for twin source or twin luminaire requirements. Push completed connections and slack back inside pole access handhole and secure cover with tamper resistant hardware.

46.33.40 Presidential Pole Selection

See STANDARDS Section 49-SW08 for available Presidential poles.

Supersedes 1/07 Issue – Deleted Table 37. Revised paragraph 46.33.10. Added paragraph 46.33.40.

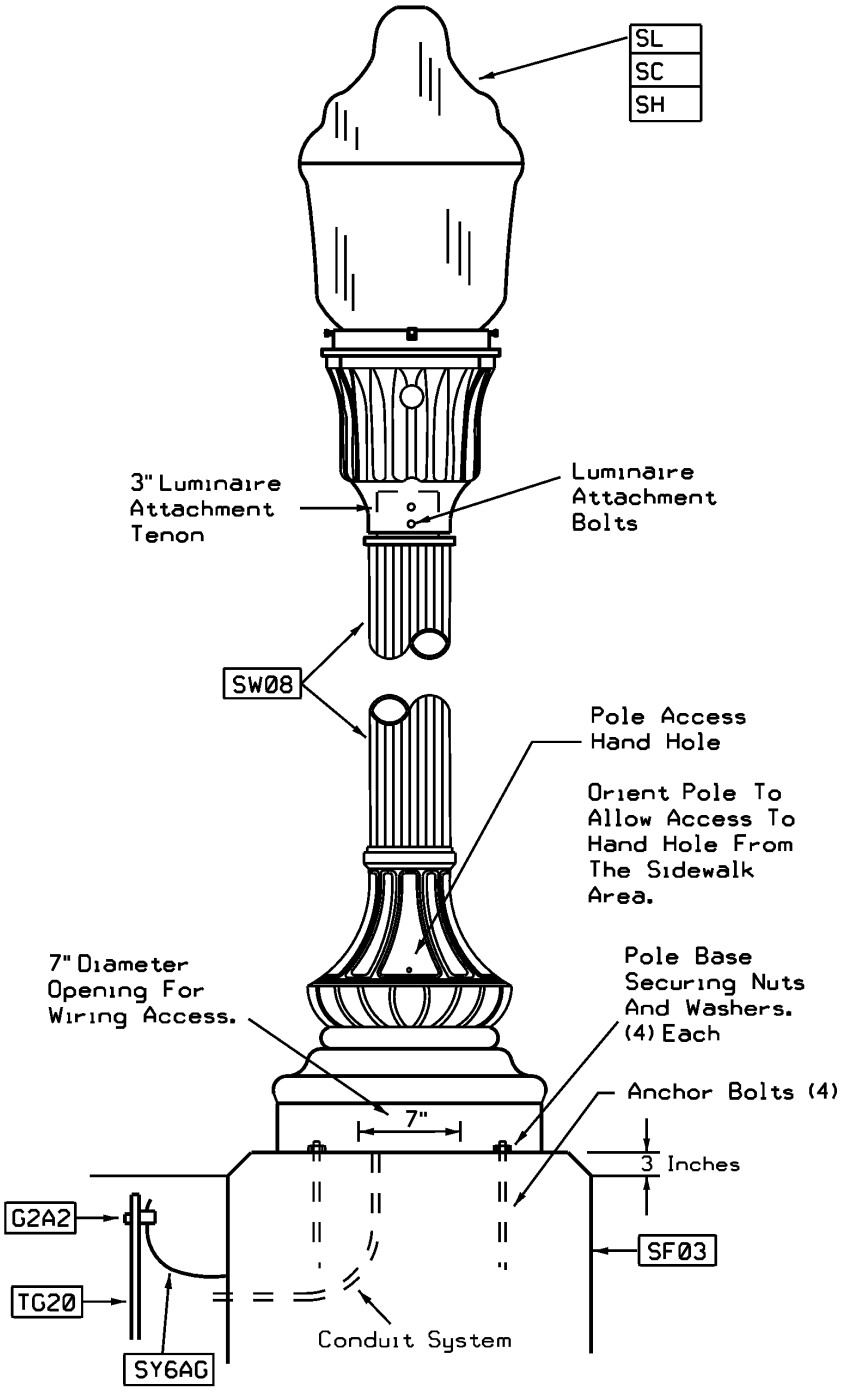


Figure 53
"Presidential" Post Top Pole – Installation Details

Supersedes 1/07 Issue – Deleted second conduit and updated STD Item numbers.

46.34 "ARMORY SQUARE" POST TOP POLE – INSTALLATION

This Section provides details for installation of an "Armory Square" aluminum, anchor base, post top lighting pole.

46.34.10 Foundation Installation

Armory Square, anchor base, aluminum, post top poles are installed on precast concrete foundations. See STANDARDS Section 46.16 for precast concrete foundation selection and. precast concrete foundation installation details.

46.34.20 Pole Installation

Attach nylon sling at a point approximately 1/3 down from pole top. Never use chain or cable. Be careful not to cut or scratch the pole surface during installation.

46.34.30 Wiring Diagram

Pull all conductors outside of pole access handhole to make connections. Allow sufficient slack for future maintenance. Complete connections in accordance with STANDARDS Section 46.19. Push completed connections back inside pole access handhole and secure cover with tamper resistant hardware.

46.34.40 Armory Square Pole Selection

See STANDARDS Section 49-SW05 for available Armory Square poles.

Supersedes 1/07 Issue – Deleted Table 38. Revised paragraph 46.34.10. Added paragraph 46.34.40.

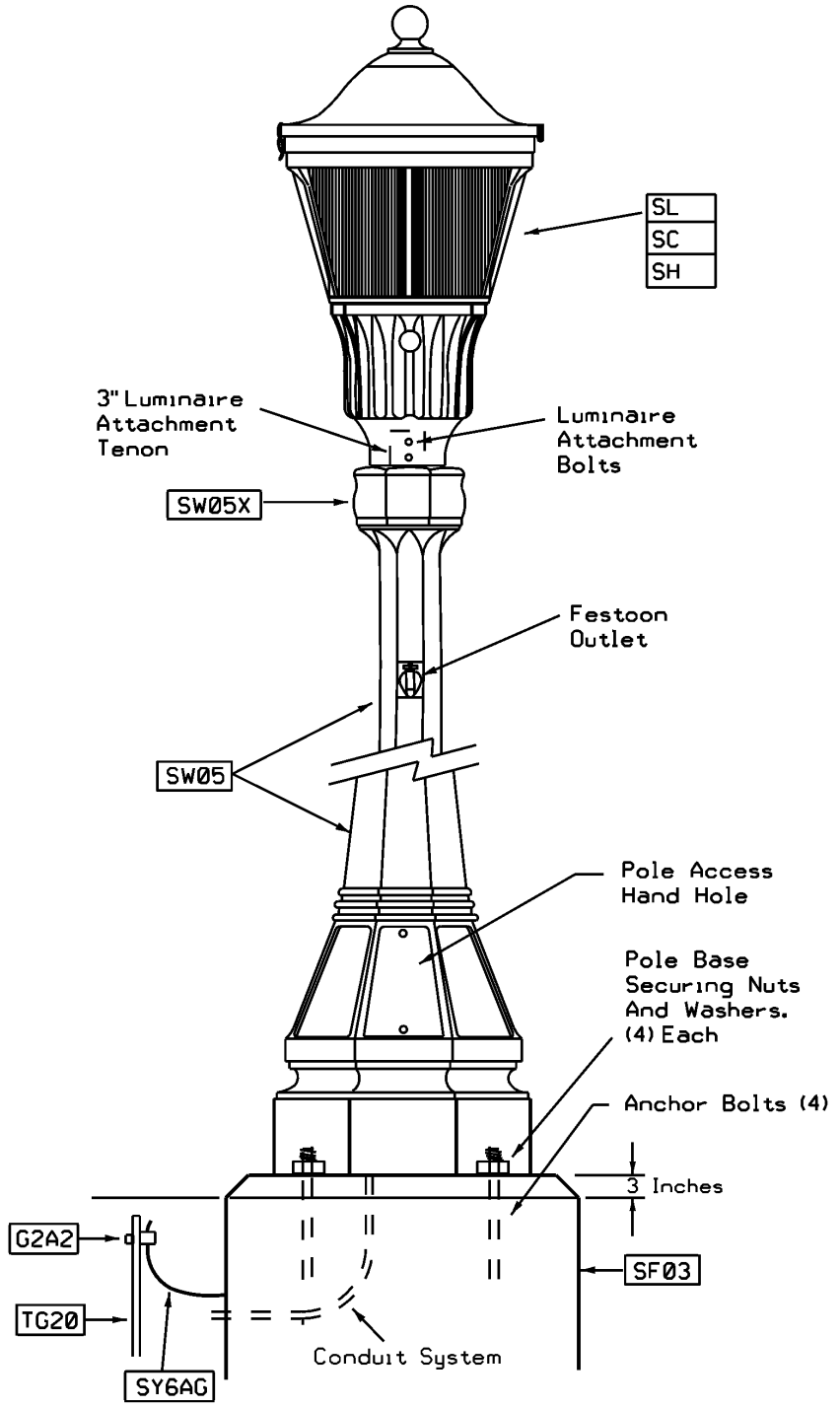


Figure 54
"Armory Square" Post Top Pole - Installation Details

NOTE 1: STD Item SX02 (Tenon Adapter) is needed only on older style Armory Square poles with a 7" tenon.
New Armory Square poles are provided with a standard 3" tenon.

Supersedes 07/09 Issue – Updated STD Item numbers and deleted second conduit.

46.35 UNDERPASS LUMINAIRE INSTALLATION

Underpass luminaires are installed on structural members of an underpass or bridge when a supporting pole cannot be used.

46.35.10 Photoelectric Control

Due to the nature of this type of installation, underpass luminaires do not have individual photoelectric controls. Underpass luminaire installations require a remote located group photoelectric control.

46.35.20 Underpass Luminaire Selection

See STANDARDS Section 49-SQ for available underpass luminaires.

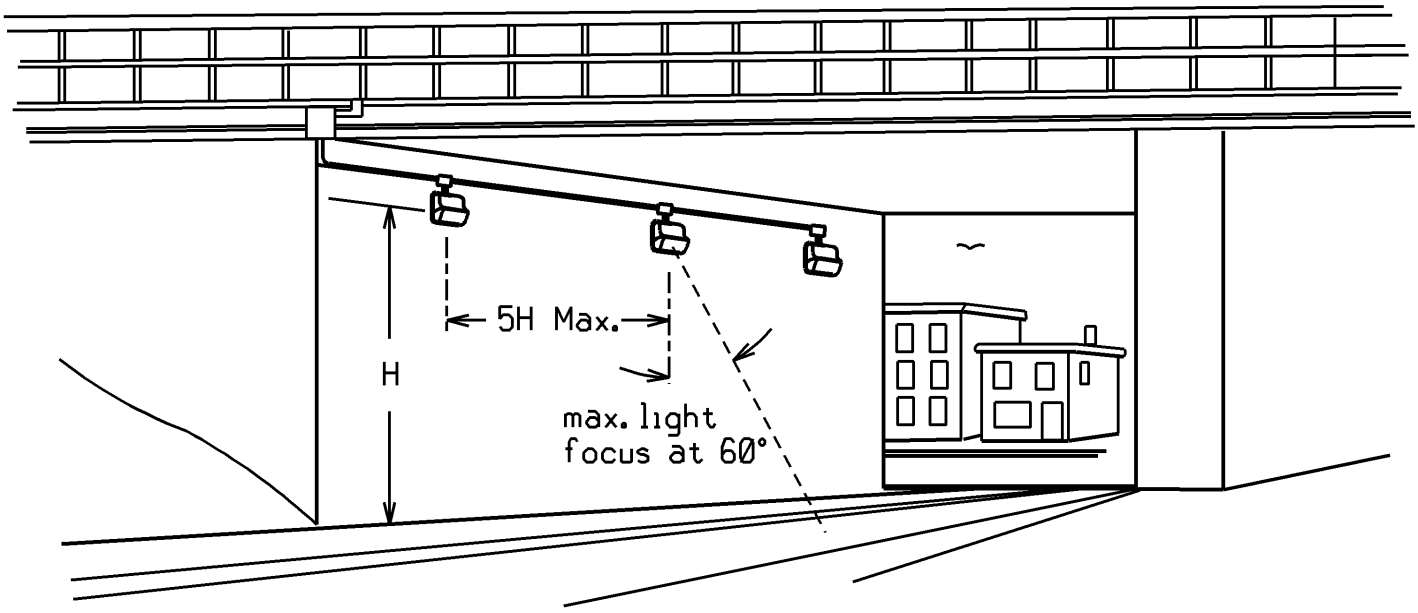


Figure 55
General Layout - Underpass Luminaire Installation

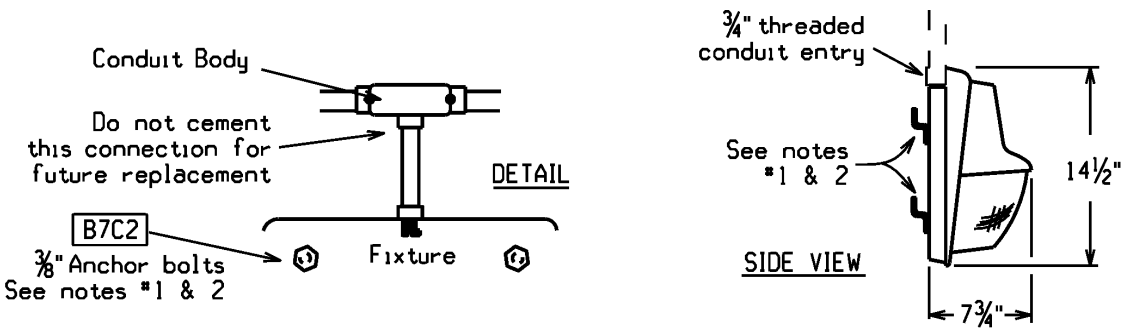


Figure 56
Underpass Luminaire Mounting Details

Note:

1. Use ½" neoprene washers or "Z" brackets to hold luminaire away from any wall where luminaire is exposed to corrosive water.

2. All equipment shall be attached to the bridge or underpass structure in accordance with state and local regulations. Use masonry anchor bolts (Std. Item B7C2) where permitted.

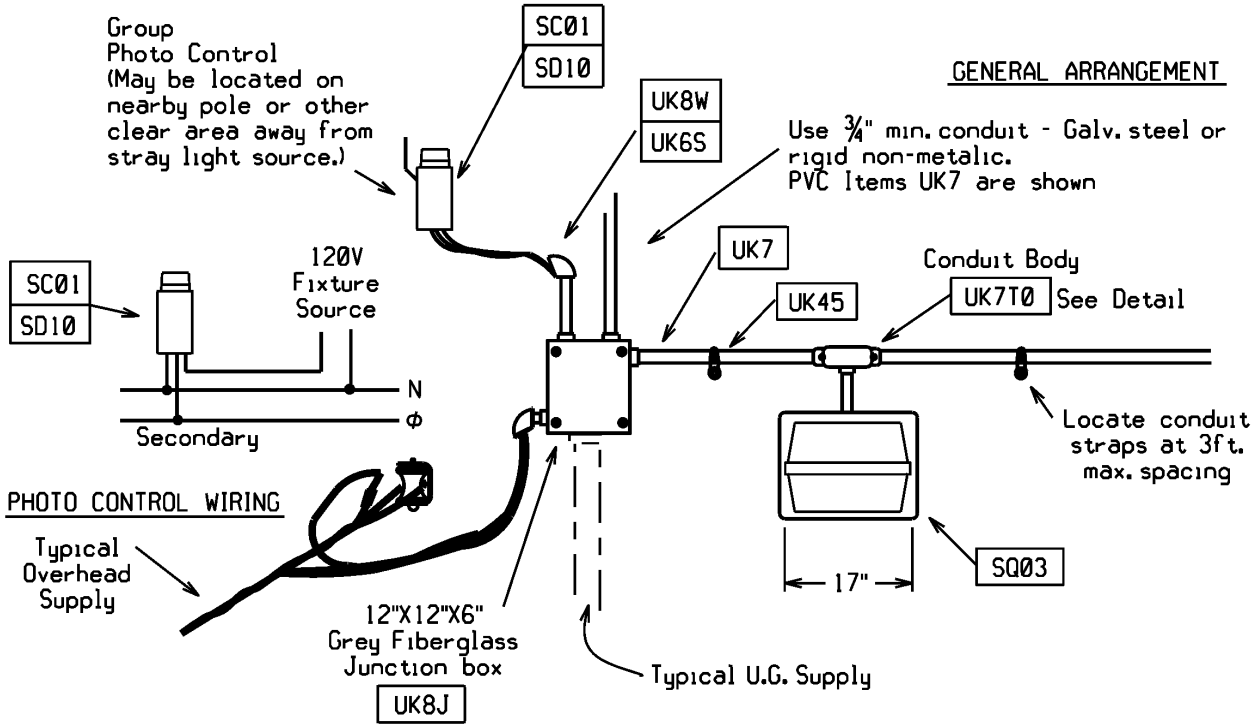


Figure 57
Underpass Luminaire Installation Details

Supersedes 1/07 Issue – Deleted STD Item number " SQ02" .

46.37 CUSTOMER OWNED STREET LIGHTING EQUIPMENT CONNECTED TO COMPANY OWNED UNDERGROUND DISTRIBUTION FACILITIES

This document contains information that is provided for reference purposes only, and should not be construed or used as a substitute for an analysis of the applicable tariffs, agreements, and safety regulations specific to each particular customer.

46.37.10 Safety

The number 1 priority of every job is:

SAFETY!

PPL's distribution poles carry electric lines that operate at voltages as high as 34,500 volts and can carry very high amperages.

PPL's underground infrastructure carries the same very high distribution voltages and amperages in a confined space and may also carry sub-transmission or transmission lines that operate at even higher voltage levels.

Outdoor street and area lights are installed within the electric space on a distribution pole. Performing work on outdoor lights may require the worker to be in close proximity to the distribution lines.

It is the responsibility of the customer that owns, operates and maintains outdoor lighting to ensure that all personnel working on the outdoor lighting system are qualified to work in the designated electric supply space of the Company's electric distribution system in accordance with OSHA 1910.269. An executed copy of the Company's ACKNOWLEDGEMENT FOR THE USE OF QUALIFIED ELECTRICAL WORKERS form is mandatory.

OVERHEAD DISTRIBUTION

No customer, customer's employees, or contractors are ever allowed to perform any work on PPL's 120/240 volt or 120/208 volt secondary conductors.

UNDERGROUND DISTRIBUTION

No customer, customer's employees, or contractors are ever allowed to enter a PPL manhole, handhole or other structure for any reason without PPL safety supervision personnel being present on site.

IF UNSURE: - **STOP** – Call PPL for assistance.

No outdoor lighting repair is too important to sacrifice personal safety.

Supersedes 7/17 Issue – Change to Customer Owned Added qualified electrical worker form reference

46.37.20 **GENERAL:** These Standards identify requirements to enable a customer to safely install, remove, and maintain a customer owned outdoor lighting system which is connected to PPL overhead or underground secondary conductors.

Standards: All customer owned outdoor lighting shall be in compliance with the applicable provisions of the National Electric Safety Code, (NESC) latest edition, and the applicable PPL Construction Standards.

Customer Owned Equipment: The customer shall be responsible to own, operate, and maintain all outdoor lighting equipment beyond the service tap connections to PPL. This shall include, but not be limited, to the following:

1. Supplying all material and labor.
2. Transferring an overhead supplied outdoor lighting attachment to a new pole in the event of a pole replacement.
3. Relocating an overhead supplied outdoor lighting attachment to accommodate other construction activities on the pole.
4. Performing any work required on the outdoor lighting underground conduit system, conductors, foundation, pole, arm and luminaire.
5. Emergency 24 hour response to remove or make safe:
   (a) the outdoor light attachment in the event of a damaged/broken pole.
   (b) the underground sourced outdoor light in the event of a damaged/structurally failed lighting standard or supporting structure.

NOTE: In an emergency, (i.e. 911 notification response, weather related storm or natural disaster restoration, etc.) PPL personnel may perform, at customer expense, any customer outdoor lighting work PPL deems necessary to maintain public or employee safety.

Electrical Separation: The customer is responsible to create an electrical separation between the PPL secondary conductors and the customer owned outdoor lighting conductors. This is required to ensure the safety of PPL and customer employees. This is accomplished by installing a dual pole in-line fuse holder with a midget cartridge style fuse on every outdoor light supply located as near as possible to the connection to the PPL owned secondary conductors. This fuse, in addition to providing electrical protection, shall serve as a future disconnect point for the customer owned outdoor light. Once installed, the customer may disconnect or reconnect a customer owned outdoor light only by means of the in-line fuse holder. See Figure 65 for overhead supplied outdoor lights, and Figures 66, 67, 68, or 69 for underground supplied outdoor lights. See Figure 71 for in-line fused disconnect details. The point of ownership demarcation is at the point of connection to the Company distribution system. The company owns up to and including the connector.

Ownership Identification: The customer is responsible to label all customer owned outdoor lighting luminaires in accordance with PPL Construction Standards and license or service agreements. See Figures 60 and 61.

Final Connections to PPL 120/240 VAC or 120/208 VAC Secondary Conductors: PPL personnel and/or their designee shall make all connections and disconnections of customer owned street light supply conductors to the Company owned secondary and grounding conductors. Customer employees or their contractors are never allowed to perform any work on Company owned secondary or grounding conductors.

Supersedes 07/17 Issue – Revised emergency response language

46.37.30 CONSTRUCTION DRAWINGS:

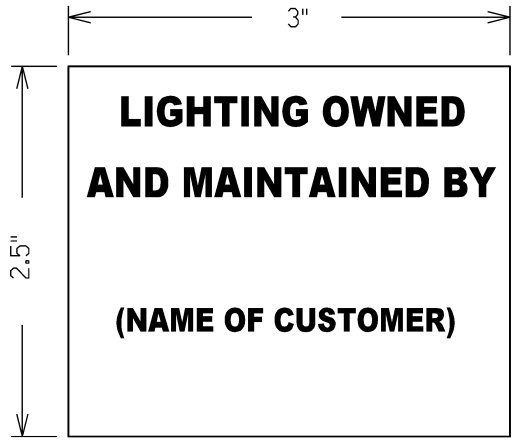


Figure 60 – Ownership Identification Label for Customer Owned Outdoor Luminaires

1. All customer owned outdoor light luminaires shall be identified with a label to clearly define ownership and maintenance responsibilities.

2. Ownership identification labels shall be reflective white with black lettering. See Figure 60.

New issue

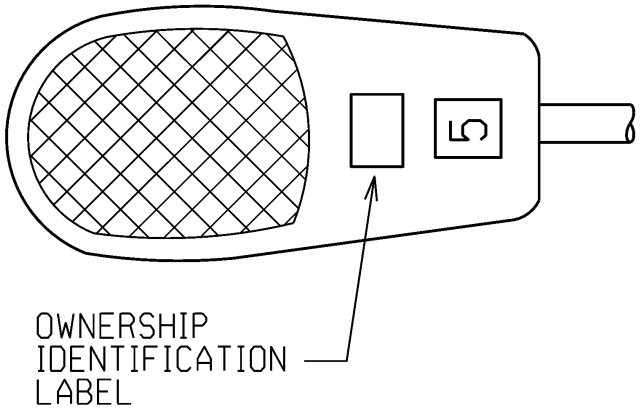
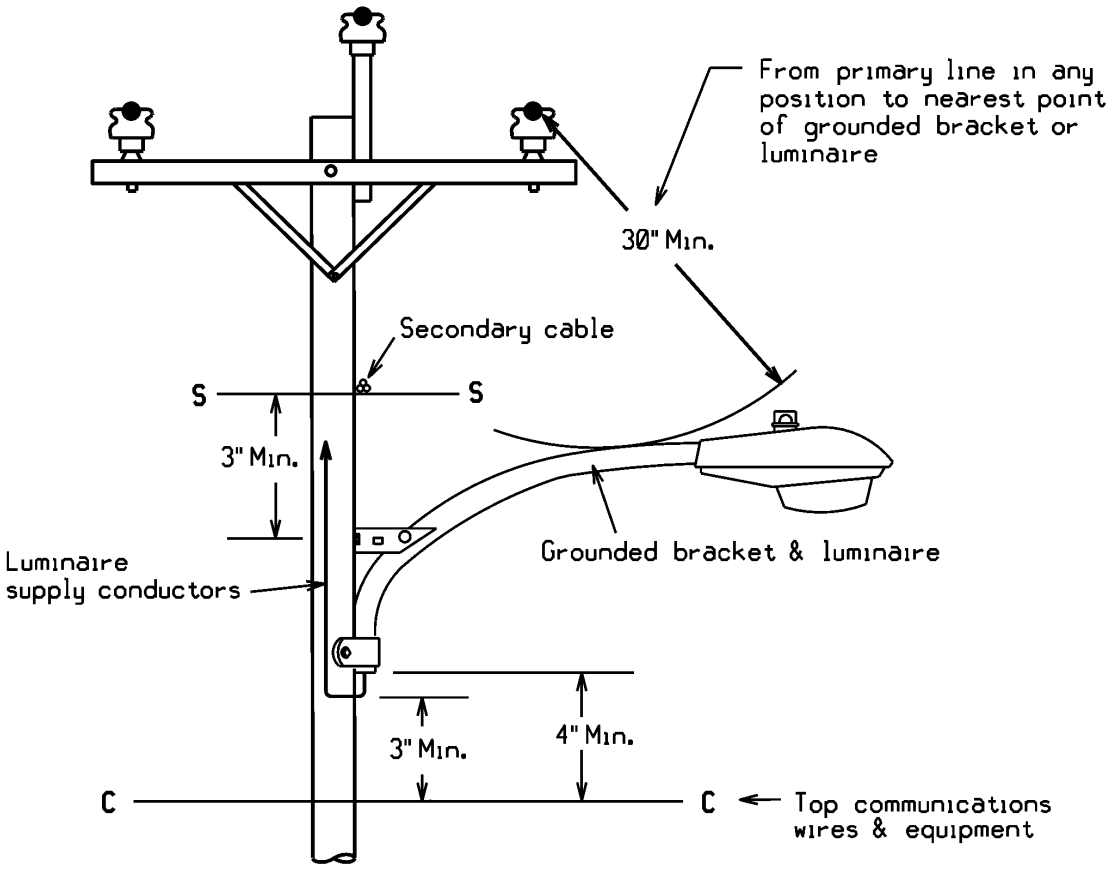


Figure 61 – Installation of Ownership Identification Label

1. Ownership identification label shall be installed on the lower door of a horizontal roadway luminaire such that it is clearly visible from the ground. See Figure 61.

2. For post top, floodlight, and other luminaires, the ownership identification label shall be installed on the luminaire housing in a location such that it is clearly visible from the ground.



New issue

Figure 62 – Outdoor Light Clearance from Overhead Conductors

1. Primary Conductors – Maintain minimum 30-inch clearance from any primary conductor or cable to nearest point of grounded luminaire or bracket.

2. Secondary Conductors – Maintain minimum 3-inch vertical clearance from secondary wires or cable to nearest point of grounded luminaire bracket. (NESC Table 239-1)

3. Communications Cables – Maintain minimum 4-inch vertical clearance from closest communication cable to nearest point of grounded luminaire bracket. (NESC Table 238-2)

   Maintain minimum 3-inch clearance from closest communications cable to nearest point of luminaire supply conductors drip loop. Luminaire supply conductors must be covered with non-metallic flexible conduit. (NESC 238D)

4. Location on Pole – Always install the outdoor light BELOW the secondary conductors. This applies to new installations and any time an existing outdoor light is relocated or transferred to a new pole.

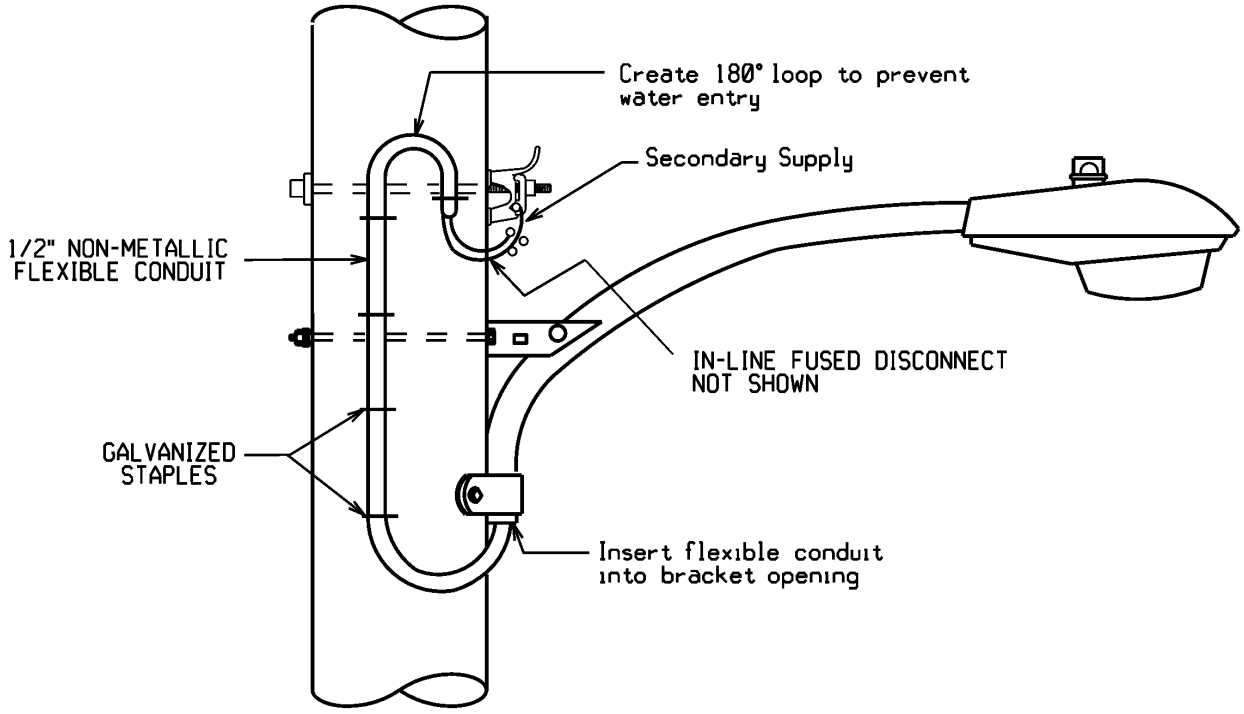


Figure 63 - Mechanical Protection for Overhead Supplied Outdoor Light Fixture Conductors

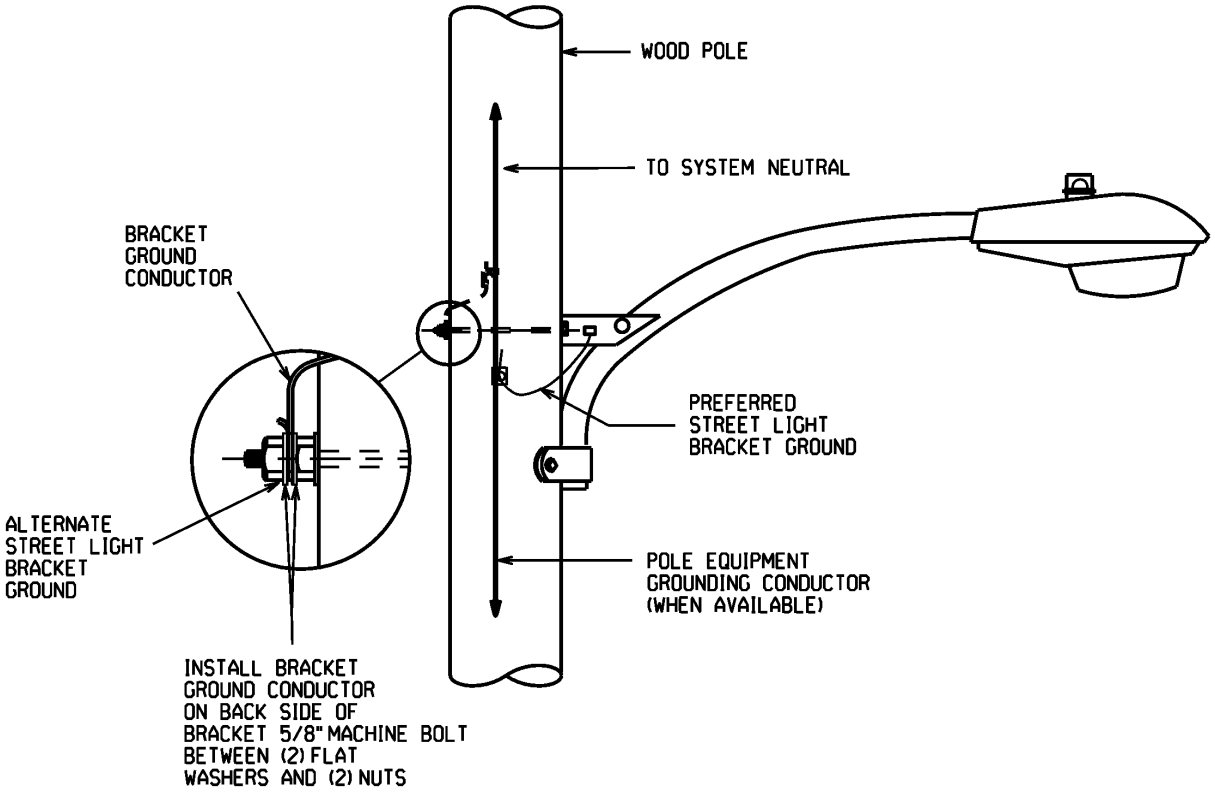
1. NESC Table 239G1 requires that all luminaire supply conductors (#10 AWG) shall have mechanical protection (1/2" non-metallic flexible conduit) installed from the point where they leave the pole end of the bracket to the connection to the secondary supply in order to take advantage of the clearance dimensions shown on page 46-808.

2. Insert the non-metallic flexible conduit into the bracket opening and extend up the pole to the secondary supply.

3. Create a 180 degree loop at the secondary supply to prevent rain water from entering and becoming trapped inside the flexible conduit.

4. Secure the non-metallic flexible conduit with galvanized staples spaced 12-inches apart or closer as necessary.

Supersedes 7/17 Issue – Updated page reference



New issue

Figure 64 – Grounding of Overhead Supplied Outdoor Light

1. Every outdoor light bracket shall be grounded. Install a #4 AWG stranded copper conductor with enough length to connect to the pole equipment grounding conductor (when available) or to the secondary system neutral. Final connections to PPL conductors may be made by a Qualified Worker.

2. Many brackets have a bracket grounding bolt located near the wood pole end of the bracket. If none exists, install a bracket grounding bolt on the bracket or connect grounding conductor to the back side of the 5/8" square head machine bolt which secures the bracket to the pole.

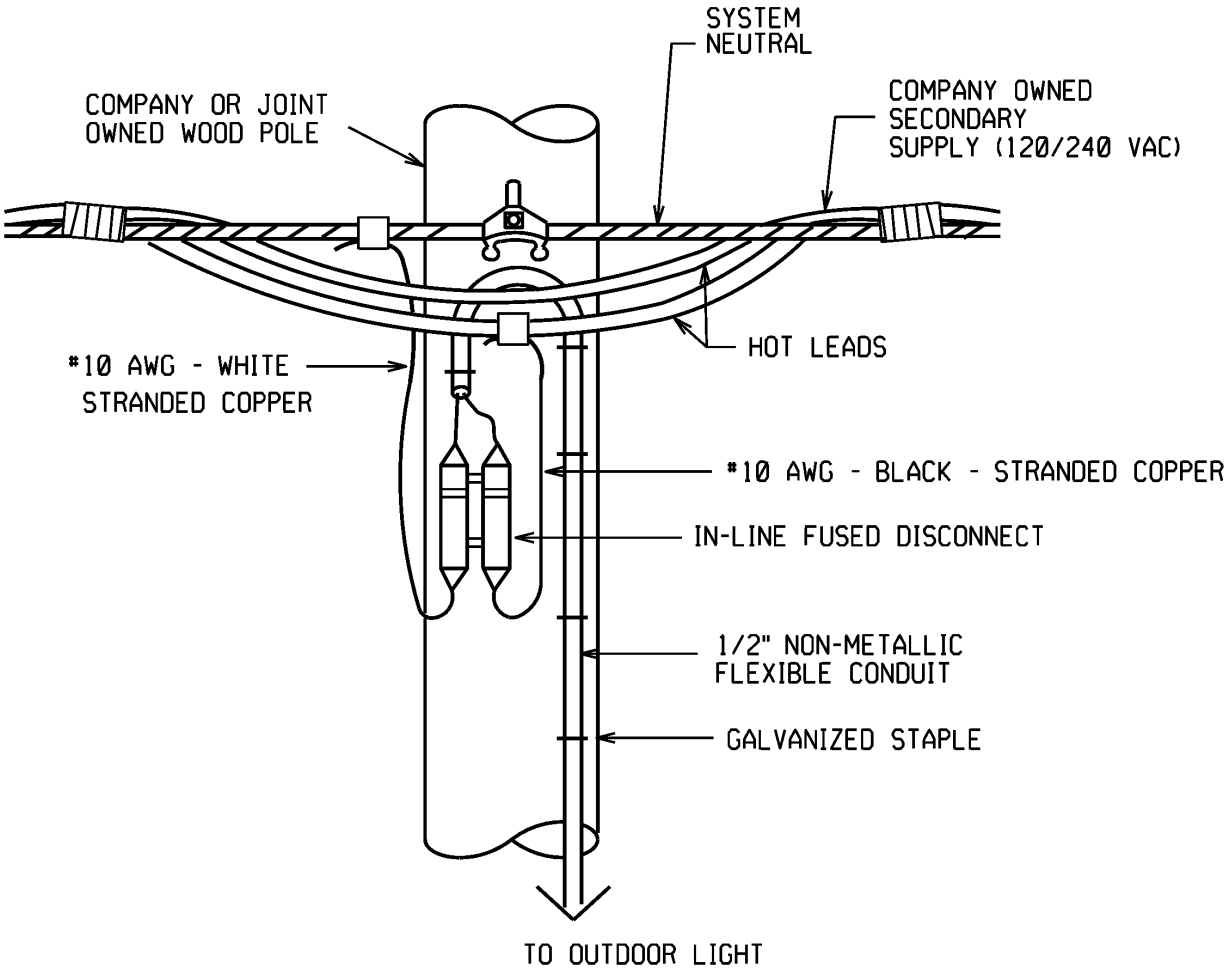


Figure 65 – Connection of Overhead Supplied Customer Owned Outdoor Light to PPL Overhead Secondary Conductors

Supersedes 7/17 Issue – Updated page reference

1 Every customer outdoor light shall have an in-line fused disconnect as described in “Electrical Separation” on page 46-806. See page 46-817 for details on the in-line fused disconnect.

2. Secure the in-line fused disconnect to the pole using a spring loaded conduit clip or galvanized staple.

3. Provide sufficient slack in the luminaire wiring to facilitate fuse replacement.

4. Outdoor lighting fixture wiring shall be #10 AWG 7-strand copper BLACK-WHITE with RHH/RHW/USE-2 insulation.

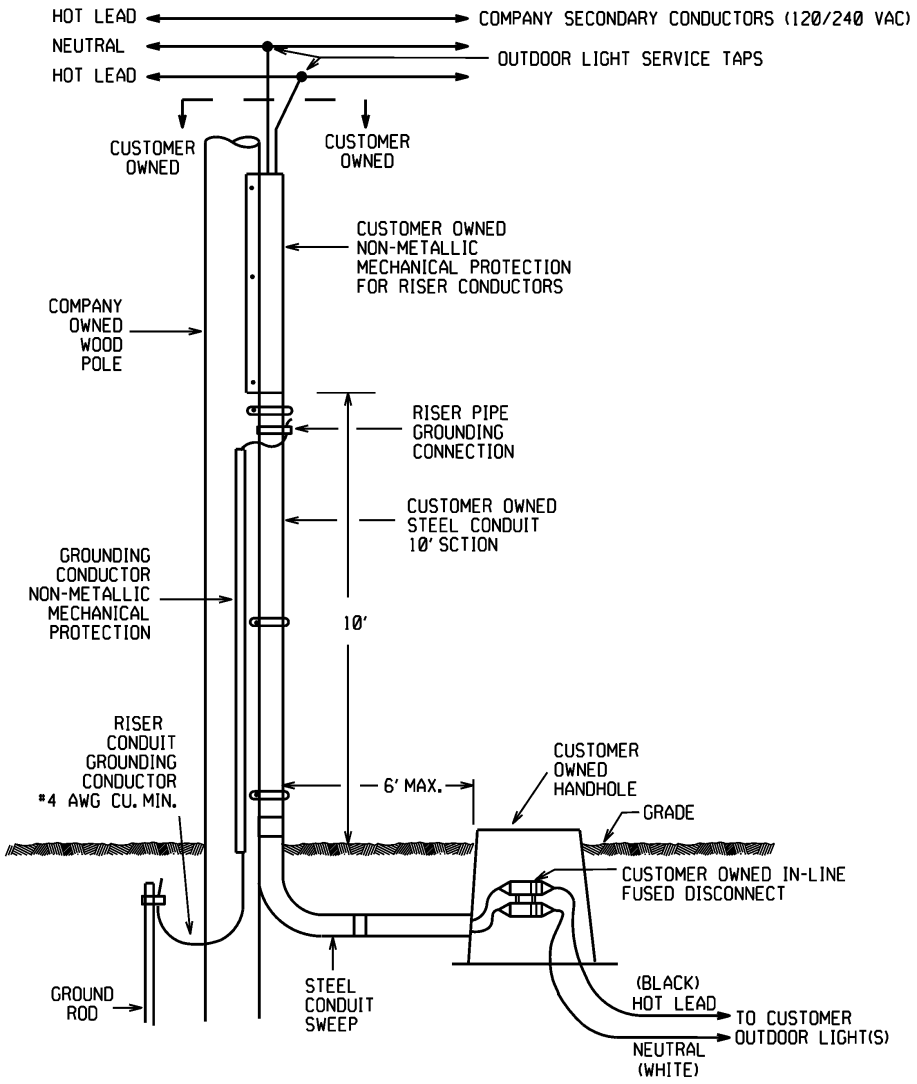


Figure 66 – Connection of Customer Owned Outdoor Lighting Riser to PPL Overhead Secondary Conductors

1. Install customer owned handhole as shown in Figure 66. Customer owned handhole shall house the in-line fused disconnect. See page 46-817 for details on the in-line fused disconnect.

2. Always install the riser conduit away from vehicle traffic.

3. No more than (2) riser conduits may be attached to a pole. Consult PPL Engineering if more than (2) risers are desired.

4. Underground supply conductors shall be #6 AWG 7-strand copper (minimum) with RHH/RHW/USE-2 insulation. Conductors shall be color coded BLACK = Hot lead, WHITE = Neutral.

Supersedes 7/17 Issue – Updated page reference

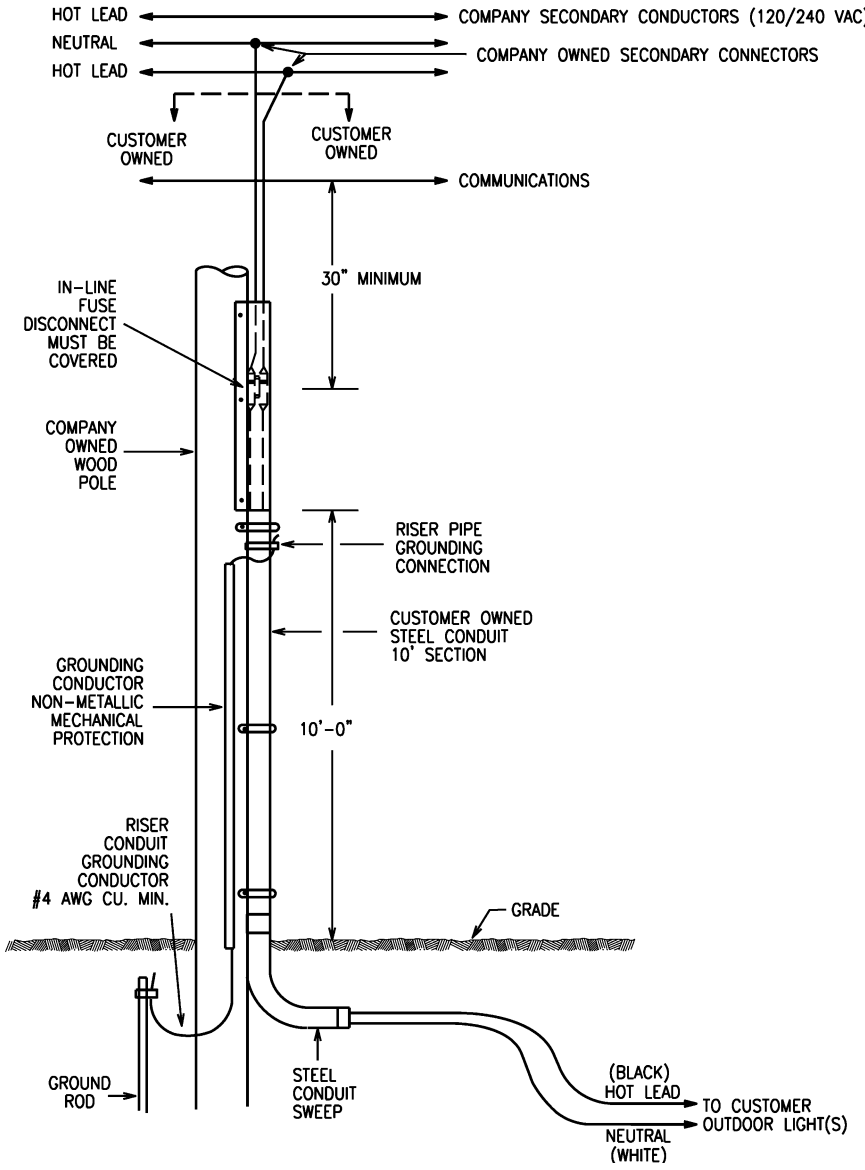


Figure 66A – Alternate Connection of Customer Owned Outdoor Lighting Riser to PPL Overhead Secondary Conductors

1. Install customer owned disconnects under conductor covering. See page 46-817 for details on the in-line fused disconnect.

2. Always install the riser conduit away from vehicle traffic.

3. No more than (2) riser conduits may be attached to a pole. Consult PPL Engineering if more than (2) risers are desired.

4. Underground supply conductors shall be #6 AWG 7-strand copper (minimum) with RHH/RHW/USE-2 insulation. Conductors shall be color coded BLACK = Hot lead, WHITE = Neutral.

7/19 - New Drawing.

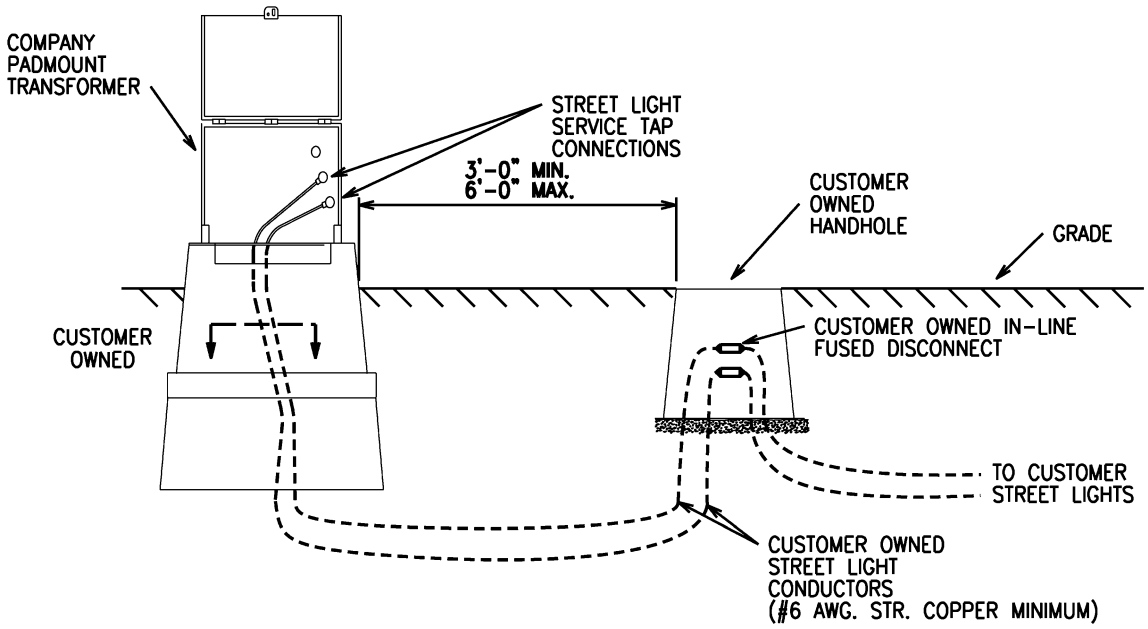


Figure 67 – Connection of Underground Supplied Street Light to PPL Padmount Transformer

1. Install customer owned handhole as shown in Figure 67. Customer owned handhole shall house the in-line fused disconnect. See page 46-817 for details on the in-line fused disconnect.

2. Underground supply conductors shall be #6 AWG 7-strand copper (minimum) with RHH/RHW/USE-2 insulation. Conductors shall be color coded BLACK = Hot lead, WHITE = Neutral.

3. In cases where a new customer conduit is to be installed into a PPL padmount transformer, PPL shall determine the conduit entrance location at the padmount transformer foundation. The customer shall install the conduit to just outside this location. PPL shall then create the opening in the padmount foundation and extend the customer conduit into the padmount foundation.

4. All electrical connections or disconnections to the secondary supply shall be performed by PPL personnel and/or their designee.

5. In all cases where customer access to PPL equipment is necessary, PPL personnel shall be present to provide safety supervision and to unlock and relock the padmount transformer.

Supersedes 7/17 Issue – Updated page reference

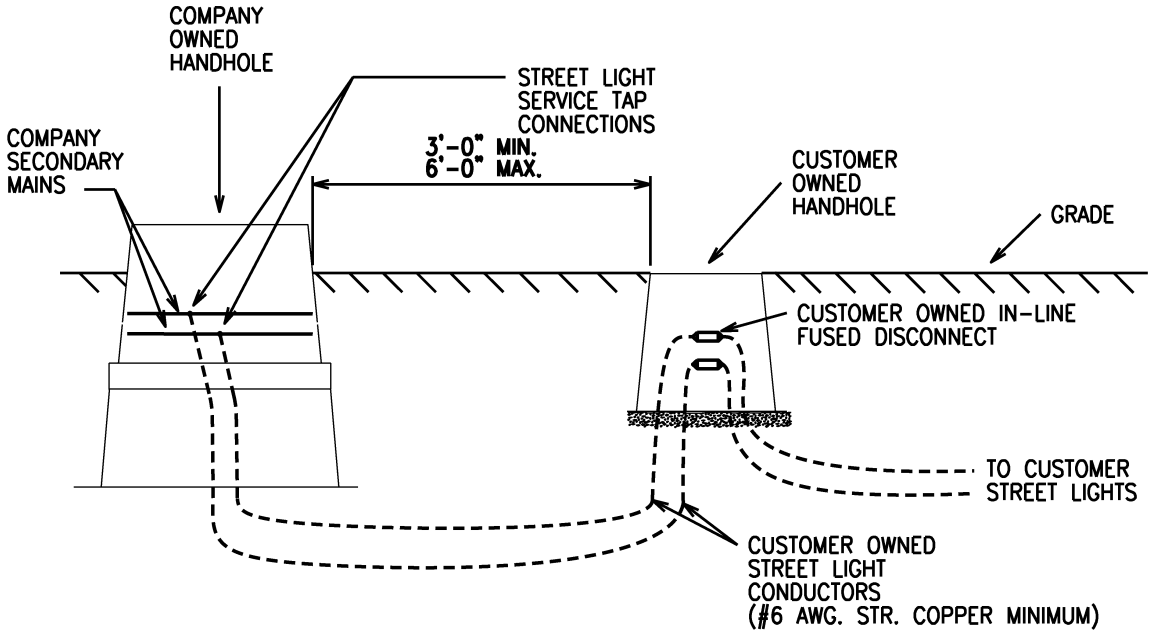


Figure 68 – Connection of Underground Supplied Customer Owned Outdoor Lighting to PPL Handhole or Manhole – Standard Connection

1. Install customer owned handhole as shown in Figure 68. Customer owned handhole shall house the in-line fused disconnect. See page 46-817 for details on the in-line fused disconnect.

2. Underground supply conductors shall be #6 AWG 7-strand copper (minimum) with RHH/RHW/USE-2 insulation. Conductors shall be color coded BLACK = Hot lead, WHITE = Neutral.

3. In cases where a new customer conduit is to be installed into a PPL manhole or handhole, PPL shall determine the conduit entrance location in the manhole/handhole. The customer shall install the conduit to just outside this location. PPL shall then create the opening in the manhole/handhole wall and extend the customer conduit into the manhole/handhole.

4. All electrical connections or disconnections to the secondary supply shall be performed by PPL personnel and/or their designee.

5. The 6' Max distance to the customer owned handhole may be extended to eliminate such handhole from being located within a roadway, street or other area subject to vehicle traffic. Contact PPL to agree on an alternate location minimizing the distance of the in-line fused disconnects from the source supply.

6. In all cases where customer access to a PPL facility is necessary, PPL personnel shall be present to provide safety supervision, ensure appropriate ingress/egress to the facility and unlock/relock equipment.

Supersedes 7/17 Issue – Updated page reference

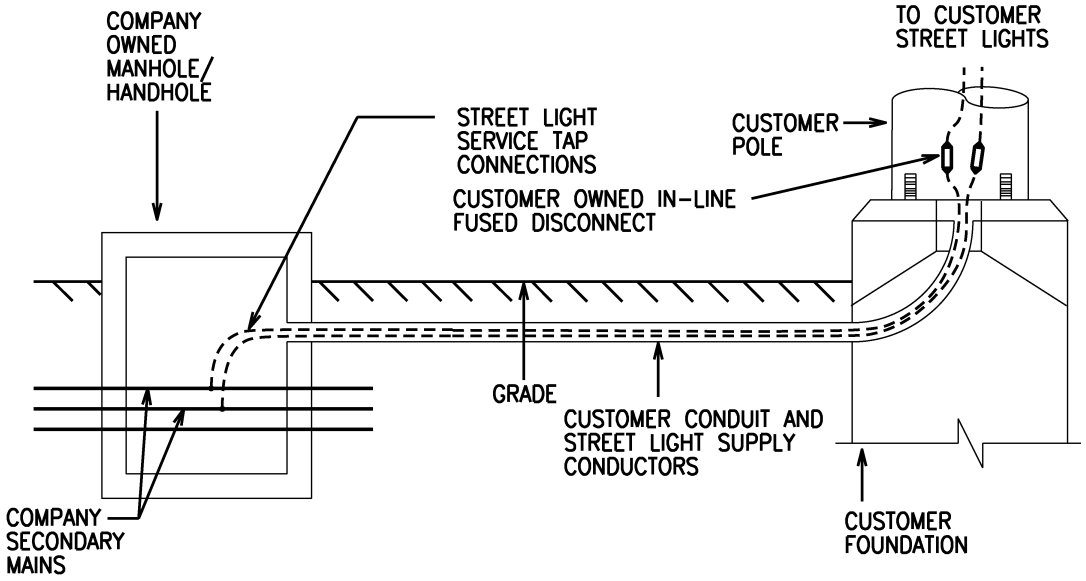


Figure 69 – Connection of Underground Supplied Customer Owned Outdoor Light to PPL Handhole or Manhole – Non-Standard Connection

1. For all new installations and modifications to existing installations, the customer is required to install an in-ground handhole located as close as possible to the company provided electrical source point, as illustrated in Figures 66, 67, and 68.

2. In the rare case where the customer owned concrete outdoor lighting foundation is immediately adjacent to the PPL manhole/handhole, installation of an in-ground customer owned handhole may be impossible. In this case, the in-line fused disconnect may be installed inside the pole access handhole. **This is allowed only in cases where no physical space exists to install the in-ground customer owned handhole.** Note that the #6 AWG underground supply conductors between the manhole and the base of the outdoor light are customer owned.

3. Underground supply conductors shall be #6 AWG 7-strand copper (minimum) with RHH/RHW/USE-2 insulation. Conductors shall be color coded BLACK = Hot lead, WHITE = Neutral.

4. In cases where a new customer conduit is to be installed into a PPL manhole or handhole, PPL shall determine the conduit entrance location in the manhole/handhole. The customer shall install the conduit to just outside this location. PPL shall then create the opening in the manhole/handhole wall and extend the customer conduit into the manhole/handhole.

5. All electrical connections or disconnections to the secondary supply shall be performed by PPL personnel and/or their designee.

6. In all cases where customer access to a PPL facility is necessary, PPL personnel shall be present to provide safety supervision, ensure appropriate ingress/egress to the facility and unlock/lock equipment.

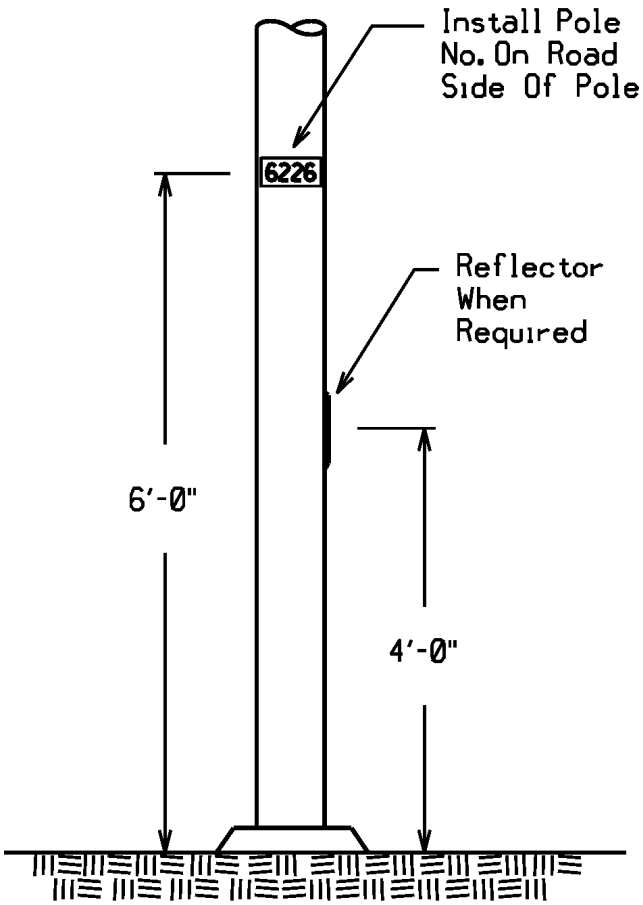


Figure 70 – Pole Numbering - Underground Supplied Customer Owned Lighting

1. Every underground supplied customer lighting pole shall be numbered in accordance with Figure 70.
2. Always use 1-3/4-inch x 3-inch, high intensity white reflective pole number decals.
3. Pole number decals shall be installed horizontal to each other as shown in Figure 70 – not vertical.

Supersedes 7/17 Issue – Updated figure reference

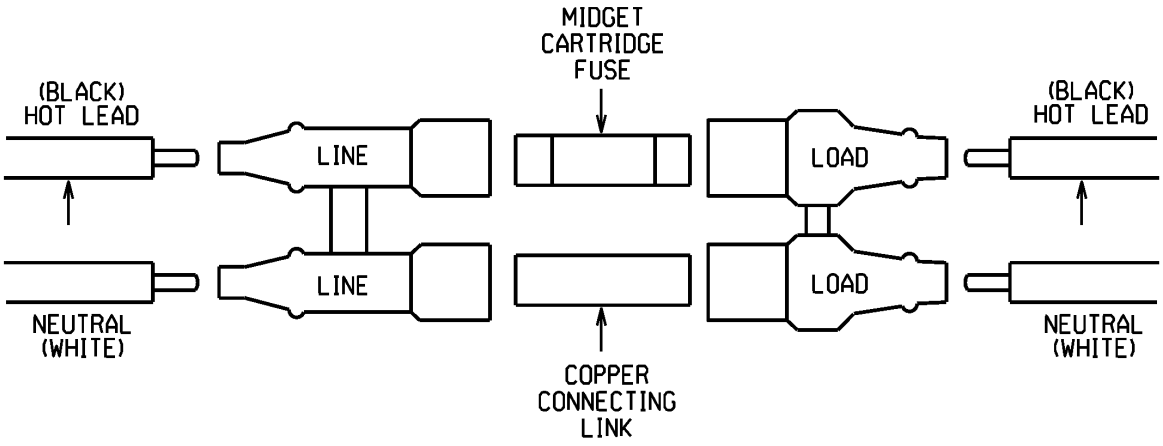


Figure 71 – In-Line Fused Disconnect Details

New issue

1. All customer owned outdoor lighting equipment shall be fused using a dual pole, watertight, in-line fuse holder and cartridge style fuse. This fuse, in addition to providing electrical protection, shall serve as a disconnection point for the customer owned outdoor lighting equipment.

2. Fuse Holder
The fuse holder shall be a watertight device suitable for use in an outdoor environment.

   The fuse holder shall be totally insulated, thus having no exposed energized parts.

   The fuse holder shall accept #14 AWG - #6 AWG stranded copper conductors on both ends.

   The fuse holder shall be a dual pole device allowing simultaneous disconnection of both the 120 VAC hot lead (black wire) and the neutral conductor (white wire).

   The fuse holder shall be designed such that, when separated, the midget cartridge fuse and copper connecting link shall be held captive in the load end of the fuse holder.

   The fuse holder shall be polarized to prevent accidental reversal of the live leg and neutral connections.

3. Cartridge Fuse
The fuse shall be a non-glass type, midget style cartridge fuse. Fuse dimensions shall be 13/32” diameter x 1½” length.

4. Neutral Connection
The neutral conductor shall not be fused. Install a 13/32” diameter x 1½” length copper connecting link in place of a cartridge fuse.

5. Always provide sufficient slack in wiring to facilitate fuse replacement.

Version	Date	Modification	Author(s)	Approval by (Name/Title)
8	7/21	• Updated SJ06A&B to SJ06E&F on Table 8A & Table 8C.		
7	07/20	• Updated Table 8A – Added new decorative LED fixtures • Updated Table 8 C – Change Item ID and Standard Item No. • Updated Table 10 B • Updated Table 10C – Added SL76A and SL76B		
6	07/19	• Updated Table 10B • Changed “Municipal Owned” to “Customer Owned” • Added emergency response language • Revised electrical separation, clarifying point of ownership for Customer Owned Lighting • Added Alternate drawing for connection of customer owned riser to OH secondary • Revised wording - Final Connection to PPL secondary for Customer Owned Lighting • Revised several drawings and updated page/figure references		
5	07/17	• Revised 46-102A to add LED Floods and Post Top. • Revise 46-102B Table 8B data and added SKo6A1. • Added 46-102C. • Revised data on pp 46-103A. • Added 46-103B. • Added 46-103C. • Expanded Customer owned street section 46.37, added 46-806 thru 817.		
4	07/16	• Revised 46.01.10 Table 1 and 46.1 Table 2 to include LED. • Revise 46.7.10, 46.7.30, 46.7.60 Table 8 to be HID only. • Added pp 46-102A and 46-102B to include LED data. • Added pp 46-103A LED label codes.		
3	07/15	• Revised paragraphs 46.6.60 and 46.6.80		

Version	Date	Modification	Author(s)	Approval by (Name/Title)
2	07/13	• General Revision of entire section. • Updated STD Item #s on multiple drawings. • Deleted twin conduit UG supply into a precast foundation as a Standard. • Added Cable Tagging Kit to multiple drawings. • Revised Municipal Owned Lighting Section.		
1	07/09	• General Revision of entire section. • Added pulse start metal halide information in multiple locations. • Added conductor color code assignments of page 46.16. • Added marketing names for poles in multiple locations. • Deleted CU Tables in multiple locations. • Updated STD Item #s on multiple drawings.		

46.38 FIELD MAINTENANCE OF HPS OUTDOOR LIGHTING EQUIPMENT

This Section provides technical instructions to diagnose common failure modes of all types of high pressure sodium vapor outdoor lighting equipment.

Refer to the Company Electric Operating Procedure # G007 for additional required maintenance activities to be preformed any time a crew has a need to perform any repairs on an outdoor lighting installation.

46.38.10 Luminaires Which Will Not Turn "On" At Night

Table 17

Step #	Action	Comment
1	Check connections at pole for signs of corrosion and replace if necessary.	Especially important in coastal areas.
2	Test photo control operation.	This will confirm an energized circuit at least to the line side of the photo control.
3A	If photo control is not working, replace unit and retest or troubleshoot for an open circuit.	Source voltage can be checked at the terminal block inside the luminaire and in the pole's handhole (if supplied by underground distribution).
3B	If photo control is working, remove photo control	De-energizes load side of circuit.
4	Check luminaire labeling for lamp wattage and type and replace lamp with proper unit.	See Note 1 below for visible signs of lamp failure.
5	Reinstall photo control and test to see if lamp strikes.	Reenergizes load side of circuit.
6	If lamp fails to strike, replace plug-in starter with a properly rated unit.	Replacement starter may have to be modified before installation. See instructions supplied with every starter.
7	If lamp still fails to strike, check inside of luminaire for loose or broken connection and check for proper supply voltage and lamp type.	
8	If lamp still fails to strike, replace luminaire	Most luminaries have a five year warranty. Date of manufacture is found on the luminaire nameplate.

Note 1:

Visible signs of lamp failure:

A. Normal end of life:

Arc tube will be blackened.

B. Arc Tube Leaker:

This occurs when sodium leaks out of the ends of the arc tube. Look for the outer glass bulb to be discolored with a transparent amber color, if a small leak, or a dark silver-black color if a large leak.

C. Air Lamp:

A crack in the outer bulb will allow air to enter the lamp and contaminate the vacuum. The "getter flash" (dark-silver-black coating on the outer glass bulb just above the lamp base) will be white and flaky pieces may be floating loose within the outer bulb. The lamp base may have a tarnished look. The "getter flash" acts as a cleaning agent to maintain the lamp's vacuum. Without a good getter, the lamp would expire in about a week.

46.38.20 Luminaires Which Cycle "On" And "Off"

Cycling is a condition common to high pressure sodium vapor lamps where the lamp cycles "on"and "off" for no apparent reason. This condition may occur only once in a while or may be continuous until corrected. The most common causes of cycling and their solutions are listed below:

A. End of Life Cycling:

The most common cause of cycling is when the lamp reaches the end of its life. After the arc is established, the voltage (measured at the lamp socket) is drawn down to as little as 12 volts. As the lamp warms up, this voltage increases to the "New Lamp Voltage Range" as shown in the table below. As the sodium vapor lamp ages, this voltage gradually increases above this value. Eventually the voltage needed by the lamp will exceed what the ballast can supply. (See "End of Life Lamp Voltage" in table below.) When this happens, the arc inside the lamp can no longer be supported, so the lamp extinguishes and must cool down before the arc will reestablish itself.

A lamp which has just reached end of life may cycle only one or two times a night. The frequency of cycling will increase as the lamp ages, and it will eventually cycle all night long.

THE SOLUTION IS TO REPLACE THE LAMP

A cycling lamp should be replaced promptly to avoid long term damage to the igniter and the ballast.

Note: If the lamp strikes, the plug-in igniter is working properly and need not be replaced.

Table 18

Lamp Wattage (Watts)	Rated Lamp Voltage (Volts)	New Lamp Voltage Range (Volts)	End of Life Lamp Voltage (Volts)
50	52	46 – 60	84
70	52	45 – 60	84
100	55	44 – 62	84
150	55	48 – 62	88
250	100	90 – 120	160
400	100	84 – 115	140
1,000	250	210 – 275	350

B. Photo control Caused Cycling:

In rare instances, artificial light from illuminated signs or headlights may cause the photocontrol to turn the lamp load "off". This unwanted "turn off" may appear as cycling hut actually is not. The solution is to adjust the luminary's photocontrol receptacle so the control window will "look" in a different direction.

C. Equipment Mismatch:

A mismatch between the lamp and the luminaire (e.g. 50 Watt lamp installed in a 250 Watt luminaire) will often cause cycling. Check the ANSI code on the lamp and the luminaire nameplate to make sure they match.

D. Broken Arc Tube Support:

A broken frame weld on the arc tube support inside the lamp may cause rapid cycling. This condition is usually caused by vibration and can damage the ballast if not promptly corrected.

E. Redirected Energy:

A condition where the lamp's energy is reflected back through the arc tube. This causes excessive heating of the arc tube and induces cycling. This condition can occur when aluminum foil is used inside the refractor to block and redirect the luminaries light output.

F. Manufacturing Defect:

The way the arc tube is manufactured may cause a rapid voltage rise and cycling. This will happen early in the lamp life and will continue for thousands of hours. Lamps with this condition should be returned to the lamp manufacturer as defective.

G. Voltage:

Low or high supply voltage to the luminaire may cause cycling or erratic lamp operation.

H. Feeder Operation

A momentary interruption in voltage or a sudden voltage drop may extinguish the arc in a sodium vapor lamp. The lamp must cool sufficiently before the arc will restrike. This condition may appear to be cycling but actually is not. No corrective action is needed.

46.38.30 Luminaires Which Stay "On" All Of The Time

Check the voltage rating of the luminaire and replace the photo electric control with a properly rated unit. Check new photocontrol for proper operation. Note that the sodium vapor lamp must cool sufficiently before the arc will restrike.

If this fails to correct the problem, check for a disconnected or broken neutral (white wire) connection inside the luminaire at the photocontrol receptacle.

46.38.40 Luminaires Which Burn Dim

A mismatch between the lamp and the luminaire may cause low light output. Check lamp wattage and compare with the wattage rating of the luminaire.

Check for low supply voltage. Measure supply voltage and compare with the voltage rating on the luminaire nameplate.

If the luminaire has a capacitor, check for signs of leaking, a bulged tank, broken connections, or a broken bleed resistor across the capacitor terminals.

Version	Date	Modification	Author(s)	Approval by (Name/Title)
1	07/09	• General Revision of entire section. • Added pulse start metal halide information in multiple locations. • Added conductor color code assignments of page 46.16. • Added marketing names for poles in multiple locations. • Deleted CU Tables in multiple locations. • Corrected STD Item #s on multiple drawings.		

Supersedes 7/19 Issue – Revised Drawings

Business Use

Supersedes 7/18 Issue – Revised drawings

GENERAL

The following Standard is the practice to be followed when designing and installing single-phase or three-phase risers on the Company's distribution system operating at 35kV and below. This Standard shall apply to primary and secondary single phase or three-phase risers installed by both the Company and/or customers. Further details for primary pole-tops are in Section 9 - Primaries.

All risers shall demonstrate the protective fusing and surge arrester protection as shown on the accompanying construction drawings. Primary dips shall be protected at each end-riser with surge arresters and isolating disconnects. Non-fused disconnects (Std. Item D5) may be used for simple sectionalizing or where over-current protection is better provided elsewhere.

Installations and ownership of customer service laterals and risers generally are the responsibility of the customer and shall be in compliance with Company requirements.

48.1 TERMINATIONS

Supersedes 7/09 Issue - Minor editorial changes.

Exposed cable ends shall never be left unsealed. High voltage applications (above 600V) are provided with terminating kits designed to seal the cable end, increase surface leakage current distance (by use of weathershed skirts), and provide electrical stress relief. Dielectric stress introduced by abrupt separation of the ground-potential shield from the outside of the cable could lead to early failure of the termination. Low voltage or secondary cables (600V or less) can be sealed while energized with cold-shrink-end caps (Std. Item UC90).

Any de-energized cable, whether it is still on the reel in the yard or recently installed and awaiting terminations, shall have cold-shrink end caps applied to all exposed cable ends. Tape wraps are not adequate for sealing out moisture.

Final termination assembly should be kept relatively straight and as vertical as practical. Rain shield skirts should never be oriented more than 45 degrees from a vertical orientation. The cable should first be trained into final position before application of the termination kit to minimize subsequent bending stress on the termination/connector assembly. All cables shall be tagged.

Terminations for #2 underground cables shall consist of a bayonet, or pin, style compression connection where bolted vise connectors are utilized to secure arrester and tap leads located within the appropriate animal guard (refer to Page 48-104 for details).

Terminations for underground cables larger than #2 shall utilize NEMA pad style compression connections where arrester and tap leads are secured using the appropriate size primary connection as outlined in Section 5 - Connectors (refer to Page 48-107 for details).

Refer to Page 48-104 for termination and concentric neutral connection and wiring detail for #2 underground riser cables and Page 48-107 for underground riser cables that are larger than #2. Further termination detail can be found in Section 37 - Terminations in the Underground Construction Standards manual.

48.2 CABLES

The following cables are standard for all normal in-conduit or direct burial 15-35 kV underground circuits. Detailed descriptions of these and other underground cables are shown in Section 35 - Cables in the Underground Construction Standards manual.

Table 1
Standard Primary Conductors

Voltage (kV)	Conductor	Packaging	Std. Item
15	#2 AL	3-1/C Parallel	UC11BJ
15	#2 CU	1-1/C	UC11BK
15	#2 CU	3-1/C Parallel	UC11BL
15	#4/0 CU	3-1/C Parallel	UC11E
15	350 CU	3-1/C Parallel	UC12F
15	500 AL	3-1/C Parallel	UC12GG
15	500 CU	3-1/C Parallel	UC17
15	750 AL	3-1/C Parallel	UC12HG
15	1000 AL	3-1/C Parallel	UC12TA
15	1000 AL	1-1/C	UC12TB
15	1000 CU	3-1/C Parallel	UC12TC
25	#1/0 CU	3-1/C Parallel	UC23CJ
25	#4/0 CU	3-1/C Parallel	UC23EC
25	350 AL	3-1/C Parallel	UC23FA
25	350 CU	3-1/C Parallel	UC23FJ
25	500 AL	3-1/C Parallel	UC23GA
25	500 CU	3-1/C Parallel	UC23GJ
25	1000 CU	3-1/C Parallel	UC23TC
25	1000 AL	3-1/C Parallel	UC23TA
35	#1/0 AL	1-1/C	UC35C1
35	#1/0 AL	3-1/C Parallel	UC35C3
35	#2/0 CU	3-1/C Parallel	UC35DJ
35	500 CU	3-1/C Parallel	UC35GJ
35	750 CU	3-1/C Parallel	UC35HJ
35	1000 CU	3-1/C Parallel	UC35TC
35	1000 AL	3-1/C Parallel	UC35TJ

Supersedes 7/11 Issue - Edited termination labeling requirement (Section 48.2.20).

48.2.10 Cable Ampacity

Allowable ampacity varies widely due to different cable arrangements. Ampacity is affected by the proximity and loading of adjacent circuits, ambient temperatures, etc. Contact Standards Engineering for ampacity ratings of circuits as necessary.

48.2.20 Cable Identification Tags

Primary riser terminations shall be labeled in accordance with Section 35.16.10 (Terminations). Secondary riser terminations shall be labeled in accordance with Section 35.16.20 (Including secondary services at pole end served from overhead transformers). See Tag Holder location on Std 48-109 and Std 48-110.

48.2.30 Phase and Feeder Numbering

Phase and feeder identification, when requested, is shown on Drawing 2-112 in Section 2-Poles. For new construction, the first pole out of a substation shall always include phase markings. Prior to any work on multi-phase lines, phase identification shall always be confirmed with proper testing equipment (e.g. phase tester).

48.3 ARRESTERS

Arresters at locations other than the cable termination point do not adequately protect the cable. One significant variable under user control is total connection lead length. This is comprised of the line lead length and the ground lead length. Line lead length is the distance from the phase conductor tap to the line terminal of the arrester. The ground lead length is the distance that the surge current flows from the arrester ground to the common ground/neutral connection with the cable metallic shield. By keeping the total connection lead length as short as possible, the total impressed transient voltage developed by the arrester installation is minimized. A minimum margin of protection greater than or equal to 20% is required for sufficient protection. Additionally, riser type surge arresters denoted with a yellow band are required for all riser pole applications.

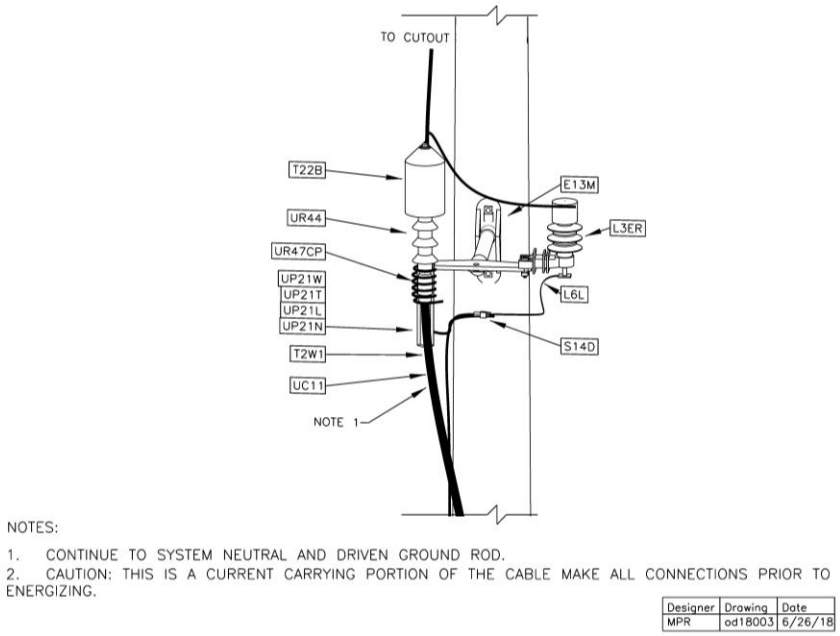


Figure 1 - Grounding for riser arresters

48.4 ANIMAL GUARDS

Animal guards shall be installed on all riser pole terminators to protect terminations from incidental flashover. The guard shall be placed over the top skirt of the termination.

48.5 RISER GUARDS

Vertical electrical supply conductors on riser poles shall be protected by a covering that gives suitable mechanical protection to a minimum of 4 inches above secondary cables for primary risers, and a minimum of 40 inches above communication cables for a secondary riser. For primary risers, the first 8 feet above ground shall be galvanized steel. The remainder shall be either u-duct or Schedule 40 PVC conduit. For secondary risers, Schedule 80 PVC conduit may be used as an alternate for the first 8 feet above ground. Secure conduit with galvanized steel straps located at 30" intervals. The remaining cable covering shall be either u-duct or Schedule 40 PVC conduit.

Risers built to the old direct buried standard did not require a metallic sweep and a metallic conduit the first 8 feet up the pole. When maintenance is performed on these risers and the pole does not require replacement a galvanized steel U duct (Std. Item UK12) shall replace the existing plastic U duct and a bond clamp (Std. Item UK39) shall be used to ground the metallic U duct.

Risers should be located on the pole in the safest available position with respect to climbing space and exposure to traffic damage (NESC Rule 362-A).

To prevent induction heating, all 3 cables of a three-phase circuit shall be installed in a single galvanized steel conduit. Where a galvanized steel conduit is used, it shall be bonded to the down ground as shown in Figure 2. This connection shall be made utilizing a compression connector. All spare galvanized steel riser pipes shall be bonded in the same manner. Locations where threaded grounding bushings are used at end of metallic conduit and u-duct will not fit over bushings, a riser reducer guard (Std. Item UK14GF) shall be installed to cover conduit and cables.

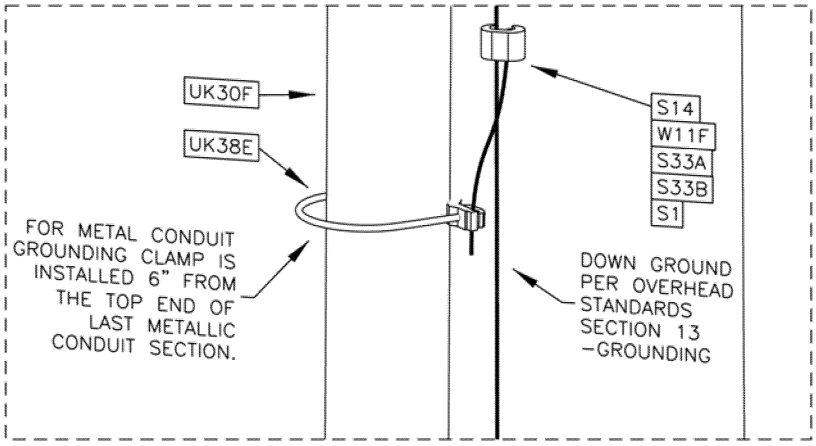


FIGURE 2 – GROUNDING DETAIL FOR GALVANIZED STEEL RISER CONDUIT

Designer	Drawing	Date
MPR	od18004	1/10/20

Figure 2 - Grounding detail for galvanized steel riser conduit.

Drawing 48-112 displays an alternate riser construction using conduit standoff brackets. This construction can be used where the riser will not interfere with pedestrian or vehicular traffic. Using conduit standoff brackets allows for easier pole climbing and easier pole replacement. U-guard (Std. Item UK11) shall be used at riser locations above the specified 8 foot minimum section of conduit to the point of secondary/neutral bracket installation where conduit (schedule 80 PVC or galvanized steel) is not used to cover the riser cables to the point of secondary/neutral bracket installation.

Supersedes 7/18 Issue – Corrected reference to compression connector Std Item S14

48.6 CONDUIT SEALING

All conduits used for risers and all spare riser pipes shall be sealed to prevent water from entering the conduit. Use Std. Item UF10 to seal all riser conduits at the top of the last piece of conduit used. This UV-resistant expanding foam can be applied in temperatures ranging from 41˚F to 95˚F and can withstand temperatures as low as -22˚F and as high as 176˚F after it has cured. The foam should be stored in a warm environment before applying as the foam tends to become clogged in the nozzle if kept in cooler storage areas. **Do not** use Std Item UF20 to seal riser conduits. UF20 is for fire sealing conduits in manholes and does not contain a UV inhibitor.

48.7 RISER ACCESSIBILITY

When constructing risers in backyards or other locations where the riser is not accessible by bucket truck, the riser shall be built so that it is easily climbable. Use of conduit standoff brackets (see Drawing 48-112 for details) are strongly recommended in these situations.

48.8 RAISING TERMINATIONS ON A POLE

This may be done to accommodate new attachments on a pole, to increase ground clearance of lines or when relocating a pole. This work may include replacing a pole with a taller pole or rearranging facilities on an existing pole.

48.8.10 Primary Cable in Conduit

Single phase and three phase #2 cable can be spliced on the pole. Splices must be located above the 8’ galvanized steel conduit and shall be staggered if 3 phases are being spliced such that all of the splices are completely covered by the riser guard (u-duct). If the riser is located at the bottom of a hill where water in the conduit is an issue, install a pull box at the base of the riser to allow water to drain (see alternate detail on most riser construction drawings).

For cables larger than #2, the cable shall be replaced from the first existing access point away from the pole (padmounted switchgear, handhole/manhole, pull box, etc.).

48.8.20 Direct Buried Primary Cable

When the primary underground cable away from the pole is direct buried, replacing the cable from the pole to an existing access point requires excavation. A galvanized steel sweep and riser pipe are required for all risers; install these items when relocating terminations on the pole if they were not previously installed. To minimize the required excavation either:

A. Direct bury the splices:
Splice the new cables to the existing cables near the base of the pole beyond the underground end of the riser sweep pipe, or

B. Install a new handhole or pull box:
Install a new handhole or pull box at the underground end of the riser sweep pipe near the base of the pole along the route of the existing cable and splice the new cables to the existing cables at the handhole or pull box. Install new riser and terminations at the new primary level on the pole. Refer to Standards Section 33.0.10 to select the appropriate handhole or pull box for the location, voltage, and cable size.

Supersedes 7/09 Issue - Added clarification on which foam to use for riser conduit sealing.

48.8.30 Secondary Risers

Secondary cables may be spliced on the pole to allow secondary riser connections to be raised on a pole. Splice the new cable to the existing cable using underground splices. Stagger the individual splices on the pole so they will fit under the u-guard. Install the splices below communication wires and at least 8 feet above ground. Install new connections at the new secondary level on the pole.

48.8.40 Cost Allocation

Refer to the applicable tariff for cost assignment(s) for the state in which the work will be performed.

If there are no tariff restrictions, the Company will perform this work and either: (i) the Company is responsible for the costs of the work or (ii) the Customer is responsible for the costs of the work, or (iii) the costs of the work may be paid by a third party as part of a reimbursable project (e.g. reimbursable highway project, third party attachment make-ready, etc.).

48.9 RISERS IN SUBSTATIONS

In general, design of substation facilities is the responsibility of the substation engineering group. However, the installation of cable risers inside substations shall comply with the requirements of Underground Distribution Standards with regards to cable terminations, lightning protection, grounding and cable support.

Refer to drawings 48-370.

48.9.10 Terminations

All terminations are to be cold shrink type, standard item UR44_ or UR45_. Lugs shall be standard item UL15_ for copper conductor and standard item UL16_ for aluminum. Do not substitute other lugs as these may not be sealed to prevent water intrusion into the conductor strands. Install an animal guard, standard item T22B on the termination. For additional information, see Section 37 of the Underground Construction Standards.

48.9.20 Lightning Arresters

A riser class lightning arrester, standard item UL3_, shall be mounted immediately adjacent to each cable termination. Install a flex ground lead, standard item L6 or L6L, from the ground terminal to station ground bus. Use #2 soft drawn, covered lead wire, standard item W13E to connect the arrester to the phase. Both the phase lead and the ground lead should be as short as possible for the best cable insulation protection.

48.9.30 Grounding

The concentric neutral from each phase termination is to be connected to the 4/0 copper ground bus. The ground bus should be connected to the below grade ground grid in a minimum of 2 places. For optimal cable insulation protection, connect the concentric neutral and the arrester ground lead to the station ground bus using a single connector, standard item S14J. If the concentric neutral leads need to be extended, see Table 2 in Section 37 of the Underground Construction Standards.

Supersedes 7/12 Issue: Text edit 18.9.

48.9.40 Cable Support

Install cable positioners to support the weight of the cable. Install a minimum of 1 positioner a maximum of 2" below the bottom of the termination. Install additional positioners such located so that the maximum distance from grade to the first positioner is less than 10' and the distance between positioners does not exceed 7'. These positioners are necessary to prevent excessive cable movement during fault current events which can put undue stress on the connection points. Do not use the lug to support the weight of the cable.

48.9.50 Riser Conduit

Install a fairleader, standard item UK49B, to protect the cable from damage due to contact with the edge of the conduit. Fill the space between the fairleader and the cable with expanding foam, standard item UF10. For metallic riser conduit, install a grounding clamp, standard item UK38_ and connect it to the station ground grid with 4/0 copper wire, standard item W19G.

7/14 New Bullet 48.10

48.9.60 Bus Supports

The maximum distance between the terminal lug on the top of the terminator and the first support for the station bus is 5'. This maximum distance is required to prevent undue forces from being imposed on the terminal lug / cable during high current faults. If the distance to the first bus support exceeds 5', install additional supports as needed.

48.9.70 Minimum Approach Distance

The first disconnecting means above the cable termination must be sufficiently far from the termination to allow connection / disconnection of the termination without violating the minimum approach distance as stated in the Safety Manual. This clearance will also be required to cable testing and maintenance. To determine the appropriate distance, add 3'6" to the minimum approach distance as stated in the safety manual for the circuit voltage.

48.10 RISER CONDUIT DRAINAGE

Primary cables in conduit risers located at a lower grade (level) may require the installation of a pullbox (Item UR6) to drain away water run-off from equipment and conduit located at a higher grade. We want to avoid water settling at conduit sweeps located on riser poles and that could freeze up with very low temperatures thus damaging the primary cable inside conduit. An "Alternate Detail" drawing is provided in Standard 18-124 for these lower grade riser pole cases. Consult with Standards Engineering if needed.

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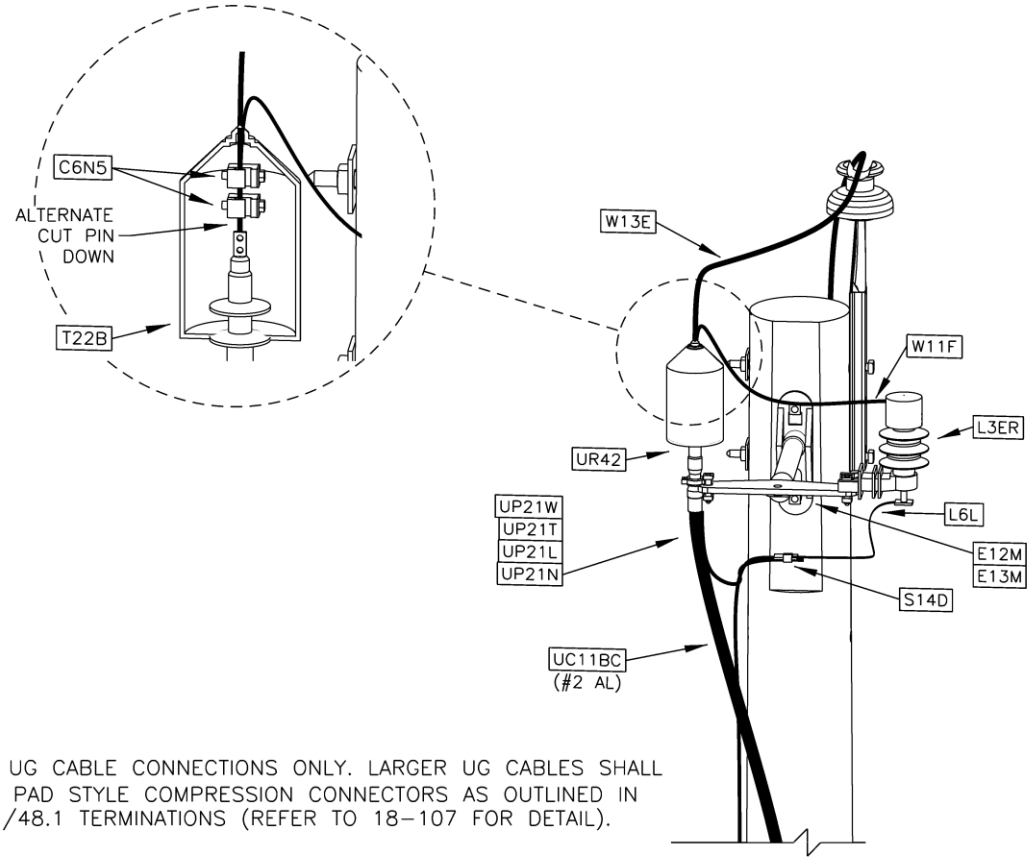
CU = CCSCT15K2R	Cold Shrink Cable Termination 15kV #2AL 1PH Riser
CU = PE12M	Equipment Mount Fiberglass 3PH
CU = PE13M	Equipment Mount Fiberglass 1PH
CU = CAL(X)KRPNE	Arrester Lightning (X)kV UG Riser MOV (X) = Voltage Rating

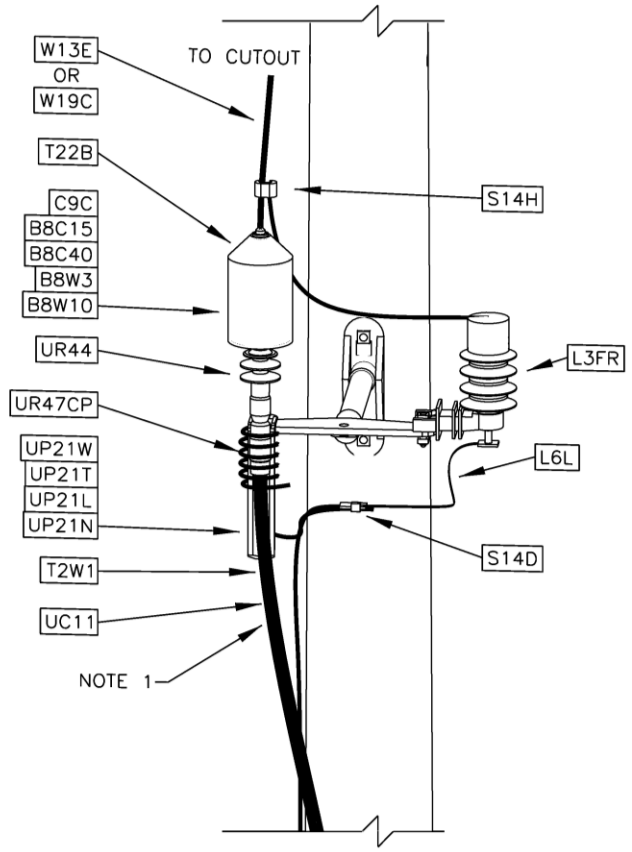


NOTE:
1. FOR #2 UG CABLE CONNECTIONS ONLY. LARGER UG CABLES SHALL UTILIZE NEMA PAD STYLE COMPRESSION CONNECTORS AS OUTLINED IN SECTION 18.1/48.1 TERMINATIONS (REFER TO 18–107 FOR DETAIL).

Designer	Drawing	Date
MPR	od18104	6/26/18

UG CABLE TERMINATION & CONCENTRIC NEUTRAL ATTACHMENT DETAIL FOR #2 CABLES ONLY

CU = CCSCT(X)K(Y)R	Cold Shrink Cable Termination (X)kV (Y) Riser, (X) =Voltage Rating, (Y) = Cable Size
CU = CCSCT35K1/0ARNE	Cold Shrink Cable Termination 35kV 1/0AL Riser 1Ph
CU = PE12M	Equipment Mount Fiberglass 3PH
CU = PE13M	Equipment Mount Fiberglass 1PH
CU = CAL(X)KRPNE	Arrester Lightning (X)kV UG Riser MOV (X) = Voltage Rating



NOTE:
1. REFER TO DRAWING 5–148 FOR TERMINAL CONNECTOR INSTALLATION NOTES.

Designer	Drawing	Date
MPR	od18107	6/26/18

Supersedes 7/11 Issue – 3D Drawing Conversion.

UG CABLE TERMINATION & CONCENTRIC NEUTRAL ATTACHMENT DETAIL FOR CABLES LARGER THAN #2			
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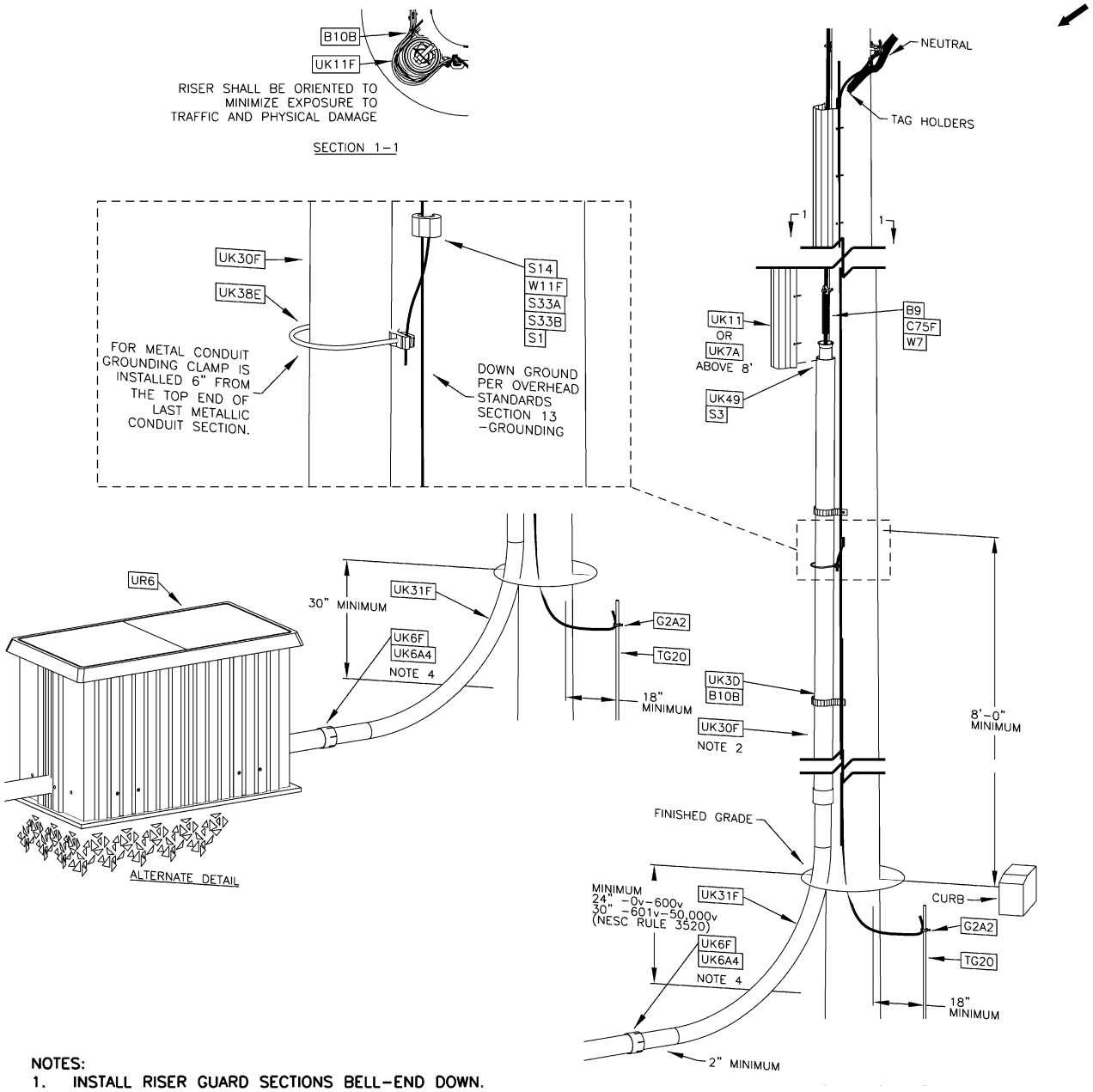
7/18	**48-107**		

CU = SER-UG-OH,(X)PH-SEC,(Y)A	Service UG to OH, (X) Phase, to Sec, (Y) Amp, (X) = 1 or 3, (Y) = 200, 400
CU = SER-UG-OH,(X)PH-TRANS,(Y)A	Service UG to OH, (X) Phase, to Transformer, (Y) Amp, (X) = 1 or 3, (Y) = 200, 400, 800
CU=SER-UG-OH, (X)PH,(Y)A,CST	Service UG to OH, (X) Phase to Sec, (Y)Amp, (X)=1 or 3 (Y) = 200 Coastal



NOTES:

1. INSTALL RISER GUARD SECTIONS BELL–END DOWN.
2. THE SERVICE LATERAL CABLE, CONDUIT, GROUND CLAMP AND SHORT SECTION OF GROUNDING CONDUCTOR SHALL BE FURNISHED BY THE CUSTOMER. NATIONAL GRID WILL INSTALL GROUND ROD AND COMPLETE BONDING REQUIREMENTS.
3. IF THE ENDS OF THE CUSTOMER OWNED SERVICE LATERAL CABLES ARE WITHOUT SUITABLE MOISTURE PREVENTING SEALS,(RUBBER CAPS OR TAPE) DO NOT ATTACH. NOTIFY SUPERVISOR IMMEDIATELY.
4. OMIT CONDUIT ON DIRECT BURIED INSTALLATIONS AND INSTALL A LEADER GUARD (UK49) IN PLACE OF THE CONDUIT ADAPTER (UK6F).
5. TO PREVENT INDUCTION HEATING OF THE METALLIC CONDUIT DO NOT SEPARATE THE PHASE CONDUCTORS OF A THREE PHASE CIRCUIT INTO SEPARATE CONDUITS.
6. ON POLES NOT ACCESSIBLE BY BUCKET TRUCK, "THE NUMBER, SIZE, AND LOCATION OF RISER DUCTS OR GUARDS SHALL BE LIMITED TO ALLOW ADEQUATE ACCESS FOR CLIMBING", NESC RULE 362B.

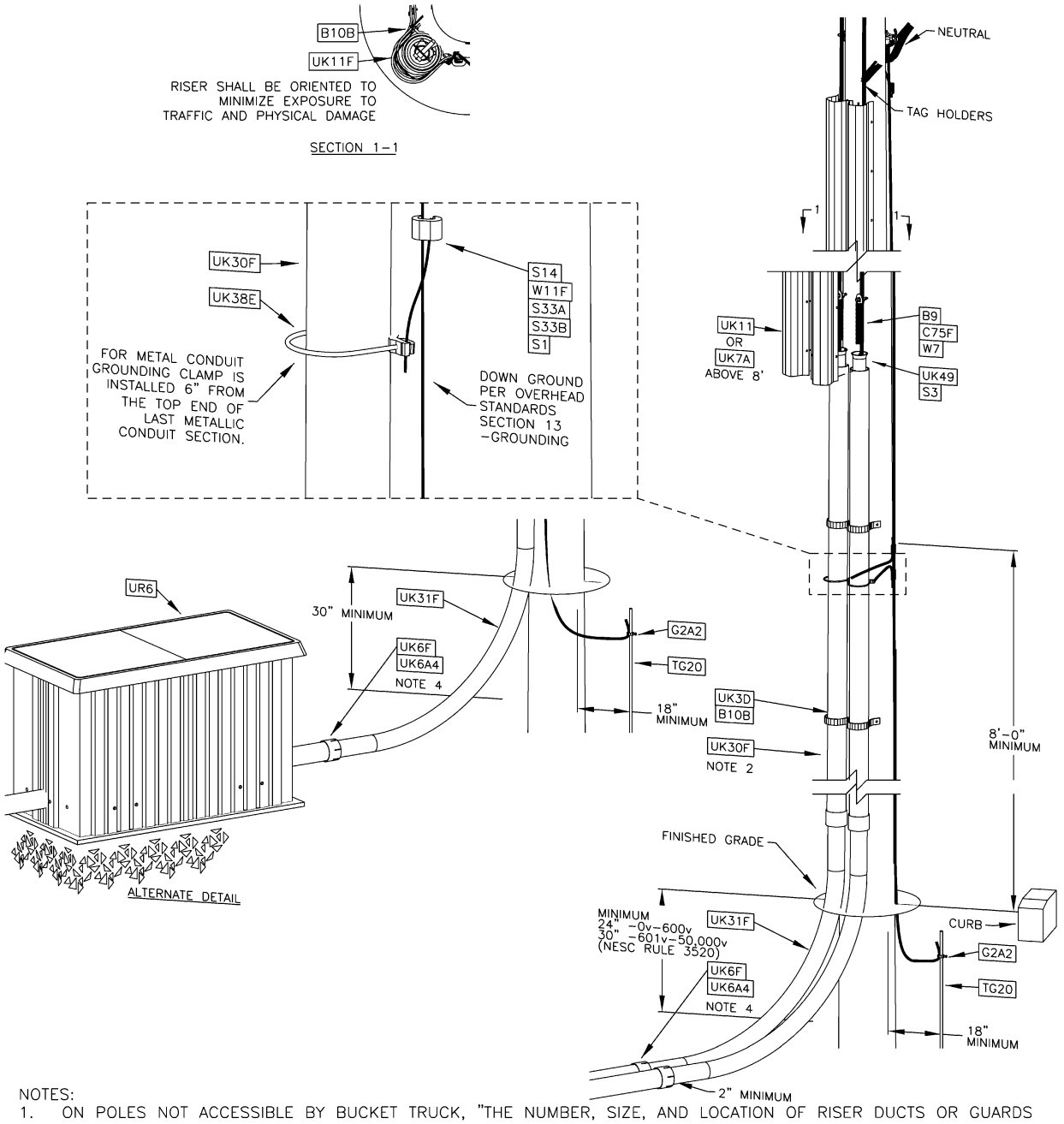
Designer	Drawing	Date
MPR	od18109	1/16/20

Supersedes 7/18 Issue – Corrected reference to compression connector Std Item S14

TYPICAL SINGLE OR THREE PHASE SECONDARY RISER DETAILS FOR SINGLE RISER PIPE INSTALLATION

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-109	7/20

SEE PAGE 18-109 FOR CUS



NOTES:

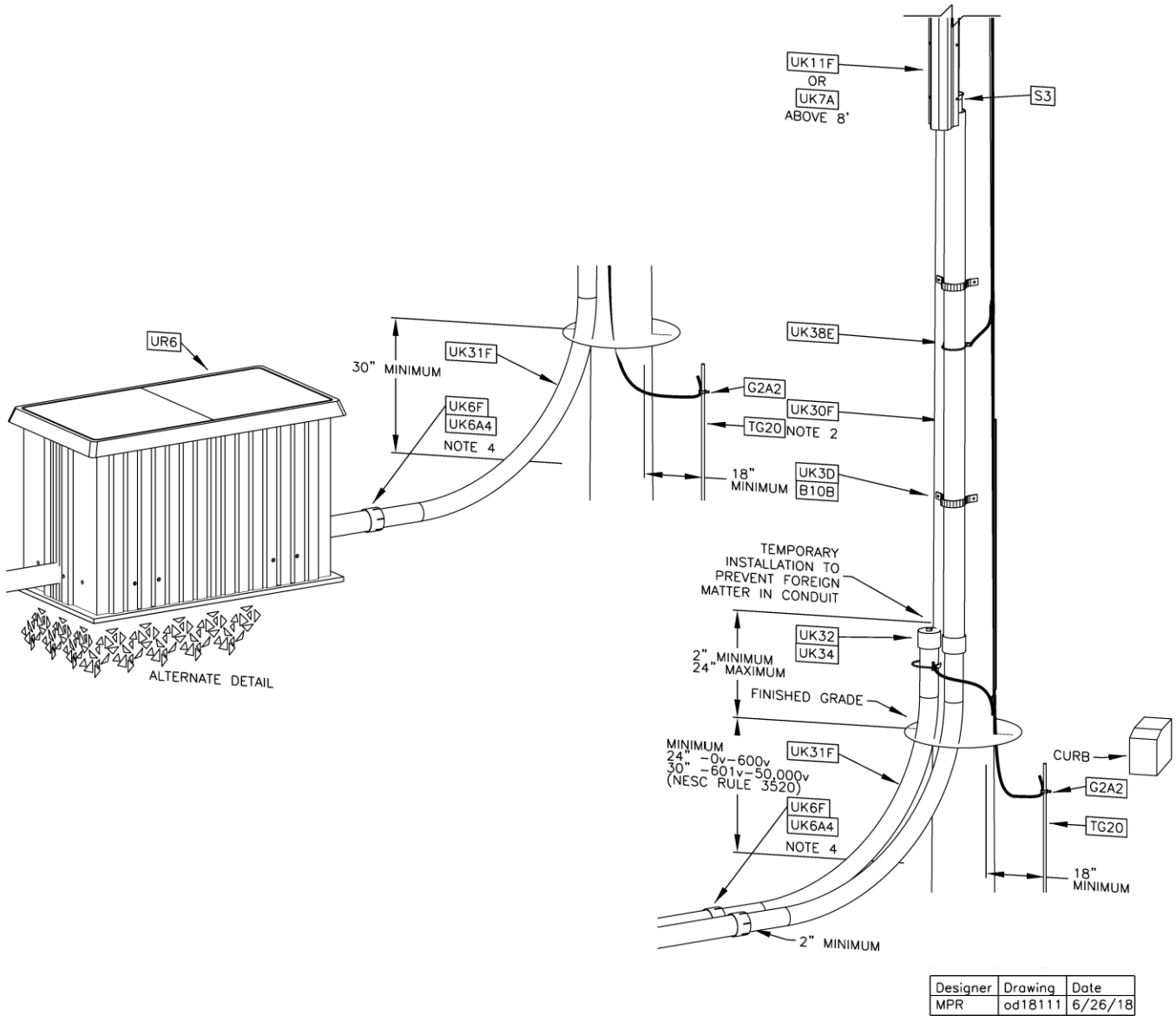
1. ON POLES NOT ACCESSIBLE BY BUCKET TRUCK, "THE NUMBER, SIZE, AND LOCATION OF RISER DUCTS OR GUARDS SHALL BE LIMITED TO ALLOW ADEQUATE ACCESS FOR CLIMBING", NESC RULE 362B.
2. THE SERVICE LATERAL CABLE, CONDUIT, GROUND CLAMP AND SHORT SECTION OF GROUNDING CONDUCTOR SHALL BE FURNISHED BY THE CUSTOMER. NATIONAL GRID WILL INSTALL GROUND ROD AND COMPLETE BONDING REQUIREMENTS.
3. IF THE ENDS OF THE CUSTOMER OWNED SERVICE LATERAL CABLES ARE WITHOUT SUITABLE MOISTURE PREVENTING SEALS,(RUBBER CAPS OR TAPE) DO NOT ATTACH. NOTIFY SUPERVISOR IMMEDIATELY.
4. OMIT CONDUIT ON DIRECT BURIED INSTALLATIONS AND INSTALL A LEADER GUARD (UK49) IN PLACE OF THE CONDUIT ADAPTER (UK6F).
5. TO PREVENT INDUCTION HEATING OF THE METALLIC CONDUIT DO NOT SEPARATE THE PHASE CONDUCTORS OF A THREE PHASE CIRCUIT INTO SEPARATE CONDUITS.
6. MAY PUT RISERS OF DIFFERENT VOLTAGES ON THE SAME POLE.

Designer	Drawing	Date
MPR	od18110	1/22/20

Supersedes 7/18 Issue – Corrected reference to compression connector Std Item S14

TYPICAL SINGLE OR THREE PHASE SECONDARY RISER DETAILS FOR MULTIPLE RISER PIPE INSTALLATIONS

CU – RISERSPARESWEEP(X)IN	(X) = 2 or 3 or 4 or 5 or 6

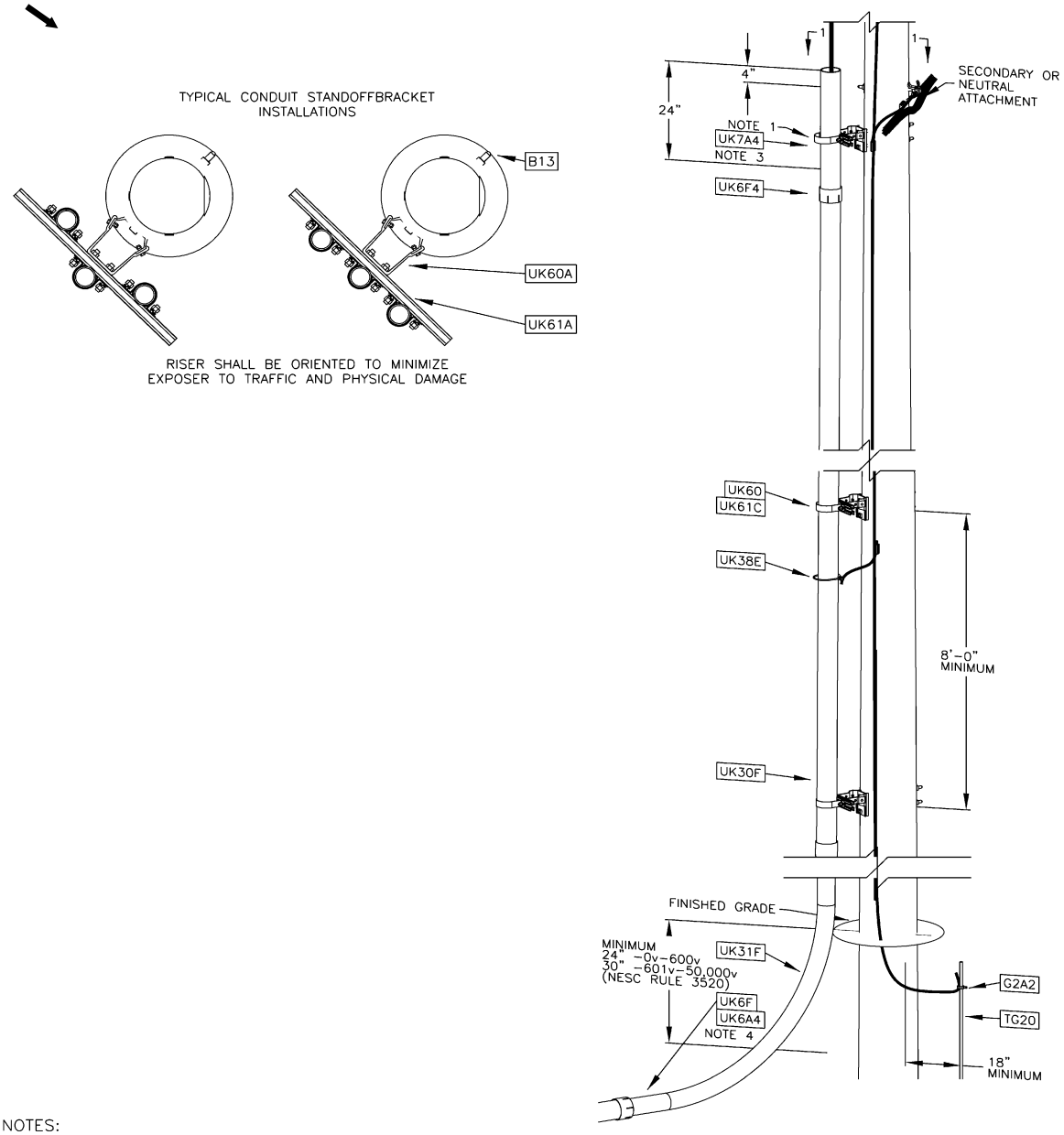


Designer	Drawing	Date
MPR	od18111	6/26/18

TYPICAL CONDUIT TERMINATION DETAIL FOR SPARE CONDUIT

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-111	7/18

CU = RCSBUK60	Riser Conduit Standoff Bracket Pole Mount
CU = RCSK(X)(Y)	Riser Conduit Strap Kits (X) = Std. ID, (Y) = Conduit Size



NOTES:

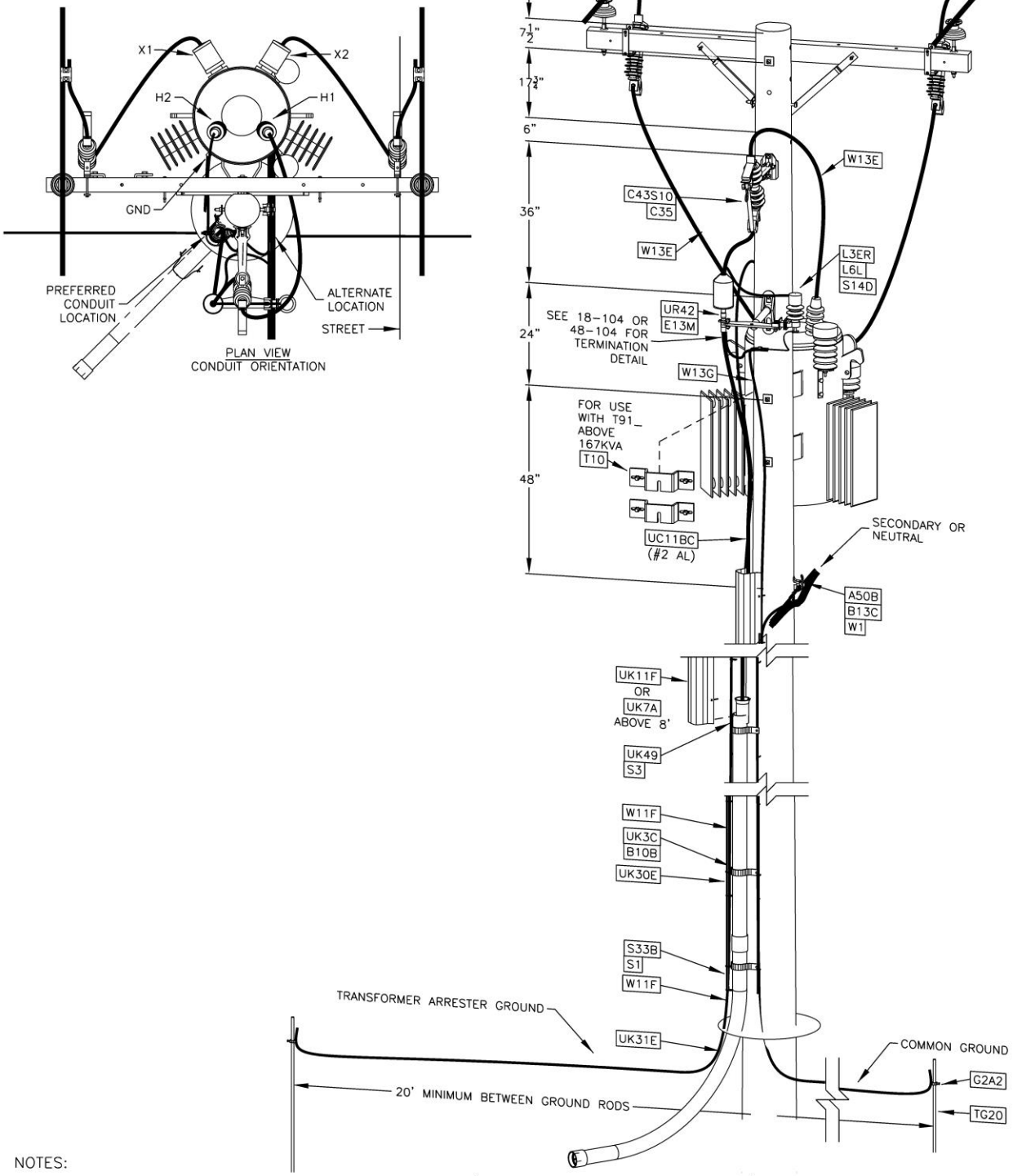
1. INSTALL THE INTERMEDIATE STANDOFF BRACKET EQUIDISTANT FROM THE UPPER AND LOWER BRACKETS.
2. RISER PIPES SHALL BE BONDED TO THE DOWN GROUND – SEE 18-111/48-111 FOR DETAILS.
3. SECONDARY SERVICES REQUIRE ELECTRICIANS TO INSTALL THE FIRST 10' OF CONDUIT UP THE POLE. NATIONAL GRID CREWS INSTALL STAND OFF BRACKETS AND 2'-10" SECTIONS OF THE PVC CONDUIT AT TOP.
4. THIS INSTALLATION CAN BE USED FOR PRIMARY RISERS. CONSULT WITH STANDARDS ENGINEERING.

Designer	Drawing	Date
MPR	od18112	12/10/18

Supersedes 7/18 Issue – Revised Drawing. Conduit strap above sweep.

RISER INSTALLATION WITH CONDUIT STANDOFF BRACKETS

RISER MU = @18-125CC(Y)K(I)(X)	Single Phase Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Riser Guard
RISER MU = @18-125CC(Y)K(I)(X)C	Single Phase Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Conduit
RATIO MU = @(W)K(X)P(Y)S(Z)T1PSU(A)(B)	(W) kVA Size, (X) Pri Code, (Y) Sec Code, (Z) Tap Code, 1 Phase, (A) Source Voltage, (B) Load Voltage



NOTES:

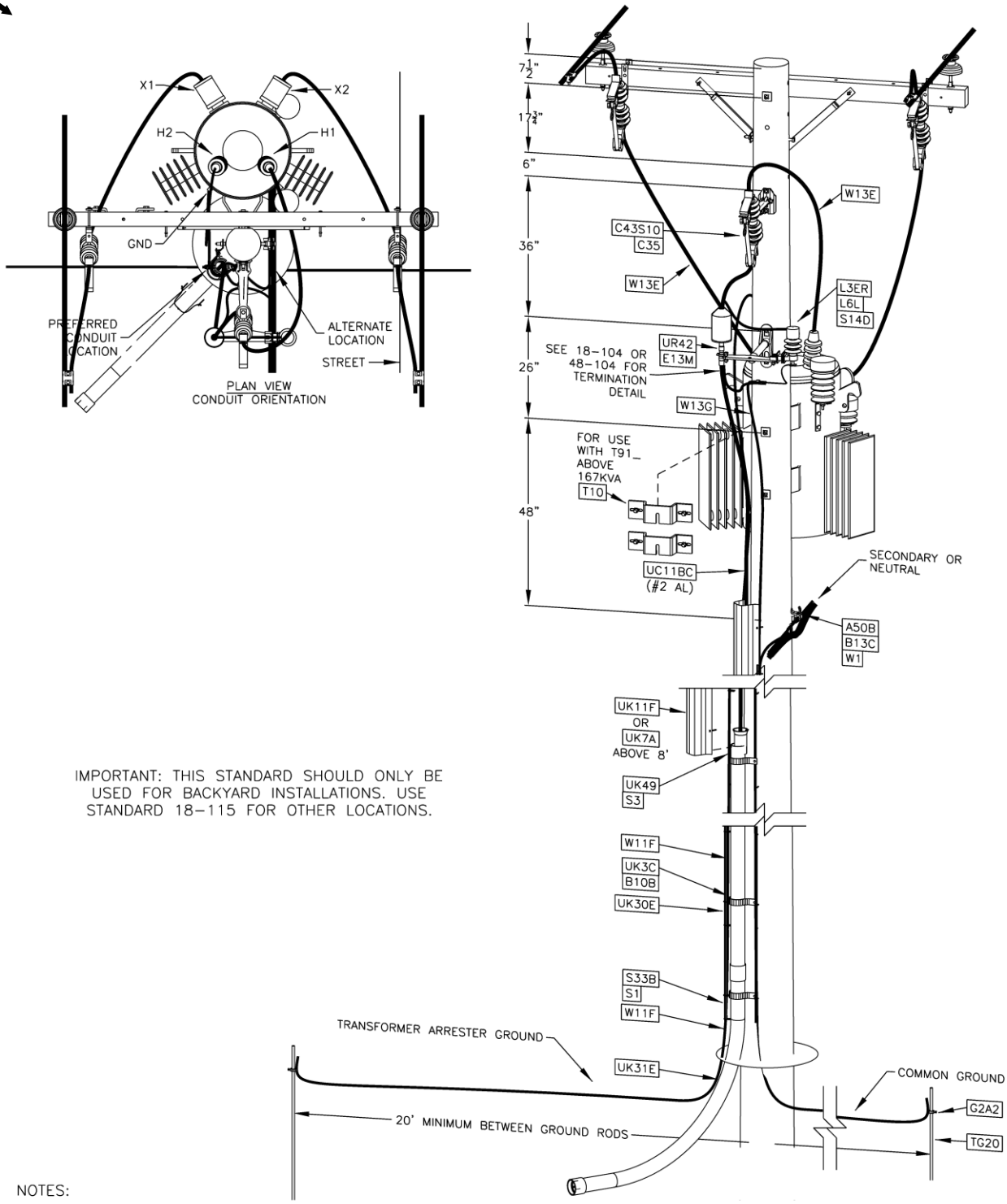
1. REMOVE HIGH-SIDE ARRESTERS ON TRANSFORMER (AT H1 AND IF ONE EXISTS AT H2). CONNECT H2, CONCENTRIC NEUTRAL AND RISER ARRESTER LEAD TO THE COMMON GROUND.
2. CONNECT THE LOW-SIDE ARRESTERS ON THE TRANSFORMER (AT X1 AND X2) AND THE TANK GROUND TO THE SEPARATE TRANSFORMER GROUND.
3. DO NOT CONNECT TRANSFORMER ARRESTER GROUND TO THE SECONDARY/NEUTRAL.

Designer	Drawing	Date
MPR	od18115	6/26/18

Supersedes 7/14 Issue – 3D Drawing Conversion.

SINGLE PHASE STEP-UP 5 kV DELTA X 15 kV WYE TRANSFORMER INSTALLATION AND SINGLE CABLE RISER

RISER MU = @18-125CC(Y)K(I)(X)	Single Phase Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Riser Guard
RISER MU = @18-125CC(Y)K(I)(X)C	Single Phase Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Conduit
RATIO MU = @(W)K(X)P(Y)S(Z)T1PSU(A)(B)	(W) kVA Size, (X) Pri Code, (Y) Sec Code, (Z) Tap Code, 1 Phase, (A) Source Voltage, (B) Load Voltage



IMPORTANT: THIS STANDARD SHOULD ONLY BE USED FOR BACKYARD INSTALLATIONS. USE STANDARD 18-115 FOR OTHER LOCATIONS.

NOTES:

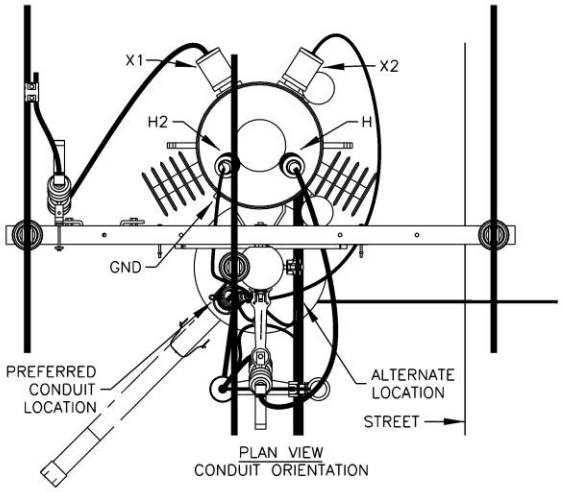
1. REMOVE HIGH-SIDE ARRESTERS ON TRANSFORMER (AT H1 AND IF ONE EXISTS AT H2). CONNECT H2, CONCENTRIC NEUTRAL AND RISER ARRESTER LEAD TO THE COMMON GROUND.
2. CONNECT THE LOW-SIDE ARRESTERS ON THE TRANSFORMER (AT X1 AND X2) AND THE TANK GROUND TO THE SEPARATE TRANSFORMER GROUND.
3. DO NOT CONNECT TRANSFORMER ARRESTER GROUND TO THE SECONDARY/NEUTRAL.

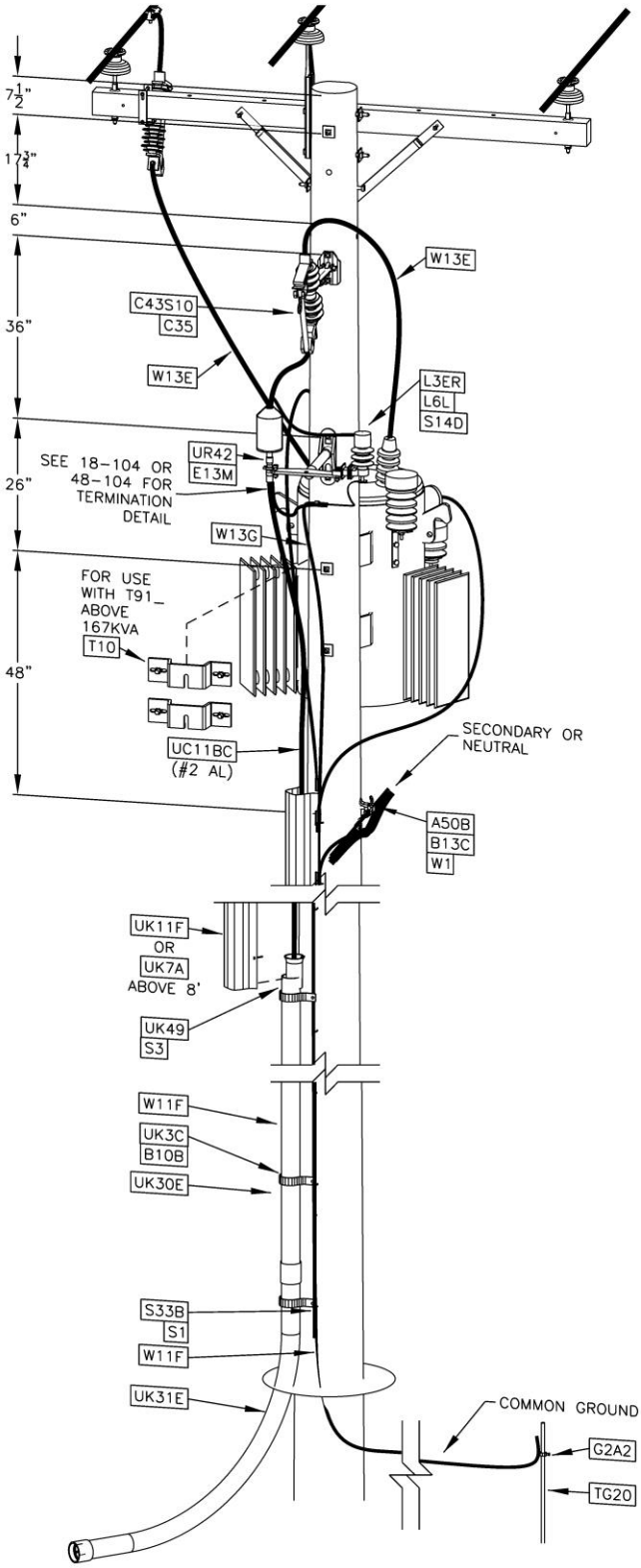
Designer	Drawing	Date
MPR	od18115B	6/26/18

Supersedes 7/16 Issue – 3D Drawing Conversion.

SINGLE PHASE STEP-UP 5 kV DELTA X 15 kV WYE TRANSFORMER INSTALLATION AND SINGLE CABLE RISER – BACKYARD

ISSUE	PAGE NUMBER		
7/18	48-115B	UNDERGROUND CONSTRUCTION STANDARD	ppl





NOTES:

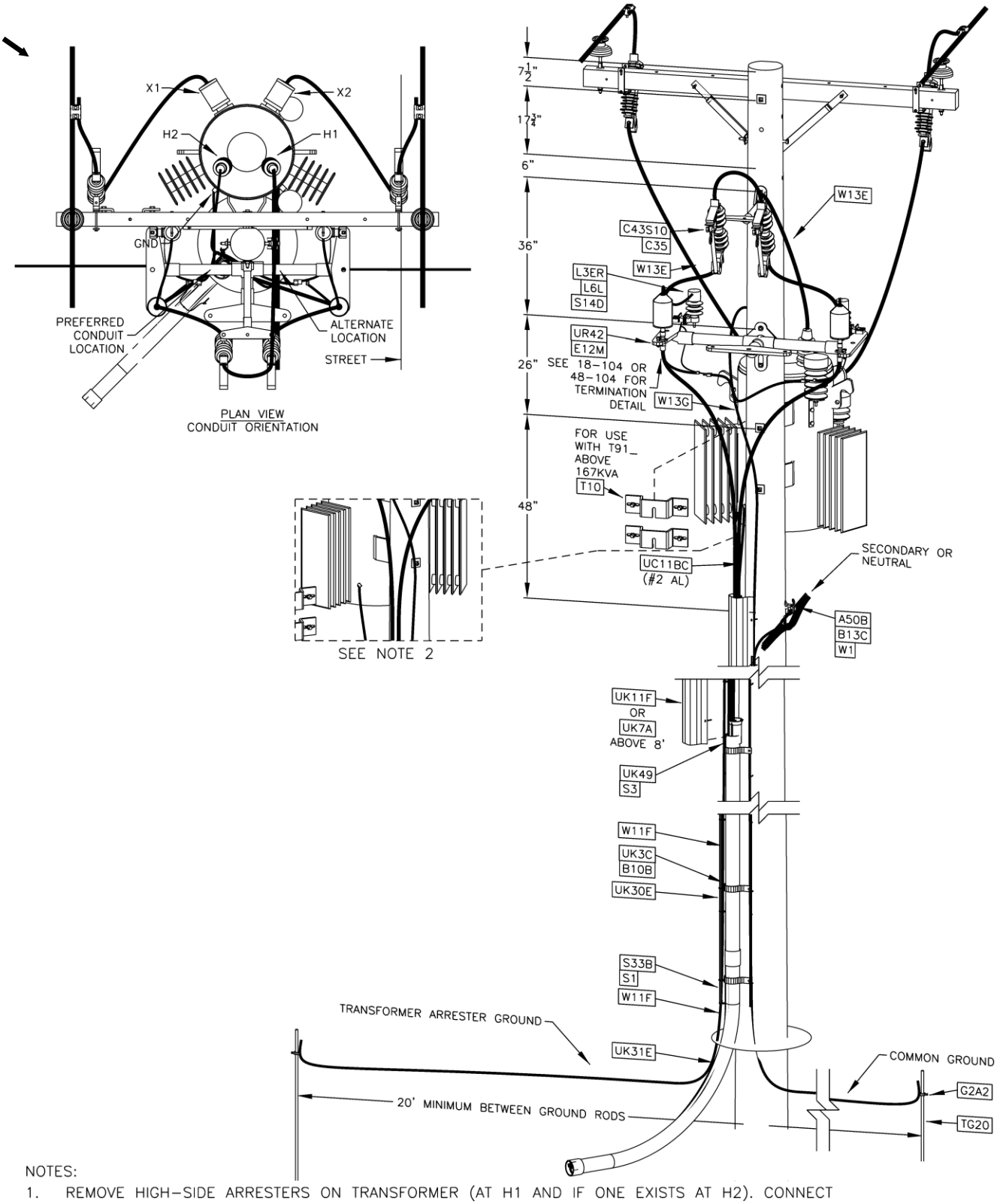
CONTINUE CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UNDERGROUND CABLE CONCENTRIC NEUTRAL (I.E. #2 OR 2/0).

Designer	Drawing	Date
MPR	od18116	6/26/18

Supersedes 7/11 Issue – 3D Drawing Conversion.

SINGLE PHASE STEP-UP 5 kV WYE X 15 kV WYE TRANSFORMER INSTALLATION AND CABLE RISER

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-116	7/18



NOTES:

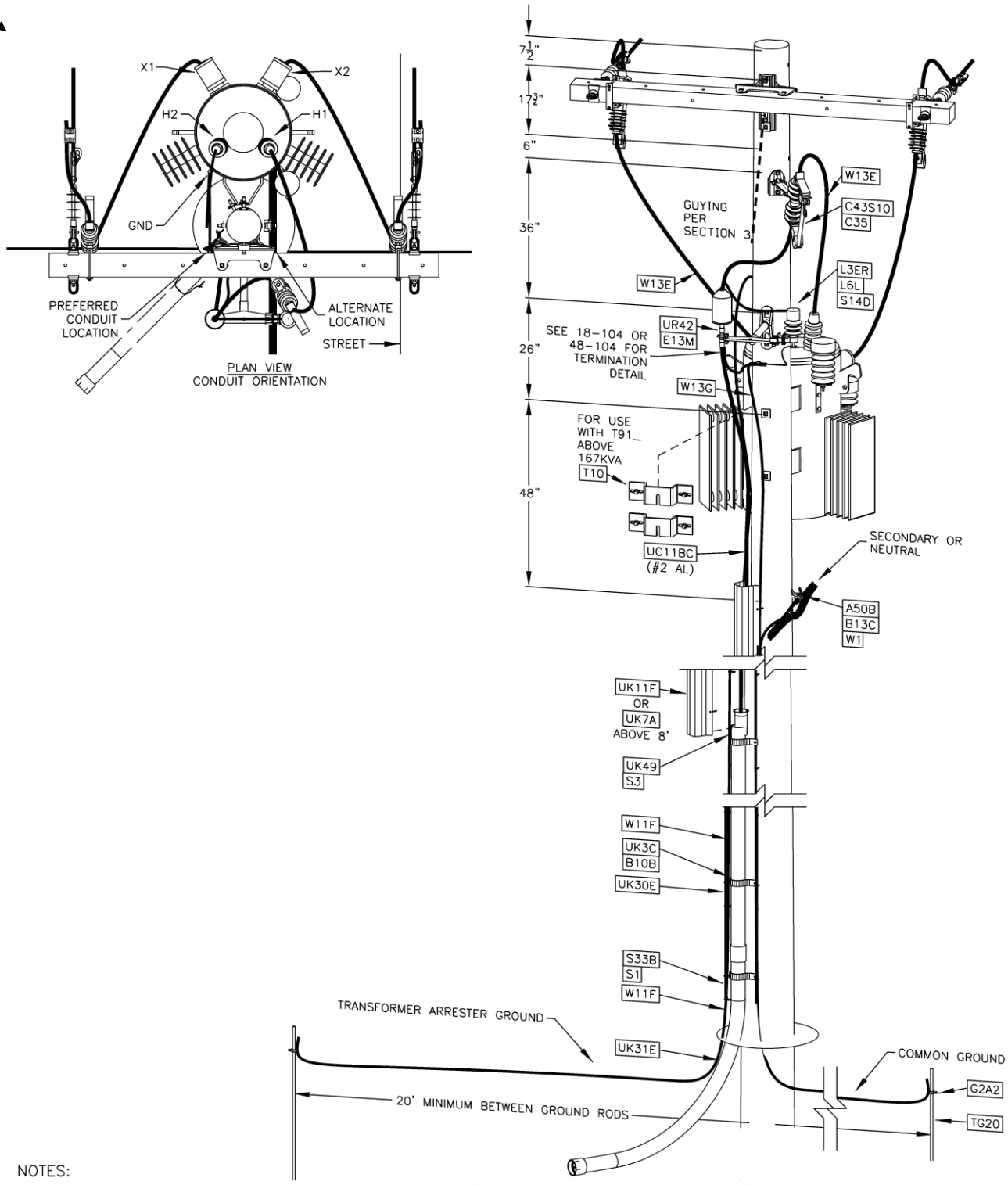
1. REMOVE HIGH-SIDE ARRESTERS ON TRANSFORMER (AT H1 AND IF ONE EXISTS AT H2). CONNECT H2, CONCENTRIC NEUTRAL AND RISER ARRESTER LEAD TO THE COMMON GROUND.
2. CONNECT THE LOW-SIDE ARRESTERS ON THE TRANSFORMER (AT X1 AND X2) AND THE TANK GROUND TO THE SEPARATE TRANSFORMER GROUND.
3. DO NOT CONNECT TRANSFORMER ARRESTER GROUND TO THE SECONDARY/NEUTRAL.

Designer	Drawing	Date
MPR	od18117	6/26/18

SINGLE PHASE 5kV DELTA x 15kV WYE STEP-UP RATIO TRANSFORMER WITH DOUBLE SINGLE PHASE 200A CABLE RISER

ISSUE	PAGE NUMBER		
7/19	48-117	UNDERGROUND CONSTRUCTION STANDARD	ppl

Supersedes 7/18 Issue – Drawing title update

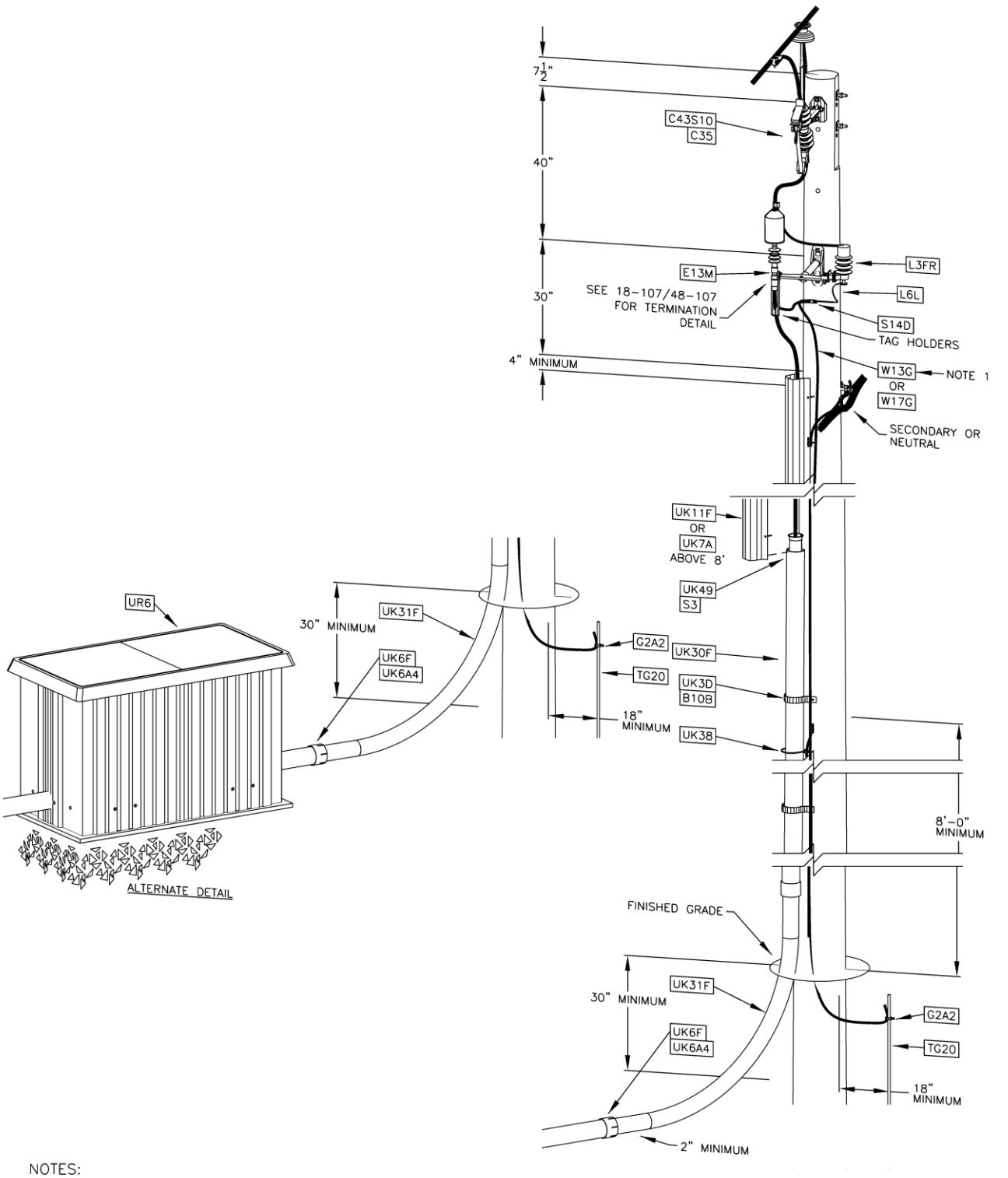


NOTES:

1. REMOVE HIGH-SIDE ARRESTERS ON TRANSFORMER (AT H1 AND IF ONE EXISTS AT H2). CONNECT H2, CONCENTRIC NEUTRAL AND RISER ARRESTER LEAD TO THE COMMON GROUND.
2. CONNECT THE LOW-SIDE ARRESTERS ON THE TRANSFORMER (AT X1 AND X2) AND THE TANK GROUND TO THE SEPARATE TRANSFORMER GROUND.
3. DO NOT CONNECT TRANSFORMER ARRESTER GROUND TO THE SECONDARY/NEUTRAL.
4. GUYING OF POLE TO BE DONE FOR THE DELTA CIRCUIT WITH TWO 54" FIBERGLASS RODS (STANDARD 3.4.20)

Designer	Drawing	Date
MPR	od18118	6/26/18

SINGLE PHASE STEP-UP 5 kV DELTA X 15 kV WYE TRANSFORMER INSTALLATION AND CABLE RISER



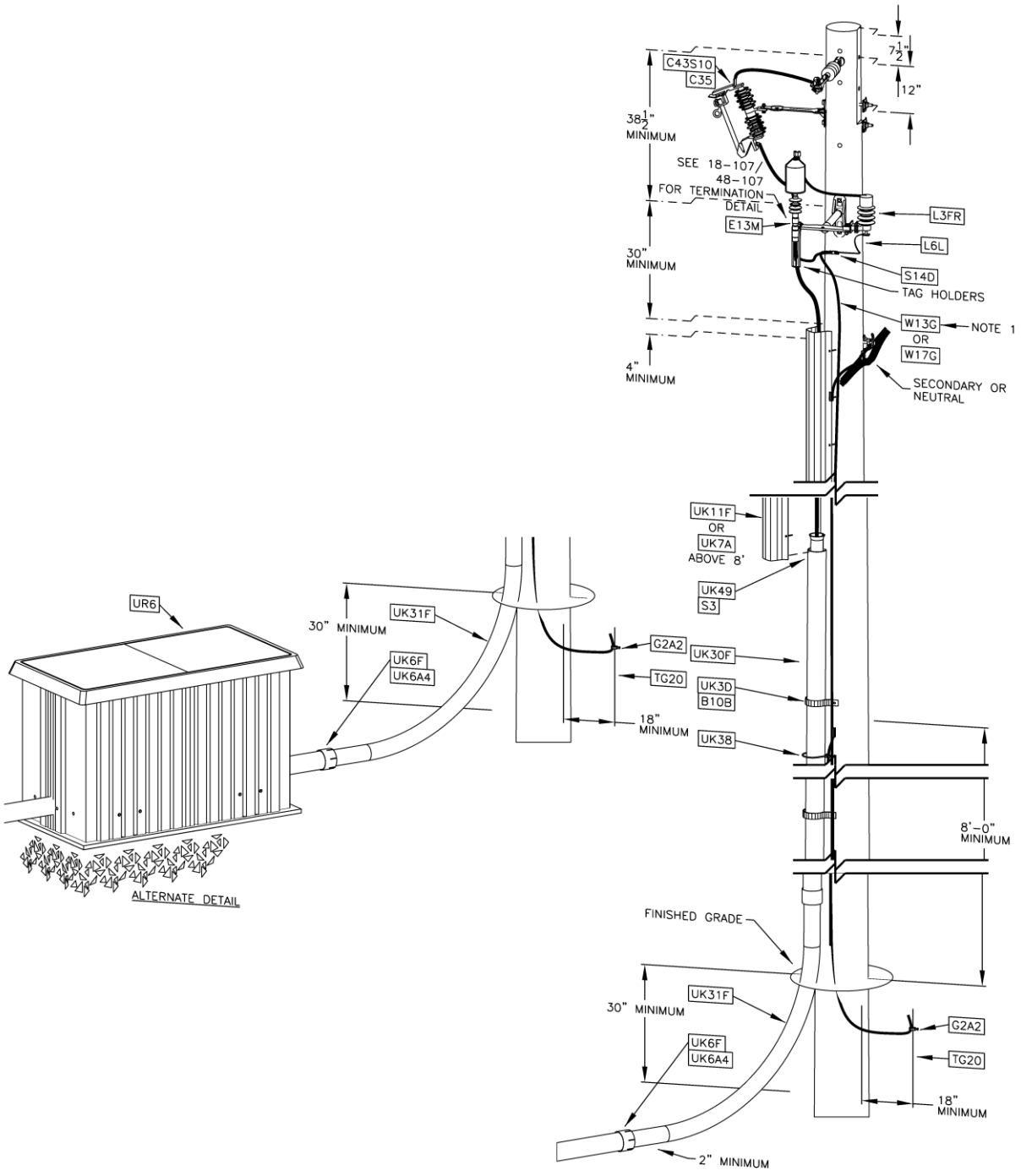
NOTES:
1. CAUTION – THIS DOWN LEAD IS PART OF THE PRIMARY NEUTRAL CONNECTION. JUMPER BEFORE REMOVING UNLESS CUTOUT IS OPEN.

Designer	Drawing	Date
MPR	od18124	6/26/18

Supersedes 7/15 Issue – 3D Drawing Conversion.

SINGLE PHASE OPEN WIRE RISER WITH FUSED CUTOUT – 15kV

New Drawing



NOTES:
1. CAUTION – THIS DOWN LEAD IS PART OF THE PRIMARY NEUTRAL CONNECTION. JUMPER BEFORE REMOVING UNLESS CUTOUT IS OPEN.

Designer	Drawing	Date
MPR	od18124A	7/22/21

SINGLE PHASE RISER DEADEND WITH FUSED CUTOUT – 15KV

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-124A	7/21

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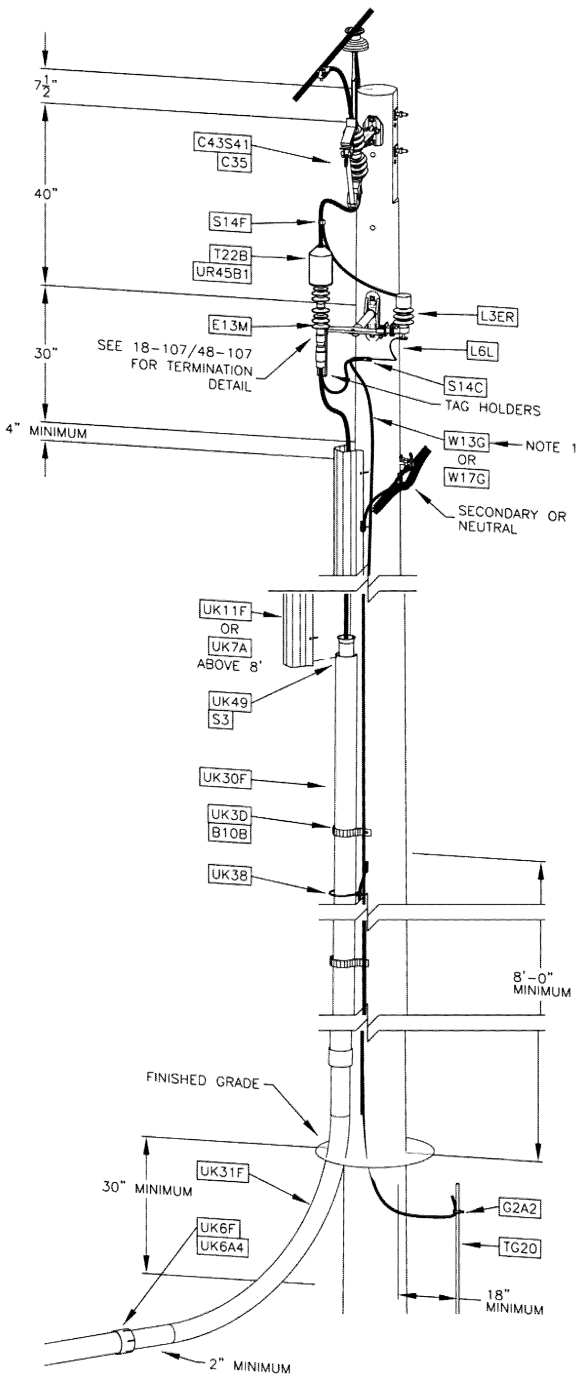
MU = @18-125CC27K(I)(X)	Single Phase Riser, 35kV, (I) Cutout Body Size, (X) Fuse Type, In Riser Guard
MU = @18-125CC27K(I)(X)C	Single Phase Riser, 35kV, (I) Cutout Body Size, (X) Fuse Type, In Conduit



NOTES:
1. CAUTION – THIS DOWN LEAD IS PART OF THE PRIMARY NEUTRAL CONNECTION. JUMPER BEFORE REMOVING UNLESS CUTOUT IS OPEN.

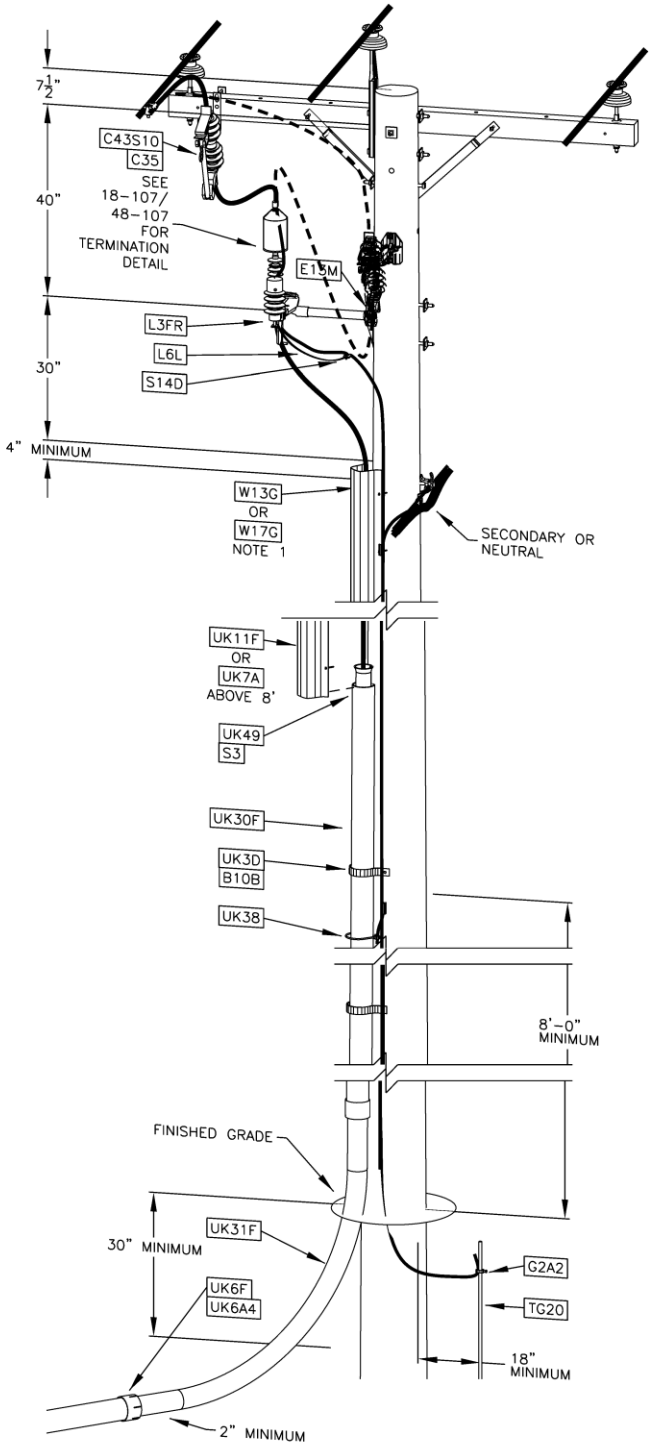
Designer	Drawing	Date
MPR	od18124M	12/3/18

Supersedes 7/18 Issue – Updated Drawing. Item T22B

SINGLE PHASE OPEN WIRE RISER WITH FUSED CUTOUT - 35KV
MAINTENANCE ONLY

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-124M	7/19

MU = @18-125CC(Y)K(I)(X)	Single Phase Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X)Fuse Type, In Riser Guard
MU = @18-125CC(Y)K(I)(X)C	Single Phase Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Conduit



NOTES:
1. CONTINUE CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UNDERGROUND CABLE CONCENTRIC NEUTRAL (I.E. #2 OR 2/0).

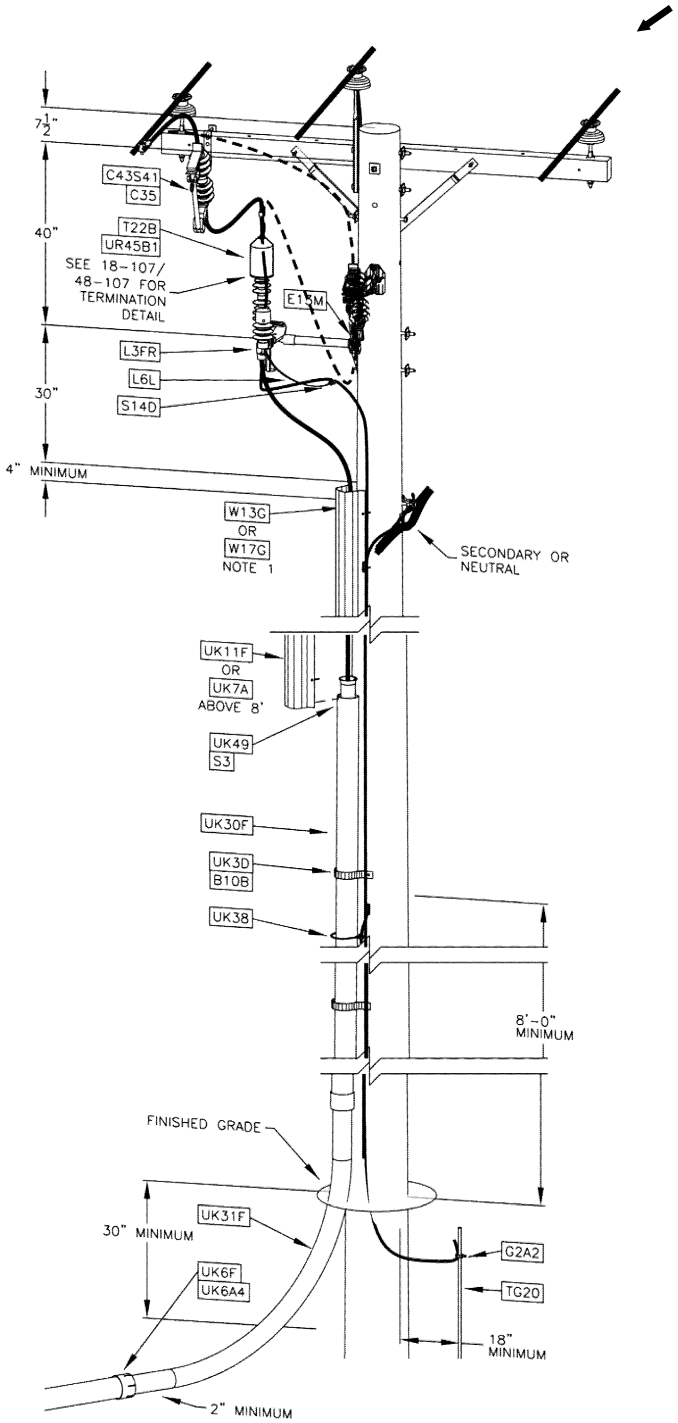
Designer	Drawing	Date
MPR	od18125	6/26/18

Supersedes 7/13 Issue – 3D Drawing Conversion.

SINGLE PHASE RISER WITH CROSSARM MOUNTED FUSED CUTOUT - 15KV

ISSUE	PAGE NUMBER		
7/18	48-125	UNDERGROUND CONSTRUCTION STANDARD	ppl

MU = @18-125CC27K(I)(X)	Single Phase Riser, 35kV, (I) Cutout Body Size, (X) Fuse Type, In Riser Guard
MU = @18-125CC27K(I)(X)C	Single Phase Riser, 35kV, (I) Cutout Body Size, (X) Fuse Type, In Conduit



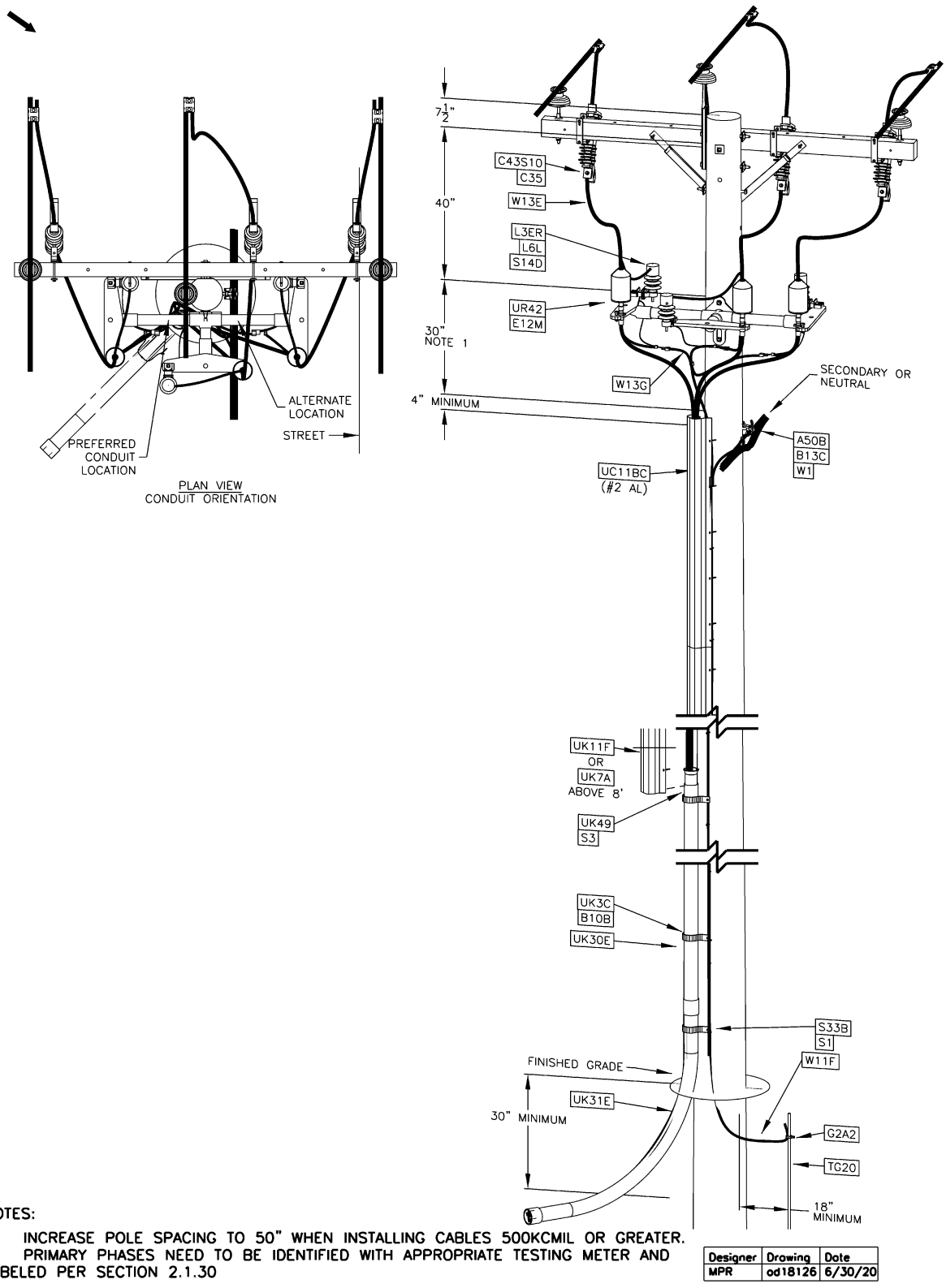
NOTES:
1. CONTINUE CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UNDERGROUND CABLE CONCENTRIC NEUTRAL (I.E. #2 OR 2/0).

Designer	Drawing	Date
MPR	od18125M	12/3/18

Supersedes 7/18 Issue – Updated Drawing. Item T22B

SINGLE PHASE RISER WITH CROSSARM MOUNTED FUSED CUTOUT - 35KV **MAINTENANCE ONLY**			
ppl	**UNDERGROUND CONSTRUCTION STANDARD**	**PAGE NUMBER**	**ISSUE**
		48-125M	**7/19**

MU = @18-126CC(Y)K(I)(X)	3 Ph Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Riser Guard
MU = @18-126CC(Y)K(I)(X)C	3 Ph Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Conduit



NOTES:

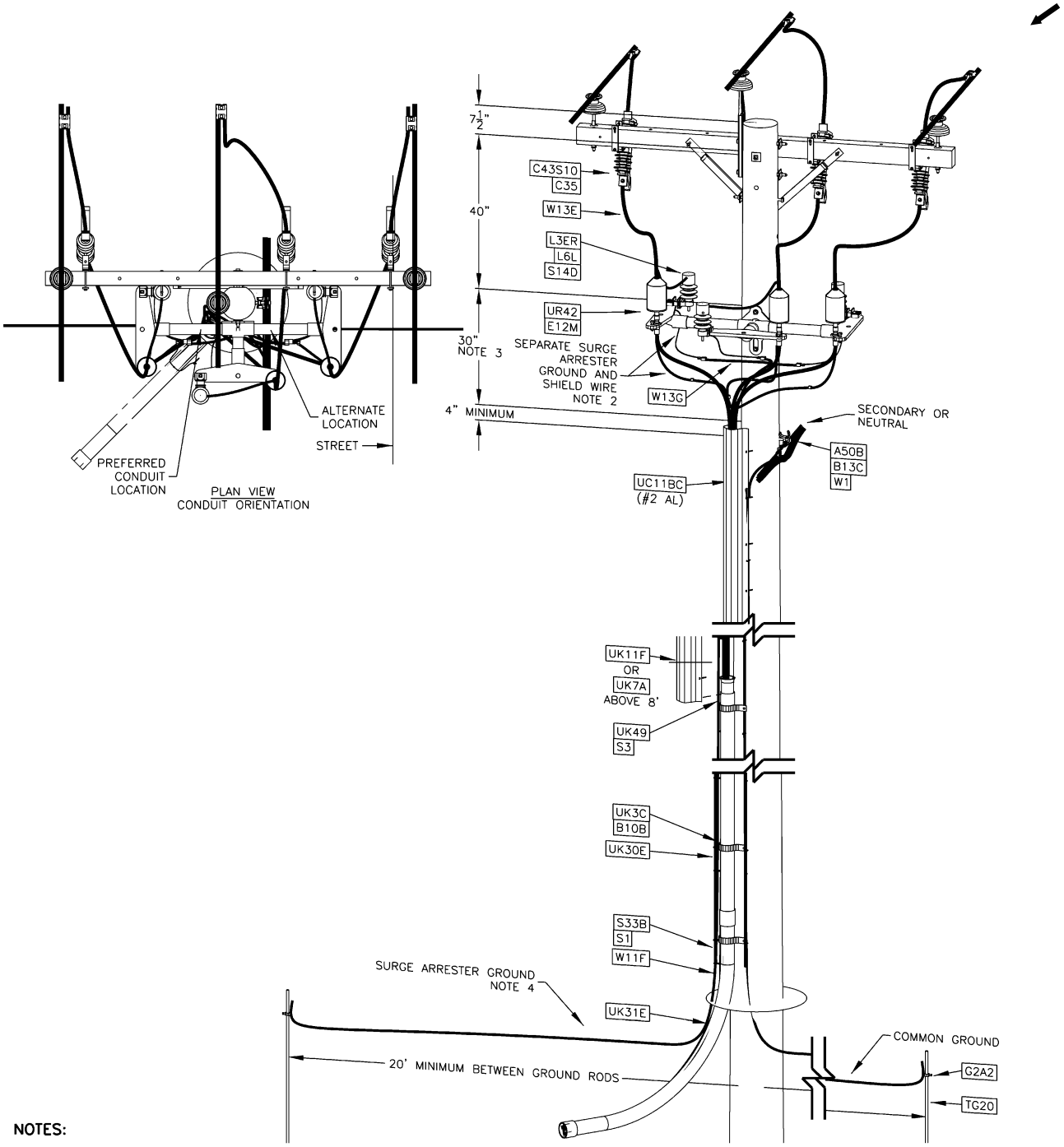
1. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES 500KCMIL OR GREATER.
2. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	od18126	6/30/20

Supersedes 7/19 Issue – Note 2 added

15 – 35 kV THREE PHASE RISER POLE WITH FUSED CUTOUTS 200 A MAXIMUM

MU = @18-126CC(Y)K(I)(X)	3 Ph Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Riser Guard
MU = @18-126CC(Y)K(I)(X)C	3 Ph Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Conduit



NOTES:

1. SEE SECTION 3 FOR GUY ASSEMBLY INSTALLATION DETAILS
2. ON DELTA PRIMARY CIRCUITS THE SURGE ARRESTER GROUNDING CONDUCTOR AND THE SECONDARY NEUTRAL GROUNDING CONDUCTOR SHALL BE RUN SEPARATELY TO TWO GROUND RODS. SEE STANDARD 13-111 FOR GROUNDING DETAILS.
3. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLE 500KCMIL OR GREATER.
4. DESIGNER TO MANUALLY ADD ADDITIONAL GROUND CU TO 18-126 MU'S FOR DELTA APPLICATIONS.
5. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	cd18126D	6/30/20

Supersedes 7/19 Issue – Note 5 added

15 – 35 kV THREE PHASE RISER POLE WITH FUSED CUTOUTS 200 A MAXIMUM – DELTA CIRCUITS

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-126D	7/20

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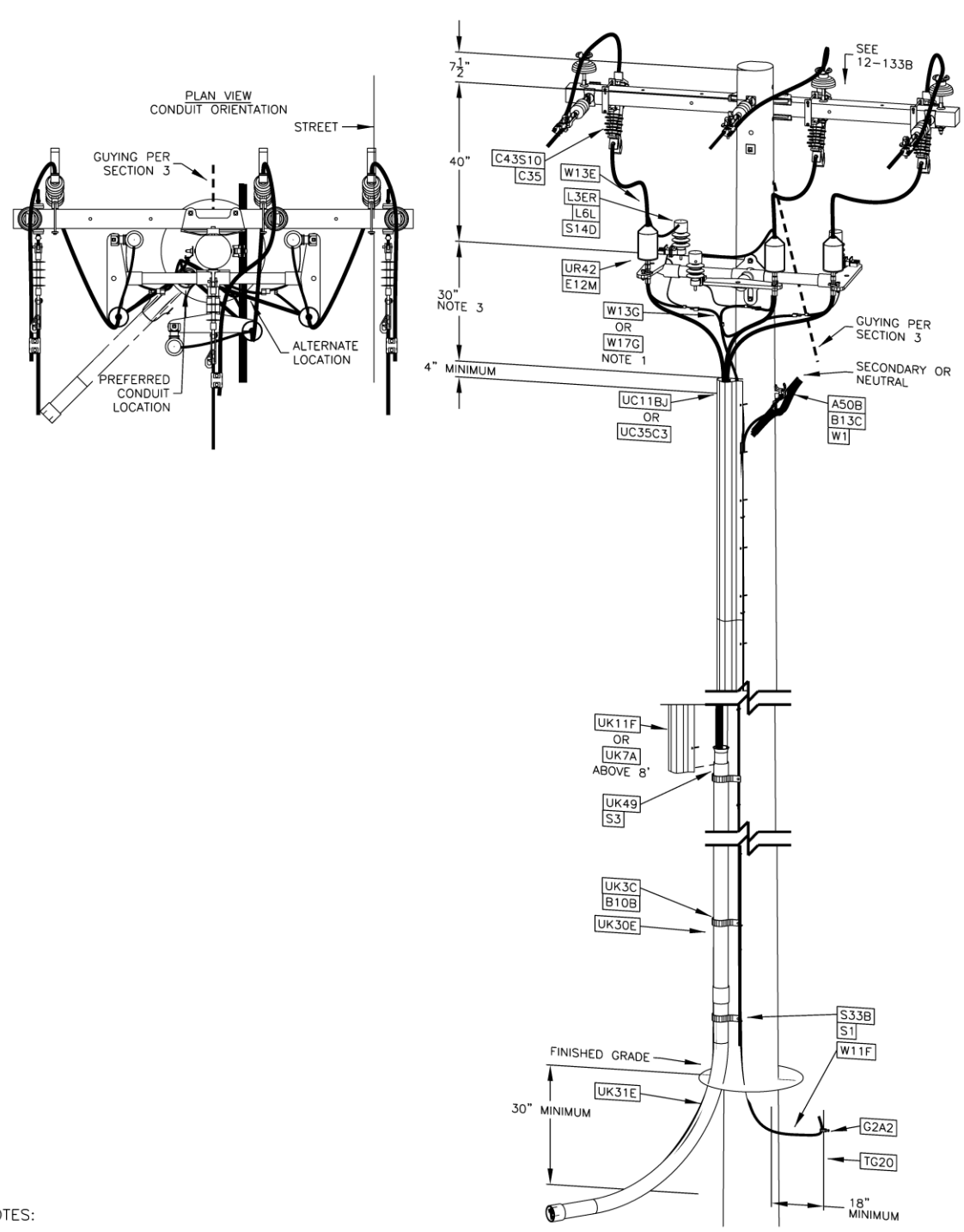
MU = @18-126CC(Y)K(I)(X)	3Ph Phase Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Riser Guard
MU = @18-126CC(Y)K(I)(X)C	3Ph Phase Riser, (Y) Insulation Rating, (I) Cutout Body Size, (X) Fuse Type, In Conduit



NOTES:

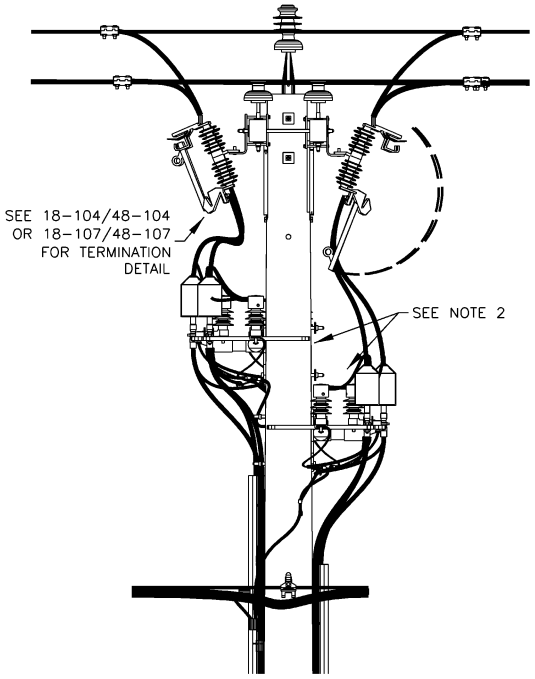
1. CONTINUE CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UNDERGROUND CABLE CONCENTRIC NEUTRAL (I.E. #2 OR 2/0).
2. SURGE ARRESTERS PROTECTING THE OVERHEAD LINE SHALL BE INSTALLED WITHIN 300' FROM THE DISCONNECT DEVICE.
3. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES 500KCMIL OR GREATER.
4. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	od18127	11/30/20

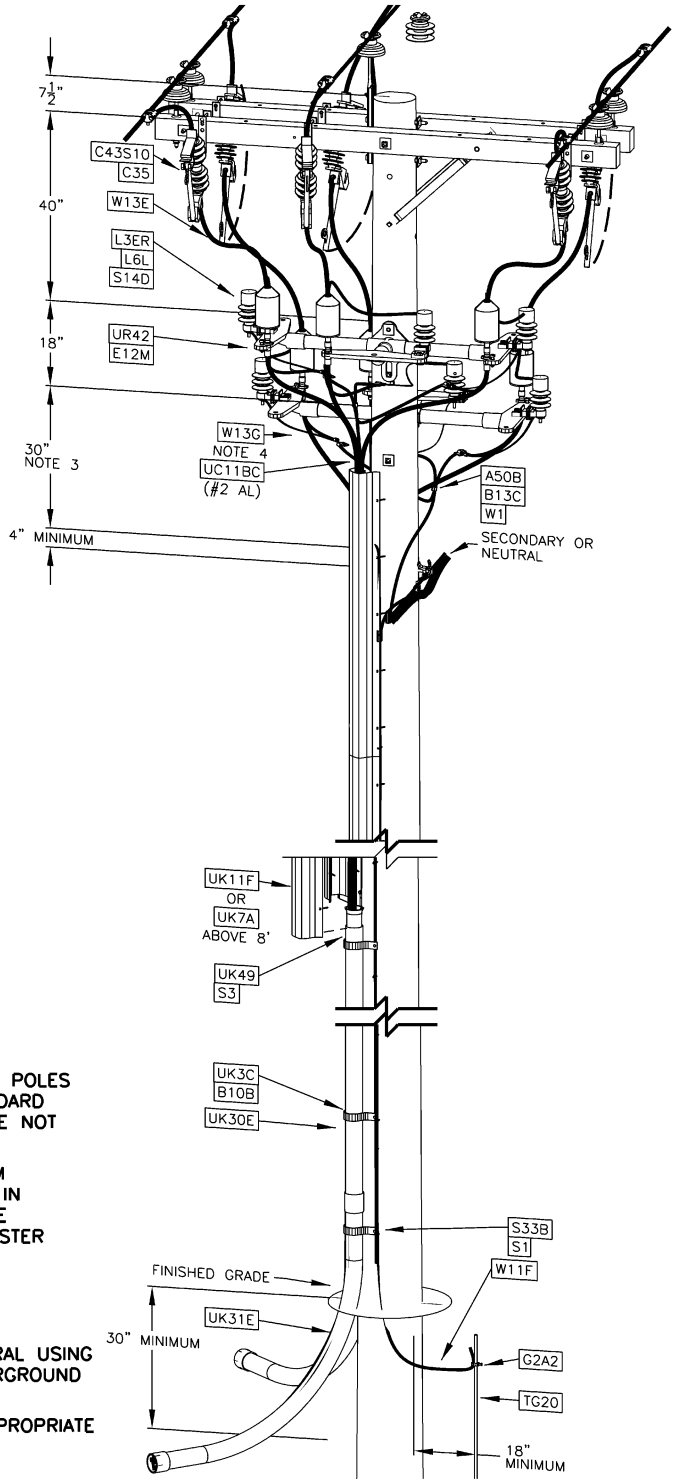
Supersedes 7/20 Issue – Replaced pole top construction to 12-133B

15-35KV THREE PHASE 200A RISER DEADEND POLE WITH FUSED CUTOUTS – 200A MAX

SEE PAGE 18-126 FOR MACROS



SIDE VIEW



NOTES:

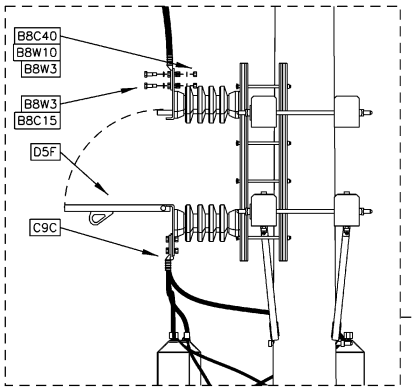
1. IMPORTANT: INSTALLATION OF RISERS ON SEPARATE POLES IS THE PREFERRED CONSTRUCTION AND THIS STANDARD SHOULD ONLY BE USED WHEN OTHER OPTIONS ARE NOT PRACTICAL.
2. USE MIDDLE POSITION OF THE RISER BRACKET ARM WHEN INSTALLING ARRESTERS ON BOTH BRACKETS IN ORDER TO HAVE ENOUGH CLEARANCE BETWEEN THE UPPER ARRESTER GROUND LEAD AND LOWER ARRESTER PRIMARY TAP.
3. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES 500KCMIL OR GREATER.
4. CONTINUE CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UNDERGROUND CABLE CONCENTRIC NEUTRAL (I.E. #2 OR 2/0).
5. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	od18128	6/30/20

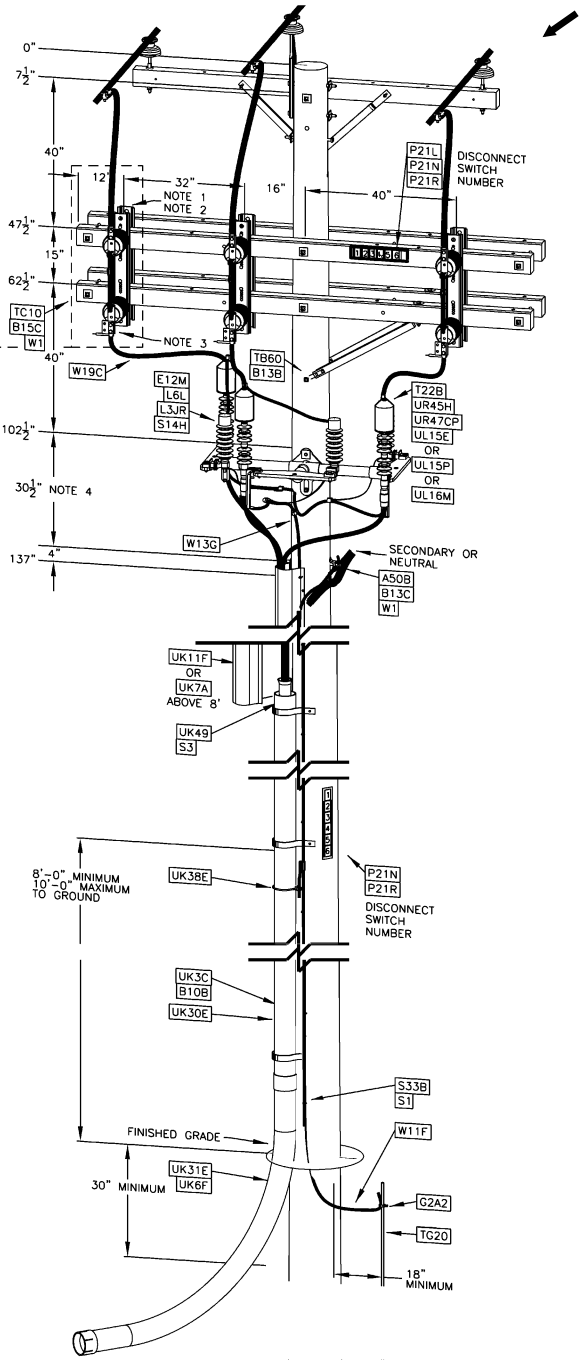
Supersedes 7/19 Issue – Note 5 added

15 – 35 KV DOUBLE THREE PHASE 200A RISER INSTALLATION

MU = @18-335(W) Add C If In Conduit	3 Ph Riser, 600A, (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000, 15kV
MU = @18-335(W)35KV Add C If In Conduit	3 Ph Riser, 600A, (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000, 35kV



SWITCH DETAIL



NOTES:

1. SURGE ARRESTERS CONNECTED TO UNGROUNDED PRIMARY CIRCUITS MUST BE SEPARATELY GROUNDED AND NOT INTERCONNECTED TO THE SYSTEM NEUTRAL AND GROUND.
2. IF CONSTRUCTED IN A LOCATION THAT IS NOT BUCKET ACCESSIBLE, SWITCHES MAY BE PLACED ON THE BACK SIDE OF THE POLE TO MAKE THE POLE EASIER TO CLIMB.
3. IF USING A FLAG STYLE TERMINAL CONNECTION, THE REQUIRED TORQUE IS 40FT-LBS.
4. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES SIZED 500KCMIL OR LARGER.
5. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

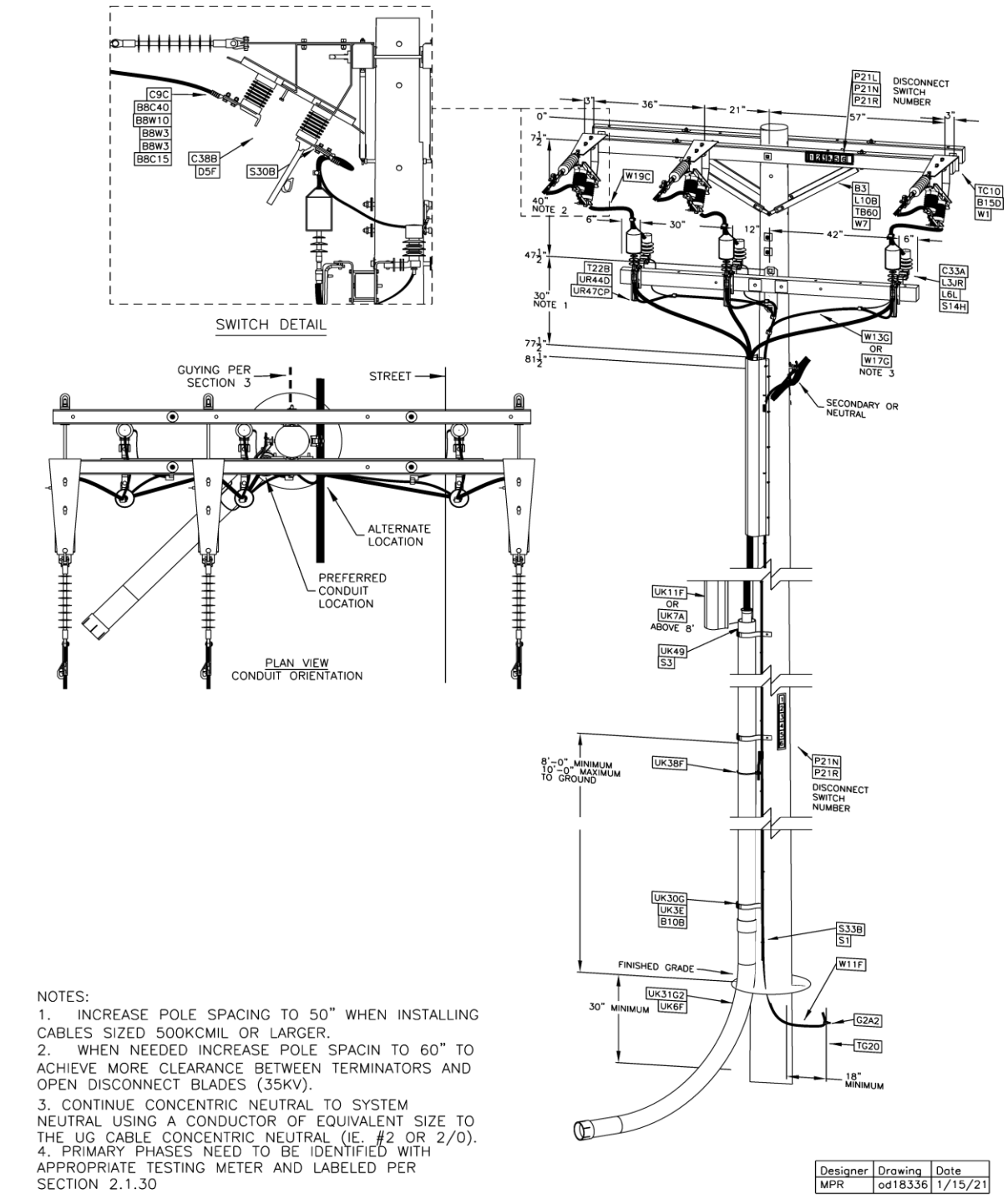
Designer	Drawing	Date
MPR	od18335	6/30/20

Supersedes 7/19 Issue – Switch numbering on crossarm and note 5 added

THREE PHASE PRIMARY 600A RISER WITH DISCONNECT SWITCHES

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-335	7/20

MU = @18-336(W) Add C If In Conduit	3 Ph Riser, 600A, (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000, 15kV
MU = @18-336(W)35KV Add C If In Conduit	3 Ph Riser, 600A, (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000, 35kV



NOTES:
1. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES SIZED 500KCMIL OR LARGER.
2. WHEN NEEDED INCREASE POLE SPACIN TO 60" TO ACHIEVE MORE CLEARANCE BETWEEN TERMINATORS AND OPEN DISCONNECT BLADES (35KV).
3. CONTINUE CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UG CABLE CONCENTRIC NEUTRAL (IE. #2 OR 2/0).
4. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

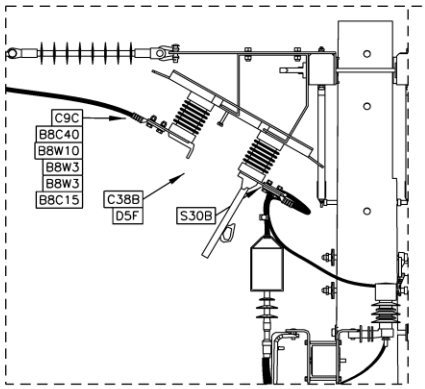
Designer	Drawing	Date
MPR	od18336	1/15/21

Supersedes 7/20 Issue – Added label for Std Item C33A

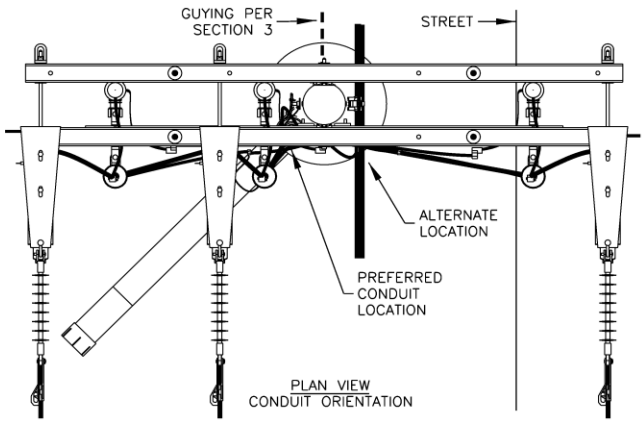
THREE PHASE PRIMARY 600A DEADEND RISER WITH DISCONNECT SWITCHES

ISSUE	PAGE NUMBER	UNDERGROUND CONSTRUCTION STANDARD	ppl
7/21	48-336		

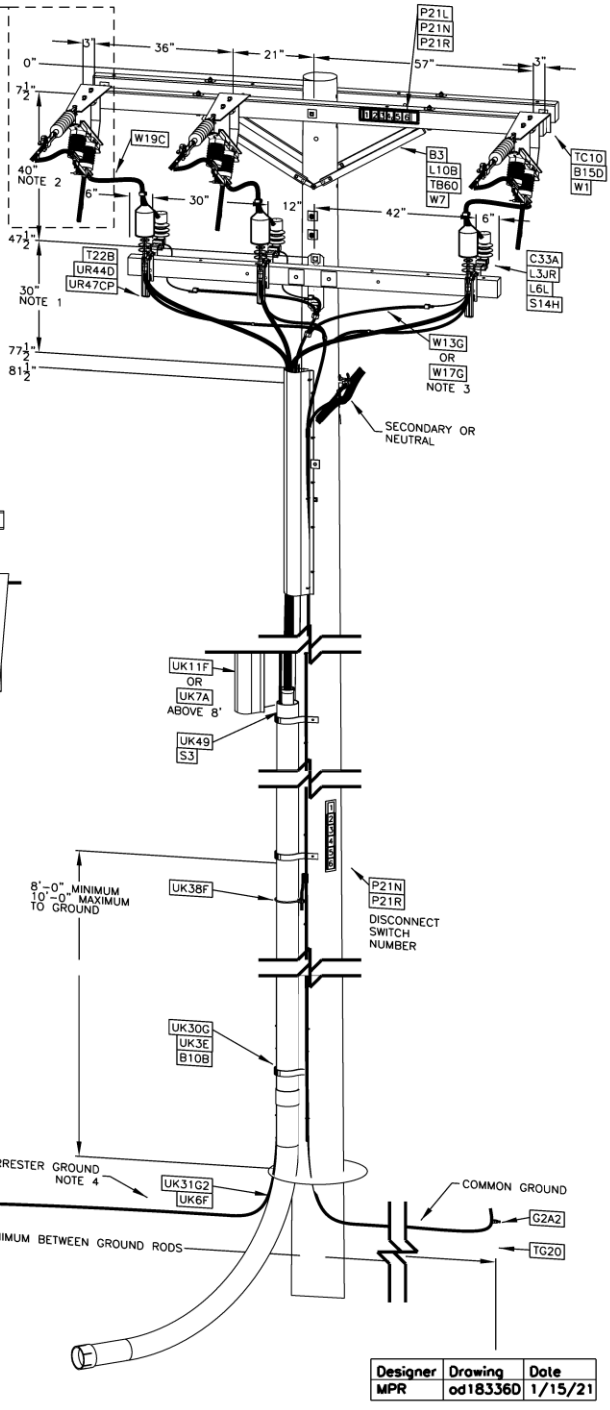
MU = @18-336(W) Add C If In Conduit	3 Ph Riser, 600A, (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000, 15kV
MU = @18-336(W)35KV Add C If In Conduit	3 Ph Riser, 600A, (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000, 35kV



SWITCH DETAIL



PLAN VIEW
CONDUIT ORIENTATION



NOTES:
1. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES SIZED 500KCMIL OR LARGER.
2. WHEN NEEDED INCREASE POLE SPACIN TO 60" TO ACHIEVE MORE CLEARANCE BETWEEN TERMINATORS AND OPEN DISCONNECT BLADES (35KV).
3. CONTINUE CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UG CABLE CONCENTRIC NEUTRAL (IE. #2 OR 2/0).
4. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

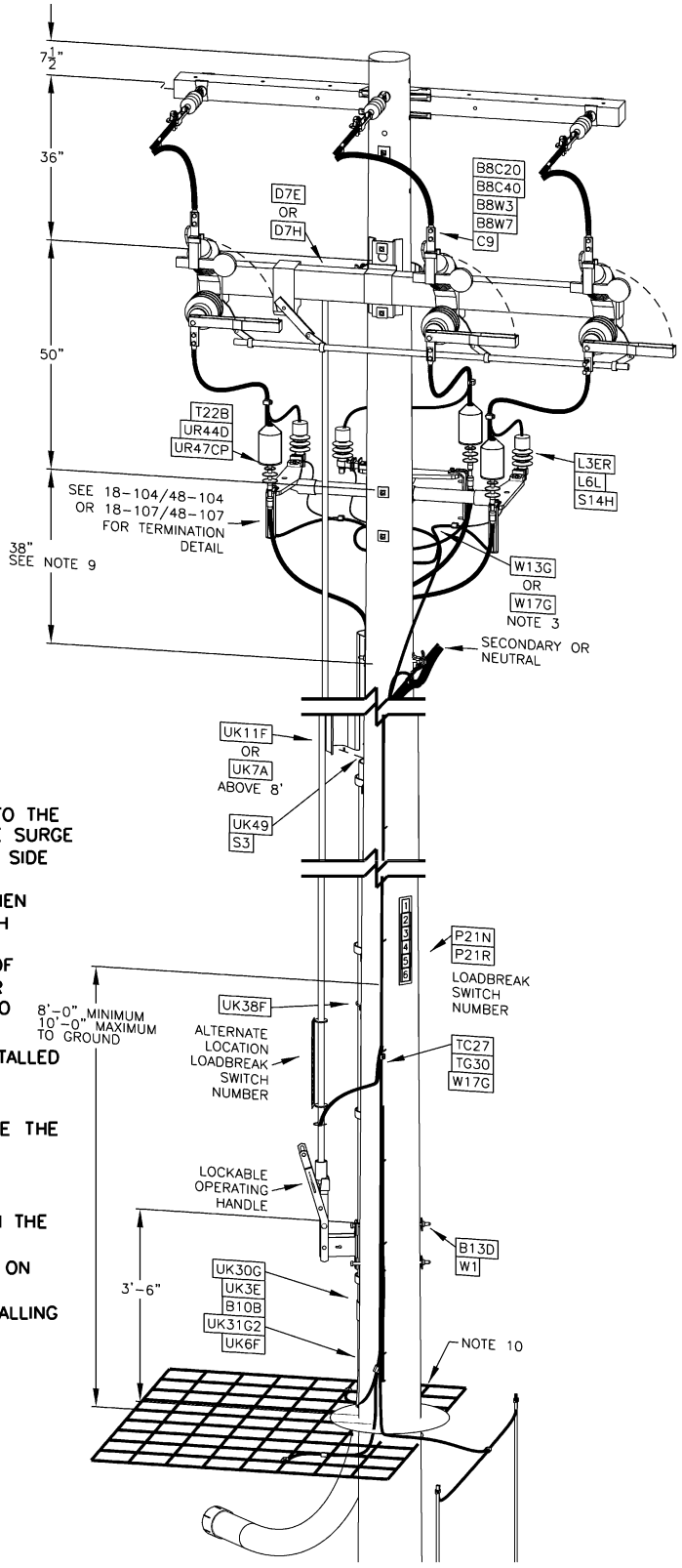
Designer	Drawing	Date
MPR	od18336D	1/15/21

Supersedes 7/20 Issue – Added label for Std Item C33A

THREE PHASE PRIMARY 600A DEADEND RISER POLE WITH DISCONNECT

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-336D	7/21

MU = @18-337 LBSW(Y)(W)	3Ph Riser 600A Loadbreak, (Y) = Voltage (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000
MU = @18-337 LBSW(Y)(W)C	3Ph Riser 600A Loadbreak, (Y) = Voltage (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000, In Conduit



NOTES:

1. SURGE ARRESTERS SHALL BE INSTALLED ONTO THE SOURCE SIDE POLE WITHIN 300'. THE RISER TYPE SURGE ARRESTERS SHALL BE INSTALLED ONTO THE LOAD SIDE PROTECTING BOTH SWITCH AND TERMINATORS.
2. USE STAINLESS STEEL BOLTS (ITEM B8C) WHEN CONNECTING COPPER LUGS (ITEM C9C) TO SWITCH PADS.
3. ON COVERED TAP CONDUCTORS, PROVIDE 6" OF BARE CONDUCTOR AT THE SWITCH TERMINALS FOR GROUNDING PURPOSES. USE 5/8" THRU BOLTS TO MOUNT OPERATING ROD GUIDES.
4. PRIMARY CONDUCTORS SHALL NEVER BE INSTALLED TO ONLY ONE SIDE OF THE SWITCH AS MAXIMUM DEADEND LOADING WILL BE EXCEEDED.
5. DO NOT INSTALL SWITCH ON A POLE WHERE THE CONSTRUCTION ANGLE IS GREATER THAN 20 .
6. LIFTING STRAPS SHALL BE REMOVED AFTER INSTALLATION IS COMPLETE.
7. OPERATING MECHANISM SHALL BE LOCKED IN THE OPEN OR CLOSED POSITION.
8. SWITCH IDENTIFICATION MOUNTED VERTICALLY ON ROAD SIDE PROVIDING MAXIMUM VISIBILITY.
9. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES SIZED 500KCMIL OR LARGER.
10. SEE 13-114 FOR GROUNDING DETAILS (USE W17G IN LIEU OF W11F).
11. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	od18337	6/30/20

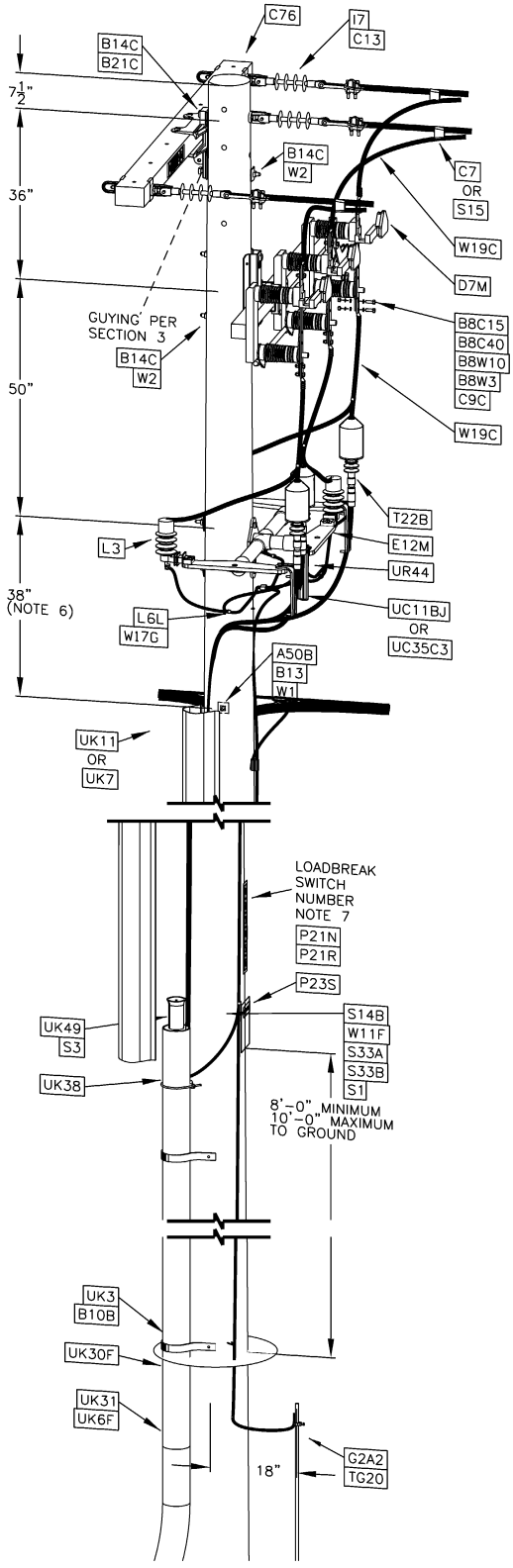
Supersedes 7/19 Issue – Removed switch numbering from crossarm and added note 11

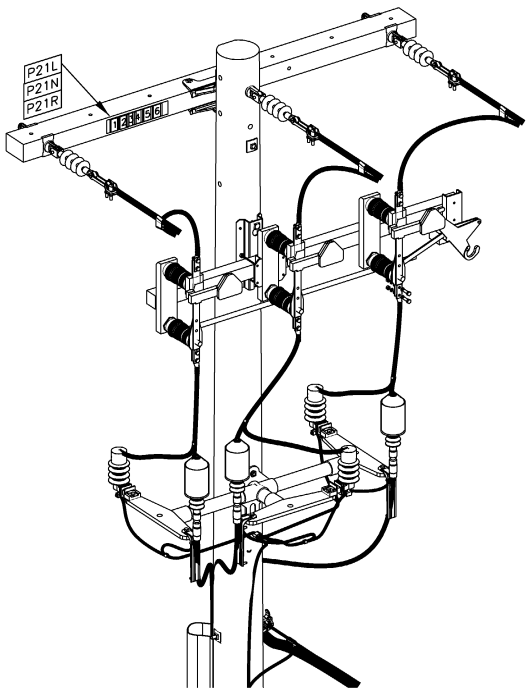
THREE PHASE PRIMARY SECTIONALIZING - LOADBREAK SWITCH RISER POLE 15-35KV

ISSUE	PAGE NUMBER		
7/20	48-337	UNDERGROUND CONSTRUCTION STANDARD	ppl

MU = @18-338LBHSSW15KV(W) add C if in Conduit	3Ph Riser 600A LDBRK, 15KV, (W) = A,B,C Cable Size with A=500,B=750,C=1000

Supersedes 7/19 Issue – Previous note 8 removed and new note 8 added





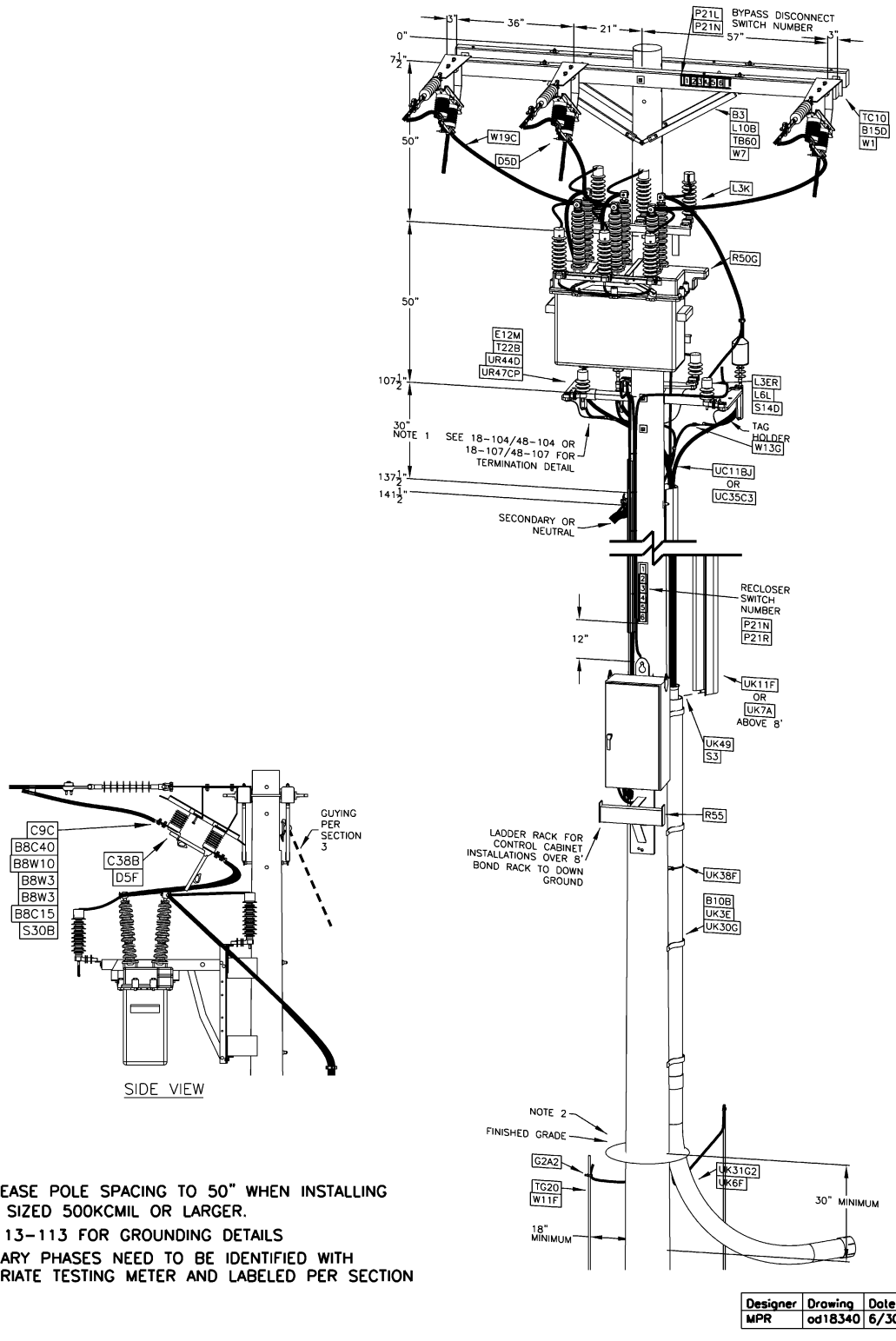
NOTE:
1. USE STAINLESS STEEL BOLTS (ITEM B8C) WHEN CONNECTING COPPER LUGS (ITEM C9C) TO SWITCH PADS.
2. ON COVERED TAP CONDUCTORS, PROVIDE 6' OF BARE CONDUCTOR AT THE SWITCH TERMINALS FOR GROUNDING PURPOSES.
3. DO NOT INSTALL SWITCH ON A POLE WHERE THE CONSTRUCTION ANGLE IS GREATER THAN 20°.
4. LIFTING STRAPS SHALL BE REMOVED AFTER INSTALLATION IS COMPLETE.
5. SWITCH IDENTIFICATION MOUNTED VERTICALLY ON ROAD SIDE PROVIDING MAXIMUM VISIBILITY.
6. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES 500 KCMIL OR LARGER.
7. WARNING: BECAUSE THERE ARE DOWN GROUNDS INSTALLED AT THIS RISER POLE, IF SWITCHING IS PERFORMED FROM GROUND LEVEL, THE SWITCH PERSON SHALL WEAR EH OVERSHOES RATED AT 15KV OR GREATER FOR PROTECTION AGAINST STEP POTENTIAL THAT MAY OCCUR DURING SWITCHING. STUDIES HAVE SHOWN STEP POTENTIAL GRADIENT VOLTAGE IN THE GROUND MAY EXCEED NORMAL WORK BOOT EH RATING.
8. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	od18338	6/30/20

THREE PHASE RISER WITH HOOKSTICK SWITCH – 15KV

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-338	7/20

RISER MU = @18-336(X) Add C if in Conduit	3Ph Riser 600A Loadbreak, (X) = A, B, C Cable Size with A = 500, B = 750, C = 1000 15 kV
RISER MU = @18-336(X)35kV Add C if in Conduit	3Ph Riser 600A Loadbreak, (Y) = A, B, C Cable Size with A = 500, B = 750, C = 1000, 35 kV
RECLOSER MU	See Page 12-333 For Recloser MU's



NOTES:

1. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES SIZED 500KCMIL OR LARGER.
2. SEE 13-113 FOR GROUNDING DETAILS
3. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

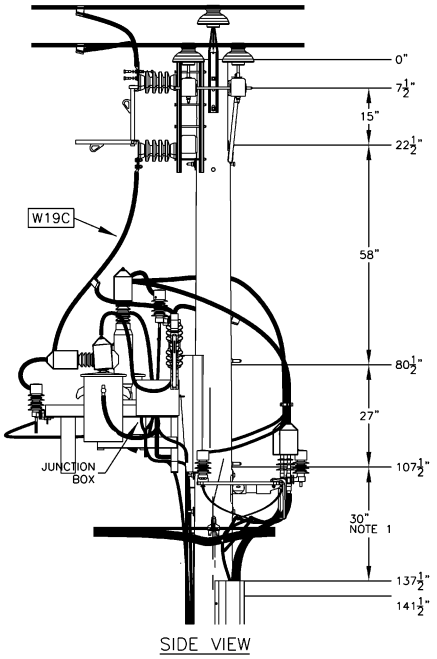
Designer	Drawing	Date
MPR	od18340	6/30/20

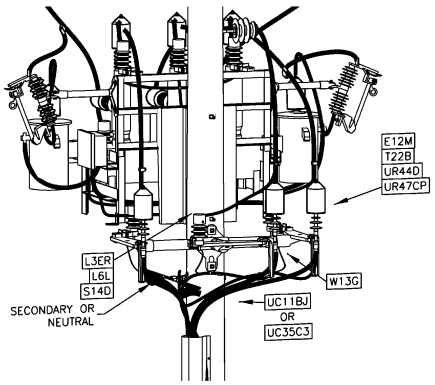
Supersedes 7/19 Issue – Switch numbering on crossarm and notes 2 and 3 added

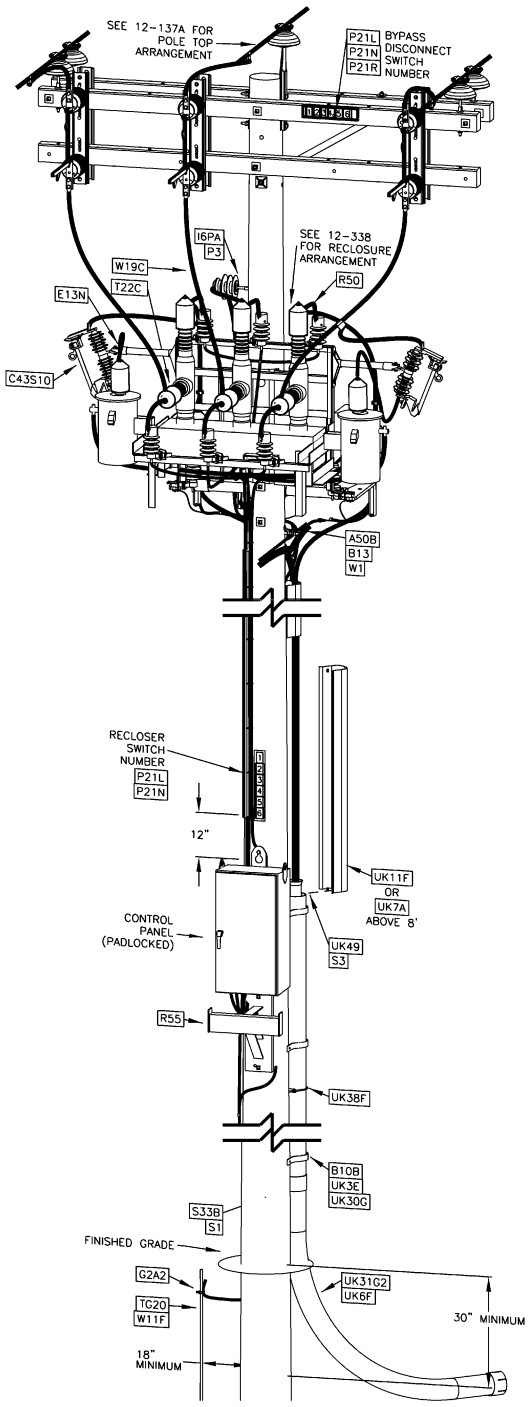
THREE PHASE DEADEND RISER WITH RECLOSER AND DISCONNECT SWITCHES
MAINTENANCE ONLY

RISER MU = @18-341(W)(Y)(Z) Add C if in Conduit	3Ph Riser 600A Loadbreak, (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000, 15 kV
RECLOSER MU	See Page 12-335 For Recloser MU's

Supersedes 7/19 Issue – Switch numbering on crossarm and note 2 added





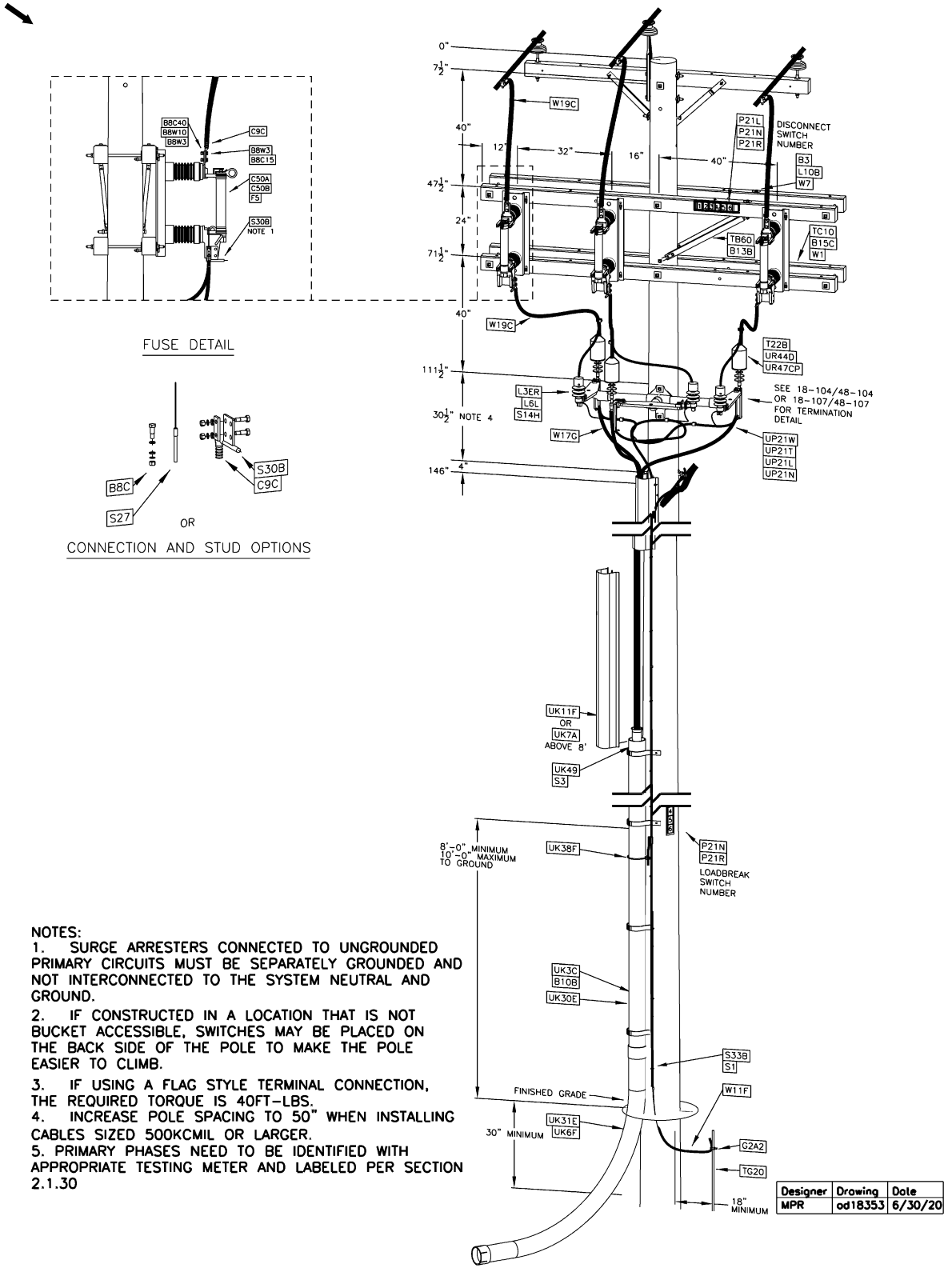


NOTES:
1. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES SIZED 500KCMIL OR LARGER.
2. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	od18341	6/30/20

THREE PHASE RISER WITH RECLOSER AND DISCONNECT SWITCHES ON OPEN WIRE (0 TO 10 DEGREES)

MU = @18-353(W)C50B(X)	3 Ph Riser, 600A (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000 (X) = Fuse Link, 15kV
MU = @18-353(W)C50B(X)C	3 Ph Riser, 600A (W) = A, B, C Cable Size with A = 500, B = 750, C = 1000 (X) = Fuse Link, 15Kv, In Conduit



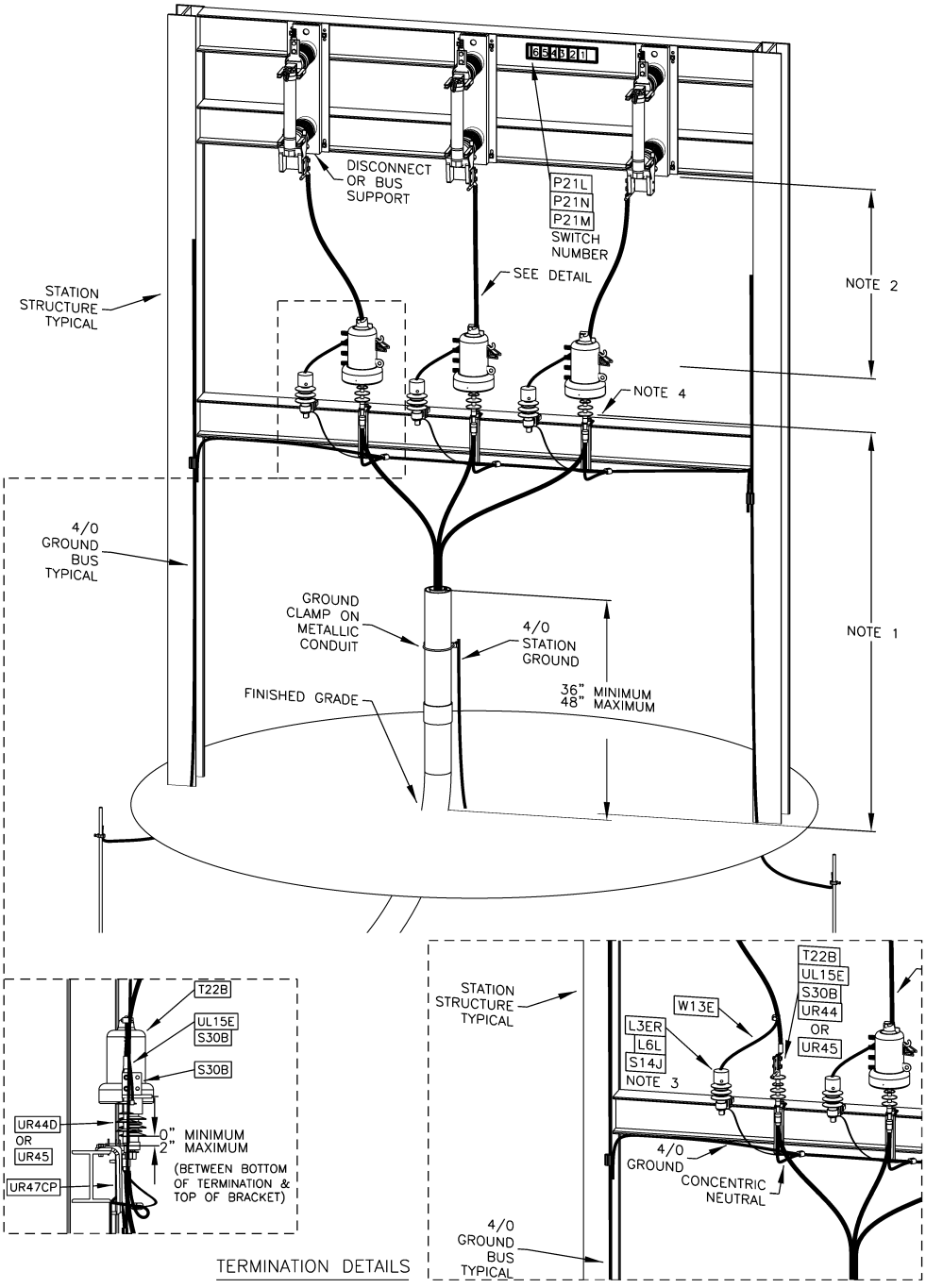
NOTES:

1. SURGE ARRESTERS CONNECTED TO UNGROUNDED PRIMARY CIRCUITS MUST BE SEPARATELY GROUNDED AND NOT INTERCONNECTED TO THE SYSTEM NEUTRAL AND GROUND.
2. IF CONSTRUCTED IN A LOCATION THAT IS NOT BUCKET ACCESSIBLE, SWITCHES MAY BE PLACED ON THE BACK SIDE OF THE POLE TO MAKE THE POLE EASIER TO CLIMB.
3. IF USING A FLAG STYLE TERMINAL CONNECTION, THE REQUIRED TORQUE IS 40FT-LBS.
4. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES SIZED 500KCMIL OR LARGER.
5. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Supersedes 7/19 Issue – Switch numbering on crossarm and note 5 added

THREE PHASE PRIMARY 600A RISER WITH 40,000A POWER FUSES

Supersedes 7/18 Issue – Switch numbering on crossarm and note 5 added



TERMINATION DETAILS

NOTES:

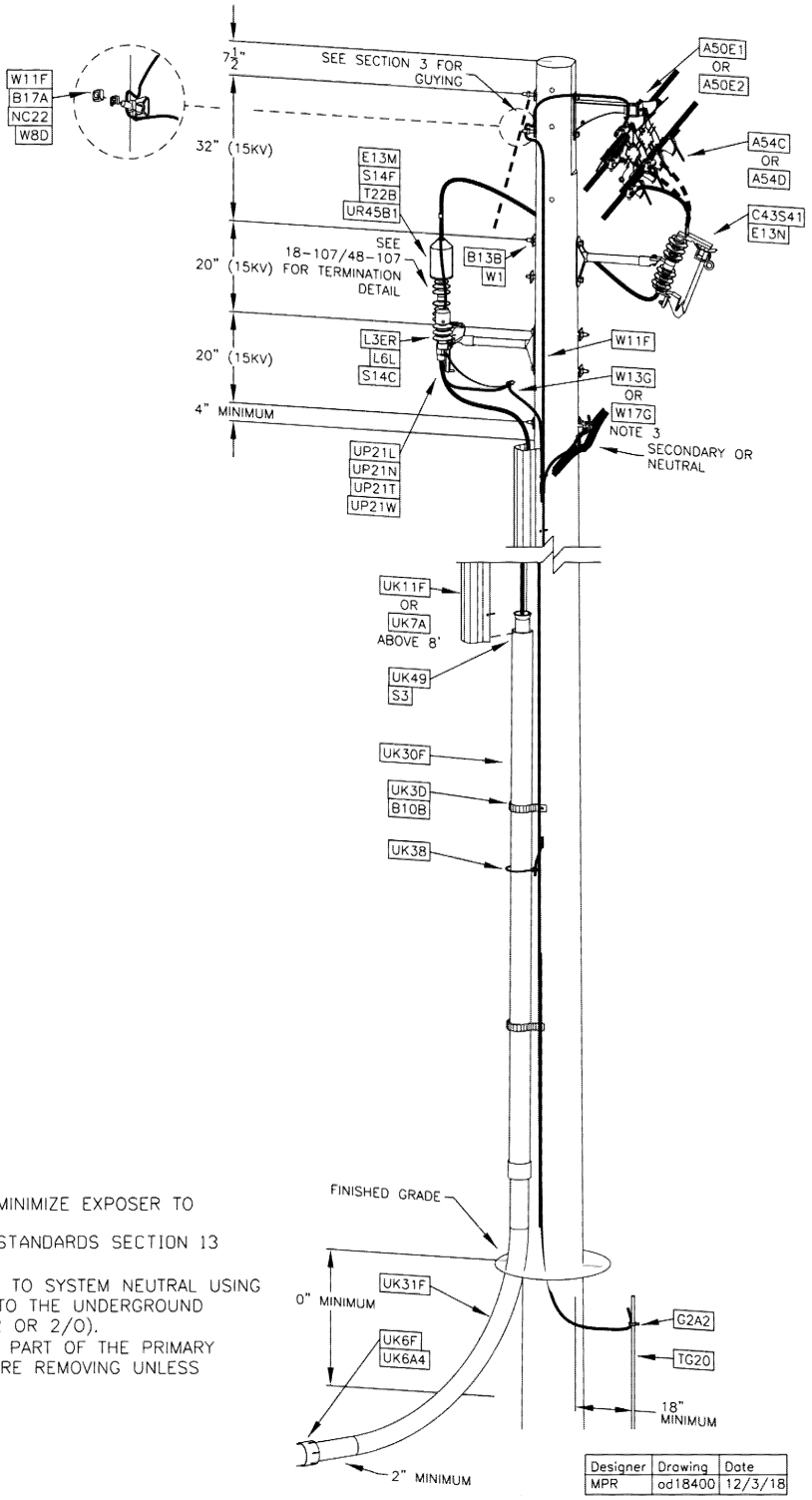
1. DISTANCE TO LIVE PARTS PER ST.02.00.002 – ELECTRICAL STATION CLEARANCES.
2. MAXIMUM DISTANCE TO BUS SUPPORT IS 5'. ALLOW SUFFICIENT DISTANCE BETWEEN THE DISCONNECTING DEVICE AND THE CABLE TERMINATION FOR MAINTENANCE AND CABLE TESTING WITHOUT VIOLATING MINIMUM APPROACH DISTANCE. ADD 3'–6" TO THE MINIMUM APPROACH DISTANCE VALUES IN THE EMPLOYEE SAFETY HANDBOOK.
3. RUN 4/0 HORIZONTAL GROUND IN WEB IF AN "I" BEAM, OR UNDERNEATH OTHER SUPPORTING STRUCTURE. CONNECT ARRESTER GROUND LEAD AND CONCENTRIC NEUTRAL TO GROUND BUS WITH SINGLE C CRIMP CONNECTOR, STANDARD ITEM S14J. KEEP LEADS AS SHORT AS POSSIBLE.
4. IF THE DISTANCE FROM GRADE TO THE TERMINATION SUPPORT IS GREATER THAN 10', INSTALL ADDITIONAL STRUCTURAL MEMBERS BELOW AND HOLD CABLE WITH CABLE POSITIONER STANDARD ITEM UR47CP. THE DISTANCE BETWEEN CABLE POSITIONERS SHALL NOT EXCEED 7'.
5. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	od18370	6/30/20

SUBSTATION RISER - THREE PHASE

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-370	7/20

SEE PAGE 18-126 FOR MUS



Designer	Drawing	Date
MPR	od18400	12/3/18

NOTES:

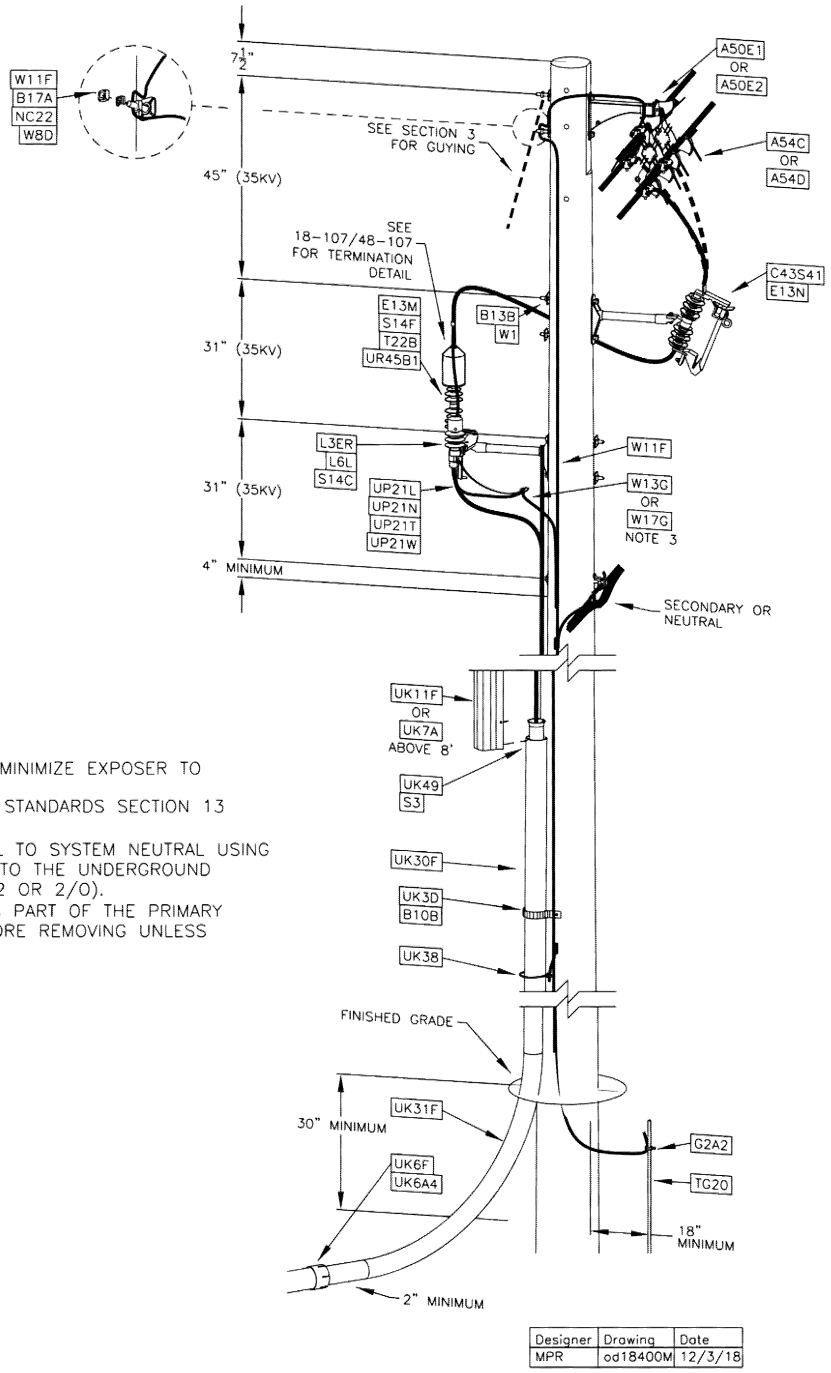
1. RISER SHALL BE ORIENTED TO MINIMIZE EXPOSER TO TRAFFIC AND PHYSICAL DAMAGE.
2. DOWN GROUND PER OVERHEAD STANDARDS SECTION 13 GROUNDING.
3. CONTINUE CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UNDERGROUND CABLE CONCENTRIC NEUTRAL (I.E. #2 OR 2/0).
4. CAUTION – THIS DOWN LEAD IS PART OF THE PRIMARY NEUTRAL CONNECTION. JUMPER BEFORE REMOVING UNLESS CUTOUT IS OPEN.

Supersedes 7/18 Issue – Updated Drawing Item T22B, drawing title

SINGLE PHASE SPACER CABLE RISER – 15KV

SEE PAGE 18-125M FOR MUS

Supersedes 7/18 Issue – Updated Drawing Item T22B, drawing title



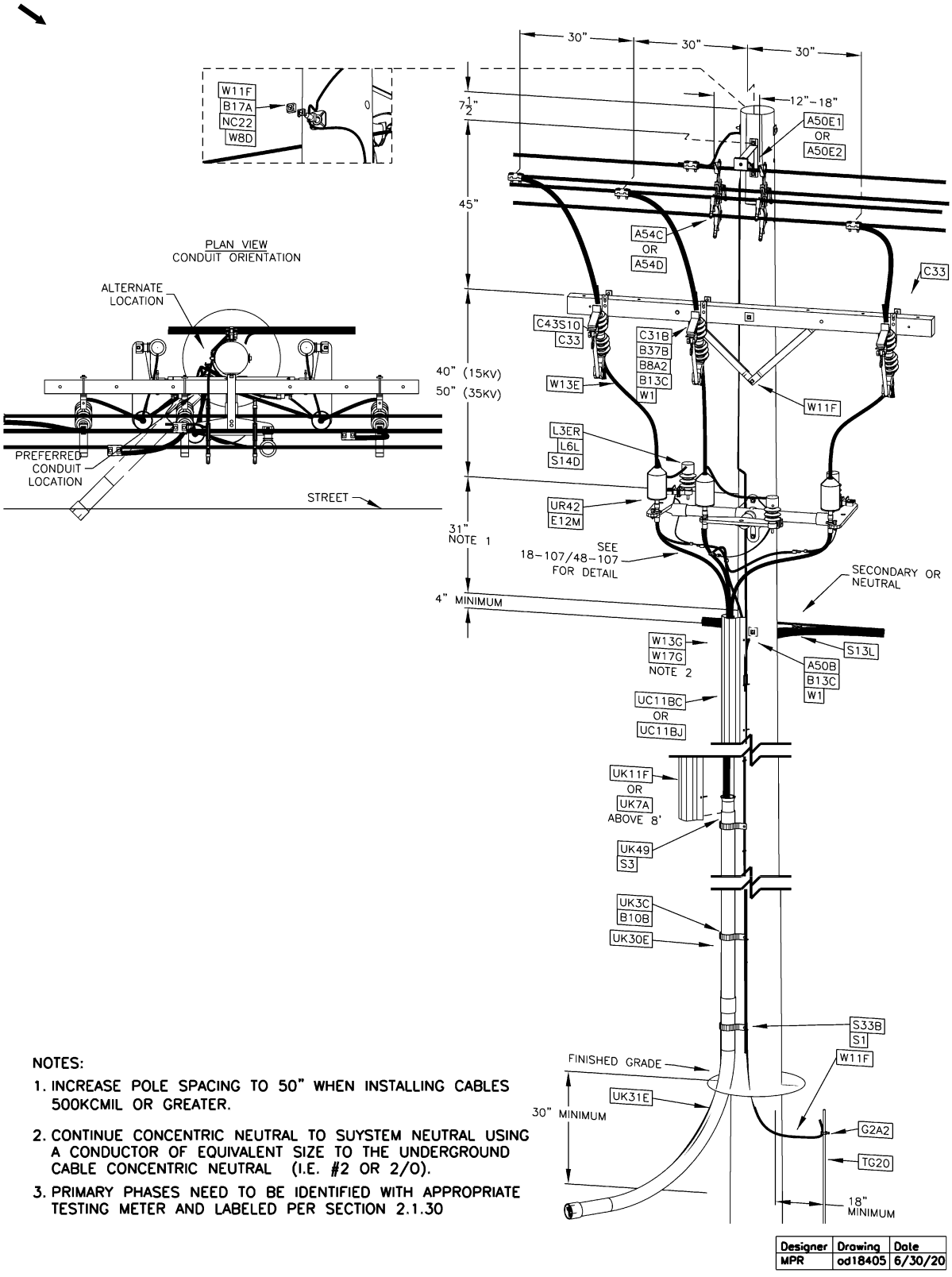
NOTES:

1. RISER SHALL BE ORIENTED TO MINIMIZE EXPOSER TO TRAFFIC AND PHYSICAL DAMAGE.
2. DOWN GROUND PER OVERHEAD STANDARDS SECTION 13 GROUNDING.
3. CONTINUE CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UNDERGROUND CABLE CONCENTRIC NEUTRAL (I.E. #2 OR 2/0).
4. CAUTION – THIS DOWN LEAD IS PART OF THE PRIMARY NEUTRAL CONNECTION. JUMPER BEFORE REMOVING UNLESS CUTOUT IS OPEN.

Designer	Drawing	Date
MPR	od18400M	12/3/18

SINGLE PHASE SPACER CABLE RISER – 35KV (MAINTENANCE ONLY)

SEE PAGE 18-126 FOR MUS



NOTES:

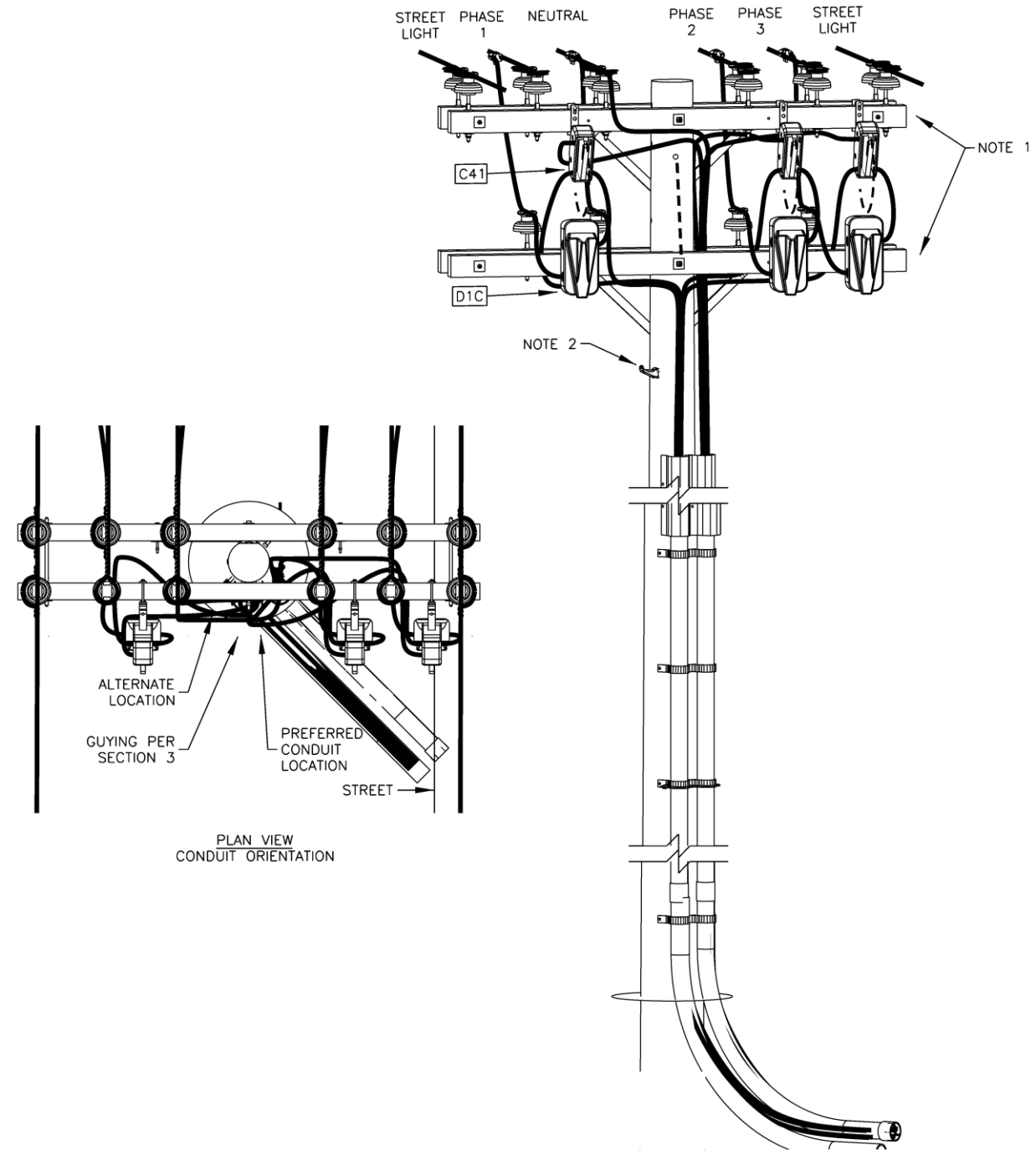
1. INCREASE POLE SPACING TO 50" WHEN INSTALLING CABLES 500KCMIL OR GREATER.
2. CONTINUE CONCENTRIC NEUTRAL TO SUYSTEM NEUTRAL USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UNDERGROUND CABLE CONCENTRIC NEUTRAL (I.E. #2 OR 2/0).
3. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	od18405	6/30/20

Supersedes 7/19 Issue – Note 3 added

THREE PHASE SPACER CABLE RISER - 15-35kV MAXIMUM DISTRIBUTION

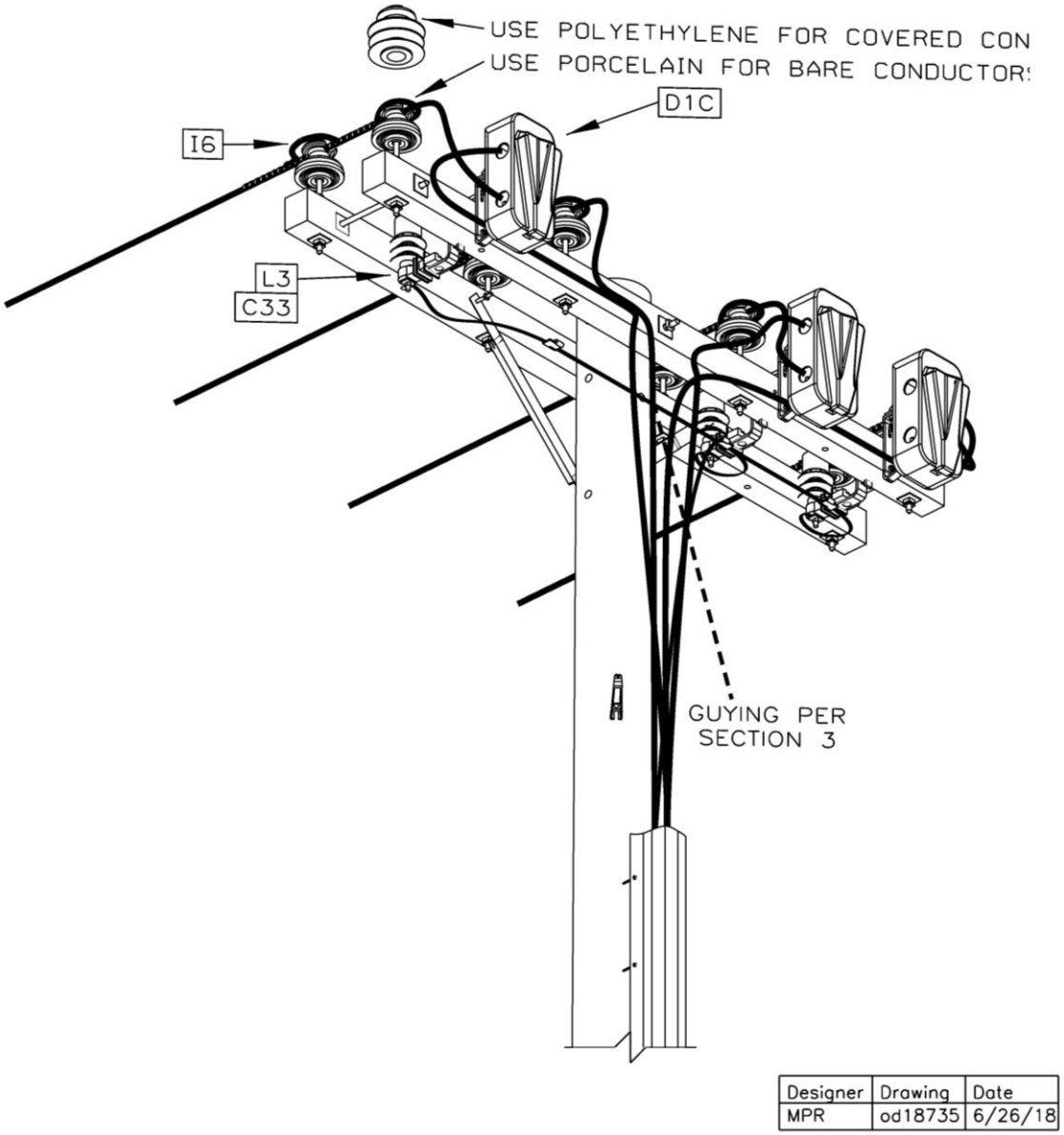
Supersedes 7/09 Issue – 3D Drawing Conversion.



NOTES:
1. IN WIND AREAS USE SPREAD CONSTRUCTION ON TOP ARM AND PLACE STREET LIGHT WIRES ON BOTTOM ARM.
2. THIS DRAWING SHOWS GENERAL ARRANGEMENT ONLY. FOR DETAILS SEE DRAWINGS WD–237–B AND WD–237–C.
3. STEP POLE IN APPROVED MANNER.

Designer	Drawing	Date
MPR	od18734	6/26/18

UG URBAN AREA SECTIONALIZING RISER POLE WITH ENCLOSED CUTOUTS - FOR BACKYARD CONSTRUCTION **(MAINTENANCE ONLY)**

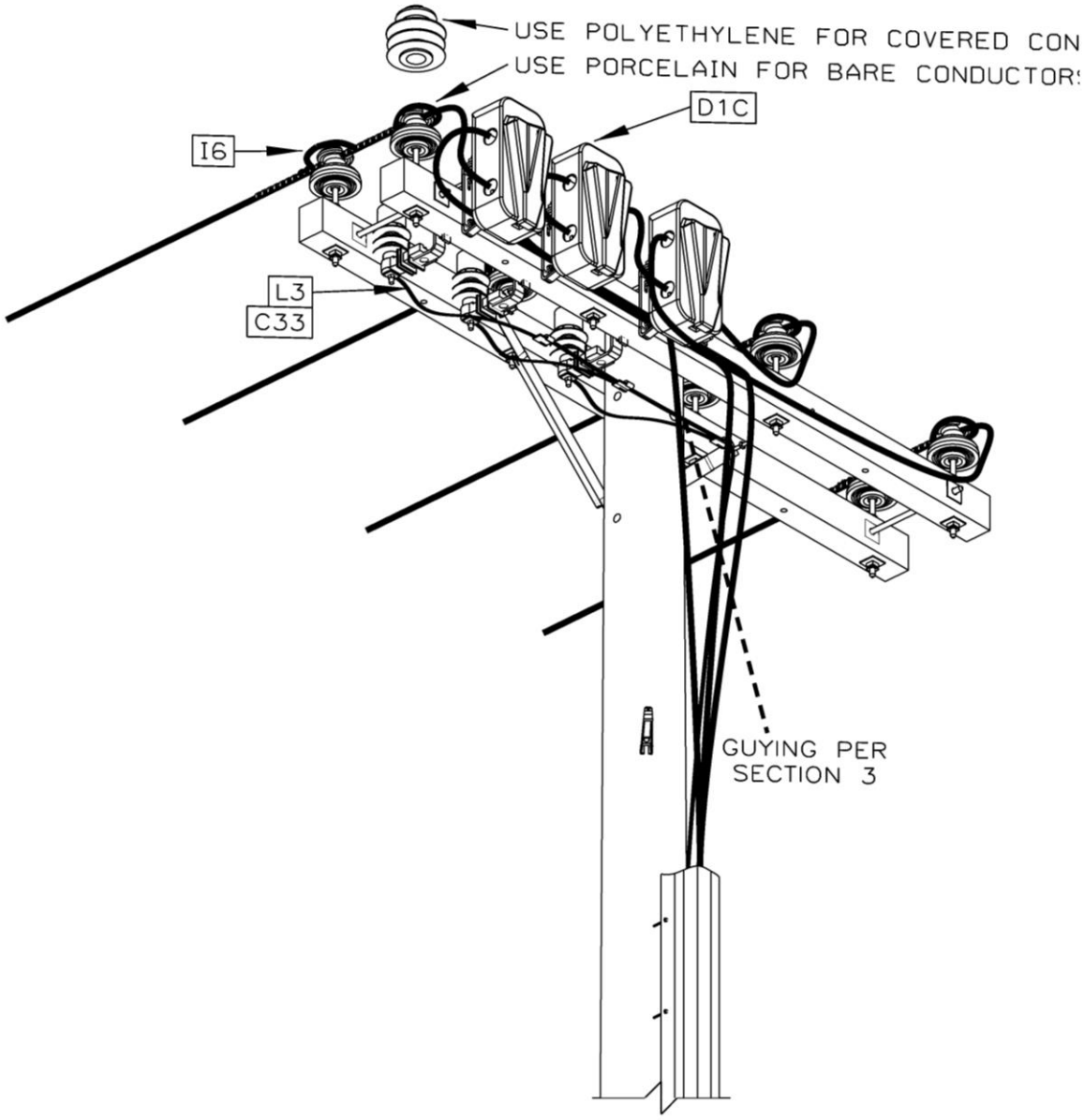


Designer	Drawing	Date
MPR	od18735	6/26/18

Supersedes 7/09 Issue – 3D Drawing Conversion.

MAIN LINE WYE SYSTEM RISER POLE WITH ENCLOSED DISCONNECT SWITCHES - FOR BACKYARD CONSTRUCTION **(MAINTENANCE ONLY)**

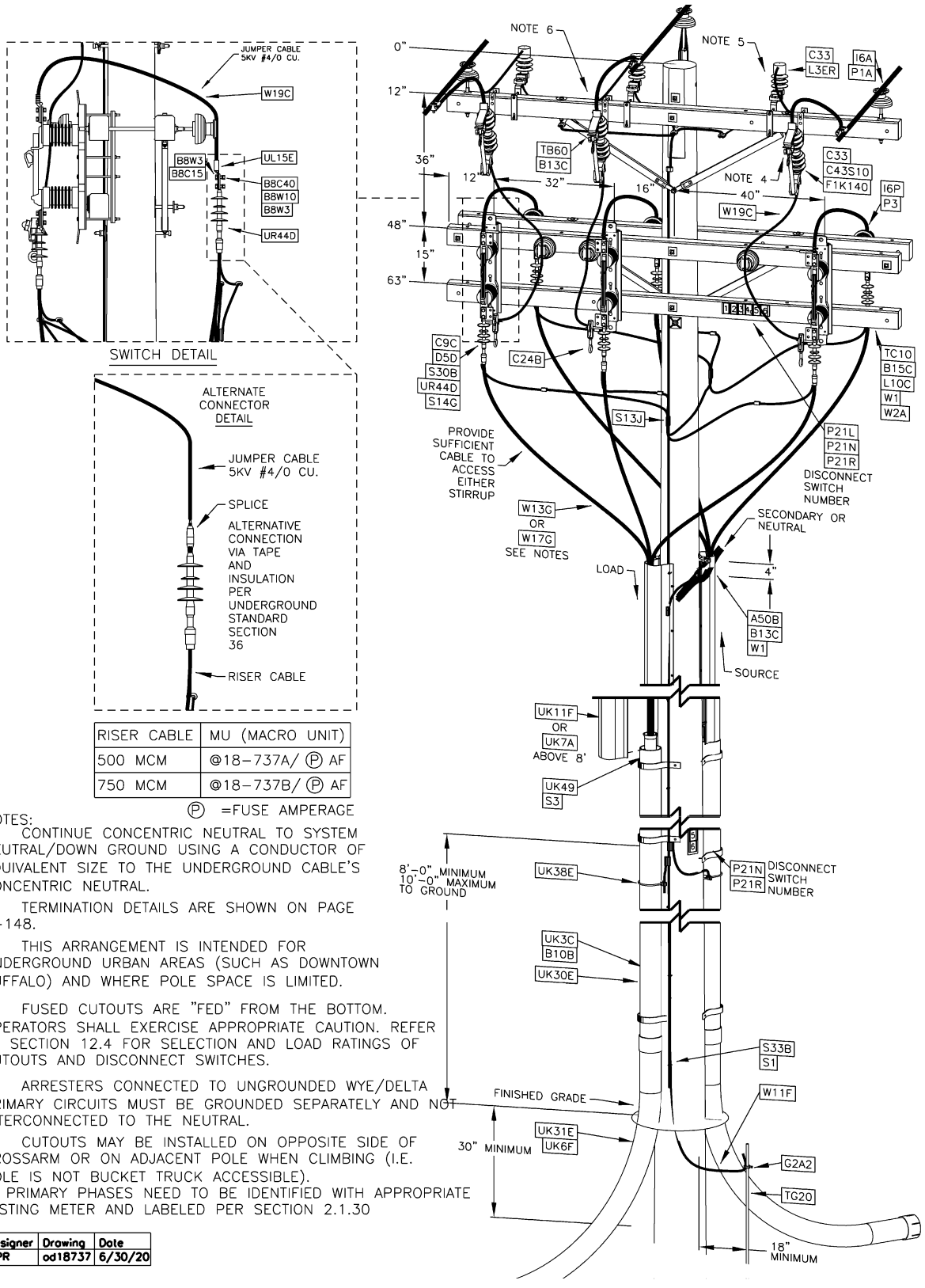
Supersedes 7/09 Issue – 3D Drawing Conversion.



Designer	Drawing	Date
MPR	od18736	6/26/18

MAIN LINE DELTA SYSTEM RISER POLE WITH ENCLOSED DISCONNECT SWITCHES - FOR BACKYARD CONSTRUCTION **(MAINTENANCE ONLY)**

MU=@18737LBSW15KV(W)/(X)AF	3Ph Riser 600A LDBRK, 15KV, (W)=Underground Cable Size, A=500,B=750,C=1000



RISER CABLE	MU (MACRO UNIT)
500 MCM	@18-737A/ Ⓟ AF
750 MCM	@18-737B/ Ⓟ AF

Ⓟ =FUSE AMPERAGE

NOTES:

1. CONTINUE CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL/DOWN GROUND USING A CONDUCTOR OF EQUIVALENT SIZE TO THE UNDERGROUND CABLE'S CONCENTRIC NEUTRAL.
2. TERMINATION DETAILS ARE SHOWN ON PAGE 5-148.
3. THIS ARRANGEMENT IS INTENDED FOR UNDERGROUND URBAN AREAS (SUCH AS DOWNTOWN BUFFALO) AND WHERE POLE SPACE IS LIMITED.
4. FUSED CUTOUTS ARE "FED" FROM THE BOTTOM. OPERATORS SHALL EXERCISE APPROPRIATE CAUTION. REFER TO SECTION 12.4 FOR SELECTION AND LOAD RATINGS OF CUTOUTS AND DISCONNECT SWITCHES.
5. ARRESTERS CONNECTED TO UNGROUNDED WYE/DELTA PRIMARY CIRCUITS MUST BE GROUNDED SEPARATELY AND NOT INTERCONNECTED TO THE NEUTRAL.
6. CUTOUTS MAY BE INSTALLED ON OPPOSITE SIDE OF CROSSARM OR ON ADJACENT POLE WHEN CLIMBING (I.E. POLE IS NOT BUCKET TRUCK ACCESSIBLE).
7. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	od18737	6/30/20

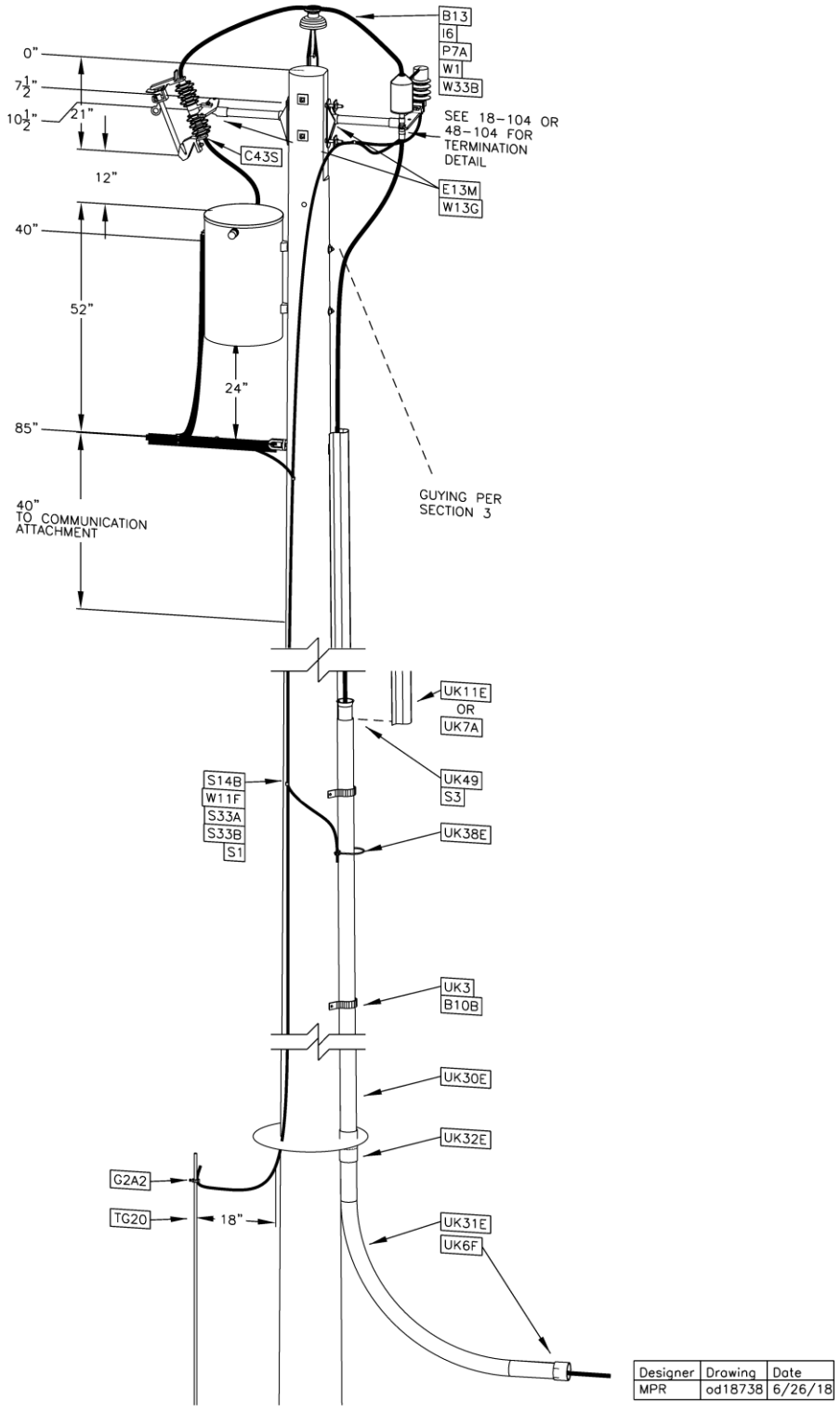
Supersedes 7/19 Issue – Switch numbering on crossarm and note 7 added

UG URBAN AREA SECTIONALIZING RISER POLE - FOR BACKYARD CONSTRUCTION – 5kV

ISSUE	PAGE NUMBER	UNDERGROUND CONSTRUCTION STANDARD	ppl
7/20	48-737		

MU @18-738-5KV
MU @18-738-5KVC

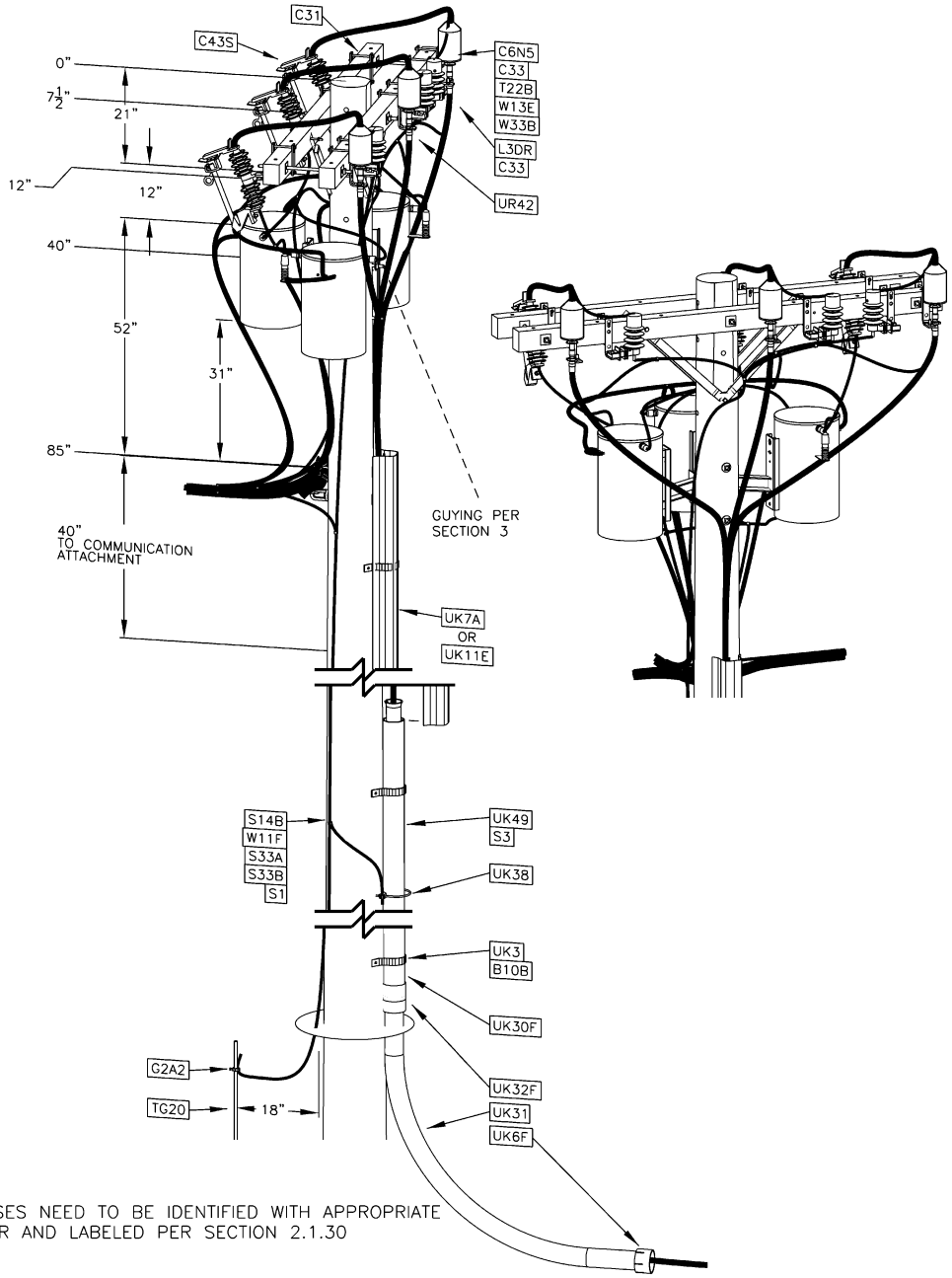
Supersedes 7/16 Issue - 3D Drawing Conversion.



UG URBAN AREA SINGLE PHASE RISER WITH TRANSFORMER FOR BACKYARD CONSTRUCTION – 5KV

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-738	7/18

MU @18-739-5KV
MU @18-739-5KVC



NOTES:

1. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

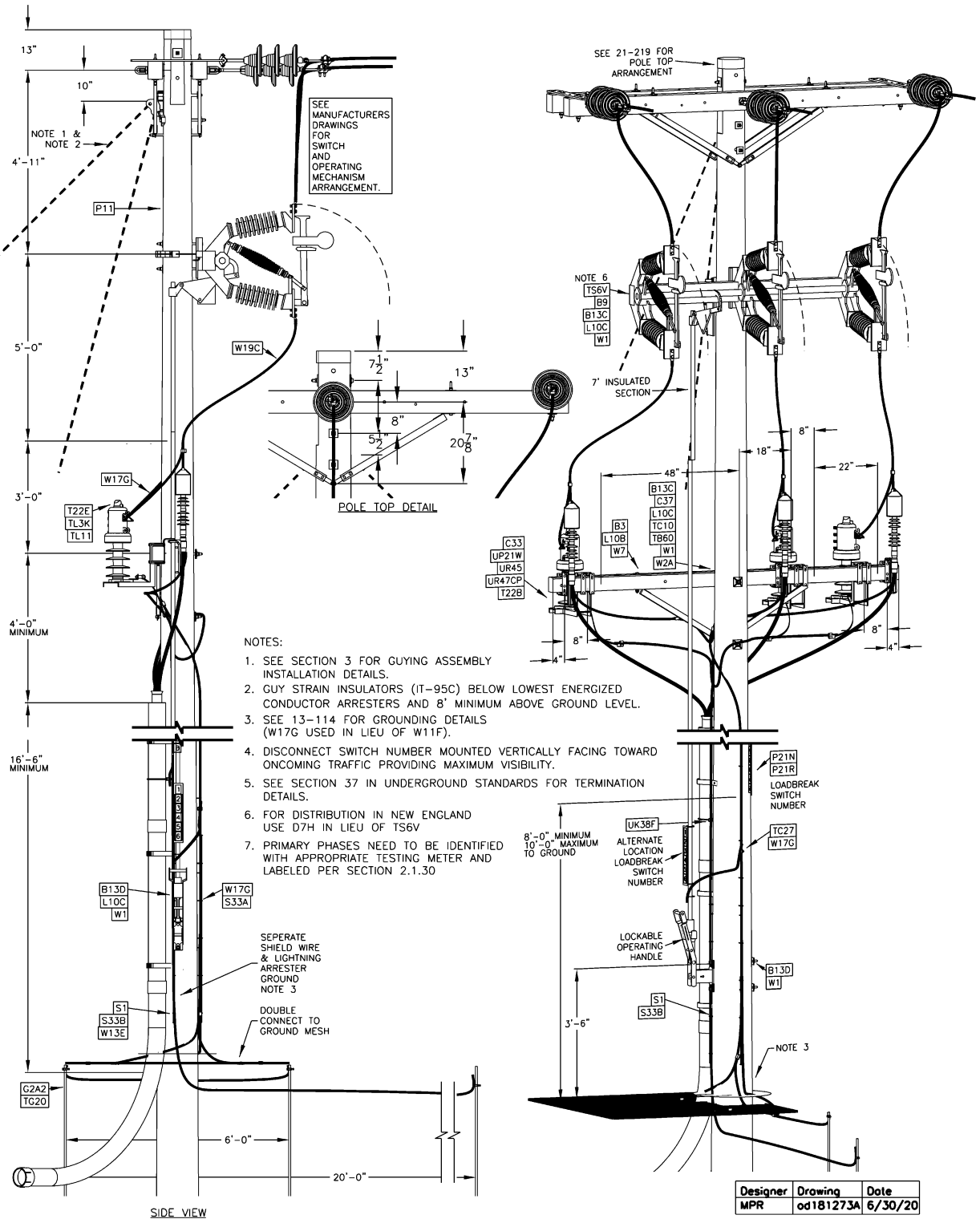
Designer	Drawing	Date
MPR	od18739	6/30/20

Supersedes 7/18 Issue – Note 1 added

UG URBAN AREA THREE PHASE RISER WITH TRANSFORMERS - FOR BACKYARD CONSTRUCTION, 5kV			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/20	**48-739**		

MU=@18-1273A(X)KV(W)	3Ph Riser 600A LDBRK, 23/35KV, (W)=OH Conductor 1/0, 336 or 477

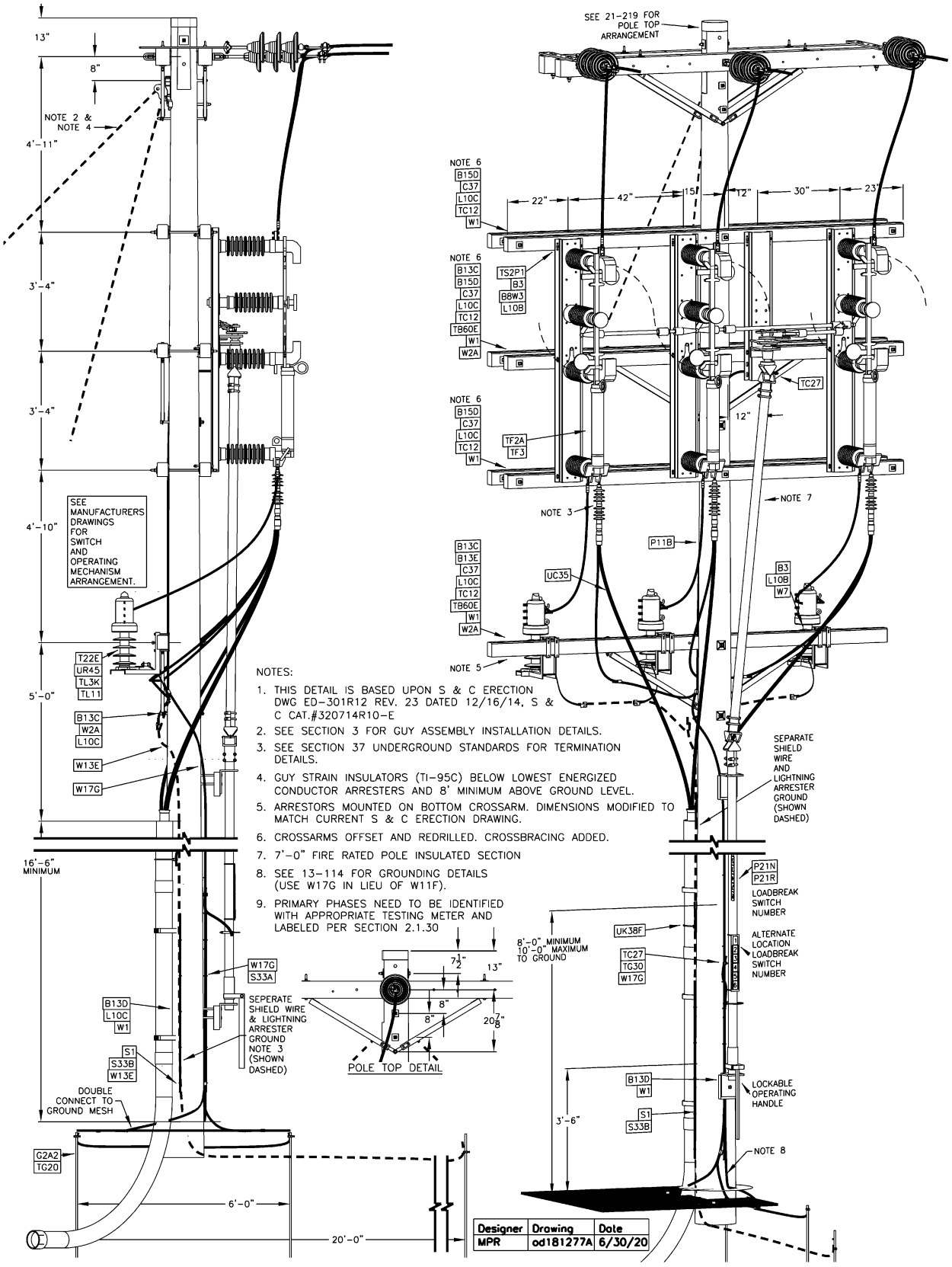
Supersedes Issue 7/19 – Note 7 added



SUB-TRANSMISSION RISER WITH VERTICAL LOADBREAK – 23/35KV

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-1273A	7/20

MU=@18-1277A35KV(W)	3Ph Riser 600A LDBRK, 35KV, (W)=OH Conductor 1/0, 336 or 477



NOTES:

1. THIS DETAIL IS BASED UPON S & C ERECTION DWG ED-301R12 REV. 23 DATED 12/16/14, S & C CAT.#320714R10-E
2. SEE SECTION 3 FOR GUY ASSEMBLY INSTALLATION DETAILS.
3. SEE SECTION 37 UNDERGROUND STANDARDS FOR TERMINATION DETAILS.
4. GUY STRAIN INSULATORS (TI-95C) BELOW LOWEST ENERGIZED CONDUCTOR ARRESTERS AND 8' MINIMUM ABOVE GROUND LEVEL.
5. ARRESTORS MOUNTED ON BOTTOM CROSSARM. DIMENSIONS MODIFIED TO MATCH CURRENT S & C ERECTION DRAWING.
6. CROSSARMS OFFSET AND REDRILLED. CROSSBRACING ADDED.
7. 7'-0" FIRE RATED POLE INSULATED SECTION
8. SEE 13-114 FOR GROUNDING DETAILS (USE W17G IN LIEU OF W11F).
9. PRIMARY PHASES NEED TO BE IDENTIFIED WITH APPROPRIATE TESTING METER AND LABELED PER SECTION 2.1.30

Designer	Drawing	Date
MPR	od181277A	6/30/20

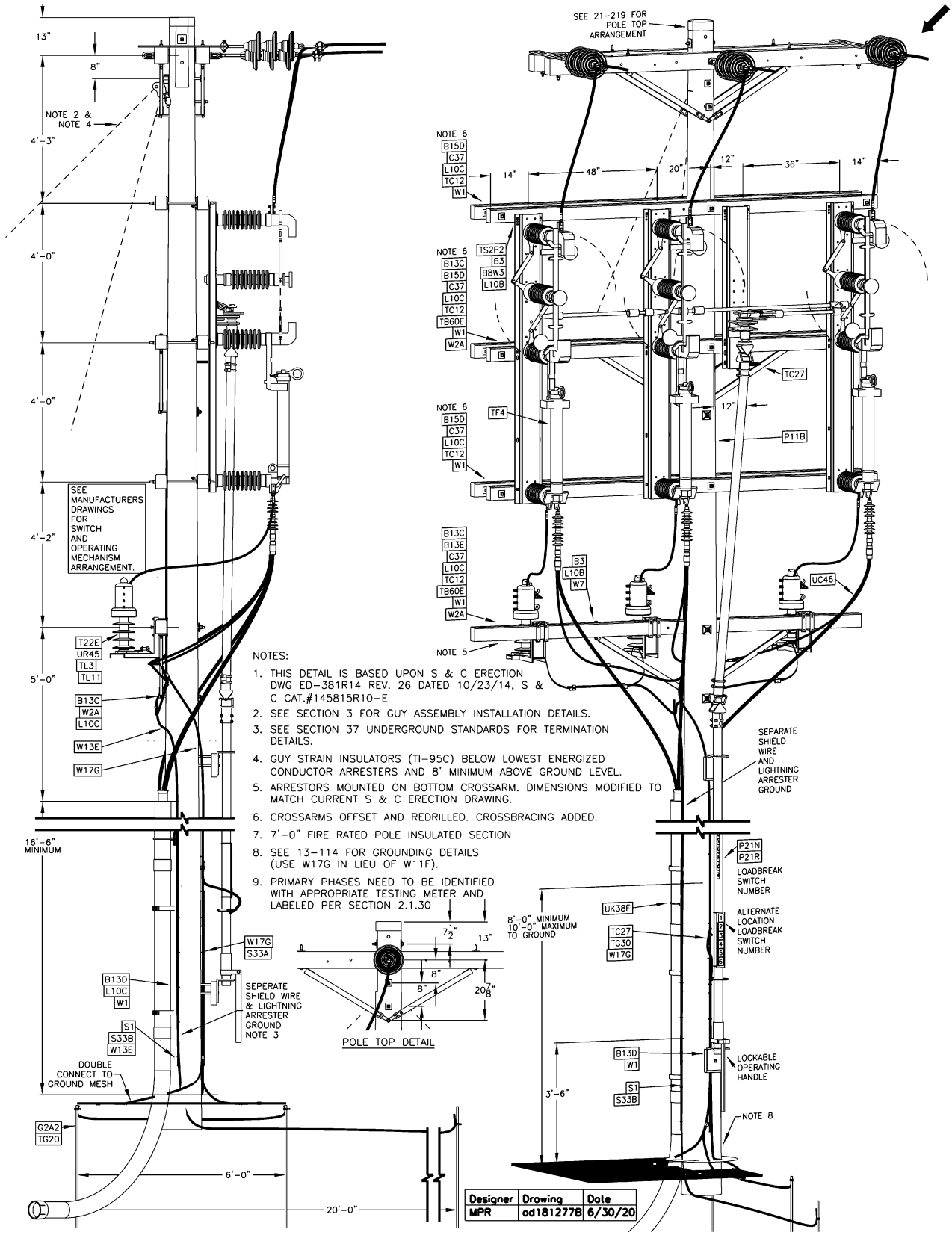
Supersedes 7/19 Issue – Clarified arrestor grounding and added note 9

SUB-TRANSMISSION RISER WITH LOADBREAK/POWER FUSE – 35KV

ISSUE	PAGE NUMBER		
7/20	48-1277A	UNDERGROUND CONSTRUCTION STANDARD	ppl

MU=@18-1277B46KV(W)	3Ph Riser 600A LDBRK, 46KV, (W)=OH Conductor 1/0, 336 or 477

Supersedes 7/19 Issue – Note 9 added



SUB-TRANSMISSION RISER WITH LOADBREAK/POWER FUSE – 46KV

		PAGE NUMBER	ISSUE
ppl	UNDERGROUND CONSTRUCTION STANDARD	48-1277B	7/20

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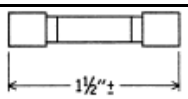
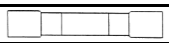
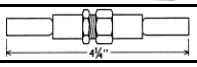
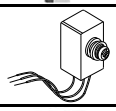
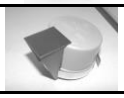
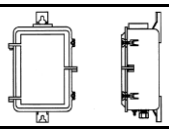
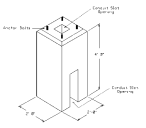
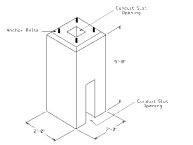
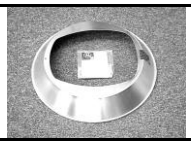
Version	Date	Modification	Author(s)	Approval by (Name/Title)
12	7/21	• Added Drawing: 48-124A • Updated Drawings: 48-127, 48-336 & 48-336D		
11	7/20	• Updated Drawing 18-003 to match Section 18 • Revised Drawings: 18-004, 18-109, 18-110, 18-126, 18-126D, 18-127, 18-128, 18-335, 18-336, 18-336D, 18-337, 18-338, 18-340, 18-341, 18-353, 18-370, 18-405, 18-737, 18-739, 18-1273A, 18-1277A, 18-1277B		
10	7/19	• Revised Drawings 18-112, 18-124M, 18-125M, 18-126, 18-126D, 18-335, 18-336, 18-336D, 18-337, 18-340, 18-341, 18-353, 18-400, 18-400M, 18-737, 18-1273A, 18-1277A and 18-1277B		
9	7/18	• 3D Drawing Conversions 48-104 – 48-337 & 48-340 – 48-738 & 48-1273A – 48-1277B • 3D Drawing Conversions for figures 1 and 2		
8	7/17	• Revised Index • New Standard 18-126D • New Standard 18-136D • Revised Standard 18-336 • New Standard 18-338 • Revised Standard 18-1273A		
7	7/16	• Revised Pages 48-4 and 48-6. • Updated Drawings 48-115B, 48-118, 48-127, 48-336, 48-337, 48-340 and 48-370 • New Std. 48-738 • New Std. 48-739 • New Std. 48-1273A • New Std. 48-1277A • New Std. 48-1277B		
6	7/15	• Text edits in 48.5 • Revised drawing reference 48.9 • Minor text change in title block 48-115B • Drawing change 48-124 • Added grounding clips to 48-400, 48-400M and 48-405.		
5	7/14	• Minor text change to Stds 48-109, 48-110, 48-112, 48-115, 48-116, 48-117, 48-118, 48-124, 48-128 & 48-336. • New Std 48-115B		
4	7/13	• Minor text change to stds 48-109, 48-110 and 48-111. • Revised Std 48-124 & 48-124M		

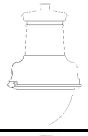
		• Revised std 48-128. • Added note for pole spacing for stds 48-126, 48-127, 48-128, 48-335, 48-336, 48-337, 48-340 and 48-353. • Added new standard 48-341		
3	7/12	• Minor text change for 48-111, 48-112 and 48-336 • Std 48-128 is being reviewed for clearances and position of riser brackets. • New Std 48-370 for sub-station risers		
2	7/11	• Added requirement for ground rod placement (18" from center of pole) on drawings where the ground rod is shown. • Removed guy wire materials on drawings where guys are shown - refer to Section 3 for all guying requirements. • Minor editorial corrections in the text portion of the section. • Corrected animal guard placement on most drawings where terminations are shown.		
1	7/09	• Text portion of the section has been completely re-written in order to combine what was previously in Section 18 and Section 48. • Updates were made to all drawings that were previously in Section 18. Some of the drawings that had previously been in Section 48 are now in this section. • Brand new drawings were introduced - particularly 48-112, 48-124M, 48-125M, 48-340, and 48-400M. • Many of the CUs and MUs listed on the drawings have either been added or updated.		

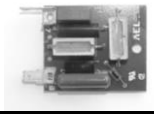
MATERIAL	STD ITEM	ILLUSTRATION
• **Fuses**		
○ Fuse – 600V	F10	
○ Fuse – 300V Class G	F11	
○ Fuse Holder – In Line 600V	F50	
• **Controls – Photoelectric**		
○ Photoelectric – Twistlock	SC01 – SC04	
○ Photoelectric - Button	SC17	
○ Receptacle Caps - Twistlock	SC20 – SC21	
○ Receptacle – Twistlock Photoelectric	SC30	
○ PEC Visor	SC 31	
• **Controls – Multiple Relays**		
○ Control – Multiple Relay	SD10A – SD10B	
• **Foundations**		
○ Foundation – Precast Concrete - for Post Top Poles	SF01 – SF03	
○ Foundation – Precast Concrete – for Roadway Poles	SF10 – SF11	
○ Foundation – Anchor Bolts	SF30 – SF31	
○ Foundation – Temporary Cover	SF40 – SF41	

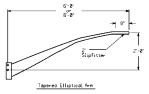
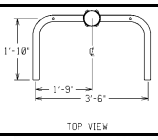
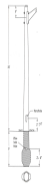
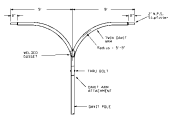
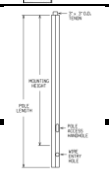
MATERIAL	STD ITEM	ILLUSTRATION
• **Handhole**		
o Handhole – Polymer Concrete	SG10	
• **Lamps**		
o Incandescent	SH01F	
o Mercury Vapor	SH02C – SH02K	
o High Pressure Sodium Vapor	SH03A – SH03G2	
o Metal Halide	SH04E – SH05K	
• **Luminaires - Floodlight**		
o High Pressure Sodium Vapor	SJ03B – SJ03K	
o Metal Halide	SJ04K – SJ05H	
o Light Emitting Diode – LED	SJ06E – SJ06F	
o Floodlight Accessories & Replacement Parts	SJ10A – SJ21D	
• **Luminaires – Horizontal Roadway**		
o High Pressure Sodium Vapor – Semi-Cutoff	SK03A – SK03K	
o High Pressure Sodium Vapor – Cutoff	SK03A1 – SK03H1	
o Metal Halide – Semi-Cutoff	SK05H – SK06H	
o Light Emitting Diode – (LED)	SK06A – SK06H	
o High Pressure Sodium Vapor – 240V - Cutoff	SK10C1	
o High Pressure Sodium Vapor – 240V - Semi-Cutoff	SK10G	
o High Pressure Sodium Vapor – 277V - Semi-Cutoff	SK20C – SK20H	

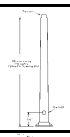
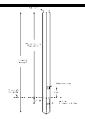
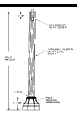
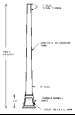
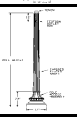
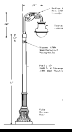
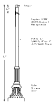
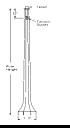
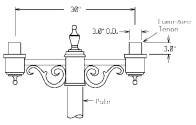
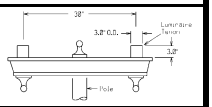
MATERIAL	STD ITEM	ILLUSTRATION
• **Luminaires – Horizontal Roadway (continued)**		
o Replacement Semi-Cutoff Refractors	SK50A1 – SK50B2	
o Replacement Cutoff Lens	SK60A3 – SK60B4	
o Light Trespass Shield	SK70	
o Replacement Bird Guard	SK71	
o Replacement Capacitor	SK80A – SK80B	
• **Luminaires – Post Top**		
o “Edison”	SL10Z1 – SL11D1	
o “Edison” Replacement Globes	SL10Z1 – SL10Z3	
o “Aspen Grove”	SL16A – SL19C	
o “Central Park”	SL21C – SL23E	
o “Coach Lamp“ - HPS	SL26B – SL26D1	
o “Contemporary“	SL30 Z1– SL31D1	

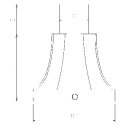
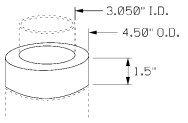
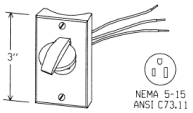
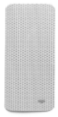
MATERIAL	STD ITEM	ILLUSTRATION
• **Luminaires – Post Top (continued)**		
o "Traditional"	SL40Z1 – SL41D1	
o "Edgewater"	SL46C – SL48E1	
o "Williamsville"	SL51A – SL54C1	
o "Williamsville" Accessories and Replacement Parts	SL50X2 – SL50Z3	
o "Franklin Square"	SL55Z1 – SL58E1	
o "Little Falls"	SL60B1	
o "University"	SL66D1	
o "Watertown"	SL70D1	
o "Carriage" – HID & LED	SL75A – SL76C	
o "Highland Park" - LED	SL80AB – SL80BG	
o "Princeton" - LED	SL85AB – SL85BG	
o "Oxford" - LED	SL90AB – SL90BG	

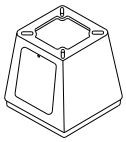
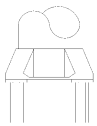
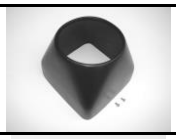
MATERIAL	STD ITEM	ILLUSTRATION
• **Luminaires – Rectilinear**		
○ Rectilinear Luminaire – Standard Housing	SM03C – SM0H	
○ Rectilinear Luminaire – Compact Housing	SM03B1 – SM03C1	
○ Arbordale (Shoebox) - LED	SM05B – SM05E	
• **Luminaires – Teardrop**		
○ “Delaware Park” Roadway	SP10D – SP12H2	
○ “Delaware Park” Replacement Parts	SP10W1 – SP10Z2	
○ “Delaware Park” Pedestrian	SP15B – SP17E2	
○ “Little Falls” Pedestrian	SP20B1	
○ “Westminster” Tear Drop	SP30CB – SP30GG	
○ “Westminster Pedestrian”	SP35GB – SP35BG	

MATERIAL	STD ITEM	ILLUSTRATION
• **Luminaires – Underpass**		
o Underpass Luminaire	SQ03C – SQ03G	
o Underpass Luminaire Replacement Parts	SQ10 – SQ12	
• **Luminaires – Accessories**		
o NEMA Wattage Labels	SR03A1 – SR05H	
o Luminaire Ownership Label	SR11	
o HPS Starters – GE Lighting Systems	SR20A – SR20G	
o HPS Starters – Cooper Lighting	SR21A – SR21C	
o HPS Starters – American Electric	SR22A – SR22D	
o HPS Starters – Holophane	SR23A – SR23B	
o		

MATERIAL	STD ITEM	ILLUSTRATION
• **Luminaires – Accessories**		
o Ballast Assembly - Holophane	SR30A – SR30E1	
• **Poles & Arms - Roadway**		
o Aluminum Pendant Pole & Arms – Anchor Base	ST01F – ST01H	
o Aluminum Pendant Pole & Arms – Arm	ST01X1 – ST01X5	
o Aluminum Pendant Pole & Arms -- Twin Parallel Arm	ST01X6	
o Aluminum Pendant Pole & Arms – Floodlight Arm	ST01X7 – ST01X8	
o Fiberglass Pendant Pole & Arms – Anchor Base	ST02F – ST02X2	
o Fiberglass Pendant Pole & Arms – Embedded	ST02F1	
o Aluminum Davit Poles & Arms – Anchor Base	ST04G – ST04X4	
o Aluminum “Niagara” Decorative Pole & Arms – Anchor Base	ST08F – ST08Y	
• **Poles – Architectural**		
o Aluminum Architectural Pole – Anchor Base	SU01D – SU01X	
o Fiberglass Architectural Pole – Embedded	SU02E – SU02X	

MATERIAL	STD ITEM	ILLUSTRATION
• **Poles & Arms – Post Top**		
o Fiberglass – Anchor Base Poles	SW01A – SW01D	
o Fiberglass – Embedded Poles - Round	SW02A – SW02D	
o Fiberglass – Embedded Poles - Square	SW03C	
o Aluminum - “Armory Square” Poles	SW05C – SW05C1	
o Aluminum “Essex” Pole	SW06C	
o Aluminum “Villager” Poles	SW07A – SW07C	
o Fiberglass “Presidential” Poles	SW08B – SW08D1	
o Aluminum “Washington” Pole	SW09A – SW09C1	
o Aluminum “Little Falls” Poles for Teardrop	SW10B1 – SW10X4	
o Aluminum “Little Falls” Poles for Acorn	SW11B – SW11B1	
o Aluminum “Winter Park” Pole	SW12B1	
o Twin Arm – “Ornamental” for Post Top Luminaires	SW50A – SW50B	
o Twin Arm – “Contemporary” for Post Top Luminaires	SW51A – SW51B	

MATERIAL	STD ITEM	ILLUSTRATION
• **Pole Accessories**		
o Tenon Adapter	SX01A – SX01B	
o Tenon Reducer	SX02B – SX02G	
o Tenon Spacing Ring	SX03	
o Festoon Outlets	SX10A – SX10B	
o Duplex Festoon Receptacle & Cover	SX11B – SX12A	
o "Festoon Receptacle" Cable Tag	SX13	
o Pole Number Decals	SX20A – SX20L	
o Pole Reflectors	SX21A – SX21B	
o Gel-Wrap Connector	SX30	
o Fastener – Tamper Resistant	SX40A – SX40D	
o Allen Wrench - Pin-in-Head	SX40W1 – SX40W4	
o Replacement Pole Access Handhole Cover	SX50	

MATERIAL	STD ITEM	ILLUSTRATION
• **Pole Accessories (continued)**		
o Replacement Pole Access Handhole Covers	SX60A – SX69A	
o Transformer Bases	SX80A – SX80B1	
o Break-Away Coupling Device	SX81	
o Anchor Bolt Shroud	SX82	
o Pole Shim	SX90	
• **Wire & Cable – Outdoor Lighting**		
o #10 AWG Copper – RHH/RHW/USE-2	SY4AG – SY4A2	
o #6 AWG Copper – RHH/RHW/USE-2	SY6AG – SY7A3	
o #2 AWG Copper – RHH/RHW/USE-2	SY8A3	
o Cable-in-Conduit – 2-#6 AWG Copper – THW	SY6B2	

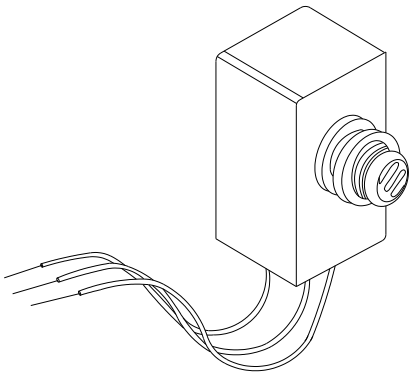
CONTROL – PHOTOELECTRIC – TWISTLOCK

Solid state electronic, 1,000w lamp load.1.5 foot-candle "turn-on" value, 2 - 5 second time delay on "turn off". In accordance with Material Specification Standard MS-6140.

	HOUSING COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
105 – 130 VAC *(Use on all 120VAC HID luminaires)*	GREY	SC01	9314677	0811055
105 – 300 VAC – Long Life *(Use on 240 VAC & 277 VAC HID luminaires)* *(Use on all LED luminaires)*	BLUE	SC02	9314675	0811057
105 – 130 VAC – Part Night *(For use in New Hampshire only)*	GREEN	SC04	9314766[E]	9202661[E]

CONTROL – PHOTOELECTRIC – BUTTON

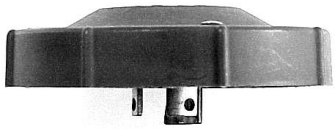
105-130 VAC, 500 W lamp load, 1½ foot-candle "turn-on" value, 5 – 10 second time delay on "turn off", with 3-12" long, #18 AWG, stranded copper leads, color coded: black=source, white=neutral, red=load. In accordance with Material Specification Standard MS-6141.



STD ITEM	SAP ITEM ID	PS ITEM ID
SC17	9311605	2501701

CONTROL – RECEPTACLE CAPS – TWISTLOCK

Use in place of the twistlock photoelectric control to leave lamp load either permanently “ON” or “OFF”. 1,000w lamp load, Low profile housing. In accordance with Material Specification Standard MS-6140.



	HOUSING COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
OPEN Receptacle Cap *(leave lamp load “OFF”)*	RED	SC20	9311953	2505407
SHORTING Receptacle Cap *(leave lamp load “ON”)*	BLACK	SC21	9314674	0811058

RECEPTACLE – TWISTLOCK – FOR PHOTOELECTRIC CONTROL

For mounting twist-lock photo control directly to pole, crossarm, or to ½” threaded conduit. With three 18” long #14 AWG (minimum) stranded copper leads, color coded: black=source, white=neutral, red=load.

STD ITEM	SAP ITEM ID	PS ITEM ID
SC30	9311954	2505403

VISOR – FOR PHOTOELECTRIC CONTROL

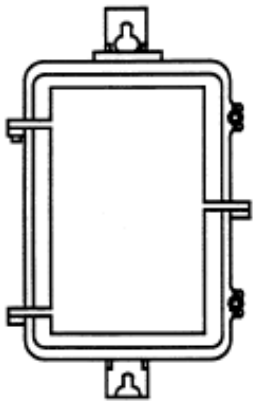
Accessory for use with photoelectric control to prevent false control operation due to stray light interference. Black aluminum visor with stainless steel mounting strap.

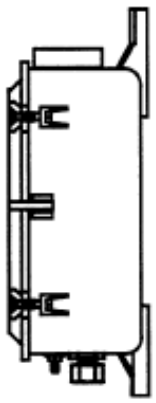
STD ITEM	SAP ITEM ID	PS ITEM ID
SC31	9306309	9202075

CONTROL – MULTIPLE RELAY

For group control of standard luminaires, 120/240V double-pole, single-throw control relay, with twistlock photocontrol receptacle for standard 120v photoelectric control, Contacts OPEN when coil is deenergized. With pole mounting bracket.

NOTE: Re-fuse with standard 60A (50A continuous) and 100A (80 amp continuous) fuses.



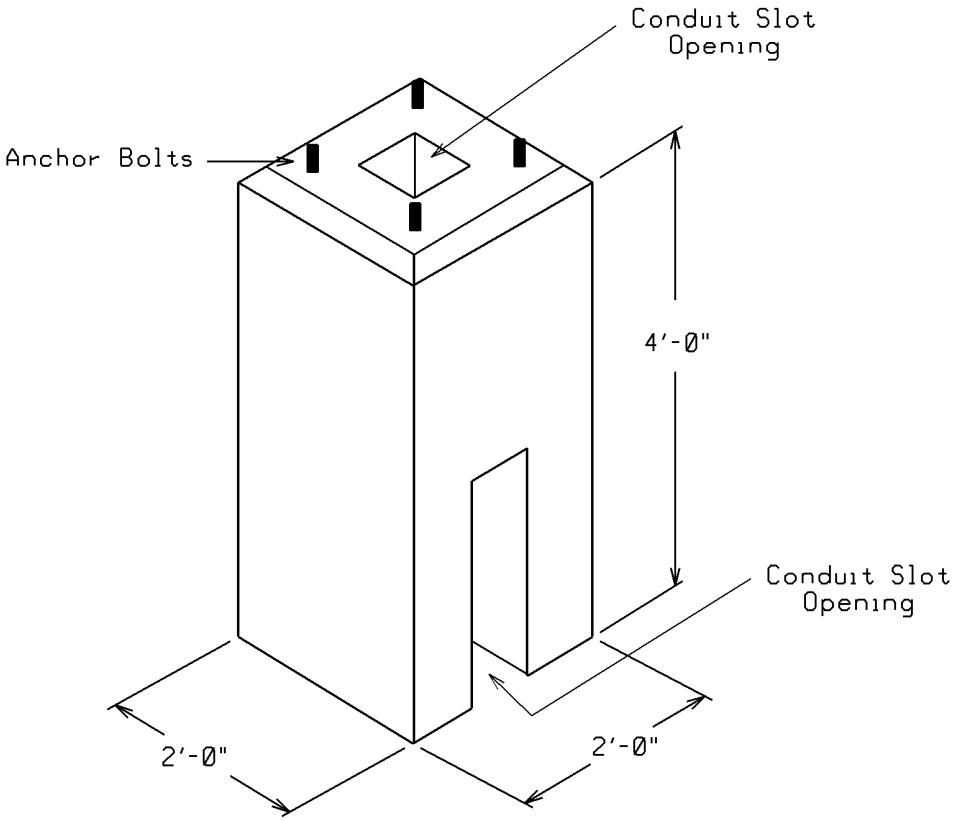


	STD ITEM	SAP ITEM ID	PS ITEM ID
60 Amp., 8” x 13” x 5”	SD10A	9311926[Y]	2505340[Y]
100 Amp., 11” x 15” x 6”	SD10B	9311925[Y]	2505341[Y]

FOUNDATION – PRECAST CONCRETE – FOR STREET LIGHTING

24” square x 48” depth, for use with anchor base, post top style poles.
(4) ¾” galvanized anchor bolts with a 2-3/4” anchor bolt projection.
In accordance with Material Specification Standards MS-6640, MS-6641, or MS-6642.

Approximate Weight
= 2,025 pounds.

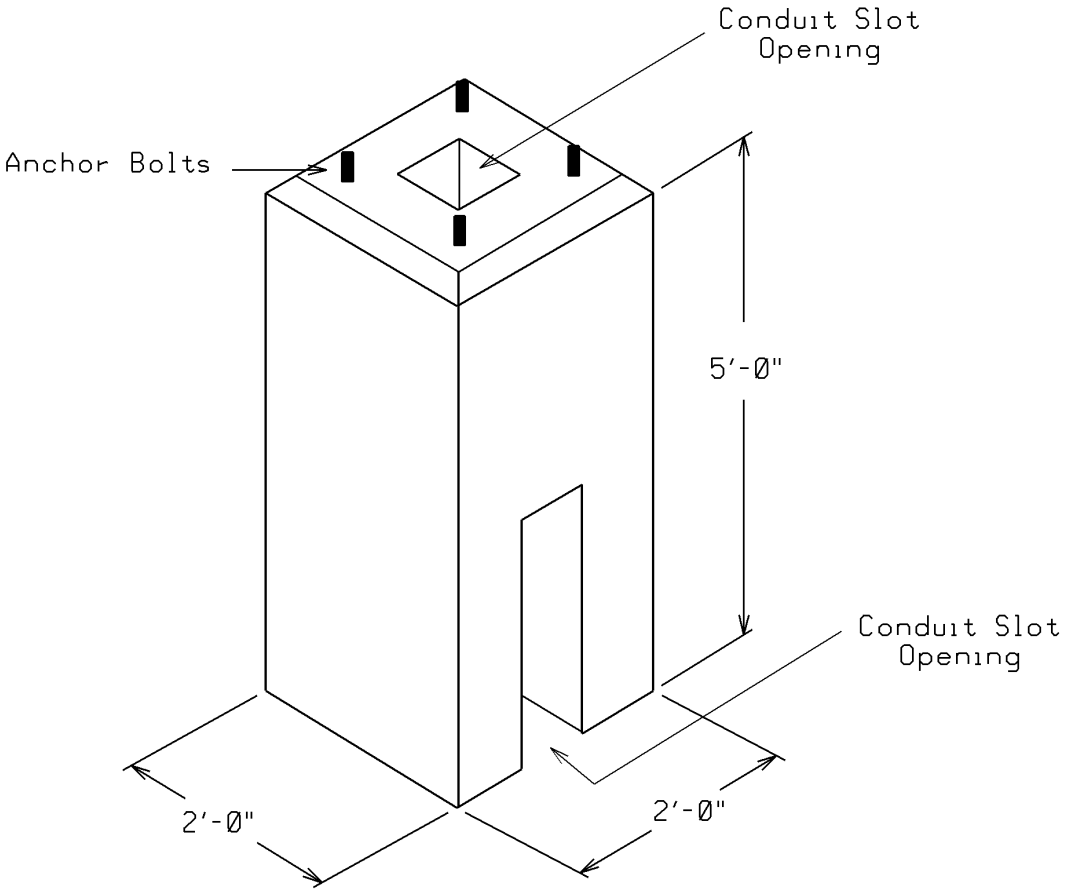


	STD ITEM	SAP ITEM ID	PS ITEM ID
8-1/2 inch Bolt Circle – 3-1/2” conduit slot opening	SF01	9308190[E]	9201524[E]
11-1/2 inch Bolt Circle – 5” conduit slot opening	SF02	9308189[Y]	9201525[Y]
15 inch Bolt Circle – 5” conduit slot opening	SF03	9308188[Y]	9201526[Y]

FOUNDATION – PRECAST CONCRETE – FOR STREET LIGHTING

24” square x 60” depth, for use with anchor base, roadway style poles.
(4) 1” galvanized anchor bolts with a 2-3/4” anchor bolt projection.
In accordance with Material Specification Standards MS-6650 or MS-6651.

Approximate Weight
= 2,500 pounds.



	STD ITEM	SAP ITEM ID	PS ITEM ID
11-1/2 inch Bolt Circle – 5” conduit slot opening	SF10	9317629	5821035
15 inch Bolt Circle – 5” conduit slot opening	SF11	9308308	9201759

FOUNDATION – ANCHOR BOLTS – FOR STREET LIGHTING

Galvanized steel with (2) galvanized steel hex head bolts, (1) galvanized steel lockwasher, and (2) galvanized steel flat washers.

	STD ITEM	SAP ITEM ID	PS ITEM ID
1-inch diameter x 36-inch length x 4-inch 90 degree offset. – Use for roadway style anchor base poles.	SF30	9321159	5822215
3/4-inch diameter x 17-inch length x 3-inch 90 degree offset. – Use for post top style anchor base poles.	SF31	9311099	9201355

FOUNDATION – TEMPORARY COVER – FOR STREET LIGHTING

Temporary cover for protection of exposed wiring in street lighting foundations. Polyethylene, penta-head bolt locking, color: ORANGE, with pole reflectors and PPL “warning” sticker.

	STD ITEM	SAP ITEM ID	PS ITEM ID
8-1/2” to 11-1/2” bolt circle	SF40	9311427	2503200
15” bolt circle	SF41	9308442	9201487

HANDHOLE – FOR STREET LIGHTING

Polymer concrete, with fiberglass flared sidewalls, 12 inch x 12 inch x 24 inch depth, with stainless steel penta-head cover attachment bolts, with “STREET LIGHTING” logo on cover, color: GREY, Heavy Duty – for use in sidewalks, alleys, and driveways – NOT for roadway use.

)

STD ITEM	SAP ITEM ID	PS ITEM ID
SG10	9310674	9201032

LAMP – INCANDESCENT

Filament, 125VAC, medium screw base, clear bulb, 6,000 hour rated life. In accordance with Material Specification Standard MS-6132.

LAMP WATTAGE	AVERAGE INITIAL LUMENS	STD ITEM	SAP ITEM ID	PS ITEM ID
189 or 202 or 205	2,750	SH01F	9319567	9001959

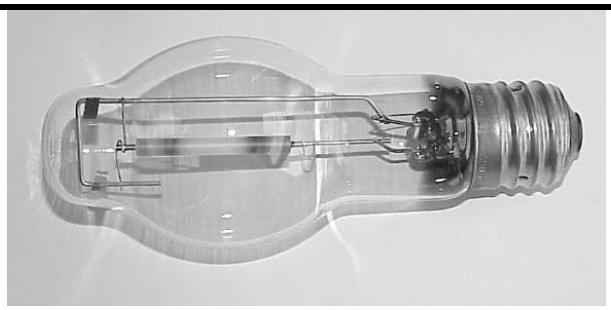
LAMP – MERCURY VAPOR

High intensity discharge, mogul screw base, phosphor coated bulb, 24,000 hour rated life. In accordance with Material Specification Standard MS-6133.

LAMP WATTAGE	ANSI LAMP CODE	AVERAGE INITIAL LUMENS	STD ITEM	SAP ITEM ID	PS ITEM ID
100	H38	4,400	SH02C	9311927	2505324
175	H39	8,500	SH02E	9311940	2505357
250	H37	13,000	SH02G	9314788	0801051
400	H33	23,000	SH02H	9311928	2505319
1,000	H36	63,000	SH02K	9311957	2505361

LAMP – HIGH PRESSURE SODIUM VAPOR

High intensity discharge, mogul screw base, clear bulb, non-cycling, 30,000 hour rated life. In accordance with Material Specification Standard MS-6134.



LAMP WATTAGE	ANSI LAMP CODE	AVERAGE INITIAL LUMENS	STD ITEM	SAP ITEM ID	PS ITEM ID
50	S68	4,000	SH03A	9321158	5824615
70	S62	6,300	SH03B	9313585	2508070
100	S54	9,500	SH03C	9313602	2508100
150	S55	16,000	SH03D	9313604	2508150
250	S50	28,500	SH03G	9313605	2508250
400	S51	50,000	SH03H	9313622	2508400
1,000	S52	140,000	SH03K	9313621	2508900

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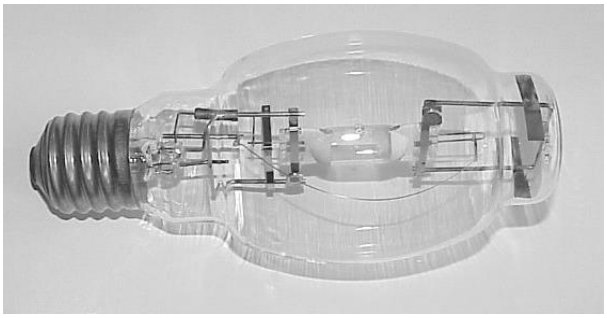
LAMP – METAL HALIDE PROBE START

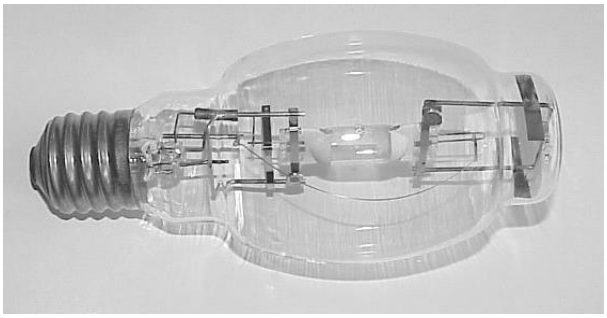
High intensity discharge, mogul screw base, clear bulb. In accordance with Material Specification Standard MS-6135.



LAMP WATTAGE	ANSI LAMP CODE	VERTICAL BURNING POSITION		HORIZONTAL BURNING POSITION		STD ITEM	SAP ITEM ID	PS ITEM ID
		AVG. INITIAL LUMENS	RATED LIFE (hours)	AVG. INITIAL LUMENS	RATED LIFE (hours)			
175	M57	14,400	10,000	12,800	7,500	SH04E	9316214	1577025
250	M58	22,000	10,000	20,000	6,000	SH04G	9314795	0800075
400	M59	36,000	20,000	32,000	15,000	SH04H	9314726	0801867
1,000	M47	110,000	15,000	107,800	9,000	SH04K	9316259	1571762

LAMP – METAL HALIDE PULSE START

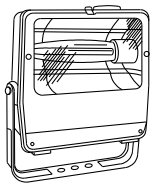
High intensity discharge, mogul screw base, clear bulb. In accordance with Material Specification Standard MS-6135.



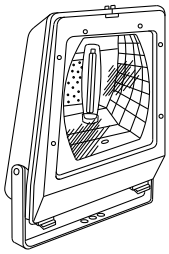
LAMP WATTAGE	ANSI LAMP CODE	VERTICAL BURNING POSITION		HORIZONTAL BURNING POSITION		STD ITEM	SAP ITEM ID	PS ITEM ID
		AVG. INITIAL LUMENS	RATED LIFE (hours)	AVG. INITIAL LUMENS	RATED LIFE (hours)			
175	M152	14,400	15,000	12,000	12,000	SH05E	9306259	9202096
250	M153	22,000	15,000	19,000	12,000	SH05G	9306258	9202097
400	M155	36,000	20,000	31,000	15,000	SH05K	9306257	9202098

FLOODLIGHT LUMINAIRE – HIGH PRESSURE SODIUM VAPOR

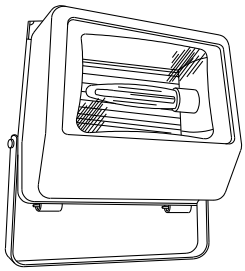
HID, Grey Housing, PEC Receptacle, In accordance with Material Specification Standard MS-6220.



70w. & 150w.



250w. & 400w.



1,000w.

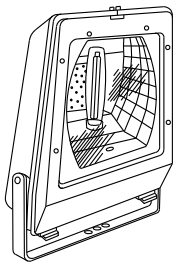
Approximate Weight
70w = 25 pounds
150w = 25 pounds
250w = 45 pounds
400w = 45 pounds
1,000w = 65 pounds

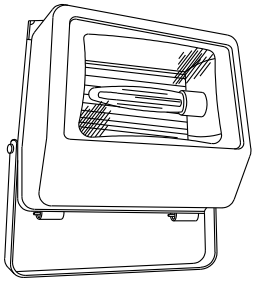
Note 1: STD ITEM SJ03K is a CLOSED OFFERING. Stock is available for maintenance of existing installations only.

	WATTAGE	BALLAST	STD ITEM	SAP ITEM ID	PS ITEM ID
120 volt	70w	Reactor	SJ03B	9305871[E]	5107009[E]
120 volt	150w	Reactor	SJ03D	9305870[E]	5107011[E]
120 volt	250w	Regulated	SJ03G	9314672	0811060
120 volt	400w	Regulated	SJ03H	9314671	0811061
277 volt	400w	Regulated	SJ03H1	9306198	9201855
(see note 1) - 120 volt	1,000w	Regulated	SJ03K	9314670	0811062

FLOODLIGHT LUMINAIRE – METAL HALIDE

HID, Grey Housing, PEC Receptacle, In accordance with Material Specification Standard MS-6220.





Approximate Weight
250w = 45 pounds
400w = 45 pounds
1,000w = 65 pounds

250w. & 400w. **1,000w.**

Note 1: 250 watt probe start metal halide floodlights have been discontinued with no replacement luminaire provided. When replacement of existing in service 250w metal halide floodlight is required, they shall be converted to 400w pulse start metal halide. Billing changes to customer apply.

Note 2: STD ITEM SJ04K is a CLOSED OFFERING. Stock is available for maintenance of existing installations only.

	WATTAGE	BALLAST	STD ITEM	SAP ITEM ID	PS ITEM ID
(see note 2) - 120 volt	1,000w	Regulated	SJ04K	9314669	0811063
120 volt	400w PSMH	Regulated	SJ05H	9306795	9202149

FLOODLIGHT LUMINAIRE – LIGHT EMITTING DIODE (LED)

LED, Grey Housing, PEC Receptacle, In accordance with Material Specification Standard MS-6221.

Approximate Weight
150 W – 28 pounds
199 W – 47 pounds

	MAXIMUM WATTAGE	DELIVERED LUMENS	STD ITEM	SAP ITEM ID	PS ITEM ID
120/277 volt	150W	14,000-20,000	SJ06E	9393538	N/A
120/277 volt	199W	28,000-30,000	SJ06F	9393537	N/A

FLOODLIGHT ACCESSORIES AND REPLACEMENT PARTS
GE LIGHTING SYSTEMS – P154 FLOODLIGHT LUMINAIRES

	STD ITEM	SAP ITEM ID	PS ITEM ID
Front door and tempered glass lens assembly - GREY	SJ10A	9305884	5107021
Vandal shield – Wire Guard	SJ10B	*future item*	*future item*
Vandal shield - Polycarbonate	SJ10C	9305270	5106595
Visor – Aluminum, Top & two side	SJ10D	9305284	5106597

FLOODLIGHT ACCESSORIES AND REPLACEMENT PARTS
GE LIGHTING SYSTEMS – PF154 FLOODLIGHT LUMINAIRES

	STD ITEM	SAP ITEM ID	PS ITEM ID
Front door and tempered glass lens assembly - GREY	SJ11A	*future item*	*future item*
Vandal shield – Wire Guard	SJ11B	*future item*	*future item*
Vandal shield - Polycarbonate	SJ11C	*future item*	*future item*
Visor – Aluminum, Top & two side	SJ11D	*future item*	*future item*

FLOODLIGHT ACCESSORIES AND REPLACEMENT PARTS
GE LIGHTING SYSTEMS – PF400 FLOODLIGHT LUMINAIRES

	STD ITEM	SAP ITEM ID	PS ITEM ID
Front door and tempered glass lens assembly - GREY	SJ12A	9309599	5820905
Vandal shield – Wire Guard	SJ12B	*future item*	*future item*
Vandal shield - Polycarbonate	SJ12C	9317662	5825811
Visor – Aluminum, Top & two side	SJ12D	9317640	5825814

FLOODLIGHT ACCESSORIES AND REPLACEMENT PARTS
GE LIGHTING SYSTEMS – PF1000 FLOODLIGHT LUMINAIRES

	STD ITEM	SAP ITEM ID	PS ITEM ID
Front door and tempered glass lens assembly - GREY	SJ13A	*future item*	*future item*
Vandal shield – Wire Guard	SJ13B	*future item*	*future item*
Vandal shield - Polycarbonate	SJ13C	*future item*	*future item*
Visor – Aluminum, Top & two side	SJ13D	*future item*	*future item*

FLOODLIGHT ACCESSORIES AND REPLACEMENT PARTS
COOPER LIGHTING – CFB FLOODLIGHT LUMINAIRES

	STD ITEM	SAP ITEM ID	PS ITEM ID
Front door and tempered glass lens assembly - GREY	SJ20A	9306324	9201363
Vandal shield – Wire Guard	SJ20B	9306326	9201361
Vandal shield - Polycarbonate	SJ20C	*future item*	*future item*
Visor – Aluminum, Top & two side	SJ20D	9306325	9201362

FLOODLIGHT ACCESSORIES AND REPLACEMENT PARTS
COOPER LIGHTING – GPF FLOODLIGHT LUMINAIRES

	STD ITEM	SAP ITEM ID	PS ITEM ID
Front door and tempered glass lens assembly - GREY	SJ21A	*future item*	*future item*
Vandal shield – Wire Guard	SJ21B	*future item*	*future item*
Vandal shield - Polycarbonate	SJ21C	*future item*	*future item*
Visor – Aluminum, Top & two side	SJ21D	*future item*	*future item*

HORIZONTAL ROADWAY LUMINAIRE
HIGH PRESSURE SODIUM VAPOR – SEMI-CUTOFF

HID, High Pressure Sodium Vapor, 120VAC, IES Medium, Semi-Cutoff, GREY housing, PECR, with 1-1/4" to 2" slip-fitter, In accordance with Material Specification Standard MS-6210.

Note 1: STD ITEM SK03K is a CLOSED OFFERING. Stock is available for maintenance of existing installations only.

Approximate Weight
50w – 150w reactor = 14 pounds
70w – 150w regulated = 30 pounds
250w = 27 pounds
400w = 39 pounds
1,000w = 76 pounds

WATTAGE	BALLAST	IES LIGHT DISTRIBUTION	REFRACTOR	STD ITEM	SAP ITEM ID	PS ITEM ID
50 W	Reactor	Type II	Prismatic Acrylic	SK03A	9309606[E]	5821438[E]
70 W	Reactor	Type II	Prismatic Acrylic	SK03B	9314688	0811068
100 W	Reactor	Type II	Prismatic Acrylic	SK03C	9314705	0811069
150 W	Reactor	Type II	Prismatic Acrylic	SK03D	9314704	0811070
250 W	Regulated	Type III	Prismatic Glass	SK03G	9314703	0811071
400 W	Regulated	Type III	Prismatic Glass	SK03H	9313589	2507400
(see note 1) - 1,000 W	Regulated	Type III	Prismatic Glass	SK03K	9314701	0811073

HORIZONTAL ROADWAY LUMINAIRE
HIGH PRESSURE SODIUM VAPOR – CUTOFF

HID, High Pressure Sodium Vapor, 120VAC, IES Medium, Cutoff, GREY housing, PECR, with 1-1/4" to 2" slip-fitter, In accordance with Material Specification Standard MS-6210.

Approximate Weight
50w – 250w = 30 pounds
400w = 39 pounds

WATTAGE	BALLAST	IES LIGHT DISTRIBUTION	REFRACTOR	STD ITEM	SAP ITEM ID	PS ITEM ID
50 W	Reactor	Type III	Flat Tempered Glass	SK03A1	9309717[E]	5821440[E]
70 W	Reactor	Type III	Flat Tempered Glass	SK03B1	9315139	0810168
100 W	Reactor	Type III	Flat Tempered Glass	SK03C1	9314656	0811065
150 W	Reactor	Type III	Flat Tempered Glass	SK03D1	9314687	0811066
250 W	Regulated	Type III	Flat Tempered Glass	SK03G1	9314706	0811067
400 W	Regulated	Type III	Flat Tempered Glass	SK03H1	9314700	0811074

HORIZONTAL ROADWAY LUMINAIRE
PULSE START METAL HALIDE – SEMI-CUTOFF

HID, Pulse Start Metal Halide, 120VAC, IES Medium, Semi-cutoff, GREY housing, PECR, with 1-1/4" to 2" slip-fitter, In accordance with Material Specification Standard MS-6210.

Approximate Weight
= 39 pounds.

WATTAGE	BALLAST	IES LIGHT DISTRIBUTION	REFRACTOR	STD ITEM	SAP ITEM ID	PS ITEM ID
400W PSMH	Regulated	Type III	Prismatic Glass	SK05H	9306796[Y]	9202148[Y]

HORIZONTAL ROADWAY LUMINAIRE
LIGHT EMITTING DIODE – (LED)

LED, 120-277 VAC, IES type II or III, 4000K LED color temperature, GREY housing, PECR, dimming capable, with 1-1/4" to 2" slip-fitter, In accordance with Material Specification Standard MS-6211.

Approximate Weight
20W – 48W = 12 pounds.
96W = 21 pounds
275W = 30 pounds

IES DISTRIBUTION	MAXIMUM SYSTEM WATTAGE (Watts)	DELIVERED LUMEN OUTPUT RANGE (Lumens)	STD ITEM	SAP ITEM ID	PS ITEM ID
Type II	20	Up to 2,000	SK06A1	9390299	N/A
Type II	25	2,001 – 4,000	SK06A	9389768	N/A
Type II	48	4,001 – 8,000	SK06C	9389795	N/A
Type III	96	8,001 – 14,000	SK06G	9389786	N/A
Type III	210	20,000 – 30,000	SK06H	9389785	N/A

HORIZONTAL ROADWAY LUMINAIRE
HIGH PRESSURE SODIUM VAPOR – CUTOFF – 240 VAC

HID, High Pressure Sodium Vapor, 240VAC – 2-wire source, IES Medium, Cutoff, GREY housing, PECR, with 1-1/4" to 2" slip-fitter, In accordance with Material Specification Standard MS-6210.

(Rhode Island only)

Approximate Weight = 30 pounds

WATTAGE	BALLAST	IES LIGHT DISTRIBUTION	REFRACTOR	STD ITEM	SAP ITEM ID	PS ITEM ID
100W	Reactor	Type III	Flat Tempered Glass	SK10C1	9310320[E]	9201152[E]

HORIZONTAL ROADWAY LUMINAIRE
HIGH PRESSURE SODIUM VAPOR – SEMI-CUTOFF – 240 VAC

HID, High Pressure Sodium Vapor, 240VAC – 2-wire source, IES Medium, Semi-cutoff, GREY housing, PECR, with 1-1/4" to 2" slip-fitter, In accordance with Material Specification Standard MS-6210.

(Route 295 – Providence, RI)

Approximate Weight = 30 pounds

WATTAGE	BALLAST	IES LIGHT DISTRIBUTION	REFRACTOR	STD ITEM	SAP ITEM ID	PS ITEM ID
250W	Regulated	Type III	Prismatic Glass	SK10G	9321187	5821524

HORIZONTAL ROADWAY LUMINAIRE
HIGH PRESSURE SODIUM VAPOR – 277 VAC

HID, High Pressure Sodium Vapor, 277VAC – 2-wire source, IES Medium, Semi-cutoff, GREY housing, PECR, with 1-1/4" to 2" slip-fitter, In accordance with Material Specification Standard MS-6210.

Approximate Weight
100w – 250w = 30 pounds
400w = 39 pounds

WATTAGE	BALLAST	IES LIGHT DISTRIBUTION	REFRACTOR	STD ITEM	SAP ITEM ID	PS ITEM ID
100W	Regulated	Type III	Prismatic Acrylic	SK20C	9317388	5821456
150W	Regulated	Type III	Prismatic Acrylic	SK20D	9317387	5821458
250W	Regulated	Type III	Prismatic Glass	SK20G	9317386	5821459
400W	Regulated	Type III	Prismatic Glass	SK20H	9309716	5821460

HORIZONTAL ROADWAY LUMINAIRE

Replacement semi-cutoff refractors

FOR USE ON:	MATERIAL	STD ITEM	SAP ITEM ID	PS ITEM ID
GE Lighting Systems - 50w – 175 Cooper Lighting - 50w – 175w American Electric – 50w – 175w	Prismatic Polycarbonate	SK50A1	9309719	5822031
GE Lighting Systems - 250w with small housing Cooper Lighting 250w – 400w American Electric 250w with small housing.	Prismatic Glass	SK50A2	9312417	2501851
GE Lighting Systems – older 250w & 400w w/large housing.	Prismatic Glass	SK50B1	9321181	5822063
GE Lighting Systems – new 400w American Electric – 400w	Prismatic Glass	SK50B2	9311685	2501861

HORIZONTAL ROADWAY LUMINAIRE

Replacement cutoff flat glass lens

FOR USE ON:	MATERIAL	STD ITEM	SAP ITEM ID	PS ITEM ID
GE Lighting Systems - 50w – 250w Cooper Lighting - 50w – 400w American Electric – 50w – 250w	Flat Tempered Glass	SK60A3	9321183	5822033
GE Lighting Systems - 400w w/ older style housing	Flat Tempered Glass	SK60B3	9301993	5106589
GE Lighting Systems – 400w w/ new style housing American Electric – 400w	Flat Tempered Glass	SK60B4	9305268	5106594

HORIZONTAL ROADWAY LUMINAIRE

360 degree external light trespass shield, aluminum, for use only with GE cutoff (flat glass lens) luminaires

FOR USE ON:	STD ITEM	SAP ITEM ID	PS ITEM ID
GE Lighting Systems – 50w. – 250w.	SK70	9305285	5106596

HORIZONTAL ROADWAY LUMINAIRE

Replacement Bird Guard – Black Plastic

FOR USE ON:	STD ITEM	SAP ITEM ID	PS ITEM ID
GE Lighting Systems – 50 W – 400 W	SK71	9311074	9201338

HORIZONTAL ROADWAY LUMINAIRE

Replacement capacitors – for use *ONLY* on GE Lighting Systems HPS horizontal roadway luminaires.

FOR USE ON:	STD ITEM	SAP ITEM ID	PS ITEM ID
GE Lighting Systems – 250 W Roadway Luminaires 28uf 330VAC, 50/60hZ	SK80A	9311090	9201339
GE Lighting Systems – 400 W Roadway Luminaires 48uf 280VAC, 50/60hZ – 2” round	SK80B	9387158	none

***"EDISON"* POST TOP LUMINAIRE**

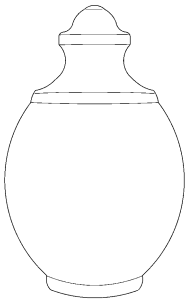
120VAC, IES long, non-cutoff, Type III when used with internal glass refractor, Type V when used without internal glass refractor, style 118 polycarbonate globe – 9-1/8" diameter neck, PEC receptacle. In accordance with Material Specification Standard MS-6242.

Approximate Weight = 20 pounds

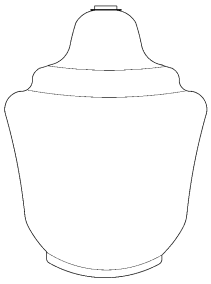
WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
70w HPS	Regulated	BLACK	SL11B	9315326[Y]	0808433[Y]
70w HPS	Regulated	GREEN	SL11B1	9315354[Y]	0805144[Y]
100w HPS	Regulated	BLACK	SL11C	9315065	0807412
100w HPS	Regulated	GREEN	SL11C1	9315253[Y]	0805145[Y]
150w HPS	Regulated	BLACK	SL11D	9315138	0810172
150w HPS	Regulated	GREEN	SL11D1	9307829	9202307

***"EDISON"* POST TOP LUMINAIRE – REPLACEMENT GLOBES**

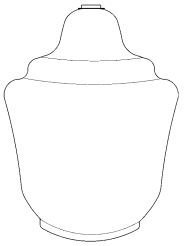
Polycarbonate replacement globe for use only with "Edison" post top luminaires.



Style 118



Style 107



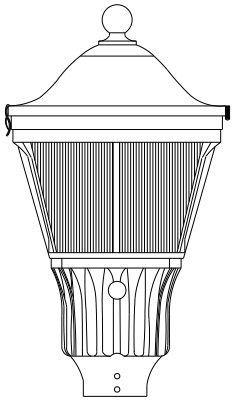
Style 109

		STD ITEM	SAP ITEM ID	PS ITEM ID
	Style 118 – 9-1/8" diameter neck	SL10Z1	9317628	5821156
	Style 107 – 9-1/8" diameter neck	SL10Z2	9317627[E]	5821157[E]
	Style 109 – 8-3/16" diameter neck	SL10Z3	9312539[Y]	2501254[Y]

"ASPEN GROVE" POST TOP LUMINAIRE HIGH INTENSITY DISCHARGE – (HID)

120VAC, IES medium, cutoff, Type III, glass refractive globe, ball finial, PEC receptacle. In accordance with Material Specification Standard MS-6252.

Approximate Weight = 47 pounds.

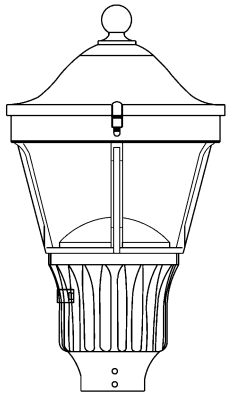


WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
50w HPS	Regulated	BLACK	SL16A	9307941[E]	9202342[E]
70w HPS	Regulated	BLACK	SL16B	9311850[Y]	2507080[Y]
100w HPS	Regulated	BLACK	SL16C	9311849	2507081
100w HPS	Regulated	GREEN	SL16C1	9308360[Y]	9201746[Y]
150w HPS	Regulated	BLACK	SL16D	9311848[Y]	2507082[Y]
175w PSMH	Regulated	BLACK	SL18E	9306725[Y]	9202129[Y]

"ASPEN GROVE" POST TOP LUMINAIRE LIGHT EMITTING DIODE – (LED)

LED, 120-277 VAC, 4000K LED color temperature, PECR, dimming capable, in accordance with Material Specification Standard MS-6260.

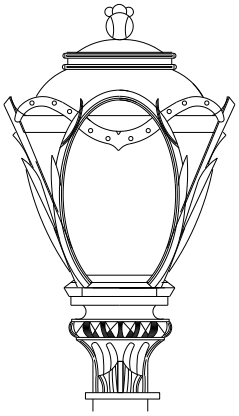
Approximate Weight = 39 pounds.



HOUSING COLOR	IES DISTRIBUTION	SYSTEM WATTAGE (Maximum)	DELIVERED LUMEN OUTPUT (Minimum)	STD ITEM	SAP ITEM ID
Black	Type III	60 watts ± 10%	5,000 Lumens ± 10%	SL19C	*future item*

"CENTRAL PARK" **POST TOP LUMINAIRE**

120VAC, IES non-cutoff, Type III, acrylic globe, PEC Receptacle. In accordance with Material Specification Standard MS-6254.



Approximate Weight = 35 pounds.

Note 1: STD item SL23F is manufactured by Sentry Electric. It is intended to be used as a maintenance item where existing Sentry "Central Park" luminaires are already in service.

	WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
	100w HPS	Regulated	BLACK	SL21C	9311591[Y]	2501666[Y]
	175w PSMH	Regulated	BLACK	SL23E	9306724[Y]	9202130[Y]
See Note 1	175W PSMH	Regulated	BLACK	SL23F	9390968[Y]	N/A

"COACH LAMP" **POST TOP LUMINAIRE**

120VAC, IES medium, cutoff, Type III, clear acrylic side panels, PEC receptacle, with chimney and non-functional decorative ladder rest. In accordance with Material Specification Standard MS-6243.

Approximate Weight
= 18 pounds.

WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
70w HPS	Reactor	BLACK	SL26B	9311851[Y]	2507078[Y]
100w HPS	Reactor	BLACK	SL26C	9311846[Y]	2507101[Y]
150w HPS	Reactor	BLACK	SL26D	9313595[Y]	2507166[Y]

***"CONTEMPORARY"* POST TOP LUMINAIRE**

120VAC, IES medium, non-cutoff, Type III, acrylic refractor, PEC receptacle. In accordance with Material Specification Standard MS-6241.

Note 1: STD ITEM SL31 luminaires are a CLOSED OFFERING. Remaining stock is available for maintenance of existing installations only.

Approximate Weight = 21 pounds.

	WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
(see notes 1) -	70w HPS	Regulated	GREY	SL31B	9311852[Y]	2507075[Y]
(see note 1) -	100w HPS	Reactor	GREY	SL31C	9314673	0811059
(see note 1) -	100w HPS	Reactor	BLACK	SL31C1	9317385[E]	5821464[E]
(see note 1) -	150w HPS	Reactor	GREY	SL31D	9313594[Y]	2507167[Y]
Replacement acrylic refractor for GE "Post Mount"				SL30Z1	9311626	2501803

"TRADITIONAL" **POST TOP LUMINAIRE**

120VAC, IES medium, semi-cutoff, Type III, acrylic refractive side panels, PEC receptacle. In accordance with Material Specification Standard MS-6240.

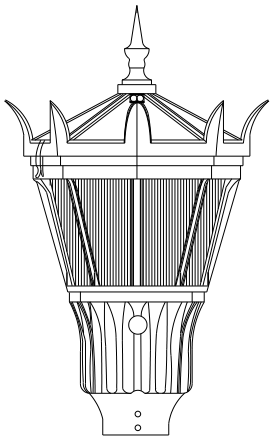
Approximate Weight
= 16 pounds.

WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
50w HPS	Reactor	BLACK	SL41A	9309715[E]	5821461[E]
70w HPS	Reactor	BLACK	SL41B	9314889	0811078
100w HPS	Reactor	BLACK	SL41C	9314696	0811079
150w HPS	Reactor	BLACK	SL41D	9313592[Y]	2507169[Y]
Replacement acrylic refractor for GE "Town & Country"			SL40Z1	9311608	2501807
Replacement acrylic lens panel for American Electric "American Revolution"			SL40Z2	9305867	5107019
Replacement acrylic lens panel for Cooper "Lexington"			SL40Z3	9305882	5107020

"EDGEWATER" **POST TOP LUMINAIRE**

120VAC, IES cutoff, Type III, acrylic panels, spike finial, 8-side spurs, PEC receptacle. In accordance with Material Specification Standard MS-6251.

Approximate Weight = 48 pounds.



WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
100w HPS	Regulated	BLACK	SL46C	9311794[Y]	2507055[Y]
100w HPS	Regulated	GREEN	SL46C1	9388915[Y]	*none*
150w HPS	Regulated	BLACK	SL46D	9311841[Y]	2507110[Y]
175w PSMH	Regulated	BLACK	SL48E	9306726[Y]	9202128[Y]
175w PSMH	Regulated	GREEN	SL48E1	9306727[Y]	9202127[Y]

"WILLIAMSVILLE" POST TOP LUMINAIRE
HIGH INTENSITY DISCHARGE – (HID)

120VAC, IES medium, cutoff, Type II, glass refractive globe, PEC receptacle. Clear finial, no decorative options. In accordance with Material Specification Standard MS-6250.

Approximate Weight = 48 pounds.

WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
50w HPS	Regulated	BLACK	SL51A	9307958[E]	9202343[E]
50w HPS	Regulated	GREEN	SL51A1	9308014[E]	9202518[E]
70w HPS	Regulated	BLACK	SL51B	9314540	0810945
70w HPS	Regulated	GREEN	SL51B1	9314097[Y]	0810601[Y]
100w HPS	Regulated	BLACK	SL51C	9314457	0810946
100w HPS	Regulated	GREEN	SL51C1	9306445	9201812
150w HPS	Regulated	BLACK	SL51D	9314434	0810947
150w HPS	Regulated	GREEN	SL51D1	9306444[Y]	9201813[Y]
175w PSMH	Regulated	BLACK	SL53E	9306700	9202134
175w PSMH	Regulated	GREEN	SL53E1	9306722[Y]	9202132[Y]

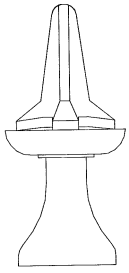
"WILLIAMSVILLE" POST TOP LUMINAIRE
LIGHT EMITTING DIODE – (LED)

LED, 120-277 VAC, 4000K LED color temperature, PECR, dimming capable, in accordance with Material Specification Standard MS-6260.

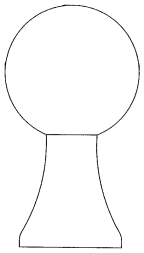
Approximate Weight = 47 pounds.

COLOR	IES DISTRIBUTION	SYSTEM WATTAGE (Maximum)	DELIVERED LUMEN OUTPUT (Minimum)	STD ITEM	SAP ITEM ID
Black	Type III	60 watts ± 10%	5,000 Lumens ± 10%	SL54C	*future item*
Green	Type III	60 watts ± 10%	5,000 Lumens ± 10%	SL54C1	*future item*

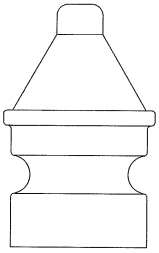
"WILLIAMSVILLE" **POST TOP LUMINAIRE – ACCESSORIES & REPLACEMENT PARTS**



"Standard" Finial



"Ball" Finial



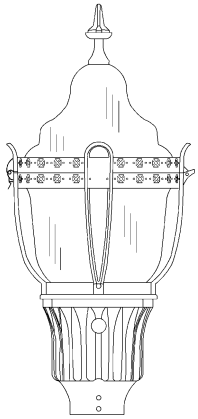
"Pawn" Finial

	STD ITEM	SAP ITEM ID	PS ITEM ID
"Standard" (Spike) style replacement Finial - BLACK	SL50X2	9386527[Y]	9203018[Y]
"Standard" (Spike) style replacement Finial - GREEN	SL50X3	9386543[Y]	9203015[Y]
"Ball" style replacement Finial - GREEN	SL50X5	9386541[Y]	9203016[Y]
"Pawn" style replacement Finial - GREEN	SL50X6	9386526[Y]	9203017[Y]
House Side Glare Shield – Fits old style Williamsville w/ non-cutoff optics – 120 degree - solid	SL50Y1	9321937	9202606
House Side Glare Shield – Fits new style Williamsville w/ cutoff optics – 120 degree - solid	SL50Y2	9308017	9202994
Replacement Glass Globe w/ cutoff optics & clear acrylic replaceable finial	SL50Z1	9386532	9203013
Replacement Glass Globe w/ non-cutoff optics & clear acrylic replaceable finial	SL50Z2	9386533[Y]	9203014[Y]
Replacement Glass Globe w/ non-cutoff optics & no finial	SL50Z3	9386531[Y]	9203012[Y]

"FRANKLIN SQUARE" **POST TOP LUMINAIRE**

120VAC, IES medium, cutoff, Type III, glass refractive globe, PEC receptacle. with decorative finial, ribs and bands. In accordance with Material Specification Standard MS-6256.

Note 1: STD Item SL56, SL57, & SL58 luminaires are a CLOSED OFFERING. Stock is available for maintenance of existing installations only.



Approximate Weight = 48 pounds.

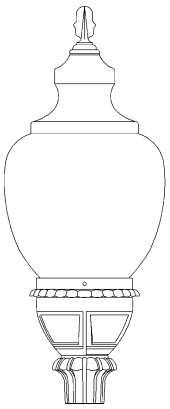
	WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
(see note 1) -	100w HPS	Regulated	BLACK	SL56C	9308355[Y]	9201752[Y]
(see note 1) -	100w HPS	Regulated	GREEN	SL56C1	9308354[Y]	9201754[Y]
(see note 1) -	150w HPS	Regulated	BLACK	SL56D	9308353[Y]	9201755[Y]
(see note 1) -	150w HPS	Regulated	GREEN	SL56D1	9308352[Y]	9201756[Y]
(see note 1) -	175w PSMH	Regulated	BLACK	SL58E	9306723[Y]	9202131[Y]
(see note 1) -	175w PSMH	Regulated	GREEN	SL58E1	9306721[Y]	9202133[Y]
Replacement Glass Globe with BLACK finial				SL55Z1	9314099[Y]	0810593[Y]
Replacement Glass Globe with GREEN finial				SL55Z2	9314136[Y]	0810723[Y]

"LITTLE FALLS" **POST TOP LUMINAIRE**

120VAC, IES non-cutoff, Type V, acrylic globe, PEC °receptacle. In accordance with Material Specification Standard MS-6253.

Note 1: STD Item SL60 is a CLOSED OFFERING. Stock is available for maintenance of existing installations only.

Approximate Weight = 50 pounds.

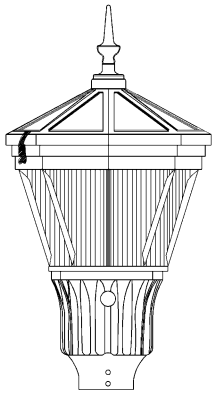


	WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
(see note 1) -	70w HPS	Reactor	GREEN	SL60B1	9306619[Y]	9201722[Y]

"UNIVERSITY" **POST TOP LUMINAIRE**

120VAC, IES cutoff, Type III, glass refractive globe, spike finial, PEC receptacle. In accordance with Material Specification Standard MS-6255.

Approximate Weight = 48 pounds.



WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
150w HPS	Regulated	GREEN	SL66D1	9308361[Y]	9201745[Y]

"CARRIAGE" **POST TOP LUMINAIRE**
HIGH INTENSITY DISCHARGE – (HID)

120VAC, IES cutoff, Type II, flat glass upper lens, no side panels, PEC receptacle. In accordance with Material Specification Standard MS-6244.

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Approximate Weight = 18 pounds.

WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
70w HPS	Reactor	BLACK	SL75B	*future item*	*none*
150w HPS	Reactor	BLACK	SL75D	*future item*	*none*

"CARRIAGE" **POST TOP LUMINAIRE**
LIGHT EMITTING DIODE – (LED)

LED, 120-277 VAC, 3,000K LED color temperature, PECR, dimming capable, in accordance with Material Specification Standard MS-6260.

Approximate Weight = 27 pounds.

HOUSING COLOR	IES DISTRIBUTION	SYSTEM WATTAGE (Maximum)	DELIVERED LUMEN OUTPUT (Minimum)	STD ITEM	SAP ITEM ID
BLACK	Type III	35 watts	2,001 – 4,000	SL76A	9393099 Y
BLACK	Type III	66 watts	4,001 – 8,000	SL76B	9393100 Y
BLACK	Type III	50 watts	5,000 Lumens ± 10%	SL76C	9390330 E

"HIGHLAND PARK" POST TOP LUMINAIRE LIGHT EMITTING DIODE – (LED)

LED, 120 – 277 VAC, 3,000K LED color temperature, semi cutoff, IES Type III, optical acrylic, ball finial, NEMA 7 pin PEC receptacle, dimming capable. In accordance with Material Specification Standard MS-6263.

Approximate Weight = 34 pounds.

HOUSING COLOR	IES DISTRIBUTION	SYSTEM WATTAGE (Maximum)	DELIVERED LUMEN OUTPUT (Minimum)	STD ITEM	SAP ITEM ID
BLACK	III	30 w LED	2,001 – 4,000	SL80AB	9393060 [Y]
GREEN	III	30 w LED	2,001 – 4,000	SL80AG	9393065 [Y]
BLACK	III	65 w LED	4,001 – 8,000	SL80BB	9393066 [Y]
GREEN	III	65 w LED	4,001 – 8,000	SL80BG	9393067 [Y]

"PRINCETON" POST TOP LUMINAIRE LIGHT EMITTING DIODE – (LED)

LED, 120 277 VAC, 3,000K LED color temperature, semi cutoff, IES Type III, prismatic acrylic, spike finial, PEC receptacle, dimming capable. In accordance with Material Specification Standard MS-6262

Approximate Weight = 34 pounds.

HOUSING COLOR	IES DISTRIBUTION	SYSTEM WATTAGE (Maximum)	DELIVERED LUMEN OUTPUT (Minimum)	STD ITEM ID	SAP ITEM ID
BLACK	III	30 w LED	2,001 – 4,000	SL85AB	9393073 [Y]
GREEN	III	30 w LED	2,001 – 4,000	SL85AG	9393101 [Y]
BLACK	III	65 w LED	4,001 – 8,000	SL85BB	9393074 [Y]
GREEN	III	65 w LED	4,001 – 8,000	SL85BG	9393075 [Y]

"OXFORD" **POST TOP LUMINAIRE**
LIGHT EMITTING DIODE – (LED)

LED, 120 – 277 VAC, 3,000K LED color temperature, no cutoff, IES Type III, prismatic acrylic, PEC receptacle, dimming capable . In accordance with Material Specification Standard MS-6261.

Approximate Weight = 16 pounds.

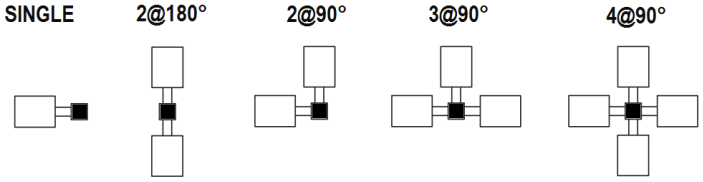
HOUSING COLOR	IES DISTRIBUTION	SYSTEM WATTAGE (Maximum)	DELIVERED LUMEN OUTPUT (Minimum)	STD ITEM	SAP ITEM ID
BLACK	III	29 w LED	2,001 – 4,000	SL90AB	9393068 [Y]
GREEN	III	29 w LED	2,001 – 4,000	SL90AG	9393069 [Y]
BLACK	III	57 w LED	4,001 – 8,000	SL90BB	9393070 [Y]
GREEN	III	57 w LED	4,001 – 8,000	SL90BG	9393028 [Y]

SHOEBOX ROADWAY LUMINAIRE

120VAC, IES medium, cutoff, Type III, PECR, bracket mount, in accordance with Material Specification standard MS-6280.

For use only with 16' or 25' architectural (square) aluminum poles. - (STD ITEM SU01)

Installation Options (Plan View)



Approximate Weight = 45 pounds each

WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
100w HPS	Regulated	BRONZE	SM03C	9315064[Y]	0807463[Y]
150w HPS	Regulated	BRONZE	SM03D	9312005[Y]	2507156[Y]
250w HPS	Regulated	BRONZE	SM03G	9313587[Y]	2507403[Y]
400w HPS	Regulated	BRONZE	SM03H	9315034[Y]	2507401[Y]

SHOEBOX ROADWAY LUMINAIRE

120VAC, IES medium, cutoff, Type III, PECR, horizontal pipe tenon mount. Compact housing. In accordance with Material Specification standard MS-6280.

For use only with 24' architectural (square) fiberglass, embedded pole and tenon adapter (STD ITEM SU02).

Approximate Weight = 34 pounds.

WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
70w HPS	Reactor	BRONZE	SM03B1	9305901[E]	5107024[E]
100w HPS	Reactor	BRONZE	SM03C1	9305885[E]	5107025[E]

ARBORDALE (SHOEBOX) ROADWAY LUMINAIRE
LIGHT EMITTING DIODE – (LED)

LED, 120 – 2777 VAC, 3,000K LED color temperature, full cutoff, IES Type III, NEMA 7 pin PECR, dimming capable, standard arm mount. bronze housing. In accordance with Material Specification standard MS-6281.

Approximate Weight = 20 pounds.

HOUSING COLOR	IES DISTRIBUTION	SYSTEM WATTAGE (Maximum)	DELIVERED LUMEN OUTPUT (Minimum)	STD ITEM	SAP ITEM ID
BRONZE	III	53 w LED	4,001 – 8,000	SM05B	9393095 [Y]
BRONZE	III	91 w LED	8,001 – 14,000	SM05C	9393096 [Y]
BRONZE	III	132 w LED	14,001 – 20,000	SM05D	9393097 [Y]
BRONZE	III	177 w LED	20,001 – 30,000	SM05E	9393098 [Y]

"DELAWARE PARK" **ROADWAY TEARDROP LUMINAIRE**

120VAC, IES short, cutoff, Type III, glass refractor, PECR, with leveling arm fitter. For use in roadway illumination applications. In accordance with Material Specification Standard MS-6270.

(Leveling arm fitter not shown)

Approximate Weight = 67 pounds.

WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID	
150w HPS	Regulated	BLACK	SP10D	9314179	0810914	
250w HPS	Regulated	BLACK	SP10G	9314178	0810915	➘
250w HPS	Regulated	GREEN	SP10G1	9311677[Y]	9202582[Y]	➘
400w HPS	Regulated	BLACK	SP10H	9314177	0810916	
400w HPS	Regulated	GREEN	SP10H1	9311686	9202581	➘
175w PSMH	Regulated	BLACK	SP12E	9306699[Y]	9202135[Y]	➘
250w PSMH	Regulated	BLACK	SP12G	9306681[Y]	9202141[Y]	
250w PSMH	Regulated	GREEN	SP12G1	9306682[Y]	9202140[Y]	
400w PSMH	Regulated	BLACK	SP12H	9306675	9202139	➘

"DELAWARE PARK" **ROADWAY TEARDROP LUMINAIRE – ACCESSORIES AND REPLACEMENT PARTS**

	STD ITEM	SAP ITEM ID	PS ITEM ID
Replacement ballast assembly – Holophane, 150w HPS, 120VAC	SP10W1	9388816[Y]	*none*
Replacement ballast assembly – Holophane, 250w HPS, 120 VAC	SP10W2	9388806[Y]	*none*
Replacement ballast assembly – Holophane, 400w HPS, 120 VAC	SP10W3	9388744[Y]	*none*
Replacement ballast assembly – King – 150w HPS, 120 VAC	SP10Y1	9388828[Y]	*none*
Replacement ballast assembly – King – 250w HPS, 120 VAC	SP10Y2	9388830[Y]	*none*
Replacement ballast assembly – King – 400w HPS, 120 VAC	SP10Y3	9388831[Y]	*none*
Replacement ring & glass globe – Holophane "Esplanade"	SP10Z1	*future item*[Y]	*none*
Replacement ring & glass globe – King "K804" Teardrop	SP10Z2	9311083[Y]	9201348[Y]

"DELAWARE PARK" **PEDESTRIAN TEARDROP LUMINAIRE**

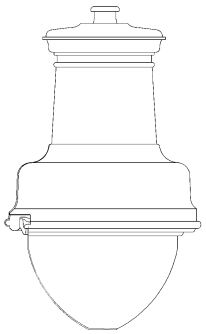
120VAC, IES short, cutoff, Type III, glass refractor, PECR, with leveling arm fitter. (Smaller version of roadway teardrop luminaire for use in pedestrian illumination applications only.- sidewalks, etc.) In accordance with Material Specification Standard MS-6270.

(Leveling arm fitter not shown)

Approximate Weight = 45 pounds.

WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
70w HPS	Regulated	BLACK	SP15B	9307266[Y]	9200135[Y]
100w HPS	Regulated	BLACK	SP15C	9307265[Y]	9200136[Y]
175w PSMH	Regulated	BLACK	SP17E	9306698[Y]	9202136[Y]

"LITTLE FALLS" **PEDESTRIAN TEARDROP LUMINAIRE**



120VAC, IES short, cutoff, Type V, acrylic refractor, no PEC. For use only with Little Falls teardrop pole and Bishop Crook style arm. In accordance with Material Specification Standard MS-6270.

Note 1: - STD Item SP20 luminaire is a CLOSED OFFERING. Stock is available for maintenance of existing installations only.

Approximate Weight = 30 pounds.

	WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
(see note 1) -	70w HPS	Reactor	GREEN	SP20B1	9306641[Y]	9201720[Y]

"WESTMINSTER" **TEARDROP LUMINAIRE**
LIGHT EMITTING DIODE – (LED)

LED, 120 – 277 VAC, 3,000 K LED color temperature, semi cutoff, IES Type III, prismatic glass, prepared for external NEMA 7 pin PEC. In accordance with Material Specification Standard MS-6264.

Approximate Weight = 60 pounds.

HOUSING COLOR	IES DISTRIBUTION	SYSTEM WATTAGE (Maximum)	DELIVERED LUMEN OUTPUT (Minimum)	STD ITEM	SAP ITEM ID
BLACK	III	84 w LED	8,001 – 14,000	SP30CB	9393103 [Y]
GREEN	III	84 w LED	8,001 – 14,000	SP30CG	9393104 [Y]
BLACK	III	141 w LED	14,001 – 20,000	SP30DB	9393105 [Y]
GREEN	III	141 w LED	14,001 – 20,000	SP30DG	9393106 [Y]
BLACK	III	243 w LED	20,001 – 30,000	SP30GB	9393107 [Y]
GREEN	III	243 w LED	20,001 – 30,000	SP30GG	9393108 [Y]

"WESTMINSTER" **PEDESTRIAN TEARDROP LUMINAIRE**
LIGHT EMITTING DIODE – (LED)

LED, 120 – 277 VAC, 3,000 K LED color temperature, semi cutoff, IES Type III, prismatic glass, prepared for external NEMA 7 pin PEC. In accordance with Material Specification Standard MS-6264.

Approximate Weight = 45 pounds.

HOUSING COLOR	IES DISTRIBUTION	SYSTEM WATTAGE (Maximum)	DELIVERED LUMEN OUTPUT (Minimum)	STD ITEM	SAP ITEM ID
BLACK	III	28 w LED	2,001 – 4,000	SP35AB	9393109 [Y]
GREEN	III	28 w LED	2,001 – 4,000	SP35AG	9393110 [Y]
BLACK	III	52 w LED	4,001 – 8,000	SP35BB	9393111 [Y]
GREEN	III	52 w LED	4,001 – 8,000	SP35BG	9393112 [Y]

UNDERPASS LUMINAIRE – (WALLMOUNT)

120VAC, IES short, non-cutoff, Type III glass refractor, no PEC .

Approximate Weight = 34 pounds.

WATTAGE	BALLAST	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
100W HPS	Regulated	GREY	SQ03C	9311590[Y]	2501675[Y]
150W HPS	Regulated	GREY	SQ03D	9311589[Y]	2501677[Y]
250W HPS	Regulated	GREY	SQ03G	9314692	0811083

UNDERPASS LUMINAIRE – (WALLMOUNT) ACCESSORY AND REPLACEMENT PARTS – HOLOPHANE *"WALLPACK IV"* LUMINAIRE

	STD ITEM	SAP ITEM ID	PS ITEM ID
Replacement glass refractor	SQ10	9311682[Y]	2501880[Y]
Vandal Shield - Wire guard	SQ11	9311681[Y]	2501881[Y]
Replacement door	SQ12	9311680[Y]	2501882[Y]

LUMINAIRE REPLACEMENT PART – NEMA WATTAGE LABEL

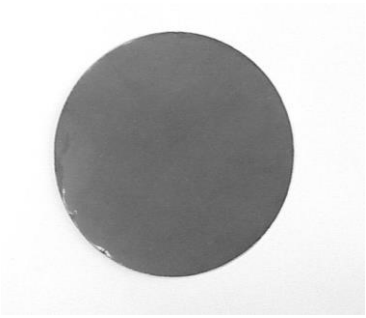
New luminaires have labels factory applied.
Replacement labels are available for maintenance.
Use 1" x 1" size labels for all post top luminaires.
Use 3" x 3" on all other luminaires. In accordance with Material Specification Standard MS-6110.

LAMP WATTAGE	LEGEND	BACKGROUND COLOR	LABEL SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
50w HPS	"5"	Yellow	1" x 1"	SR03A1	9314602	0811044
70w HPS	"7"	Yellow	1" x 1"	SR03B1	9314623	0811045
100w HPS	"10"	Yellow	1" x 1"	SR03C1	9314624	0811046
150w HPS	"15"	Yellow	1" x 1"	SR03D1	9314625	0811047
50w HPS	"5"	Yellow	3" x 3"	SR03A	9314684	0811048
70w HPS	"7"	Yellow	3" x 3"	SR03B	9314683	0811049
100w HPS	"10"	Yellow	3" x 3"	SR03C	9314682	0811050
150w HPS	"15"	Yellow	3" x 3"	SR03D	9314681	0811051
250w HPS	"25"	Yellow	3" x 3"	SR03G	9314680	0811052
400w HPS	"40"	Yellow	3" x 3"	SR03H	9314679	0811053
1,000w HPS	"X1"	Yellow	3" x 3"	SR03K	9314678	0811054
175w MH	"17"	Red	1" x 1"	SR04E1	9314565	0811040
175w MH	"17"	Red	3" x 3"	SR04E	9314640	0811037
250w MH	"25"	Red	3" x 3"	SR04G	9314564	0811041
400w MH	"40"	Red	3" x 3"	SR04H	9314890	0811042
1,000w MH	"X1"	Red	3" x 3"	SR04K	9314563	0811043
175w PSMH	"17"	Red / White	1" x 1"	SR05E1	*future item*	*future item*
175w PSMH	"17"	Red / White	3" x 3"	SR05E	*future item*	*future item*
250w PSMH	"25"	Red / White	3" x 3"	SR05G	*future item*	*future item*
400w PSMH	"40"	Red / White	3" x 3"	SR05H	*future item*	*future item*

LUMINAIRE ACCESSORY –
LUMINAIRE OWNERSHIP LABEL

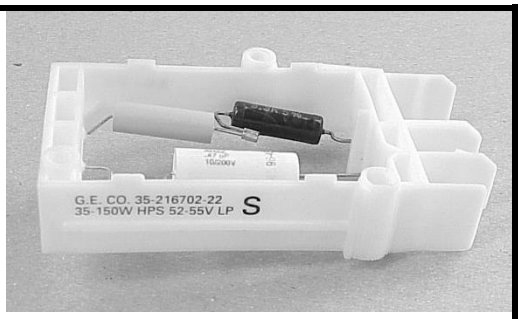
4” circular, reflective, red label. no legend.

Used to identify customer owned luminaire maintained by Massachusetts Electric Company under street lighting rate “S2”.



STD ITEM	SAP ITEM ID	PS ITEM ID
SR11	9317411[E]	5821380[E]

LUMINAIRE REPLACEMENT PART – HPS STARTER – GE LIGHTING SYSTEMS

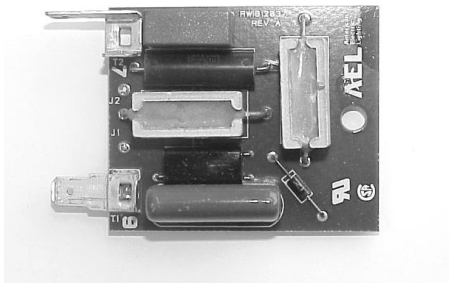


	STD ITEM	SAP ITEM ID	PS ITEM ID
Plug-in replacement for 35w – 150w luminaires	SR20A	9309827	5104839
Plug-in replacement for 250w– 400w luminaires	SR20B	9305283	5106598
Replacement for 100w luminaires - flat board type	SR20D	9312533[Y]	2503036[Y]
Replacement for 35w – 150w luminaires – flat board type	SR20E	9311673	2503013
Replacement for 250w – 400w luminaires	SR20F	9311672[Y]	2503014[Y]
Replacement for 250w – 1,000w luminaires	SR20G	9311671[Y]	2503015[Y]

LUMINAIRE REPLACEMENT PART – HPS STARTER – COOPER LIGHTING

	STD ITEM	SAP ITEM ID	PS ITEM ID
Plug-in replacement for 35w – 150w luminaires – white base	SR21A	9310432	5825826
Plug-in replacement for 250w – 400w luminaires – green base	SR21B	9310428	5825827
Plug-in replacement for 150w– 400w luminaires	SR21C	9311688	2503017

LUMINAIRE REPLACEMENT PART – HPS STARTER – AMERICAN ELECTRIC



	STD ITEM	SAP ITEM ID	PS ITEM ID
Plug-in replacement for 35w – 150w luminaires – 2-wire	SR22A	9311690[Y]	2503018[Y]
Plug-in replacement for 35w – 150w luminaires – 3-wire	SR22B	9314599[Y]	0810845[Y]
Plug-in replacement for 250w – 400w luminaires	SR22C	9312534[Y]	2503030[Y]
Plug-in replacement for 35w – 400w luminaires – DUAL	SR22D	9309746[E]	5825828[E]

LUMINAIRE REPLACEMENT PART – HPS STARTER – HOLOPHANE

	STD ITEM	SAP ITEM ID	PS ITEM ID
Plug-in replacement for 50w – 150w luminaires – (55 volt)	SR23A	9311426	2503310
Plug-in replacement for 250w – 400w luminaires – (100 volt)	SR23B	9308016[Y]	9202995[Y]

LUMINAIRE REPLACEMENT PART – BALLAST ASSEMBLY – HOLOPHANE

Replacement ballast assembly for Holophane Utility Series post top luminaires. Includes PECR and capacitor.

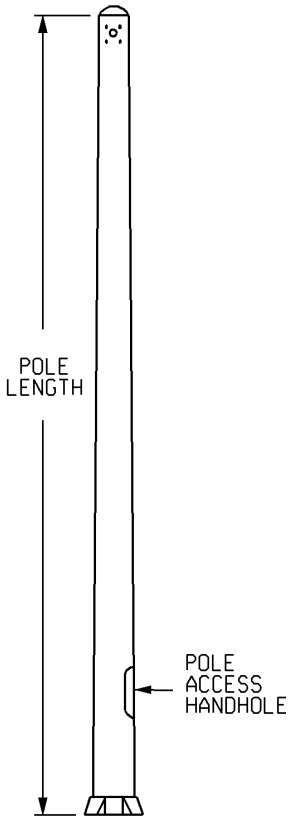
For use only on the following Holophane post top luminaires:
"Aspen Grove"
"Edgewater"
"Williamsville"
"Franklin Square"
"University"

VOLTAGE	WATTAGE	BALLAST	STD ITEM	SAP ITEM ID	PS ITEM ID
120VAC	50w HPS	Regulated	SR30A	9307475[E]	9202913[E]
120VAC	70w HPS	Regulated	SR30B	9306437[Y]	9201822[Y]
120VAC	100w HPS	Regulated	SR30C	9306231	9201823
120VAC	150w HPS	Regulated	SR30D	9306232[Y]	9201824[Y]
120VAC	175w MH	Regulated	SR30E	9306233[Y]	9201825[Y]
120VAC	175w PSMH	Regulated	SR30E1	9307476[Y]	9202912[Y]

POLE – *"PENDANT"* – ALUMINUM – FOR HORIZONTAL ROADWAY LUMINAIRES

Anchor base, 11-1/2" bolt circle using (4)-1" diameter anchor bolts, w/ 4" x 6" handhole, round tapered shaft, satin brushed finish, 6" diameter top, factory drilled for single or twin arm installation. In accordance with Material Specification Standard MS-6710.

Approximate Weight
ST01F = 125 pounds
ST01F1 = 143 pounds
ST01G = 163 pounds
ST01G1 = 178 pounds
ST01H = 255 pounds

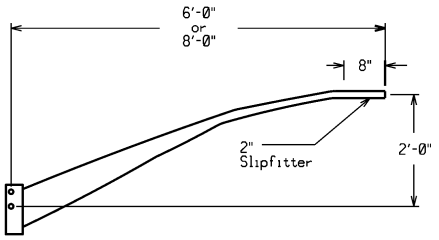


Pole Length	Wall Thickness	Pole Options	STD ITEM	SAP ITEM ID	PS ITEM ID
25'	0.156"		ST01F	9314562	0811022
25'	0.188"	with festoon outlet box & blank cover	ST01F1	9314175	0810919
30'	0.188"		ST01G	9309713[E]	5821833[E]
30'	0.250"	with festoon outlet box & blank cover	ST01G1	9308303[E]	9202005[E]
35'	0.250"		ST01H	9309712[E]	5821834[E]

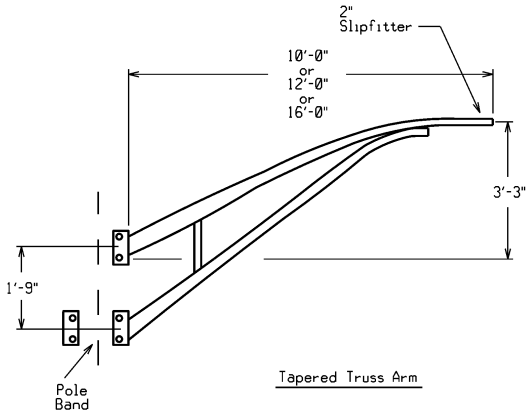
ARM – *"PENDANT"* – ALUMINUM – FOR HORIZONTAL ROADWAY LUMINAIRES

Arm, aluminum, tapered elliptical or tapered truss, for use only with "Pendant" aluminum (STD Item ST01) poles. In accordance with Material Specification Standard MS-6711.

Approximate Weight
ST01X1 = 13 pounds
ST01X2 = 14 pounds
ST01X3 = 23 pounds
ST01X4 = 31 pounds
ST01X5 = 54 pounds



Tapered Elliptical Arm



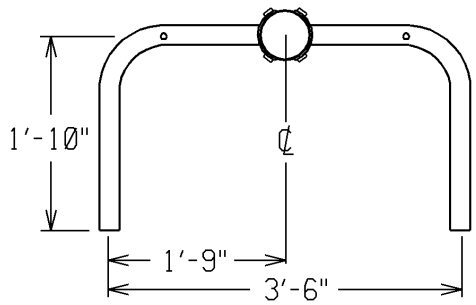
Tapered Truss Arm

	STD ITEM	SAP ITEM ID	PS ITEM ID
6' Arm – Tapered Elliptical – Aluminum	ST01X1	9314579	0811023
8' Arm – Tapered Elliptical – Aluminum	ST01X2	9314891	0811024
10' Arm – Tapered Truss – Aluminum	ST01X3	9314577	0811026
12' Arm – Tapered Truss – Aluminum	ST01X4	9314578	0811025
16' Arm – Tapered Truss – Aluminum	ST01X5	9307867	9202269

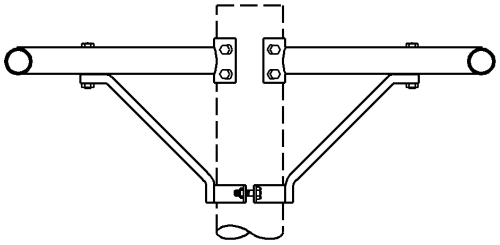
ARM – TWIN PARALLEL – FOR HORIZONTAL ROADWAY LUMINAIRES

Aluminum, Two unit assembly – 2” schedule 40 pipe. Used to parallel mount two horizontal roadway luminaires in the same direction on the same aluminum pendant pole. for use only on “Pendant” aluminum (STD Item ST01) poles with a 6-inch diameter top.

Approximate Weight = 19 pounds.



TOP VIEW



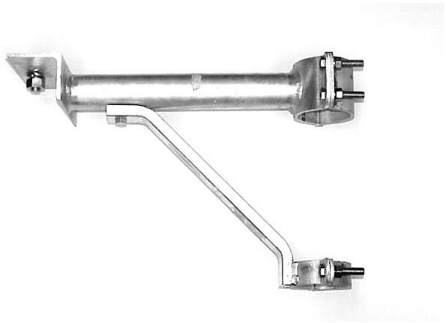
SIDE VIEW

STD ITEM	SAP ITEM ID	PS ITEM ID
ST01X6	9309008[E]	5110828[E]

ARM – FOR FLOODLIGHT LUMINAIRES

Aluminum, 16-inch length, used to mount a single floodlight luminaire on an aluminum pendant pole. for use only on “Pendant” aluminum (STD Item ST01) poles. In accordance with Material Specification Standard MS-6712.

Approximate Weight = 17 pounds.

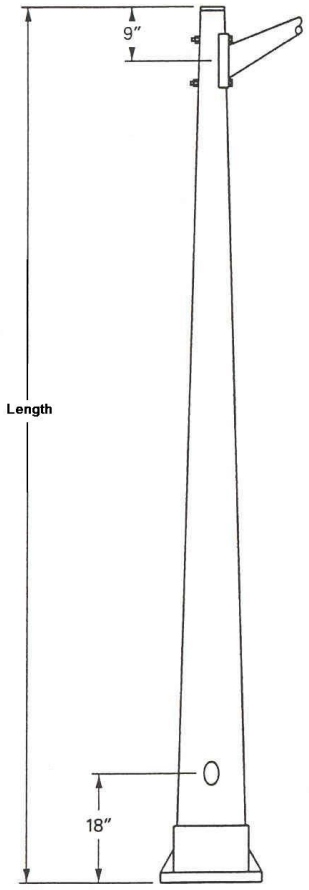


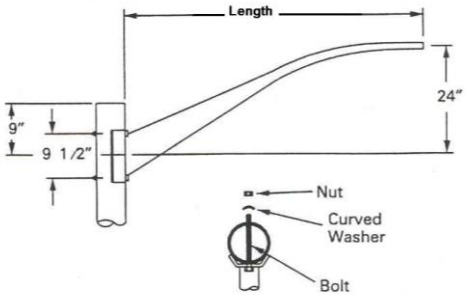
	STD ITEM	SAP ITEM ID	PS ITEM ID
For aluminum poles with a 4-1/2-inch diameter pole top	ST01X7	9309730[E]	5825345[E]
For aluminum poles with a 6-inch diameter pole top	ST01X8	9309731	5825355

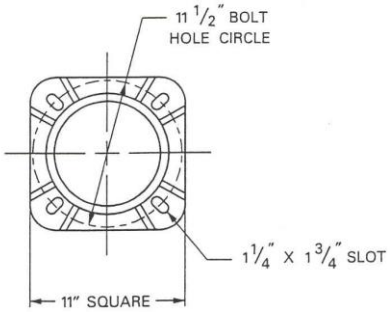
POLE & ARM – *"PENDANT"* – FIBERGLASS – ANCHOR BASE – FOR HORIZONTAL ROADWAY LUMINAIRES

11-1/2" bolt circle using (4)-1" diameter anchor bolts, w/ handhole, round tapered shaft, for single arm installation. In accordance with Material Specification Standards MS-6740.

Approximate Weight
ST02F = 75 pounds
ST02X1 = 10 pounds
ST02X2 = 14 pounds
STo2X3 = 17 pounds







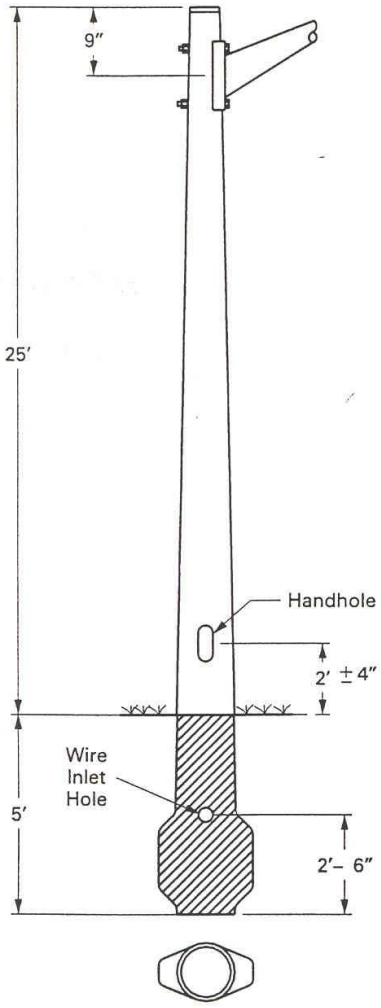
	STD ITEM	SAP ITEM ID	PS ITEM ID
25' Fiberglass Pole – BLACK	ST02F	9308842	5100004
6' Arm – Tapered Elliptical – Aluminum – BLACK	ST02X1	9311773	2505706
8' Arm – Tapered Elliptical – Aluminum – BLACK	ST02X2	9311792[Y]	2505708[Y]
10' Arm – Tapered Truss – Aluminum – BLACK	ST02X3	9311774[Y]	2505710[Y]

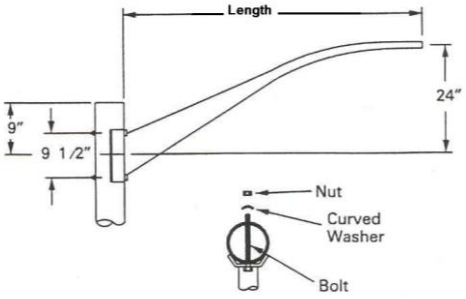
POLE & ARM – *"PENDANT"* – FIBERGLASS – EMBEDDED – FOR HORIZONTAL ROADWAY LUMINAIRES

30' pole length, 25' luminaire mounting height, round tapered pole shaft, for single arm application, includes one 6-foot tapered elliptical BLACK aluminum arm. In accordance with Material Specification Standards MS-6741.

Note: CLOSED OFFERING – Stock is available for maintenance of existing installations only.

Approximate Weight = 77 pounds (pole)



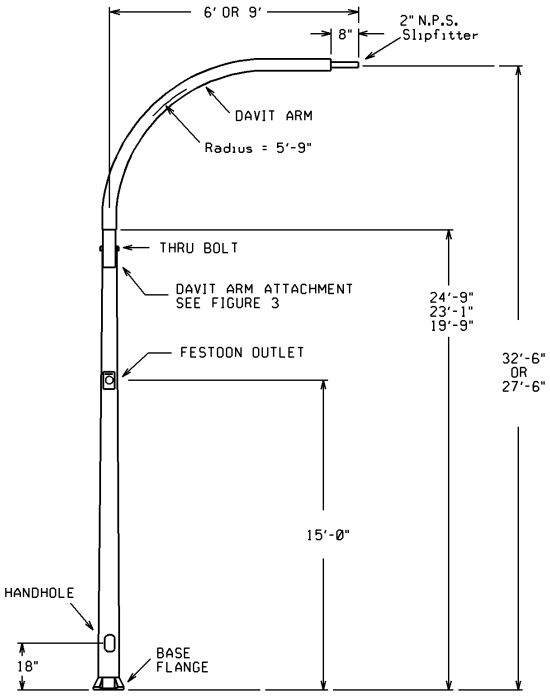


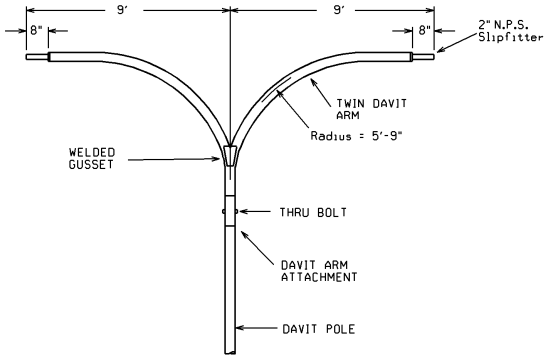
STD ITEM	SAP ITEM ID	PS ITEM ID
ST02F1	9310453[E]	5821830[E]

POLE & ARM – *"DAVIT"* – ALUMINUM – FOR HORIZONTAL ROADWAY LUMINAIRES

Anchor base, 11-1/2" bolt circle using (4)-1" diameter anchor bolts, round tapered shaft, satin brushed finish, for single or twin davit arm installation. In accordance with Material Specification Standards MS-6720.

Approximate Weight
ST04G = 140 pounds
ST04H = 173 pounds
ST04H1 = 162 pounds
ST04X1 = 43 pounds
ST04X3 = 55 pounds
ST04X4 = 82 pounds



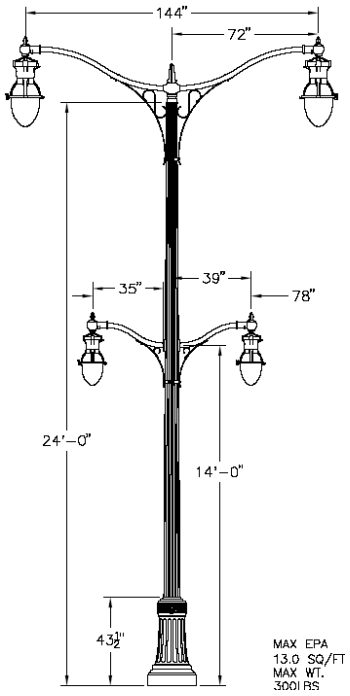


	STD ITEM	SAP ITEM ID	PS ITEM ID
19' Aluminum Pole – for single or twin davit arm – w/ handhole	ST04G	9306991[Y]	9201090[Y]
24' Aluminum Pole – for single or twin davit arm – w/ handhole	ST04H	9312042[Y]	2505533[Y]
23' Aluminum Pole – for single or twin davit arm – w/o handhole	ST04H1	9312023[Y]	2505524[Y]
6' Aluminum single davit arm	ST04X1	9311543[Y]	2505263[Y]
9' Aluminum single davit arm	ST04X3	9315038[Y]	2505191[Y]
9' Aluminum with davit arm	ST04X4	9311508[Y]	2505195[Y]

POLE & ARM – *"NIAGARA"* – FOR TEARDROP LUMINAIRES

Aluminum, 25' length, anchor base, 11-1/2" bolt circle diameter using (4) 1" anchor bolts, 0.188" wall, tapered, fluted, shaft, for use w/ roadway and pedestrian teardrop luminaires.

Approximate Weight
ST08F = 121 pounds
ST08X1 = 100 pounds
ST08X2 = 35 pounds
ST08X3 = 50 pounds
ST08Y = 150 pounds



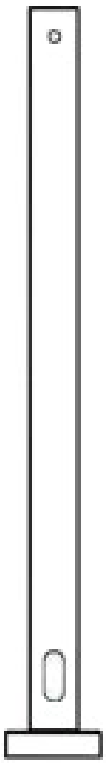
NOTE: Shown with "Delaware Park" roadway and pedestrian teardrop luminaires

	STD ITEM	SAP ITEM ID	PS ITEM ID
25' "Niagara" Aluminum decorative pole - BLACK	ST08F	9310483[Y]	0811226[Y]
6' Arm – aluminum decorative, for single roadway teardrop luminaire - BLACK	ST08X1	9310509[Y]	0811229[Y]
6' Arm – aluminum decorative, for twin roadway teardrop luminaire - BLACK	ST08X2	9310507[Y]	0811230[Y]
3' Arm – aluminum decorative, for single pedestrian teardrop luminaire - BLACK	ST08X3	9310540[Y]	0811228[Y]
Base, decorative, cast aluminum, clamshell design - BLACK	ST08Y	9310541[Y]	0811227[Y]

POLE – *"ARCHITECTURAL"* – ALUMINUM – ANCHOR BASE – FOR SHOEBOX LUMINAIRES

Anchor base, w/ handhole, square, straight shaft, color: BRONZE, for use only with shoebox luminaires (STD ITEM SM03). Both the 16-foot and 25-foot poles support a total of 4 shoebox luminaires. 25-foot pole (STD ITEM SU01F) equipped with factory installed festoon outlet box and blank cover 15-feet above grade.

Approximate Weight
SU01D = 82 pounds
SU01F = 205 pounds

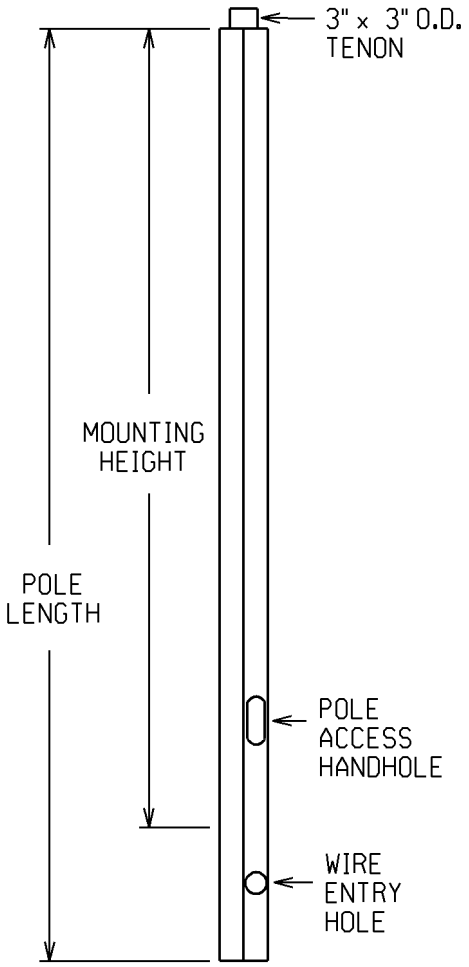


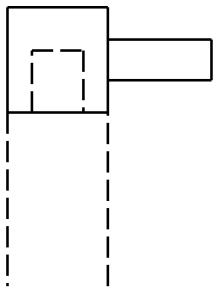
POLE LENGTH	BOLT CIRCLE	STD ITEM	SAP ITEM ID	PS ITEM ID
16-feet	11-1/2-inch	SU01D	9311755[Y]	2505633[Y]
25-feet	15-inch	SU01F	9311756[Y]	2505632[Y]

POLE – *"ARCHITECTURAL"* – FIBERGLASS, – EMBEDDED – FOR SHOEBOX LUMINAIRES

Embedded, w/ handhole, 5-inch x 5-inch, square, straight, shaft, 3" tenon top, color: BRONZE, for use only with pole top tenon adapter and tenon mount rectilinear shoebox luminaires.(STD ITEM SM03B1 or SM03C1).

Approximate Weight = 123 pounds.





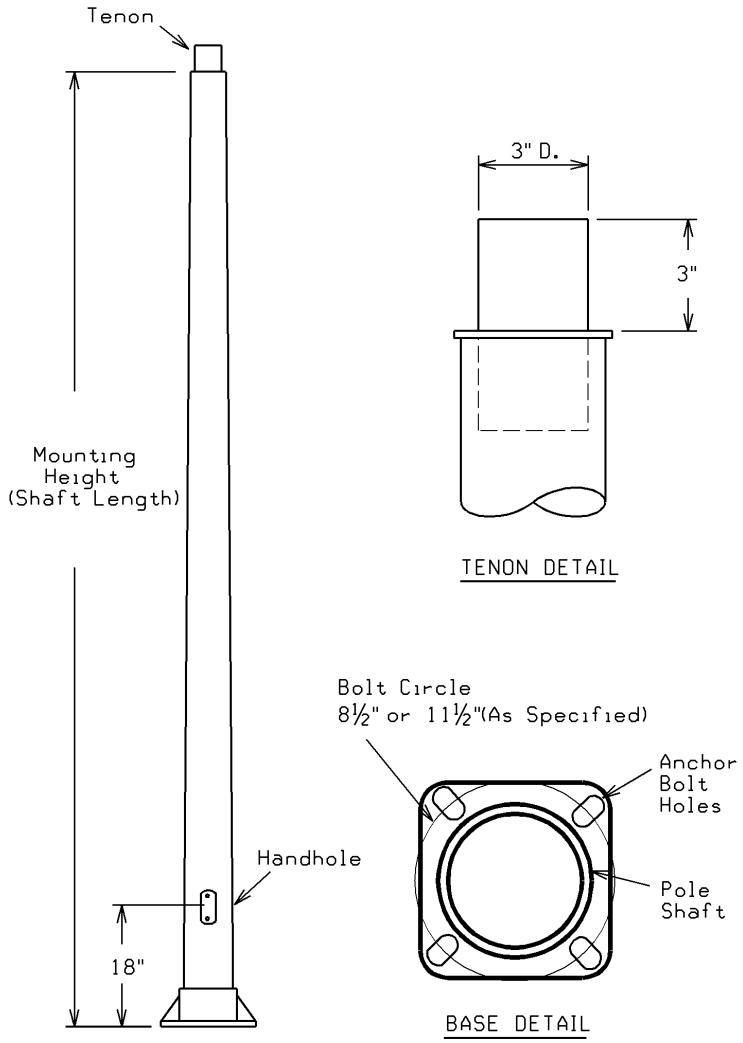
POLE TOP TENON ADAPTER

POLE LENGTH	LUMINAIRE MOUNTING HEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
24-foot	20-foot	SU02E	9301994[E]	5106587[E]
Tenon Mounting Adapter - Aluminum		SU02X	9305282[E]	5106599 [E]

POLE – *"SUBURBAN"* – ROUND, ANCHOR BASE, – FOR POST TOP LUMINAIRES

Fiberglass, anchor base, round, tapered shaft, 3-inch tenon, no festoon outlet, with handhole, In accordance with Material Specification Standard MS-6810.

Approximate Weight
SW01A = 32 pounds
SW01B = 38 pounds
SW01C = 43 pounds
SW01C1 = 32 pounds
SW01D = 48 pounds

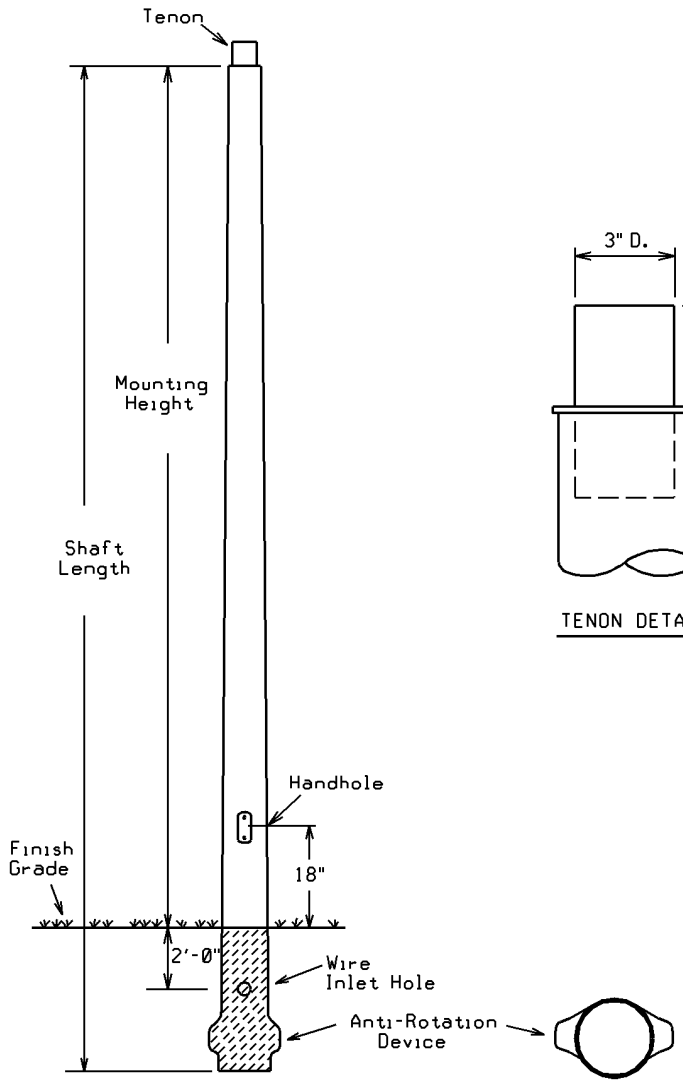


POLE SHAFT LENGTH	BOLT CIRCLE	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
10'	11-1/2"	BLACK	SW01A	9311441[Y]	2505050[Y]
12'	11-1/2"	BLACK	SW01B	9311460[Y]	2505052[Y]
14'	11-1/2"	BLACK	SW01C	9311459[Y]	2505054[Y]
14'	8-1/2"	BLACK	SW01C1	9309196[E]	5100003[E]
16'	11-1/2"	BLACK	SW01D	9311458[Y]	2505056[Y]

POLE – *"SUBURBAN"* – ROUND, EMBEDDED, – FOR POST TOP LUMINAIRES

Fiberglass, embedded, round, tapered shaft, 3-inch tenon, no festoon outlet, with handhole. In accordance with Material Specification Standard MS-6811.

Approximate Weight
SW02A = 24 pounds
SW02B = 28 pounds
SW02C = 34 pounds
SW02D = 38 pounds

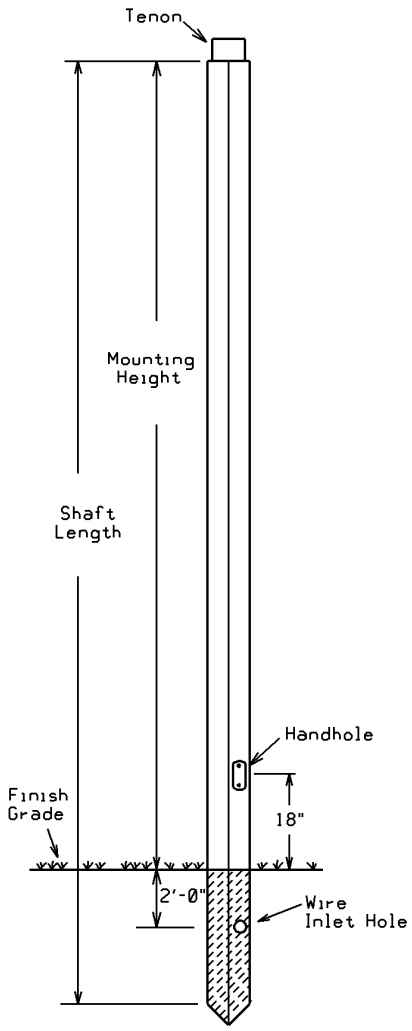


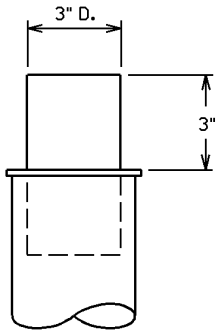
POLE SHAFT LENGTH	LUMINAIRE MOUNTING HEIGHT	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
13'	10'	BLACK	SW02A	9314709[Y]	0809793[Y]
15'	12'	BLACK	SW02B	9315147[Y]	0809791[Y]
18'	14'	BLACK	SW02C	9314220	0809894
20'	16'	BLACK	SW02D	9315146[Y]	0809792[Y]

POLE – *"SUBURBAN"* SQUARE, EMBEDDED, – FOR POST TOP LUMINAIRES

Fiberglass, embedded, square straight shaft, 3-inch tenon, no festoon outlet, with handhole. In accordance with Material Specification Standard MS-6812.

Approximate Weight = 92 pounds





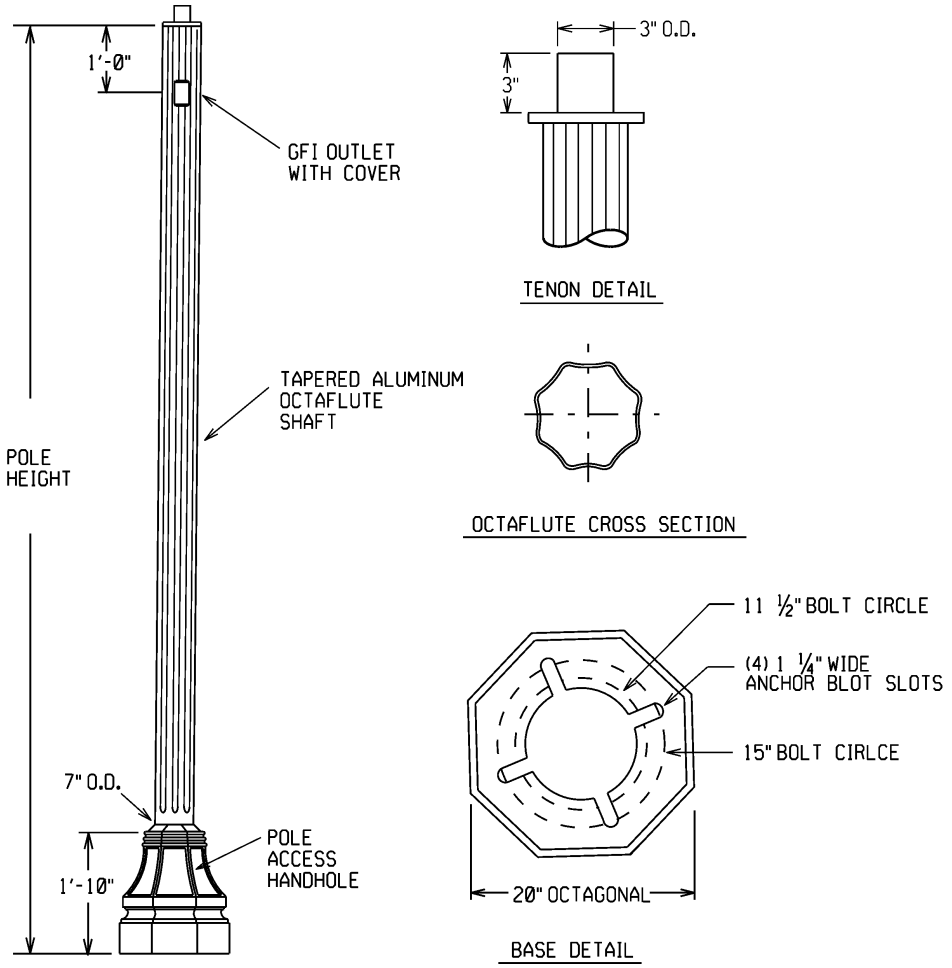
TENON DETAIL

POLE SHAFT LENGTH	LUMINAIRE MOUNTING HEIGHT	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
18'	14'	BRONZE	SW03C	9301950[E]	5106561[E]

POLE – *"ARMORY SQUARE"* – FOR POST TOP LUMINAIRES.

Aluminum, anchor base, octagonal shaped, fluted shaft, 3"-tenon, with provision for festoon outlet, with handhole, 11-1/2" to 15" bolt circle range using (4)-3/4" anchor bolts, In accordance with specification in PPL Standard MS-6833, latest issue.

Approximate Weight = 129 pounds



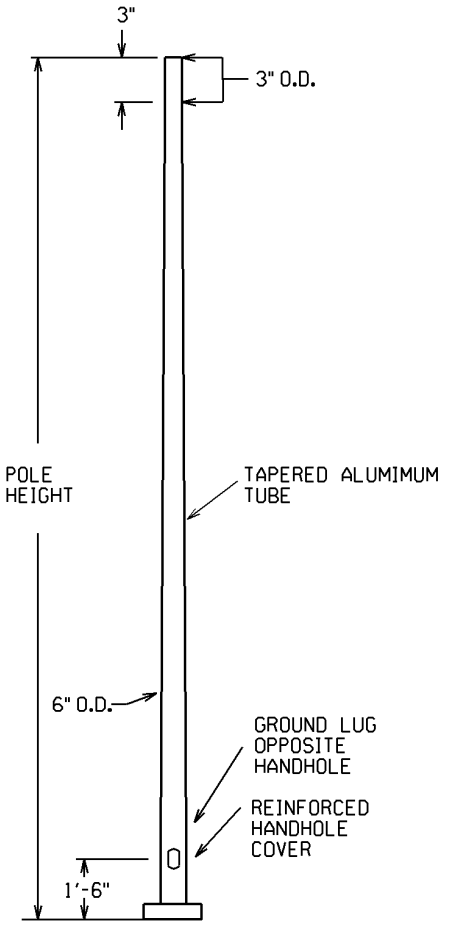
POLE SHAFT LENGTH	BOLT CIRCLE RANGE	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
14'	11-1/2" – 15"	BLACK	SW05C	9306777[Y]	9201673[Y]
14'	11-1/2" – 15"	GREEN	SW05C1	9308293[Y]	9202014[Y]

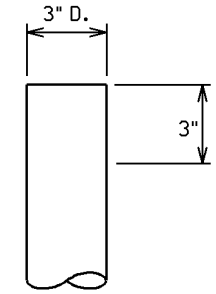
POLE – *"ESSEX"* – FOR POST TOP LUMINAIRES.

Aluminum, anchor base, round, tapered, shaft, 3"-tenon top, no festoon outlet, with handhole, 8-1/2" to 11-1/2" bolt circle range using (4)-3/4" anchor bolts, In accordance with Material Specification Standard MS-6814.

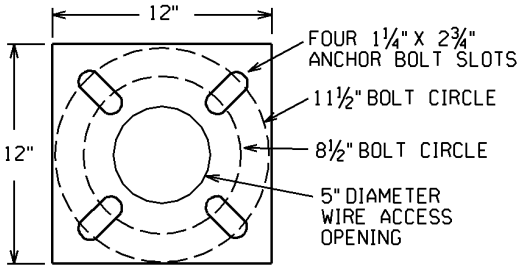
Note: CLOSED OFFERING – Stock is available for maintenance of existing installations only.

Approximate Weight = 38 pounds





TENON DETAIL



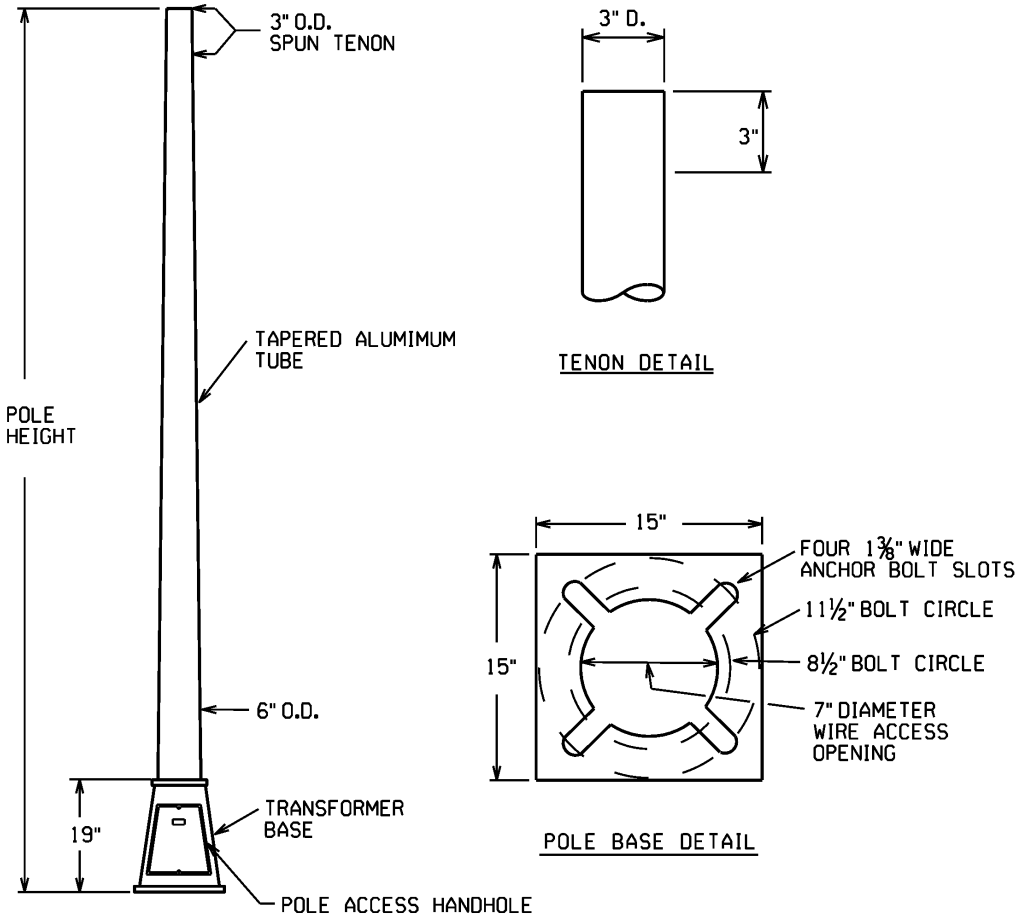
POLE BASE DETAIL

POLE SHAFT LENGTH	BOLT CIRCLE RANGE	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
14'	8-1/2" – 11-1/2"	Satin Brushed Aluminum	SW06C	9306250[E]	9201827[E]

POLE – "VILLAGER" – **FOR POST TOP LUMINAIRES**

Aluminum, anchor base, round, tapered, shaft, 3"-tenon top, no festoon outlet, 8-1/2" to 11-1/2" bolt circle range using (4)-3/4" anchor bolts, with integral transformer base and handhole, In accordance with Material Specification Standard MS-6813.

Approximate Weight
SW07A = 31 pounds
SW07C = 40 pounds

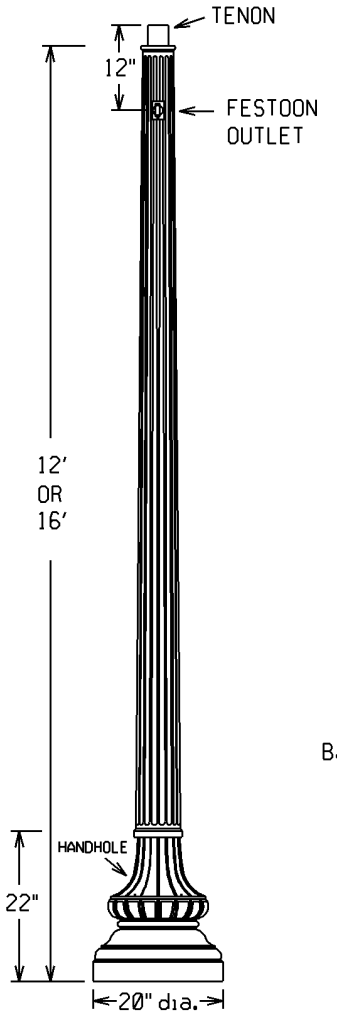


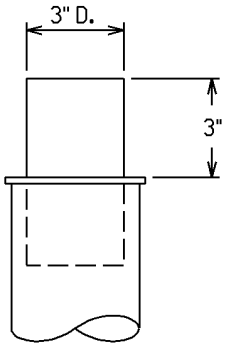
POLE LENGTH	BOLT CIRCLE RANGE	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
10'	8-1/2" - 11-1/2"	BLACK	SW07A	9306244	9201841
14'	8-1/2" - 11-1/2"	BLACK	SW07C	9306243	9201842

POLE – *"PRESIDENTIAL"* – FOR POST TOP LUMINAIRES

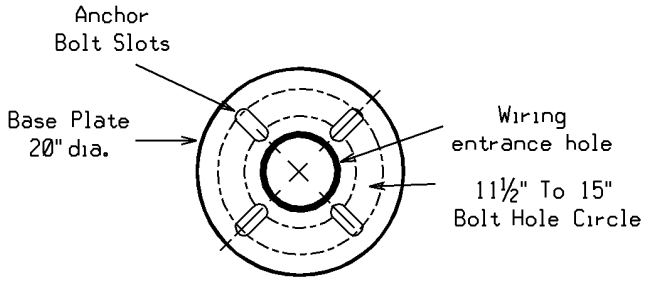
Fiberglass, anchor base, round, fluted, tapered shaft, 3-inch tenon, with provision for festoon outlet, with handhole, In accordance with Material Specification Standard MS-6834.

Approximate Weight
SW08B = 100 pounds
SW08D = 125 pounds
SW08D1 = 125 pounds





TENON DETAIL



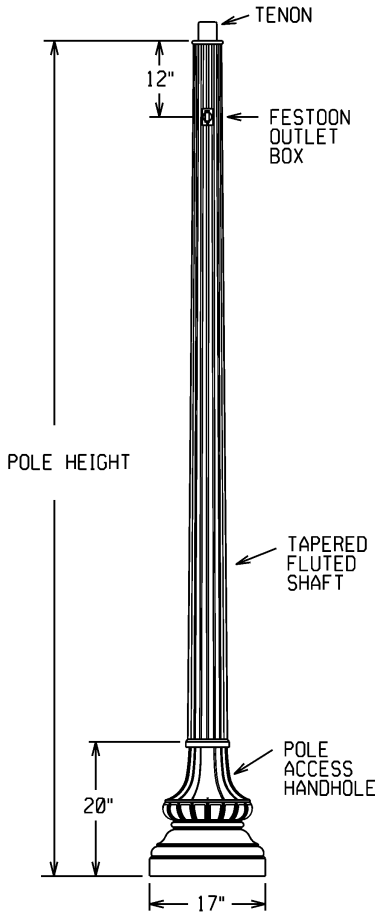
BASE DETAIL

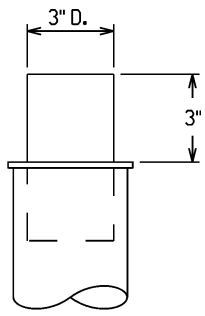
POLE SHAFT LENGTH	BOLT CIRCLE RANGE	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
12'	11-1/2" – 15"	BLACK	SW08B	9314730[Y]	0802713[Y]
16'	11-1/2" – 15"	BLACK	SW08D	9314769[Y]	0802720[Y]
16'	11-1/2" – 15"	GREEN	SW08D1	9314142[Y]	0810701[Y]

POLE – *"WASHINGTON"* – FOR POST TOP LUMINAIRES

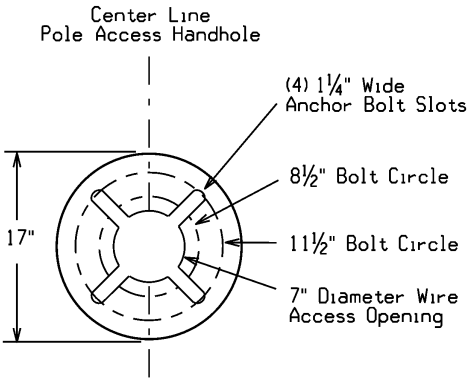
Aluminum, anchor base, round, fluted, tapered shaft, 3-inch tenon, with provision for festoon outlet, with handhole, In accordance with Material Specification Standard MS-6830.

Approximate Weight
SW09A = 90 pounds
SW09C = 106 pounds





TENON DETAIL



POLE BASE DETAIL

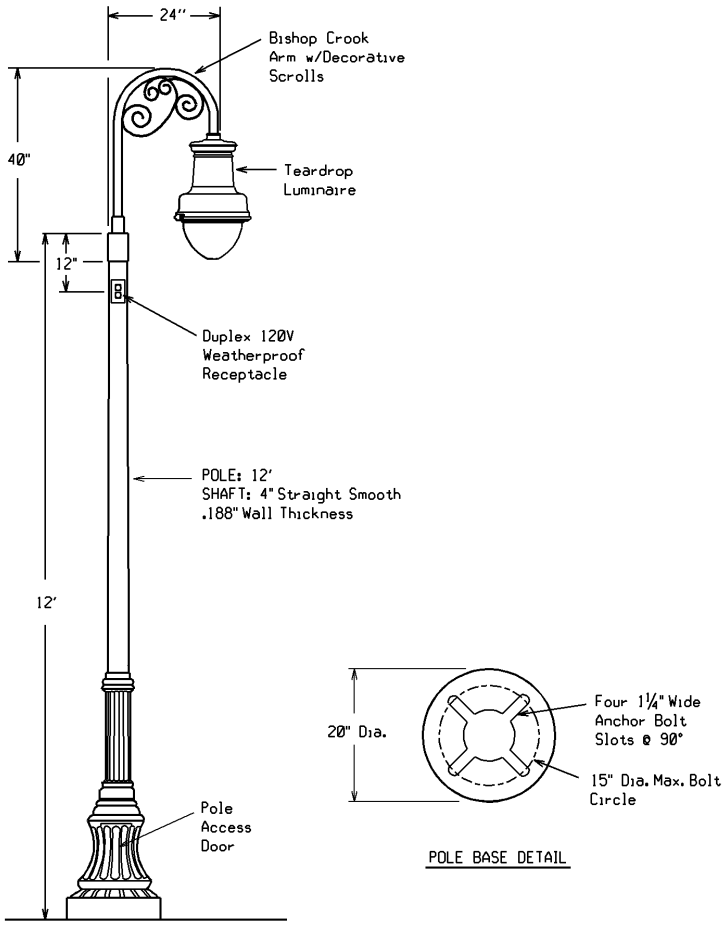
POLE SHAFT LENGTH	BOLT CIRCLE RANGE	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
10'	8-1/2" – 11-1/2"	BLACK	SW09A	9307593[E]	9202478[E]
10'	8-1/2" – 11-1/2"	GREEN	SW09A1	9307573[E]	9202479[E]
14'	8-1/2" – 11-1/2"	BLACK	SW09C	9311231[E]	5104882[E]
14'	8-1/2" – 11-1/2"	GREEN	SW09C1	9307571[E]	9202480[E]

POLE & ARM – *"LITTLE FALLS"* – FOR "LITTLE FALLS" TEARDROP LUMINAIRES

Aluminum, anchor base, round, straight shaft, 4-inch tenon top, with provision for festoon outlet, with handhole, In accordance with Material Specification Standard MS-6835.

Note: CLOSED OFFERING – Stock is available for maintenance of existing installations only.

Approximate Weight
SW10B = 95 pounds
SW10X2 = 20 pounds



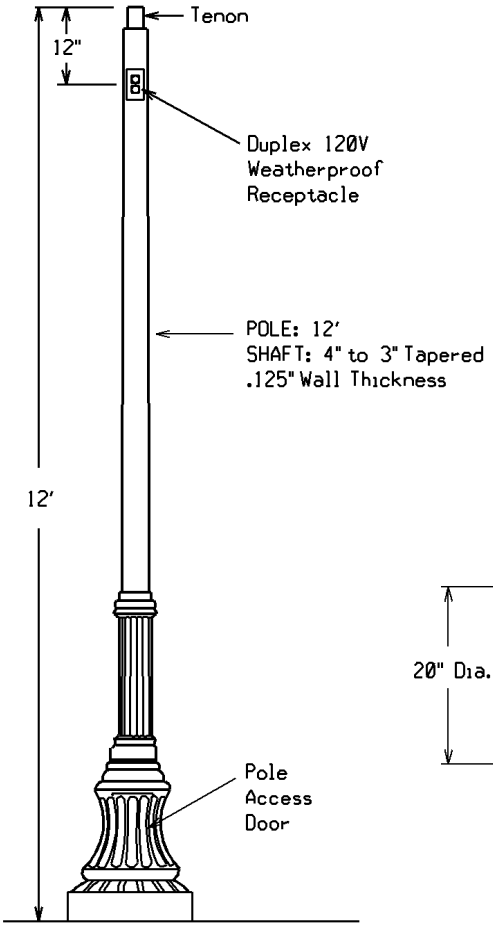
POLE SHAFT LENGTH	BOLT CIRCLE RANGE	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
12'	11-1/2" - 15"	GREEN	SW10B1	9306640[Y]	9201721[Y]
Bishop Crook Style Arm – w/o PECR		GREEN	SW10X2	9306642[Y]	9201719[Y]
Bishop Crook Style Arm – with PECR		GREEN	SW10X4	9311457[Y]	9202580[Y]

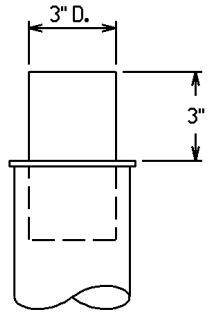
POLE – *"LITTLE FALLS"* – FOR POST TOP LUMINAIRES

Aluminum, anchor base, round, tapered shaft, 3-inch tenon top, with provision for festoon outlet, with handhole, In accordance with Material Specification Standard MS-6836.

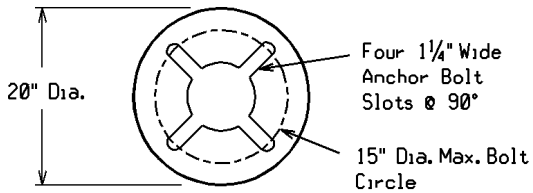
Note: CLOSED OFFERING – Stock is available for maintenance of existing installations only.

Approximate Weight = 95 pounds





TENON DETAIL



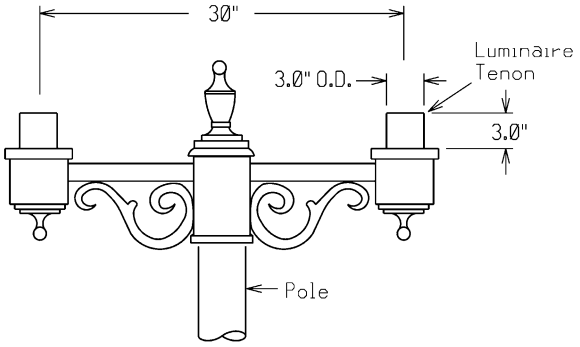
POLE BASE DETAIL

POLE SHAFT LENGTH	BOLT CIRCLE RANGE	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
12'	11-1/2" - 15"	BLACK	SW11B	9306617[Y]	9201724[Y]
12'	11-1/2" - 15"	GREEN	SW11B1	9306618[Y]	9201723[Y]

TWIN ARM – *"ORNAMENTAL"* – FOR POST TOP LUMINAIRES

Aluminum, 30" length, 3"-tenon top, In accordance with specification in PPL Standard MS-6820, latest issue.

Approximate Weight = 13 pounds

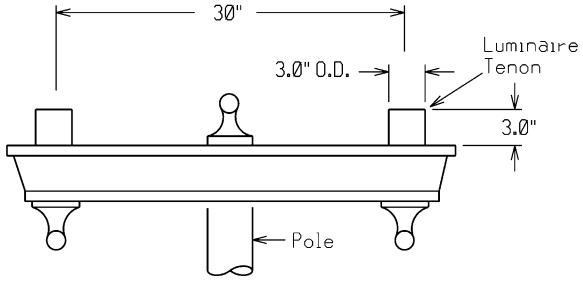


COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
BLACK	SW50A	9311221	5105296
GREEN	SW50B	9314982	9202652

TWIN ARM – *"CONTEMPORARY"* – FOR POST TOP LUMINAIRES+

Aluminum, 30" length, 3"-tenon top. In accordance with specification in PPL Standard MS-6820, latest issue.

Approximate Weight = 22 pounds



COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
BLACK	SW51A	9314319	0810549
GREEN	SW51B	9314541	0810944

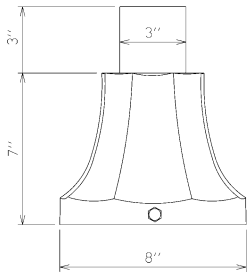
POLE ACCESSORY – TENON REDUCER

Aluminum, Attaches to a non-standard diameter pole top to create a standard 3-inch OD tenon.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
4-1/2” to 3”	SX01A	9315037[Y]	2505413[Y]
5-1/4” to 3”	SX01B	9307921[Y]	9202839[Y]

POLE ACCESSORY – TENON REDUCER

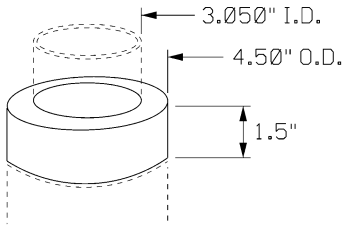
Aluminum, Used to convert a 7-inch diameter pole top tenon to a standard 3-inch OD tenon.



COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
BLACK	SX02B	9306203[Y]	9201850[Y]
GREEN	SX02G	9306210[Y]	9201851[Y]

POLE ACCESSORY – TENON SPACING RING

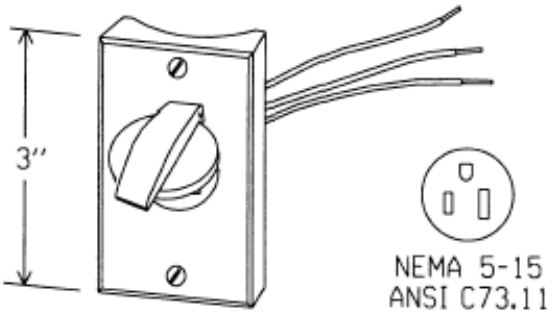
Aluminum, Use to fill in the gap for an over height tenon.



STD ITEM	SAP ITEM ID	PS ITEM ID
SX03	9316086[Y]	2010320[Y]

POLE ACCESSORY – FESTOON OUTLET

15 amp., 125 VAC, 3-wire, single receptacle with weatherproof cover.



	STD ITEM	SAP ITEM ID	PS ITEM ID
For 3-1/4" to 5-1/4" diameter poles	SX10A	9311929[Y]	2505301[Y]
For 5-1/4" to 7-1/4" diameter poles	SX10B	9311439[Y]	2505002[Y]

POLE ACCESSORY – DUPLEX FESTOON RECEPTACLE & COVER

Receptacle, Duplex, ground fault circuit interrupter, 125V, 20-amp. 2 pole, 3-wire, grounding, weather resistant, color: White, for use on street lighting poles with a factory installed duplex receptacle box.

	STD ITEM	SAP ITEM ID	PS ITEM ID
Duplex ground fault circuit interrupter receptacle	SX11B	9388239	none
Low profile wet-while-in-use metal cover	SX12A	9388240	none

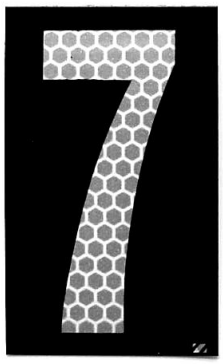
POLE ACCESSORY – "FESTOON RECEPTACLE" CABLE TAG

Festoon receptacle cable tag, 10-mil vinyl, 1" x 2". Legend "FESTOON RECEPTACLE" in black on white background. With 7" nylon cable tie, for use in identifying festoon receptacle wiring in street lighting poles.

STD ITEM	SAP ITEM ID	PS ITEM ID
SX13	9388445	none

POLE ACCESSORY – POLE NUMBER DECAL

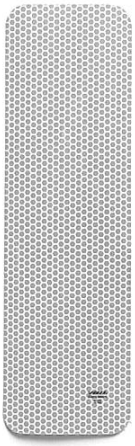
Number, vinyl, pressure sensitive, 1-3/4" wide x 2-7/8" tall overall size, Legend to be 2-1/2" tall, Helvetica typeface, high intensity grade reflective white on a black background. 25-labels per package. For use in numbering aluminum and fiberglass street light poles.



	STD ITEM	SAP ITEM ID	PS ITEM ID
Legend "0"	SX20A	9310658	9200644
Legend "1"	SX20B	9310688	9200635
Legend "2"	SX20C	9310726	9200636
Legend "3"	SX20D	9310687	9200637
Legend "4"	SX20E	9310685	9200638
Legend "5"	SX20F	9310663	9200639
Legend "6"	SX20G	9310662	9200640
Legend "7"	SX20H	9310661	9200641
Legend "8"	SX20J	9310660	9200642
Legend "9"	SX20K	9310659	9200643
Legend "-"	SX20L	9310657	9200645

POLE ACCESSORY – POLE REFLECTOR

Reflector, vinyl, pressure sensitive, 1-3/4” wide x 2-7/8” tall overall size, high intensity grade reflective white or yellow. 25-labels per package. For use on metal and fiberglass street light poles.



	STD ITEM	SAP ITEM ID	PS ITEM ID
White	SX21A	9309448	5480425
Yellow	SX21B	9309507	5480435

POLE REPLACEMENT PART – TAMPER RESISTANT FASTENER

Stainless steel button head socket type cap screw. Requires special pin-in-head Allen type wrench. For attachment pole access handhole covers and transformer base access doors.

	STD ITEM	SAP ITEM ID	PS ITEM ID
¼” x ¾” x 20 NC	SX40A	9321946	7011162
¼” x 1-1/2” x 20 NC	SX40B	9309116[Y]	7011163[Y]
5/16” x 1-1/2” x 18NC	SX40C	9321945[Y]	7011164[Y]
3/8” x 1-1/2” x 16 NC	SX40D	9321944[Y]	7011165[Y]

POLE ACCESSORY – PIN-IN-HEAD ALLEN WRENCH

Pin-in-head Allen wrench for use with tamper resistant fastners.

	STD ITEM	SAP ITEM ID	PS ITEM ID
5/32” (for ¼” screw)	SX40W1	9302938[E]	5489530[E]
5/32” (for ¼” screw)	SX40W2	9315567[Y]	6512404[Y]
3/16” (for 5/16” screw)	SX40W3	9315622[Y]	6512416[Y]
7/32” (for 3/8” screw)	SX40W4	9315601[Y]	6512415[Y]

POLE REPLACEMENT PART – POLE ACCESS HANDHOLE COVER

Replacement pole access handhole cover for use on round aluminum or steel poles with a outside diameter of 6 – 8 inches, inclusive. Use penta-head wrench to secure.

STD ITEM	SAP ITEM ID	PS ITEM ID
SX50	9309923	5105517

POLE REPLACEMENT PART – POLE ACCESS HANDHOLE COVER

Replacement pole access handhole cover for use on “Suburban” round fiberglass post top poles with an 2-1/2” x 5” handhole opening. Fits STD ITEM poles SW01C1and SW02 poles. BLACK

	STD ITEM	SAP ITEM ID	PS ITEM ID
Shakespeare -	SX60A	9306693	9201909

POLE REPLACEMENT PART – POLE ACCESS HANDHOLE COVER

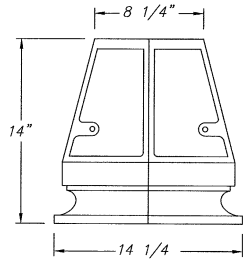
Replacement pole access handhole cover for use on “Suburban” round fiberglass post top poles with a 3” x 9” handhole opening. Fits STD ITEM poles SW01A, SW01B, SW01C, and SW01D poles. BLACK

(photograph not available)

	STD ITEM	SAP ITEM ID	PS ITEM ID
Shakespeare -	SX61A	9306284[Y]	9202116[Y]

POLE REPLACEMENT PART – POLE ACCESS HANDHOLE COVER

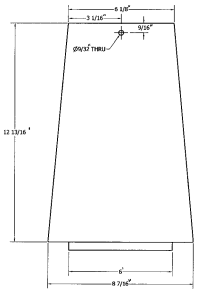
Replacement pole access handhole cover for use on “Armory Square” aluminum post top poles with an 8”” x 11” x 14” handhole opening. Fits STD ITEM poles SW05Cand SW05C1 poles.



	STD ITEM	SAP ITEM ID	PS ITEM ID
Hapco – BLACK	SX62A	9307929	9202335
Hapco – GREEN	SX62A1	9307922	9202334

POLE REPLACEMENT PART – POLE ACCESS HANDHOLE COVER

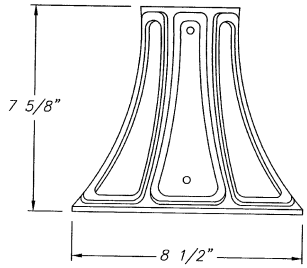
Replacement pole access handhole cover for use on “Villager” aluminum post top poles with a 7-1/2” x 5”3/4” x 8” handhole opening. Fits STD ITEM poles SW07A and SW07C poles.



	STD ITEM	SAP ITEM ID	PS ITEM ID
Hapco - BLACK	SX64A	9306285	9202115

POLE REPLACEMENT PART – POLE ACCESS HANDHOLE COVER

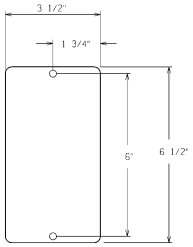
Replacement pole access handhole cover for use on “Washington” aluminum post top poles with a 3-17/8” x 8-3/4” x 7-11/16” handhole opening. Fits STD ITEM poles SW09A and SW09C poles.



	STD ITEM	SAP ITEM ID	PS ITEM ID
Hapco - BLACK	SX65A	*future item*	*future item*
Hapco - GREEN	SX65B	*future item*	*future item*

POLE REPLACEMENT PART – POLE ACCESS HANDHOLE COVER

Replacement pole access handhole cover for use on “Architectural” square aluminum post top poles with an 3” x 5” handhole opening. Fits STD ITEM poles SU01Dand SU01F poles.

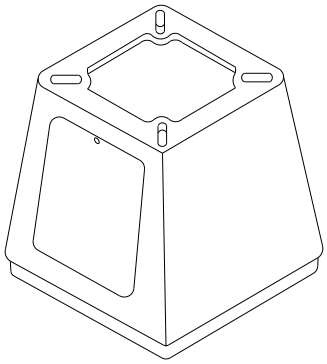


	STD ITEM	SAP ITEM ID	PS ITEM ID
Hapco - BRONZE	SX69A	9306291[Y]	9202117[Y]

POLE ACCESSORY – TRANSFORMER BASE

20” high. top bolt circle = 10” - 12”, bottom bolt circle = 10” – 15”. With pole attachment hardware.
Note: In NY use is restricted to locations subject to DOT Break-away requirements.

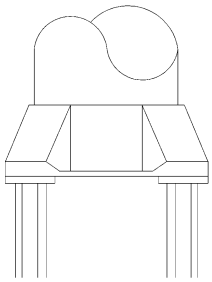
Approximate Weight = 45 pounds (aluminum)



	STD ITEM	SAP ITEM ID	PS ITEM ID
Aluminum – non-break-away	SX80A	9309881	5106997
Aluminum – break-away	SX80B	9311507[Y]	2505512[Y]
Replacement Door for Hapco non-breakaway T-base	SX80A1	9310418	9200658
Replacement Door for Hapco breakaway T-base	SX80B1	9310417[Y]	9200659[Y]

POLE ACCESSORY – BREAK-AWAY COUPLING ASSEMBLY

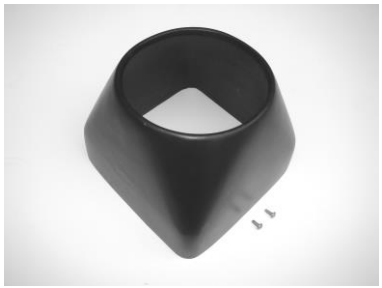
Four piece coupling assembly for use on 1-inch diameter anchor bolts. Two piece cover (skirt)



	STD ITEM	SAP ITEM ID	PS ITEM ID
Break-away assembly	SX81	9305187[E]	5107006[E]
Two piece aluminum cover	SX81	9305186[E]	5107007[E]

POLE REPLACEMENT PART – ANCHOR BOLT SHROUD

Replacement anchor bolt pole shroud for use only on Shakespeare fiberglass post top poles. Fits STD ITEM SW01C1 only. BLACK



STD ITEM	SAP ITEM ID	PS ITEM ID
SX82	9306694	9201908

POLE ACCESSORY – POLE SHIM

Aluminum pole shim. Overall size = 3-1/2” x 3” x 1/16”. Used to field straighten all styles of anchor base outdoor lighting poles.

STD ITEM	SAP ITEM ID	PS ITEM ID
SX90	9311082	9201337

WIRE & CABLE – STREET LIGHTING – LUMINAIRE SUPPLY CONDUCTORS

Use as fixture wiring between base of pole and the luminaire. 7-strand soft drawn copper, RHH/RHW/USE-2 600-volt insulation. In accordance with Material Specification Standard MS-6150.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
1-1/c #10 AWG – GREEN	SY4AG	9313591	9202616
2-1/c #10 AWG – BLACK-WHITE twisted pair	SY4A2	9313590	9202617

WIRE & CABLE – STREET LIGHTING – UNDERGROUND SUPPLY CONDUCTORS

Use as underground supply conductors between electrical source and base of lighting pole. Suitable for conduit or direct buried applications. 7-strand soft drawn copper, RHH/RHW/USE-2 600-volt insulation. In accordance with Material Specification Standard MS-6150.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
1-1/c #6 AWG – GREEN	SY6AG	9316004	9202613
2-1/c #6 AWG – BLACK-WHITE twisted pair	SY6A2	9310173	9201271
3-1/c #6 AWG – BLACK-WHITE-RED twisted triplex	SY6A3	9310174	9201270
3-1/c #2 AWG – BLACK-WHITE-RED twisted triplex	SY8A3	9313682	9202622

WIRE & CABLE – STREET LIGHTING – CABLE-IN-CONDUIT

2-1/c - #6 AWG, 7-strand copper conductors, type THW, 600 volt, color coded: BLACK – WHITE, pre-assembled in 1-inch polyethylene conduit. packaged in 500-foot single wound lengths on non-returnable reel. In accordance with Material Specification Standard MS-6151.

STD ITEM	SAP ITEM ID	PS ITEM ID
SY6B2	9302586[E]	5947789[E]

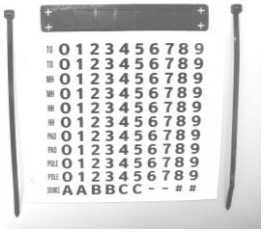
CABLE END CAP

Molded EPDM rubber cap for sealing ends of street lighting underground supply cables. Fits cables with maximum OD over insulation of 0.250” to 0.425” (#6 AWG to #2 AWG) 600-volt rating.

STD ITEM	SAP ITEM ID	PS ITEM ID
SZ01	9313626	2031061

CABLE TAG KIT

Black polyethylene tag with adhesive, reflective number decals and nylon cable ties. Used for field identification of underground street lighting cables.



STD ITEM	SAP ITEM ID	PS ITEM ID
SZ02	9307624	9202954

CABLE SPLICE

Compression splice with one-piece insulating rubber cover. Used to splice underground street lighting cables. Suitable for direct burial.

WIRE SIZE (AWG)	DIE	STD ITEM	SAP ITEM ID	PS ITEM ID
#6 Stranded Copper	Burndy #6A	SZ03F	9387753	none
#4 Stranded Copper	Burndy #163	SZ03G	9388066	none
#2 Stranded Copper	Burndy #163	SZ03H	9388046	none

IN-LINE FUSED DISCONNECT

In-line fused disconnect with copper connecting link. Accepts #12 AWG - #4 AWG copper or aluminum conductors. Use in underground supplied lighting inside pole access handhole as the line (hot lead) connection. Will accept a non-glass midget cartridge fuse (STD ITEM SZ05) in place of the copper connecting link. In accordance with Material Specification Standard MS-6620.

STD ITEM	SAP ITEM ID	PS ITEM ID
SZ04A	9309936	5105198

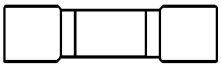
IN-LINE FUSE HOLDER

In-line fuse holder. Accepts stranded copper conductors. (0.250” to 0.425” maximum outside diameter over cable insulation) Used as a sectionalizing device in underground lighting circuits. For use with ¾” x 3” long non-glass cartridge fuse (STD ITEM SZ06).

STD ITEM	SAP ITEM ID	PS ITEM ID
SZ04B	*future item*	*future item*

FUSE – MIDGET CARTRIDGE STYLE

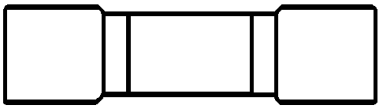
Fuse, midget cartridge style, 13/32” diameter x 1-1/2” length, non-glass, time delay, dual element, with an interrupting rating of 10,000A @ 125V. Use inside the base of the pole to fuse an individual luminaire. For use with in-line fused disconnect (STD ITEM SZ04A).



	STD ITEM	SAP ITEM ID	PS ITEM ID
10 amp.	SZ05B	9302161	5106428
20 amp.	SZ05D	9302160	5106429

FUSE – CARTRIDGE STYLE

Fuse, cartridge style, 3/4” diameter x 3” length, non-glass, time delay, dual element, with an interrupting rating of 10,000A @ 125V. Use on underground supplied dedicated outdoor lighting circuits in an in-ground handhole to sectionalize the circuit. For use in multiple control relay (STD Item SD10A).



	STD ITEM	SAP ITEM ID	PS ITEM ID
40 amp.	SZ06F	9321875	none
60 amp.	SZ06G	9321886	none

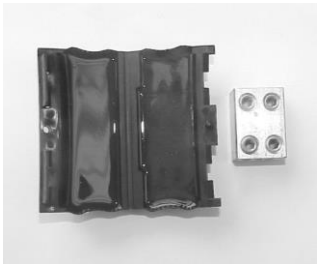
FUSE – CARTRIDGE STYLE W/ BLADE

Fuse, cartridge style, 3/4” diameter x 5-7/8” length, non-glass, time delay, class RK5, 250VAC, current limiting, with blades, For use in multiple control relay (STD Item SD10B).

	STD ITEM	SAP ITEM ID	PS ITEM ID
80 amp.	SZ06H	9321887	none
100 amp.	SZ06J	9321904	none

POLE ACCESSORY – GEL-WRAP CONNECTOR

Street light connector with insulating cover and sealing gel. 4-position for copper or aluminum conductors. Installation requires an allen head wrench.
In accordance with Material Specification Standard MS-6620.



STD Item SX30A – Use in all underground supplied lighting inside the pole access handhole for the connection between the underground source conductors and the #10 AWG luminaire fixture wiring.

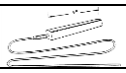
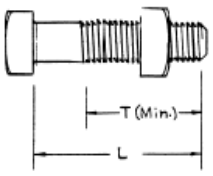
STD Item SX30B – Use for underground street light cable supply connections.

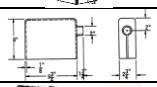
	STD ITEM	SAP ITEM ID	PS ITEM ID
#14 AWG to #2 AWG	SZ07A	9309937	5105197
#14 AWG to #2/0 AWG	SZ07B	*future item*	*future item*

CABINET – STREET LIGHTING RISER

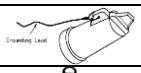
Cabinet, pole mounted, 60-amp., dual pole, with neutral bus bar, for use with SZ06 cartridge style fuses, Used to provide a means to de-energize dedicated underground street lighting circuits at the riser pole for maintenance..

STD ITEM	SAP ITEM ID	PS ITEM ID
SZ08	*future item*	none

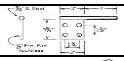
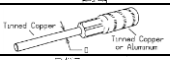
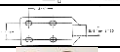
MATERIAL	STD ITEM	ILLUSTRATION
• **Abrasive Cloth**	T5U1	
• **Adapter**		
○ Female, PVC Conduit	UK6F0 – UK6F6	
○ Male, Schedule 40 PVC	UK7M0 – UK7M3	
○ PVC Conduit, Square to Round	UK7SA	
○ Reducing	UN6P	
○ Steel Plate	UM12	
• **Anchor**		
○ Bolt	B7D1 – B7D2	
○ Masonry	B7C1 – B7CD	
• **Angle, Corner**	UM18D6–UM18D7, UM18E1	
• **Anode, Magnesium**	UA17	
• **Arm, Channel, Galvanized**	UM18D–UM18D1	
• **Arrester, Surge**		
○ Bushing Well	UR40C3	
○ Cubicle	L3EC – L3JC	
○ Elbow	UR40A3–UR40A6	
○ Ground Lead	L6 – L6L	
○ Parking Stand	UR40B3	
○ Riser	L3DR – L3JR	
• **Bag, Vinyl**	A80A	
• **Bail Assembly, 15kV Loadbreak Elbow**	UR68B	
• **Barrier**		
○ Switch	US36BS	
○ Fuse	US36BF	
○ Clip	US36C	
• **Base Spacer –** See **Switchgear**		
• **Bell, End –** See **End Bell**		
• **Bend Conduit –** See **Sweep**		
• **Blanket**		
○ Arc Protection Kit	B50BL – B50BS	
○ Roll	B50R	
• **Blower**	B30 – B30E	
• **Bolt**		
○ Machine, galvanized, hex head	B5C10 – B5W7A	
○ Eye	UB10 – UB12	
○ Machine, galvanized, square head	B1 – B4A	
○ Pentahead	B19B – B19D	
○ Stainless steel, round head	B10A12 – B10A15	
○ Stainless steel, hex head	B8B15 – B8C30	
• **Boot, Breakout**	UR89B – UR89B1	

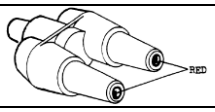
MATERIAL	STD ITEM	ILLUSTRATION
• **Boot, Bus Covering**	B40B – B40S	
• **Boot, Insulating, Secondary Bushing**	UR16G	
• **Boot, Temporary, Secondary End Cap**	UN7	
• **Box**		
○ Cover, PVC Switch	UK8C	
○ Padmount, Reinforced Plastic Mortar	UR12EP	
○ Primary Pull & Splice	UR6	
○ PVC, Single Gang	UK8B	
○ PVC, Receptacle/Switch	UK8BD	
• **Bracket**		
○ Angle	UM18D9	
○ Cable Support for Switchgear	US36E – US36E1	
○ Conduit Standoff	UK60 – UK60A	
○ Vacuum Switch, Stainless Steel	US44	
• **Braid, Grounding**	T1T4 – T1T5	
• **Bus**		
○ Copper Bus	B60D – B60H	
○ Copper Bus Assembly	B60A – B60B	
○ Copper Connector Plate	B60C	
• **Bushing**		
○ **Grounding**	UK42A	
○ **Insulated, Grounding**	UK37A1 – UK37G	
○ **Dead Front to Live Front, 15kV**	UR30 – UR30A	
○ **Well Insert**		
○ 15kV Loadbreak	UR36B	
○ 35kV Loadbreak	UR94	
○ **Extension, Deadbreak Elbow, 5–25kV**	UR69 – UR69A	
○ **Well Replacement Stud**	UT10S	
○ **Dead End Plug**	UR24S	
• **Cable Adapter, Deadbreak Elbow**	UR64A1 – UR64B6	
• **Cable Marker –** See **Sign**		
• **Cable Positioner**	UR47CP	
• **Cable Support**		
○ Arm	UM17A – UM17E	
○ Board	UM17V	
○ Clamp	UM18CA - UM18CC	

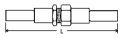
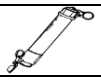
MATERIAL	STD ITEM	ILLUSTRATION
○ Polyethylene Insulator	UM18C	
○ Porcelain Insulator – Heavy Duty	UM18A – UM18B	
○ Porcelain Insulator	UM18D2 – UM18D3	
○ Spiking Stem	UR71G15 – UR71G35	
○ Stanchions V Notch Style	UM17G – UM17M	
○ Cable Saddle	UM17S	
• **Cable Tie**	P27T	
○ Nylon, 50lbs max	UP21T	
○ Nylon, 120lbs max 3-1/2" maximum diameter	P27T1	
○ Nylon, 175lb max 18" long	P27T2	
○ Nylon, 120lbs max 5" maximum diameter	P27TA	
○ Stainless Steel	P27T	
• **Cable, 600V**		
○ Aluminum, URD Secondary	UC8JR – UC8L	
○ Copper	UC5B – UC5H1	
○ Network, Copper	UC9B – UC9G4	
• **Cable, 5kV, Copper**	UC7E – UC7G1	
• **Cable, 15kV**		
○ Aerial	A60E – A62G	
○ URD, #2 Aluminum	UC11BC	
○ #2 Aluminum	UC11BJ	
○ #2 Copper	UC11BK – UC11BL	
○ 4/0 Copper	UC11E	
○ 350 Copper	UC12F	
○ 500 Aluminum	UC12GG	
○ 500 Copper	UC17	
○ 500 Copper, Reduced Diameter	UC16G	
○ 750 Aluminum	UC12HG	
○ 1000 Aluminum	UC12TA – UC12TB	
○ 1000 Copper	UC12TC – UC12TD	
○ Submarine, #2, Al	UC12BL – UC12BR	
• **Cable, 23kV**		
○ Aerial	A61FA – A61G	
○ 1/0 Copper	UC23CJ	
○ 3/0 Copper – Reduced Diameter	UC23ED	
○ 4/0 Copper	UC23EC	
○ 350 Copper, Reduced Diameter	UC23GG	
○ 350 Aluminum	UC23FA	
○ 350 Copper	UC23FJ	
○ 500 Aluminum	UC23GA	
○ 500 Copper	UC23GJ	
○ 400 Copper	UC23GK	
○ 500 Copper, Reduced Diameter	UC23GL	
○ 750 Aluminum	UC23HJ	
○ 1000 Aluminum	UC23TA	
○ 1000 Copper	UC23TC	

MATERIAL	STD ITEM	ILLUSTRATION
• **Cable, 35kV**		
○ Aerial	A62D – A62G	
○ 1/0 Aluminum	UC35C1 – UC35C3	
○ 2/0 Copper	UC35DJ	
○ 500 Copper	UC35GJ	
○ 500 Copper, Reduced Diameter	UC33GJ	
○ 750 Copper	UC35HJ	
○ 1000 Aluminum	UC35TJ-UC35TK	
○ 1000 Copper	UC35TC – UC35TD	
• **Cap**		
○ Deadbreak Elbow Bushing, Insulated	UR65	
○ End, Powerstrut	UM18E – UM18EV	
○ H & Y Joints, Insulating	UR73A – UR73B	
○ Loadbreak Bushing, Insulated 15kV	UR24	
○ Loadbreak Bushing, Insulated 25kV	UR24C	
○ Loadbreak Bushing, Insulated 35kV	UR91	
• **Case, Steel, Cable Tags**	UP21S	
• **Cement, Solvent, PVC Conduit**	UK6S	
• **Channel, Uni–Strut**	UM18D4	
• **Clamp**		
○ Grounding, Galvanized Conduit	UK38D – UK38H	
○ H-Body Separable Joint, Stainless Steel	UR71HC	
○ Hose	UN6HC	
○ Kit – for knob–hub, telephone, or V–notch	UM18K – UM18V	
○ Constant Force Spring	US1A – US1E	
○ Riser Conduit Ground	UK39	
• **Cleaner, Cable**		
○ Can	UC80F	
○ Towelette, Dry	UC80D	
○ Spray Bottle	UC80B – UC80B1	
• **Clip**		
○ Galvanized Conduit	UK3B – UK3F	

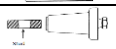
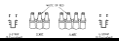
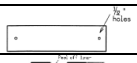
MATERIAL	STD ITEM	ILLUSTRATION
• **Cold Shrink**		
○ Cable Jacket	UR75A – UR76CS	
○ End Cap	UC90C – UC95D	
○ Splice – See **Splices**		
○ Termination – See **Terminations**		
• **Compound**		
○ Duct Seal	S3	
○ Electrical Joint	NG9D	
○ Fire Stop Sealing	UK50	
○ Petrolatum	UC76	
○ Sealing, Rubber, Cartridge	S2	
• **Conduit**		
○ Adapters – see **Adapter**		
○ Coupling – See **Couplings**		
○ Fairleader	UK49A – UK49B	
○ Fitting, Type LB	UK8G	
○ Flexible	C29F – C29J; UK20A – UK20C	
○ Galvanized Steel	UK30A – UK30H	
○ Innerduct	UK9NB – UK9SW	
○ Plug, Duct (adjustable)	UK34J – UK34M	
○ Plug, PVC	UK6G2 – UK6G6	
○ Plug, Galvanized	UK34D – UK34H	
○ PVC Loc–Duct (Split Duct)	UK9A2 – UK9A5	
○ PVC, Schedule 40, 1"	C29E10 – C29E11	
○ PVC, Schedule 40, other sizes	UK7A0 – UK7A6	
○ PVC, Schedule 80	UK15A – UK15E	
○ PVC Tee	UK7T0	
○ PVC, Type DB	UK6A2 – UK6A6	
○ Sweep – see **Sweep**		
• **Connectors**		
○ 15kV Loadbreak Elbow	UR23T	
○ 35kV Loadbreak Elbow	UR90T	
○ Adapters	UC65E1 – UC65E2	
○ Anode Ground Lead	C21	
○ Cable Rack Grounding	C18A – C18D	
○ Compression, Aluminum	UC61A – UC61G	
○ Compression, Aluminum, Reducing	UC63A – UC63M	
○ Compression, C Tap	S14A – S14L	
○ Compression, Copper	UC60A – UC60R	
○ Compression, Copper, Reducing	UC62A1 – UC62L1	
○ Compression, Copper, H tap	UC65A – UC65B	
○ Eyebolt (Cable to Flat)	C17B – C17F	
○ Flood seal, Insulated	UR15F4 – UR15F16	
○ Ground, Transformer Tank & Street Lighting	C23A – C23B	
○ Ground Rod	G2A2 – G4	
○ Lug, Deadbreak Elbow	UR63A – UR63J	

MATERIAL	STD ITEM	ILLUSTRATION
○ Network Crab	UC57A	
○ Padmount Secondary, Straight, URD	UR21 – UR21E	
○ Plug, Connector, Deadbreak Elbow	UR66A – UR66B	
○ Terminal Flag	S30B	
○ Terminal Pin	S27F – S27H	
○ Transformer Secondary Spade	UR20A – UR20B	
○ Shear Bolt	UC58A – UC59C	
○ Unitap, Insulated 600 V	Ur15G	
○ URD Secondary, Insulated, 350 max	UR15A4 – UR15A8	
○ URD Secondary, Insulated, 500 max	UR15E4 – UR15E8	
○ Vise	C6N1 – C6N8	
• **Cord Cap**		
○ Female, General Purpose	X10D52	
○ Male, General Purpose	X10D51	
• **Coupling**		
○ Flexible Conduit, HDPE	UK21A – UK21B	
○ Flexible, PVC Conduit	UK7F	
○ Galvanized Conduit	UK32B – UK32H	
○ Galvanized Conduit, Split	UK35D – UK35H	
○ PVC Conduit	UK6C0 – UK6C6	
○ PVC Conduit, 5º	UK6D2 – UK6D6	
○ PVC Conduit	UK7CC3 – UK7CC4	
○ PVC, Split Sleeve	UK9C2 – UK9C5	
○ Swedge Reducer, Schedule 40 PVC	UK7E	
• **Cover**		
○ Bollard	C80 – C80G	
○ Floodseal	UR15C	
○ Manhole – Galvanized Steel	UM10B – UM10B1	
○ Primary Pull & Splice Box, Rectangular	UR6C	
○ Sump Hole	UR11AC	
• **Curbing, Oil Containment**	UF7A – UF7B	
• **Decal**		
○ Normal Open	P25PNO	
○ Warning --- Recloser with DITT	P25PR	
• **DGA**		
○ Sensor, DGA	UN8SA-UN8SG	
○ Kit – Communications Network DGA	UN9K	
○ Sensor, Water Level, Network Vault/DGA	UN9W	
• **Elbow**		
○ 15kV Loadbreak	UR23A – UR23A4	
○ 35kV Loadbreak	UR90C – UR90D	
○ Deadbreak, 600 Amp (T–body)	UR60A – UR60E	
○ Jacket Seal	UR23B – UR23B1	

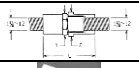
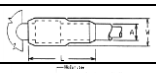
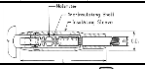
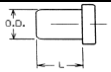
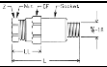
MATERIAL	STD ITEM	ILLUSTRATION
○ Replacement Contact Pin, 15kV	UR23P	
○ Spanner Wrench	UR70	
○ Threaded Stud (for Deadbreak Elbow)	UR61A – UR61B	
○ With Reducing Tap Well	UR60R	
• **Encapsulant, Re-Gel**	UR2AB – UR2SM	
• **Enclosure**		
○ Box, Fiberglass	UN1B	
○ Fuse, Amp Trac, 600V	UP70FB-UP70FBC	
○ Junction, 1–phase & 3–phase	US33	
○ Junction, Fiberglass, 3–phase	US33F	
○ Junction, Fiberglass, 1–phase	US33F1	
• **End Bell, Conduit**		
○ Female, PVC Conduit	UK6E – UK6E6	
○ Galvanized Conduit	UK36D – UK36H	
• **Equipment Mount**		
○ 1Ø	E13M	
○ 1Ø – 1–Position	E13N	
○ 3Ø – 36”	E12M1	
○ 3Ø – 48”	E12M	
• **Expansion Tank, OFC**	F18	
• **Extension Cord, Portable**	X10A50	
• **Fabric, Oil Containment**	F70	
• **Fault Indicator, LED**	UF50BB – UF50HG	
○ Reset Magnet	UF50A	
○ Fiberoptic Extension Cables	UF50C – UF50CC	
○ Underground – LED	UF50TL – UF50TS	
• **Feed Thru**		
○ Insert, Rotatable, 15kV Loadbreak	UR37	
○ Insert, Rotatable, 35kV Loadbreak	UR95F	
○ 15kV Loadbreak	UR29B – UR29B3	
○ 25kV Loadbreak	UR29C3	
○ 35kV Loadbreak	UR92 – UR92DB6	
○ 15kV Deadbreak	UR29DB6	
• **Filler – Fire Stop**	UK51	
• **Filter Sock – High Volume**	UF70B	
• **Fluid (Oil)**		
○ Dielectric Insulating	F60	
○ Flushing	UC74	
• **Flux – Paste**	US7	
• **Foam, Expanding**	UF10 – UF20	
• **Foundation, 3 Phase Padmount**	UF8A – UF8G	
• **Foundation – Network Transformer**	UF8E – UF8F	
• **Frame – Polymer, URD vault to padmount conv.**	UR12EC	

MATERIAL	STD ITEM	ILLUSTRATION
• **Fuse**		
○ Amp Trap	F11B1 – F11B10	
○ Bay–O–Net, 4kV – 25kV	F3B08 – F3B140	
○ Bay–O–Net, 35kV	F3A03 – F3A65	
○ Cartridge, 250V	F8A1.0 – F8A600	
○ Cartridge, 300V (use with F50JD)	F11A60	
○ Cartridge, 600V	F9A10 – F9A600	
○ Cartridge, 600V (use with F50B)	F10A06 – F10A30	
○ Current Limiting, Bay–O–Net	F12C1 – F12C22	
○ Current Limiting, Bay–O–Net, Type EL	F14A20 – F14A25	
○ Current Limiting, with Arc Strangler	F13C1 – F13C19	
○ Holder, 250 volt	UN4F	
○ Holder, In–Line, 600 volt	F50BA – F50JD	
○ Network Protector, GE, 125/216V	UP5C1 – UP5C3	
○ Network Protector, GE	UP4A – UP4I	
○ Network Protector, Westinghouse CMD	UP5A1 – UP5A4	
○ Network Protector, Westinghouse	UP5B1 – UP5B5	
○ OFC Link, GE OFCs	F15A10 – F15AOS	
○ OFC Link, G&W OFCs	F16A10 – F16O20	
• **Fuse, SM–4**		
○ End Fittings, SM–20 Livefront Switchgear	C51	
○ End Fittings, SM–20 Deadfront Switchgear	C51E – C51ECL	
○ End Fittings, SM–4 Deadfront Switchgear	C51E25	
○ Holder, 7kV – 35kV	C49A – C49D	
○ SMU–20, 14.4kV	F6E020 – F6K200	
○ SMU–20, 25kV	F8E100 – F8K140	
○ Refill, 7.2kV	F21E15	
○ Refill, 14.4kV	F4E10 – F4S200	
○ Refill, 25kV	F19E03 – F19S19	
○ Refill, 35kV	F24E40 – F24E25	
• **Fuse, SM–5**		
○ Holder, 7.2kV – 25kV	C50A – C50C	
○ Holder, 34.5kV	F7H – TF2A	
○ Refill, 4.16kV	F20E15	
○ Refill, 7.2 kV	F22E20 – F22E40	
○ Refill, 14.4kV	F5E010 – F5E400	
○ Refill, 25 kV	F23E05 – F23E30	
○ Refill, 34.5kV	F7E5 – F7E300	
• **Gauge**		
○ Fluid Level Gauge	UN10L1-UN10L5	
○ Temperature Gauge	UN10T1-UN10T4	

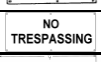
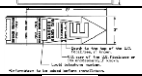
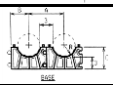
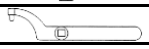
MATERIAL	STD ITEM	ILLUSTRATION
• **Grating**		
○ Sump	UR11A	
○ Sidewalk Vault	UR11B – UR11C	
○ Sidewalk Vault Entrance	UR11D	
○ Transformer Vault	UR12T	
• **Grease**		
○ Anti–Oxide	G9B	
○ Gasket	UP9G	
○ Silicone	UG2	
• **Ground**		
○ Elbow, 15kV	UR32	
○ Elbow, 35kV	UR93	
○ Grid, Mesh Roll	TG21	
○ Kit, Grounding, Cable Neutral	UR89G1 – UR89G3	
○ Lead, Arrester	L6 – L6L	
○ Rod	TG20	
• **Guard**		
○ Riser, U-Duct HDPE	UK11D -- UK11H	
○ Riser, Galvanized Steel	UK12 – UK12A	
○ Riser, Reducer	UK14GF	
• **Handhole**		
○ Cover & Frame, 16"	SH1A – SH1B	
○ Cover & Frame, 18”	UM11A – UM11B	
○ Heavy Duty, Pre–cast	UM19 – UM19A	
○ Secondary, Rectangular, Conduit Systems	UR10G – UR10GR	
○ Secondary, Rectangular, Direct Buried Cables	UR10PE – UR10PED	
• **Hatch –** see **Manhole**		
• **Heat Shrink**		
○ Insulating Sheet	UT6S	
○ Insulating Tape – see **Tape**		
○ Oil Barrier Tube	UR89T1 – UR89T2	
○ Rejacketing Sleeve	UR89R1 – UR89R2	
○ Splice – see **Splice**		
○ Tubing (1000 V)	UR89R3 – UR89R4	
• **Holder, Cable**	UM17R	

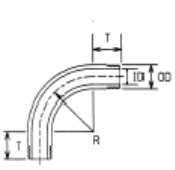
MATERIAL	STD ITEM	ILLUSTRATION
• **Hose, Black, Flexible**	UN6H	
• **Indicating Light**	UN3G	
• **Insulating Plug, Deadbreak Elbow**	UR67A – UR67B	
• **Jacket Seal, Deadbreak and Loadbreak Elbows**	UR23B – UR23B1	
• **Junction, 15kV Loadbreak Elbow**	UR28C – UR28DH	
• **Joint**		
○ Separable, H & Y	UR71AH – UR71BY	
○ Separable Deadbreak, Sacrificial	UR71G15 – UR71G35	
○ Separable Deadbreak, Cold Shrink	UR74A-UR74E	
• **Kit**		
○ 900 Amp Elbow	UR62A – UR62G2	
○ Epoxy Resin	US9	
○ Conduit Strap	UK61A – UK61E	
○ Fiberglass Patch	US10	
○ Filter Sox	UF70 – UF70A	
• **Label (see also Signs or Tags)**		
○ Caution, Oil Containment Barrier Below	P25PC	
○ Danger, Padmount Equipment	P25PD	
○ Livefront	P25PL	
○ Mounting Panel	P21M – P21R19	
○ Numbers & Letters, 1–3/4” wide self stick	P21L – P21N	
○ Padmounted Transformer	P25T1 – P25T2	
○ PCB	Z5 – Z7	
○ PCB Information	Z8 – Z11B	
○ Transformer Vent	P22T	
○ Warning, Equipment Clearance	P25P	
○ Warning, Stepdown Transformer	P25ST	
• **Ladder**		
○ Ladder	L14 – L18	
○ Assist Pull Up Handle	LU	

MATERIAL	STD ITEM	ILLUSTRATION
• **Lamp**	UN3LL	
○ **Lead**		
○ Ribbon, (Strap)	US3A – US3B	
○ **Light Fixture**	UN3L	
○ **Lightning Arrester: See Arrester, Surge**		
○ **Limiter**		
○ Cable to Offset Bus, 200kA, 600V	UL5D – UL5S	
○ Cable to Cable, 200kA, 600V	UL4D – UL4S	
○ Cable to Cable, Non–replaceable, 30kA, 600V	UL6CR – UL6GPL	
○ Cable to Cable, Replaceable, 20kA, 600V	UL7B – UL7G	
○ Cable to Mole, 200kA, 600V	UL3B – UL3E	
○ Link, Replacement	UL8B – UL8F	
• Lug, 30kA, 600V	UL9C – UL9H	
○ Mole, Limiter Assembly	UC56A – UC56D	
○ **Locknut, Galvanized Conduit**	UK43A1 – UK43G	
• **Lube**		
• Anti–Seize	UC77	
○ Cable Pulling	UC75 – UC75A	
• OFC	UL25	
• **Lug, Terminal**		
○ Aluminum	UL16A – UL16R4	
○ Copper	UL15A – UL15R4	

MATERIAL	STD ITEM	ILLUSTRATION
• **Manhole**		
○ Adjusting Ring, Steel	UM12P – UM12X	
○ Chimney Collar, Concrete	UM15C – UM15FR	
○ Cover & Frame, 37 ¾”	UM12A – UM12C	
○ Cover	UM12G	
○ Cover, Distribution, Barrel Shape	UM33 – UM34	
○ Cover, Slotted 27 7/8”	UM12NE	
○ Cover, Slotted 37 ¾”	UM12NY	
○ Distribution, 2–Way, 2–piece	UM22	
○ Distribution, 3–Way	UM23	
○ Distribution, 4–Way	UM24	
○ Distribution, Double Entry	UM31 – UM32	
○ Distribution, Medium Size, Rectangular	UM39	
○ Distribution, Sidewalk	UM28	
○ Distribution, Split Bottom, 2–Way	UM22S	
○ Distribution, Switchgear	UM21, UM35	
○ Frame & Cover, 24”	UM13A – UM13R	
○ Frame & Cover, 26”	UM14C, UM14F1	
○ Frame, 36”	UM14F	
○ Hatch (for precast sidewalk MH), 5’x5’	UM15HH	
○ Hatch (for precast sidewalk MH), 6’x4’	UM15H	
○ Hatch	UM15J – UM15K	
○ Ring, 26” –> 36”	UM14R	
○ Ring, Grading (use with precast sidewalk hatch)	UM15S	
○ Switchgear	UM20A – UM20N	
• **Marker Flag**	UM50	
• **Meter**		
○ Ampere Demand, Network Transformers	UM2B	
○ Socket	UM3 – UM4	
• **Mastic, Heat Shrink, Red**	UR89S	
• **Mole**		
○ Compression Cone	UC52A1 – UC52D1	
○ Coupler, Mole to Mole	UC55	
○ Holder	UC50H3	
○ Insulated Bus, 2000A	UC50A1 – UC50A6	
○ Insulated Bus, 1500A	UC50B1 – UC50B4	
○ Insulated Bus, Threaded Stud Mount	UC50C1 – UC50C6	
○ Insulating Sleeve	UC53A – UC53B	
○ Limiter Assembly	UC56A – UC56D	
○ Outlet Plug, Rubber	UC54A – UC54B	
○ Socket & Nut Assembly	UC51A – UC51C	

MATERIAL	STD ITEM	ILLUSTRATION
• **Mounting Plate**	UN1P	
• **Network Protector**	UP2B – UP3H	
○ Door Bolt	UPB1 – UPB5	
○ Link box	UP7LBL – UP7LBSTC	
○ Link box Adaptors	UP7LA – UP7SA3	
○ Relay, Microprocessor	UP6A – UP6D	
○ Terminal Spades	UP7SP2 – UP7ST9	
○ Terminal Replacement Kit	UP8A – UP8L3	
○ Wall Mount Link Box	UL7LBW – UL7LBX	
• **Nut, Stainless Steel, 3/8" & ½"**	B8B40 – B8C40	
• **Nut, Uni–Strut Spring**	UM18F – UM18F1	
• **Oil**		
○ Transformer	UC78	
• **Pad, Concrete Pre-cast, Transformer Foundation**	UF8A – UF8D	
• **Pad, URD Vault to Padmount Conversion**	UR12F – UR12P	
• **Padlock**	UL20K – UL20S	
• **Paint**		
○ Insulating	UP10	
○ Network	UP12B	
○ Network Primer	UP12P	
○ Padmount Green	UP11G	
• **Parking Stand**		
○ 15kV Loadbreak	UR38	
○ 35kV Loadbreak	UR93P	
• **Primary Metering** – see **Switchgear**		
• **Pump, Sump**	UN6	
○ Check Valve	UN6V	
○ Control Unit	UN5C	
○ Filter	UN6F – UN6G	
○ Relief Valve	UN6PRD	
○ Sensing Probe	UN5P	
○ Stainless Steel Basket	UN6B	
• **Rack, Cable**	UM16A – UM16C	
• **Receptacle, with PVC Box and Cover**	UK8R	
• **Recloser – Padmount, 27kV, 560 amp**	US50	
○ Base -- Fiberclass	US50R	
○ Communications	US52A – US52B	

MATERIAL	STD ITEM	ILLUSTRATION
• **Reducing Tap Well, Deadbreak Elbow**	UR68A – UR68D	
• **Re–Gel**	UR2AB	
• **Relay**	B30BR	
• **Ring – Grading, Round, Rubber**	UM15DB – UM15DP	
• **Rings, Retaining**	UR72 – UR72F	
• **Screw**		
○ Cap, Head Hex	UM18F2	
○ Lag	B10B	
○ Lag, Gimlet Point	1BLS	
• **Seal, Live End**	UR77A1 – UR77G3	
• **Sealant**		
○ Kit	S4	
○ Backer Rod	SBR1 – SBR3	
○ Concrete Adhesive	S5	
○ Grey	SBR	
• **Shield, URD, Submersible Vault**	UR13B	
• **Signs (See also Labels or Tags)**		
○ Caution – Feeder Tie Point	P22P2	
○ Dead Operation Only	UP22DO	
○ Electrical Safety	P23A1 – P23C3	
○ No Trespassing	P25NT	
○ Permanent Location, UG Cables (Cable Marker)	P22R1 – P22R3	
○ Submarine Cable Crossing	UP22W1 – UP22W2	
○ Temporary Location, UG Cables	P22S	
○ Warning – Tie Point – Not in Phase	P22P1	
• **Sleeve, OFC**	F17A – F17C	
• **Solder**		
○ Stick	US5	
○ Wiping	US4	
• **Spacer**		
○ Galvanized Conduit	UK46	
○ PVC Conduit	UK4E – UK5H	
• **Spanner Wrench, Deadbreak Elbow**	UR70	
• **Splice**		
○ Cold Shrink, 5kV – 35kV	UR49A1 – UR51E	
○ Heat Shrink, 3/C, PILC, 15kV – 25kV	UR83B1 – UR83C2	
○ Heat Shrink Mod Kit for Y Joint	UR89Y1 – UR89Y2	
○ Heat Shrink, Straight, 15kV – 25kV	UR85B1 – UR85RH	

MATERIAL	STD ITEM	ILLUSTRATION
○ Heat Shrink, Straight, 1000V	UR87	
○ Heat Shrink, Submarine, 15kV	UR86SC	
○ Heat Shrink, Transition, 600V, Oil Stop	UR89LV	
○ Heat Shrink, Transition, Straight, 5kV – 35kV	UR79A1 – UR79D2	
○ Heat Shrink, Transition, Reducing, 15kV – 25kV	UR80B1 – UR80D3	
○ Heat Shrink, Transition, Trifurcating, 15kV - 25kV	UR81B1 – UR81D3	
○ Heat Shrink, Transition, Reducing, Trifurcating, 15kV – 35kV	UR82B1 – UR82C1	
○ Heat Shrink, Wye, 15kV	UR84B1 – UR84B2	
○ Plate, 2–hole	UM18D5	
○ Premolded, #2 Aluminum, URD	UR50	
○ Repair, Premolded, #2 Aluminum, URD	UR50R – UR50R1	
○ Shim Kit for Heat Shrink Splices, 5–35kV	UR89SK – UR89SL	
• **Spliceboard**	UB4A1 – UB4B	
• **Splice Box**	UR7	
• **Split Duct –** see **Conduit**		
• **Stack**	B30C – B30D	
• **Stacklight**	UN3SL	
• **Stanchion – for use with arc protection blanket**	B50S	
• **Starter**	B30B	
• **Strap**		
○ Galvanized Conduit	UK45A1 – UK45A2	
○ Perforated	C30	
○ PVC Split Duct	UK9S	
• **Support, Stanchion, "Z" Shape**	UM18D8	
• **Surge Arrester** – see **Arrester, Surge**		
• **Sweep**		
○ Galvanized Conduit, 90º	UK31A – UK31H2	
○ PVC, Schedule 40, 90º	UK7B0 – UK7B7	
○ PVC, Type DB, 11.25º	UK6BA4 – UK6BA5	
○ PVC, Type DB, 22.5º	UK6BB4 – UK6BB5	
○ PVC, Type DB, 45º	UK6BC4 – UK6BC5	
○ PVC, Type DB, 90º	UK6B2 – UK6B6	
• **Switch**		
○ Disconnect, Network	US60A – US60C	
○ Fuse pad, 15kV	US34 – US34SS	
○ Toggle, 120–277V, 15A	UK8SB1 – UK8SI3	
○ Stand	US40GA	
○ Vacuum, Submersible, 15kV Hi Duty 40kA	US40L-US40LBS	
○ Vacuum, Submersible, 15kV	US40L1 – US40LS, US41A – US41CR	
○ Vacuum, Submersible, 23kV	US42A – US42BA	
○ Vacuum, Submersible, 35kV	US42AA – US43B	
○ Vacuum, Non Submersible, 15kV	US40H – US40J	
○ Vacuum	US43	

MATERIAL	STD ITEM	ILLUSTRATION
• **Switchgear**		
○ 15kV, Padmounted	US36H – US36L	
○ 15kV, Padmounted, Automatic	US39H	
○ 15kV, Padmounted, Scada Ready	US39I	
○ 15kV, Padmounted, PMH–4 – Maint. Only	US32	
○ 15kV, Padmounted, Deadfront	US45 – US45SS	
○ 23kV, Padmounted	US37H – US37HA	
○ 23kV, Padmounted, Deadfront	US46 – US46D6	
○ 35kV, Padmounted	US38E – US38HT	
○ 38kV, Padmounted	US38C – US38DA	
○ Base Spacer, 15kV	US36B1 – US36B3	
○ Base Spacer, 35kV	US38B	
○ Blade	US36D – US36D1	
○ Primary Metering	US39M – US39P	
○ Scada ready	US39J – US39L	
○ Vault Pad, Fiberglass	UF3 – UF4	
○ Vault Pad, Fiberglass, Cover	UF3A – UF3C	
○ Vault Pad, Fiberglass, Adapter Cover	UF3D	
• **Tag, 1", Polyethylene**		
○ Cable Phase Identification	UP21A – UP21C	
○ Cable Tie, Nylon, Black, 12"	UP21T	
○ Holder	UP21W – UP21W2	
○ Holder for Switch Handle	US41BB	
○ Letter	UP21L	
○ Number	UP21N	
○ Phrase	UP21P	
○ Storage Case	UP21S	
• **Tape**		
○ Anti–slip	T2A	
○ Black Teflon	T2T	
○ Cable Pulling (muletape)	T4A	
○ Cold Applied	1WBP	
○ Copper Foil	T2C	
○ Cotton	T1C	
○ Fire Proof (or Arc Proof)	T1F3	
○ Friction	T1A	
○ Glass Cloth	T1G5	
○ Insulating, HV Rubber	T5B – T5B6	
○ Insulating & Sealing (Mastic, Permanent)	T5M	
○ Insulating, Heat Shrink	UT6A – UT6B	
○ Marking, Underground Cable	UT8	
○ Paper, Kraft	T3P	
○ Plastic Sealer (removable)	T5D4 – T5D4P	
○ Semiconducting	T1S	
○ Shielding, Braid, Tinned Copper	T1U – T1U25	

MATERIAL	STD ITEM	ILLUSTRATION
○ Silicone Rubber	T5S1	
○ Varnished Cambric	T1V1 – T1V5	
○ Varnished Polyester Glass, Dry	T3V – T3V3	
○ Varnished Polyester Glass, Oil	T1P1	
○ Vinyl Plastic	T2W1 – T2W2	
• **Tee, Schedule 40 PVC Conduit, ¾"**	UK7T0	
• **Termination**		
○ Cold Shrink, 5kV – 35kV	UR42 – UR45H	
○ Ground Kit	UR47T4 – UR47T5	
• **Test Rod, Loadbreak Bushings, 5 – 35kV**	UR95	
• **Thermostat**	B30A	
• **Transformer**		
○ Current, Network Transformer	UT2D5 – UT2K5	
○ Pad, Concrete, 3 Phase Padmount	UF8	
○ Single Phase, Industrial	UT70C – UT70T	
○ 1 phase, minipad	UT31A – UT31K	
○ 1 phase, submersible	UT20A – UT21JR	
○ 1 phase, subway	UT25A – UT27C	
○ 3 phase, network	UT50A1 – UT56B	
○ 3 phase, 600Y/346 Volt Secondary	UT39KT – UT39XT	
○ 3 phase, pad–mounted, dead front	UT41A – UT42LT; UT46A – UT49A	
○ 3 phase, pad–mounted, live front	UT40B – UT40C; UT45C – UT45PT	
○ 3 phase, pad–mounted, step down	UT60ET – UT61FT	
○ 3 phase, subway	UT28A – UT28N	

MATERIAL	STD ITEM	ILLUSTRATION
• **Tubing**		
○ Heat Shrink – Insulating 5kV thru 35kV	UT7A – UT7D	
• **Twine**		
○ Flax	T3T	
○ Nylon	T3N	
• **URD Vault Conversion Pad – see Pad**		
• **Valve, Check, Bronze**	UN6V	
• **Vault – Distribution Network**	UM36 – UM38	
• **Bar, Hatch Lock Open**	UM18W	
• **Vault Pad, Fiberglass**	UR11U	
○ Cover	UR9G	
○ Mini–Pad	UR8B – UR9F	
○ Spacer	UR9S	
• **Washer**		
○ Belleville, ½", Stainless Steel	B8W10	
○ Flat, Galvanized, 3/8", ½", ¾'	W5 – W8	
○ Flat, Galvanized, 5/16"	5WAA	
○ Flat, Stainless Steel, 3/8", ½"	B8W2 – B8W3	
○ Lock, Galvanized, ½"	B5W7A	
○ Lock, Stainless Steel, 3/8" & ½"	B8W6 – B8W7	
○ Zinc Plated, ½"	UM18G	
• **WB Door Lock Assembly**	UL20CM – UL20K	
• **Weatherhead, 3/4", PVC**	UK8W	
• **Wire, Bare, Copper**		
○ #12, solid, tinned	UC2V	
○ #4, solid, tinned	W11F1	
○ #2, stranded, tinned	W13F	
○ #2, stranded	W13G	
○ 2/0, stranded	W17G	
○ 4/0, stranded copper – Hard Drawn	W19B	
○ 4/0, stranded	W19G	
• **Wire, Covered, Copper**		
○ #4, solid, tinned	W11F	
○ #2, stranded, 45 mils PE	W13E	
• **Wire, Ferrel Sleeve**	W60 – W60S	
• **Wire, General Purpose**		
○ #10, 600 volt, stranded	W54B – W54W	
○ #12, 600 volt, stranded	W52B – W52W	
• **Wrench, Spanner, Deadbreak Elbow**	UR70	

CABLE, AERIAL, 15kV – 35kV

3 phase preassembled, lashed aerial cable. Fully insulated and shielded for installation within the secondary area, for express or second-primary circuits. Jacketed Concentric Neutral cable with covered lashing tape. 5000 lb. design tension. 7/16" EHS copperweld messenger for 15kV - 23kV cables, ½" EHS copperweld messenger for 35kV cables.

Preferred Termination 15kV-23kV – UR44C
Preferred Splice 15kV-23kV – UR51B
Preferred Termination 35kV - UR45C3
Preferred Splices 35kV – UR51D & UR51E

	INSULATION					
CONDUCTOR AWG / KCMIL	THICKNESS	O.D.	STD REEL	STD ITEM	SAP ITEM ID	PS ITEM ID
15kV - 4/0 cu	0.220"	1.03"	1000'	A60E	9315602	4020420
15kV – 500 al	0.175"	1.08"	1000'	A61GA	9386946	none
23kV – 350 al	0.260"	1.26"	1000'	A61FA	9315099	0808660
23kV – 500 cu	0.260"	1.39"	1000'	A61G	9315949	4033355
35kV – 2/0 cu	0.345"	1.115"	1000'	A62D	9315096[Y]	0808825[Y]
35kV – 350 cu	0.345"	1.42"	1000'	A62F	9314085[Y]	0810635[Y]
35kV – 500 cu	0.345"	1.56"	1000'	A62G	9306450	9201806

CLAMP, SECONDARY / NEUTRAL SUPPORT

Galvanized malleable iron suspension clamp. Threaded body for ⅝" through bolt. 0.25" – 0.5" diameter cable range, provides 1½" pole offset.

0° - 30° Line Angles

STD ITEM	SAP ITEM ID	PS ITEM ID
A50B	9311777	3502812

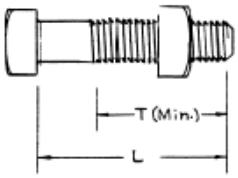
BAG, VINYL

Blue vinyl bag with handles to protect the UG Distribution Standards book.

STD ITEM	SAP ITEM ID	PS ITEM ID
A80A	9306754	9202163

BOLT, MACHINE

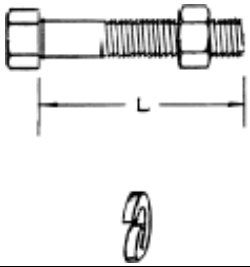
Square head galvanized steel bolt (with nut) per ANSI Standards C135.1 (and B18.2) Zinc coated in accordance with ASTM A135 or B695.



NOM. BOLT SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
⅜" X 4½"	B1	9319838	7001537
½" X 6"	B3	9319829	7001590
½" X 8"	B4A	9316016	7001570

BOLT ASSEMBLY, MACHINE

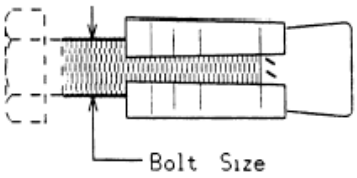
½" galvanized steel hex head bolt, nut and lock washer. Bolt and nut to be in accordance with ASTM A-394. Threads to be in accordance with ANSI B1.1, series UNC; Class 2A (bolts) and 2B (nuts). Lock washers shall be regular helical spring galvanized carbon steel.



SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
½" X 1"	B5C10	9321525	7009501
½" X 1½"	B5C15	9321425	7009503
½" X 2"	B5C20	9321424	7009505
½" X 3½"	B5C35	9321420	7009511
½"Lock Washer	B5W7A	9321667	7006104

ANCHOR, MASONRY

Masonary anchor, without bolt, cast of zinc-base alloy, for use with machine bolts on masonry construction. Anchor to be in accordance with the GSA Specification FF-S-325.



BOLT SIZE (INCHES)	DRILL SIZE (INCHES)	STD ITEM	SAP ITEM ID	PS ITEM ID
¼	⅜	B7C1	9319743[Y]	8024204[Y]
⅜	⅝	B7C2	9319742[Y]	8024206[Y]
½	¾	B7C3	9319741[Y]	8024208[Y]

ANCHOR, MASONRY

Masonry, anchor, pin, cast of zinc-base alloy, for use of securing cable tags to masonry construction.

PIN SIZE (INCHES)	DRILL SIZE (INCHES)	STD ITEM	SAP ITEM ID	PS ITEM ID
¼	7/16	B7CD	9389479	

BOLT / SCREW, ANCHOR

Anchors made from stainless steel.

		STD ITEM	SAP ITEM ID	PS ITEM ID
Bolt Style	½" x 3-3/4" – for Cable Racks	B7D1	9309992	5460210
	½" x 5-1/2" – for OFC's	B7D2	9309991	5460213
Screw Style	½" x 3"	B7D3	9393835	
	½" x 5"	B7D4	9393804	

BOLT, CARRIAGE

Galvanized steel construction with corresponding nut.

DIA.	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
½"	6"	B8A1	9307345[E]	5981154[E]
⅜"	4½"	B8A2	9306391	5981044
⅜"	6"	B8A2A	9305940	5106128
⅜"	7"	B8A3	9306974	5981070

BOLT, MACHINE – STAINLESS STEEL

Non-magnetic stainless steel construction manufactured of series 18-8 material (18% chromium, 8% nickel). UNC fully threaded up to 2". Bolts longer than 2" have minimum thread length of 2". The belleville washer is 301 stainless steel.

NOTES	STAINLESS STEEL GRADE	DIA.	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
Hex Bolt	304	⅜"	1½"	B8B15	9303903	5622735
Hex Bolt		⅜"	2"	B8B20	9303773	5622737
Hex Bolt		⅜"	2 ¼"	B8B21	9391757	N/A
Hex Bolt		⅜"	2 ½"	B8B25	9304693	5622740
Hex Bolt		⅜"	2 ¾"	B8B27	9319746	7009300
Hex Bolt		½"	1"	B8C10	9304788	5624913
Hex Bolt		½"	1 ¼"	B8C12	9321512	7009310
Hex Bolt		½"	1½"	B8C15	9304787	5624915
Hex Bolt		½"	2"	B8C20	9304786	5624920
Hex Bolt		½"	2½"	B8C25	9304785	5624925
Hex Bolt		½"	3"	B8C30	9304784	5624927
Hex Nut	316	⅜"	N/A	B8B40	9304774	5625193
Hex Nut		½"	N/A	B8C40	9319754	7001719
Flat Washer	304	⅜"	N/A	B8W2	9304688	5629591
Flat Washer		½"	N/A	B8W3	9319831	7006021
Split Washer	304	⅜"	N/A	B8W6	9304691	5629210
Split Washer		½"	N/A	B8W7	9304690	5629229
Belleville Washer	301	½"	N/A	B8W10	9319830	7006022

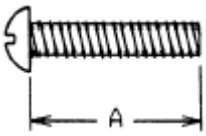
LAG SCREW

Steel lag screw with square head, shoulder shank, fetter or twist drive, and pilot/drive point. However, ⅝" doesn't have a pilot/drive point. In accordance with NEMA PH3. Zinc coated in accordance with ASTM A153 or B695.

DIA.	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
½"	4"	B9	9309115	7011833
⅜"	3"	B9N1	9307185	5995685
⅝"	4"	B9N2	9307177	5995825

BOLT, STAINLESS STEEL

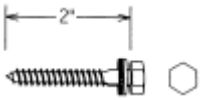
Round head ¼" X 20 slotted machine bolt, 18-8 stainless steel. Threads to be in accordance with ANSI B1.1, series UNC; class 2A for external threads. The bolt shall be fully threaded. For use with machine bolt anchor, item B7C1.



A	STD ITEM	SAP ITEM ID	PS ITEM ID
1-1/4"	B10A12	9321679[Y]	7009091[Y]
1-1/2"	B10A15	9321501[Y]	7009092[Y]

LAG SCREW, U-DUCT & RISER CONDUIT CLIPS

Galvanized steel lag screw with hex head, shoulder shank, and gimlet point with steel/neoprene washer. In accordance with ANSI B18.2.1. Zinc coated in accordance with ASTM A153 or B695. Standard fastener for U-duct and riser conduit clips.



DIA.	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
¼"	2"	B10B	9322030	7011830

BOLT, MACHINE ⅝"

Square head steel bolt (with nut) per ANSI Standard C135.1. Zinc coated in accordance with ASTM A153 or B695. (Min. tensile strength 12,400 lbs.)

L	T	STD ITEM	SAP ITEM ID	PS ITEM ID
10"	4"	B13A	9315997	7001500
12"	6"	B13B	9320033	7001501
14"	6"	B13C	9309119	7001503
16"	6"	B13D	9320015	7001505
18"	6"	B13E	9320032	7001506
20"	6"	B13F	9320031	7001507
24"	6"	B13G	9319840	7001533
8"	4"	B13H	9319836	7001546
6"	3"	B13J	9320549	5983260
2"	1½"	B13K	9320550	5983220

BOLT, MACHINE ¾"

Square head steel bolt (with nut) per ANSI Standard C135.1. Zinc coated in accordance with ASTM A153 or B695. (Minimum tensile strength 18,350 lbs.)

L	T	STD ITEM	SAP ITEM ID	PS ITEM ID
8"	4"	B14A	9319834	7001555
10"	4"	B14B	9319841	7001530
12"	6"	B14C	9314896	7001556
14"	6"	B14D	9319846	7001520
16"	6"	B14E	9319786	7001521
18"	6"	B14F	9319844	7001522
20"	6"	B14G	9319837	7001540
2"	1¾" (XMFR mounting)	B14H	9307158	9200904

BOLT, DOUBLE ARMING ⅝"

Galvanized steel construction, ⅝" diameter, full threaded rod with (4) square nuts. Minimum tensile strength of 12,400 lbs. Manufactured per ANSI Standard C135.1. Zinc coated per ASTM 153 or B695.

L	STD ITEM	SAP ITEM ID	PS ITEM ID
16"	B15A	9320701	7002926
18"	B15B	9320034	7002925
20"	B15C	9321366	7002929
22"	B15D	9320702	7002930
24"	B15E	9321592	7002931
26"	B15G	9307343[E]	5981526[E]
28"	B15F	9321589	7002946
30"	B15H	9321588	7002949

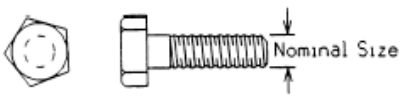
NUT, SQUARE

Galvanized steel ½ inch height square nut.

DIAMETER	STD ITEM	SAP ITEM ID	PS ITEM ID
5/8"	B17A	9319911	5993400
3/4"	B17B	9307167	5993410

BOLT, PENTAHEAD

Pentahead bolt of 18-8 stainless steel in accordance with REA U-5 and ANSI C57.12.25. Threads to be in accordance with ANSI B1.1 series UNC; Class 2A for external threads. The number of threads per inch shall be 16 for ⅜ inch nominal size and 13 for ½ inch nominal size fasteners. Threads shall be a minimum of 1¼ inch in length. For securing distribution equipment and enclosures.



NOMINAL SIZE	L	STD ITEM	SAP ITEM ID	PS ITEM ID
⅜"	1½"	B19B	9321500	7009102
⅜"	2½"	B19B1	9393387	none
½"	1½"	B19C	9321499	7009104
½"	5"	B19D	9387723	none

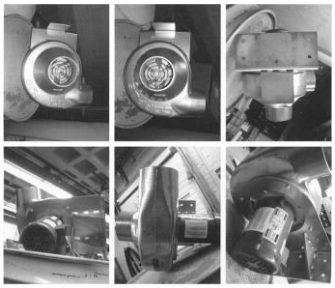
BOLT EYE, THIMBLE EYELET

Galvanized ferrous eyelet, for use with clevis and pin dead-end hardware. NEMA Standard PH5.

BOLT SIZE	BOLT HOLE DIMENSION	STD ITEM	SAP ITEM ID	PS ITEM ID
⅝"	$^{11}/_{16}$" X 1"	B21B	9313558	3503116
¾"	$^{13}/_{16}$" X 1⅛"	B21C	9313557	3503117

BLOWER Single Speed

230 volt, 3-phase, PV-1000, Coppus Electric blower, fully enclosed with mounting bracket, output 940 CFM, cast aluminum frame, for use in Rhode Island enclosed network systems only.
NOTE: motors installed after the fall of 2014 will be “explosion proof” style and will include the starter and thermostat.



STD ITEM	SAP ITEM ID	PS ITEM ID
B30	9309512[E]	5640800[E]

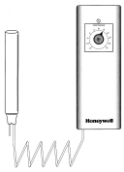
BLOWER Two Speed

230 volt, 3-phase, PV-1000, Coppus Electric blower, fully enclosed with mounting bracket, output 940 CFM on high speed, cast aluminum frame, for use in Rhode Island enclosed network systems. Motor operated by a 3 position switch for operation at low, high or auto. In auto mode the blower operates at low speed until temperature reaches 90 degrees and fan switches over to high speed. All components are explosion proof.

STD ITEM	SAP ITEM ID	PS ITEM ID
B30E	9389105[E]	

THERMOSTAT (for maintenance use)

Remote bulb, 55°-175° F, to open circuit on temperature fall. Thermostat switch to be single pole, single throw mercury type. Thermostat to have standard 5-foot long element. Element and bulb to be made of copper.



STD ITEM	SAP ITEM ID	PS ITEM ID
B30A	9303970[E]	5648200[E]

STARTER (for maintenance use)

Electric motor type: magnetic NEMA size: 00 contact rating: 208VAC, 60HZ 3PH, coil voltage:**** contact arrangement: ***** AC complete with general purpose enclosure, selector switch cover – Hands-Off-Auto-, & 2 overload relay heaters, used with Dresser Rand/Coppus ventilator PV1000 in Rhode Island area.

STD ITEM	SAP ITEM ID	PS ITEM ID
B30B	9310458[E]	5647250[E]

RELAY (for maintenance use)

Motor starter for use with CR-306A123, overload sensing, relay heater, used with Dresser Rand/Coppus ventilator PV1000 in Rhode Island area.

STD ITEM	SAP ITEM ID	PS ITEM ID
B30BR	9306703[E]	9201893[E]

STACK

Vent for network manhole, aluminum alloy schedule 40, 12'-9" high, inner vent 6" ID, both vent tops screened with a 3/8" mesh area for ventilation. Use with Dresser Rand/Coppus ventilator

STD ITEM	SAP ITEM ID	PS ITEM ID
B30C	9303845[E]	5647220[E]

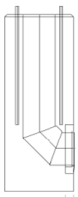
STACK

Vent for network manhole, aluminum alloy schedule 40, 13' high, vent 10" ID, both vent top screened with a 3/8" mesh area for ventilation. Use with Dresser Rand/Coppus ventilator

STD ITEM	SAP ITEM ID	PS ITEM ID
B30D	9389252[E]	

STACK BASE

Base for stack B30DB, precast concrete. 54" high x 21"x21".



STD ITEM	SAP ITEM ID	PS ITEM ID
B30D	9391748	

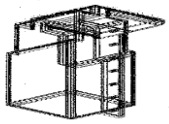
BRACE, FLAT WOOD CROSSARM – ONE PAIR

1" X 1¾" treated wood section with aluminum or galvanized steel end fittings. 26" center-to-center between one 7/16" d. and one 9/16" d. end bolt holes (each brace). Approximately 4 lbs. each pair.

STD ITEM	SAP ITEM ID	PS ITEM ID
B37B	9314904	0810389

BOOT

Boot, Bus covering, 38kV, for covering the termination to the bus work ¼" thick x 4" wide, red



90 degree bend

Straight

	STD ITEM	SAP ITEM ID	PS TEM ID
90 degree bend	B40B	9316278	9202643
Straight	B40S	9316279	9202642

BLANKET, 40kA ARC PROTECTION, KIT

Kit comes in storage bag, includes blanket, kevlar strap for each eyelet and carabineer for each eyelet.

	STD ITEM	SAP ITEM ID	PS ITEM ID
48" x 96"	B50BL	9307581	9202980
48" x 60"	B50BS	9307580	9202981

KIT, KEVLAR STRAPS AND CARABINERS

The kit has 16 Kevlar straps and 32 carabiners. The kit can be used for replacements for blast blanket installation or for the installation of supporting Lexan barriers used in network vaults.

STD ITEM	SAP ITEM ID	PS ITEM ID
B50C	9393329	NA

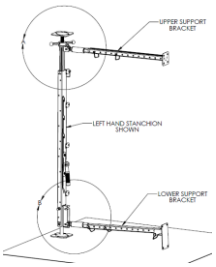
BLANKET

Blanket, Roll, Class 1, Type II, 3 feet by 30 feet, Yellow/Orange, Weight = 36 pounds

STD ITEM	SAP ITEM ID	PS ITEM ID
B50R	9307950	9202823

STANCHION KIT

Stanchion, steel, complete system includes left and right stanchions, adjustable 5 to 7 feet high, adjustable back braces and steel span wires (right side shown)



STD ITEM	SAP ITEM ID	PS ITEM ID
B50S	9386607	9203048

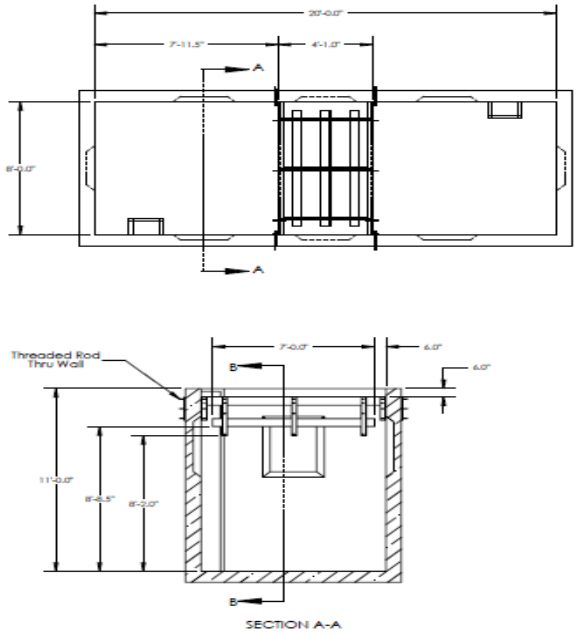
BARRIER, LEXAN, SHEET

Barrier used for protecting equipment in manholes and vaults.,48x96x.25 inches, polycarbonate, UV protectant coated, clear in color.

STD ITEM	SAP ITEM ID	PS ITEM ID
B55	9393655	

BUS ASSEMBLY, COPPER

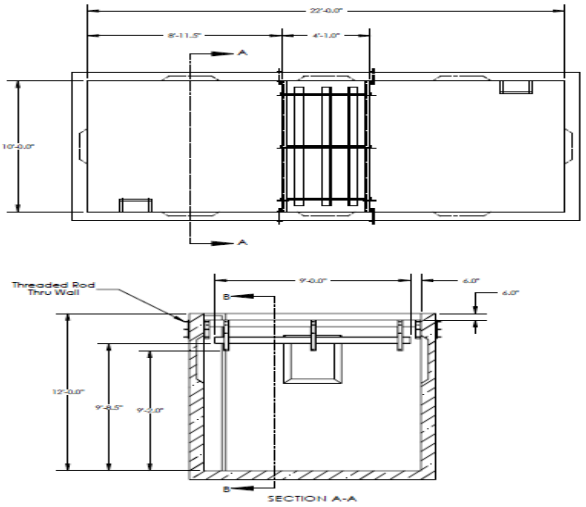
Copper bus assembly for 8’ x 20’ network vault. Three phase tubular copper bus 5” x 6”, 600V, 4000A rating. Bus is supported on insulated hanger system, 4’-1” wide x 7’ long.



STD ITEM	SAP ITEM ID	PS ITEM ID
B60A	9387738	None

BUS ASSEMBLY, COPPER

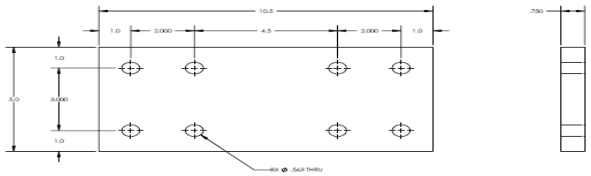
Copper bus assembly for 10’ x 22’ network vault. Three phase tubular copper bus 5” x 6”, 600V, 4000A rating. Bus is supported on insulated hanger system, 4’-1” wide x 9’ long.



STD ITEM	SAP ITEM ID	PS ITEM ID
B60B	9387710	None

BUS, CONNECTOR PLATE, COPPER

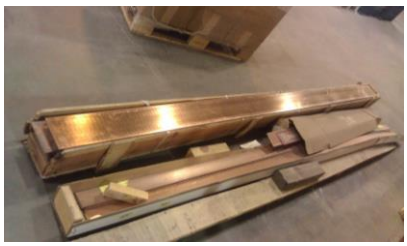
Bus, copper, connector plate for connecting two secondary network buses together. Dimensions are 5” x 10.5” x 0.75”.



STD ITEM	SAP ITEM ID	PS ITEM ID
B60C	9387765	None

BUS, COPPER

Bus, copper, for building secondary network buses.



SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
2” x ¼” x 12’ L	B60D	9303071	5691027
3” x ¼” x 12’ L	B60E	9303070	5691030
4” x ¼” x 12’ L	B60F	9303076	5691033
5” x ¼” x 12’ L	B60G	9303086	5691036
6” x ¼” x 12’ L	B60H	9303094	5691038

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CONNECTOR VISE

For copper-to-copper connections for use in the secondary network customers service box. Each connector will accept two of the conductors listed below and any combination in between.

MAX. WIRE SIZE		STD ITEM	SAP ITEM ID	PS ITEM ID
SOLID	STRAND			
6	8	C6N1	9320125	5963920
4	4	C6N2	9320124	5963930
2	3	C6N3	9320123	5963935
1	2	C6N4	9320122	5963940
2/0	1/0	C6N5	9320412	5963945
3/0	2/0	C6N6	9308891[E]	5103923[E]
4/0	4/0	C6N7	9320121	5963955
500	500	C6N8	9389771	

CONNECTOR – TERMINAL LUG

Standard NEMA 2-hole tinned aluminum or copper terminal lug. 46 kV and below, ANSI C119.4, Class A Class 2 minimum. Aluminum connectors shall be compound filled and capped.

	CABLE SIZE	L (IN.)	CRIMPING TOOL / DIE / # OF CRIMPS						STD ITEM	SAP ITEM ID	PS ITEM ID
			MD6		Y34A	Y34PR	Y35 OR Y39				
			DIE	#/CR.	NEST	INDENT	DIE	#/CR.			
COPPER	#2	4.8	W162	4	A2CD	1	U2CRT	2	C9A	9311388	3506429
	#1/0	4.9			A25D	1	U25RT	2	C9B	9311381	3506426
	#2/0	5			A26D	1	U26RT	2	C9B1	9309141	3506463
	#4/0	5.4					U168	2	C9C	9311409**	3506453**
	350	5.8			A31D	2	U31RT	4	C9D	9311399	3506431
	500	6			A34D	2	U34RT	4	C9E	9311400	3506432
	750	7					U39RT S39RT P39RT	*4	C9E1	9311480	3506485
ALUMINUM	#2	5.0	W243	3	A243	3	U243	2	C9H	9311663	3506401
	#1/0 Al. or ACSR	5.3 – 6.3	BG	8			UBG	4	C9J	9311417Y	3506433Y
			WBG	4							
	#2/0	5.5 – 6.5	W245	5			U245	2	C9K	9311664Y	3506400Y
	#3/0	5.5 – 6.8	W247	5			U247	3	C9P	9311389Y	3506404Y
	#4/0	6.0 – 6.9					U249	3	C9M	9311662Y	3506402Y
	336.4 – 350 Al or ACSR	6.5 – 7.6					U655	3	C9L	9311416Y	3506434Y
	500	6.8 – 8.1					U34ART	4	C9G	9311415	3506436
	750	7.4 – 8.3					U39ART	*4	C9N	9311387	3506405

* Do not use Y35 tool. Need 15 ton tool

** Use this terminal lug for switches and disconnects. Otherwise, use Std Item UL15E (Item ID 9201251). See UG Material Catalog, Section 50, for more information on UL15E.

NOTES:

*1.) In **Y45** tool use Y35 die with "S" adapter (Burndy Cat. No. PT-6515).*

*2.) In **Y46** tool use Y35 die with "P" adapter (Burndy Cat. No. P-UADP).*

For 1000 MCM connector (non-standard) use Y45 / S44ART or Y46 / P44ART (4 Crimps).

CLAMP, STRAIN

Deadend clamps for distribution construction with copper, CCW, aluminum, or ACSR conductors.

	MATERIAL	CAPACITY (lbs)	DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
	Galv. Mal. Iron	5,000	#6 to #2 Cu. #6A to #2A CCW	C13A1	9315731	3506760
	Galv. Mal. Iron	9,000	* #2 to 4/0 Cu. #6A to 2A CCW	C13A2	9312434	3504158
	Galv. Mal. Iron	10,000	#4/0 to 400kcmil Cu.	C13B	9315732[Y]	3506758[Y]
	Aluminum	6,000	* #4 to 2/0 Al. or #6 to 2/0 ACSR	C13H	9315730	3506763
	Aluminum	8,000	* 3/0 to 556.5 Al. or 2/0 to 556.5 ACSR	C13J	9307352	5985783
	Aluminum	15,000	3/0 to 477 Al. or 336.4 to 1000 ACSR	C13K	9307354	5985564
	Galvanized Steel	15,000	.25-.5” galv. steel or #4 to 4/0 Cu.	C13L	9307353	5985605
	Aluminum	35,000	397.5 to 1431 Al. or 336.4 to 1272 ACSR	C13M	9320354	5985660
	Aluminum	15,000	336.4 – 1000 Al.	C13N	9307359	5985784
	Galv. Mal. Iron	8,000	2/0 solid to 4/0 Cu. & copperweld	C13P	9307369[E]	5985905[E]
	Aluminum	-	1/0 secondary neutral to service messenger mid-span clamp	C13S	9308334	9201457
	Aluminum	1,250	1/0 to 2-4 AWG Al service and neutral	C13Q	9307433	

** Side opening / Hot stick type clamp*

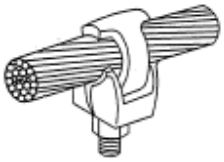
CONNECTOR, CABLE RACK GROUNDING

Tinned connector for connecting 4/0 AWG bare copper ground to cable rack.

MOUNTING	STD ITEM	SAP ITEM ID	PS ITEM ID
Light Duty Rack	C18A	9310598	9200986
Heavy Duty Rack, Rack Mount Hole	C18B	9310597	9200987
Heavy Duty Rack, Rack Arm Hole	C18C	9310596	9200988
Light Duty Rack	C18D	9306213	9202070

CONNECTOR, EYEBOLT (CABLE TO FLAT)

Outdoor heavy duty, pressure eyebolt connector, copper alloy body with a high strength bronze eyebolt, with ½" – 13 UNC threaded stud, lock washer and nut. For use with copper conductors and for mounting directly to a ¼" maximum thickness, flat surface.



CABLE RANGE AWG / kcmil	STD ITEM	SAP ITEM ID	PS ITEM ID
#8 sol. – 2/0 str.	C17B	9316651[Y]	2014802[Y]
#6 sol. – 250 kcml	C17D	9316645[Y]	2014846[Y]
1/0 sol. – 500 kcml	C17F	9316652	2014800

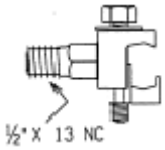
CONNECTOR, ANODE GROUND LEAD

Tinned Copper Crimp connector for connecting anode ground lead (#12) to manhole ground bus (#4/0). Crimp with P654 die in Y46 crimping tool.

STD ITEM	SAP ITEM ID	PS ITEM ID
C21	9306988	9201093

CONNECTOR, GROUND

Bronze vise-type Grounding Connector for copper conductors. For Street Lighting Poles and Bases and Transformer Tanks.

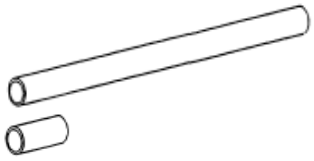


CABLE RANGE AWG	STD ITEM	SAP ITEM ID	PS ITEM ID
#6 sol. – #2/0 Str.	C23A	9312543	3504058
#3 Sol. - #4/0 Str.	C23B	9312542[Y]	3504059[Y]

*Item C23B supplied with locknut on stud.

CONDUIT, PVC, SCHEDULE 40, 1"

Rigid Gray PVC conduit and coupling. For indoor or outdoor applications. See Item UK6S for PVC cement and Item S33C for Staples.



SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
1" X 10' Straight Section	C29E10	9316094	2010253
1" X 2" Straight Coupling	C29E11	9316095[Y]	2010252[Y]

CONNECTOR, GROUND, SPLIT BOLT

Copper, split bolt type, grounding connector for copper conductors. To be used to connect padmounted transformer grounds and bonding wires.

CABLE RANGE AWG	STD ITEM	SAP ITEM ID	PS ITEM ID
#2 sol. – #2/0 Str.	C24	9313780	5961547

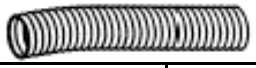
CONNECTOR, HOT LINE - ALUMINUM

Clamp type plated aluminum hot line tap connector for copper and aluminum.

RUN	TAP	CURRENT RATING	STD ITEM	SAP ITEM ID	PS ITEM ID
1/0 Al or ACSR	#3 Cu - 1/0 Al or Cu	200A	C24A	9313040[E]	5960210[E]
4/0 Al, 336.4 Al, or ACSR	#3 Cu - 1/0 Al or Cu	200A	C24A1	9313039[E]	5960215[E]
#6 – 4/0	#6 –4/0	230A	C24B	9313393	3504025
#4 – 336.4	#4 – 336.4	600A	C24C	9313392[Y]	3504026[Y]
4/0 - 800	#4- 350	524	C24CC	9386558	9203022

CONDUIT, PVC, FLEXIBLE

Gray PVC flexible conduit for indoor or outdoor street lighting and underground applications per latest NEMA Std. TC12.



NOMINAL I.D.	APPROX I.D.	ACTUAL O.D.	SHIPPING LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
¾”	0.83”	1.04”	200’ Coil	C29F	9316093	2010254
2”	2.045”	2.375”	250’ Coil	C29J	9316092	2010255

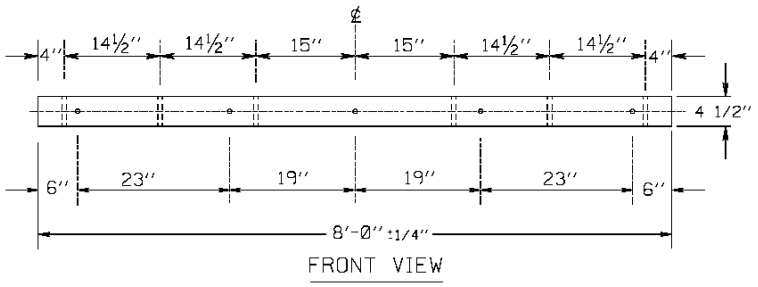
STRAP, PERFORATED

¾” wide X 20 gauge (0.35” thick) Galvanized steel with ¼” to 9/32” D. Holes centered along the strap on ½” to ⅝” centers.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
50 Ft. Roll	C30	9321416[Y]	7503017[Y]

CROSSARM, 6 PIN STANDARD DUTY

3½” x 4½” x 8’ Douglas Fir, pentachlorophenol treated per latest NG MS 2121.



FRONT VIEW

STD ITEM	SAP ITEM ID	PS ITEM ID
C31B	9315007	3502022

BRACKET, CUTOUT / ARRESTER

Galvanized steel construction, for mounting an arrester or cutout onto crossarms, ANSI C37.42. C33 (left picture) is for mounting a single arrester or cutout on a wooden crossarm. C33A (right picture) is for an arrester and a cutout mounted on a fiberglass deadend crossarm (C76D).

STD ITEM	SAP ITEM ID	PS ITEM ID
C33	9311948	3502149
C33A	9387997	N/A

BRACKET, CUTOUT / ARRESTER

12" galvanized bracket for mounting cutouts, arresters, or terminators on a pole.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
Single Position	C35	9320108	5984503
Three Position (For mounting a cutout & arrester)	C35A	9311015	5102584

GAIN, CROSSARM

For use between pole and cross arms. Galvanized iron per ANSI C135.33.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
3" X 4" For use between pole and cross arm at 30° to 60° dead-ends.	C37	9311443	3502243
For use with distribution supply wood crossarms or four inch channel arms, channel flanges can be turned up or down. 6" – 12" pole range, ¾" max. mounting bolt.	C37A	9307195	5988935

BRACKET, 600A DISCONNECT

Galvanized disconnect switch mounting bracket per MS2760. For 15kV-35kV, 600A open type single stick operated disconnect switches.

STD ITEM	SAP ITEM ID	PS ITEM ID
C38B	9307448	5984552

CUTOUT, ENCLOSED PORCELAIN 5 kV FUSED AND DISCONNECTING

Grey porcelain housing, hook stick operable door with fuse tube or solid blade. Self-contained dropout operation. Fuse tubes accept standard K-link fuses (STD ITEM F1K) and includes NEMA standard crossarm mounting bracket. For MAINTENANCE ONLY

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
100A Small Box, Heavy Duty Dropout Fused	C41B1	9311902	2023930
100A Large Box, Extra Heavy Duty Indicating Fused	C41D1	9311766	2023562
200A Extra Large Box, Indicating Blade Disconnecting	C41D2	9311901[Y]	2023939[Y]

CUTOUT, OPEN TYPE, 15KV STANDARD

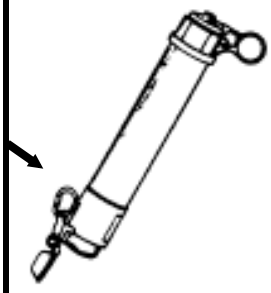
Open type single stick operated fused cutout or disconnect for outdoor application on all overhead primary distribution circuits through 15 kV. Grey non-porcelain insulator, plated copper – eyelet connectors for #6 through 4/0 conductors, and galvanized load buster hooks PER NG MS2731.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
15 kV CUTOUT – 100A (Frame with 100A Fuse Holder)	C43S10	9309170	2023700
15 kV CUTOUT – 200A (Frame with 200A Fuse Holder)	C43S20	9314394	0811133
15 kV CUTOUT – 300A (Frame with 300A Solid Blade)	C43S30	9314395	0811134
100A FUSEHOLDER (For 10 – 100A Fuse links Only)	C43S11	9311747	2023701
200A FUSEHOLDER (For 140 & 200A Fuse links Only)	C43S21	9311746	2023702
300A SOLID BLADE (Non-Fused Disconnect)	C43S31	9311745	2023703

FUSE HOLDER, POWER, SM - 4

S&C type SM-4, 200A max., power fuse holder for use with type SM-4 power fuse mounting. Indoor units include the snuffler, outdoor units do not include the snuffler. Use the correct voltage rating type SM-4 fuse refill, item F4, F19, F21, or F24.

***** Item Has Been Discontinued



KV	UNI-RUPTER	USE	STD ITEM	SAP ITEM ID	PS ITEM ID
7.2	No	Outdoor	C49A *		
14.4	No	Indoor	C49B	9312508	2018474
14.4	Yes	Indoor	C49B1	9318879[E]	5909490[E]
14.4	No	Outdoor	C49B2 *	9317116[E]	5909505[E]
25	No	Outdoor	C49C	9317114[E]	5909515[E]
25	Yes	Indoor	C51L25	9387605	NA
35	No	Outdoor	C49D	9317111[E]	5909523[E]

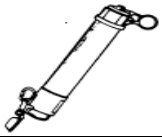
FUSE HOLDER, POWER, SM – 5 OUTDOOR STYLE

S&C type SM-5, 400A max., outdoor, power fuse holder for use with type SM-5 power fuse mounting, item C50A (see Section 22 in Overhead Book) use with SM-5 fuses, Std. Item F5_, F22E_ or F23_.

KV	STD ITEM	SAP ITEM ID	PS ITEM ID
7.2	C50A	9317105[E]	5909530[E]
14.4	C50B	9311770	2023521
25	C50C	9317104[E]	5909540[E]

FUSE HOLDER, POWER, SM – 5 INDOOR STYLE

S&C type SM-5S, 300A max, indoor style for use on S&C DML-9 switchgear, power fuse holder with silencer for use with type SM-5 power fuse mounting, 27kV class, use with type SM-5 fuses, Std. item F23_.



KV	STD ITEM	SAP ITEM ID	PS ITEM ID
25	C50I	9393160	

FUSE END FITTINGS, POWER, SM-20 LIVEFRONT SWITCHGEAR

S&C type SML-20, 14.4 kV, 200A max., indoor power fuse end fittings (top & bottom) with “Silencer” for use with type SMU-20 power fuses (STD. item F6__).

STD ITEM	SAP ITEM ID	PS ITEM ID
C51	9311767	2023529

FUSE END FITTINGS, POWER, SM-20 DEADFRONT SWITCHGEAR

S&C type SME-20, Universal used on both 14.4 kV and 25kV class switchgear, 200A max., indoor power fuse end fittings (top & bottom) with “Silencer” for use with type SMU-20 power fuses (STD item F6__ or F8__),

STD ITEM	SAP ITEM ID	PS ITEM ID
C51E	9307620	9202463

FUSE END FITTINGS, CLIP IN, NX STYLE, DEADFRONT SWITCHGEAR

S&C fault fiter type, 14.4 kV, 200A max., indoor power fuse end fittings (top & bottom) clip in style for use with type Cooper NX (STD Item F12C__).

STD ITEM	SAP ITEM ID	PS ITEM ID
C51ECL	9387847	none

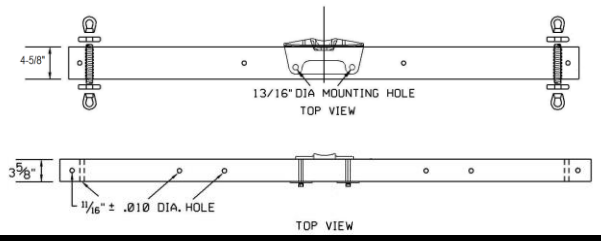
FUSE END FITTINGS, POWER, SM-4 SWITCHGEAR

S&C type SM_-4, 25 kV, 200A max., indoor power fuse end fittings (top & bottom) with “Silencer” for use with type SM-4 power fuses, Std. item F4.

Front	Style	STD ITEM	SAP ITEM ID	PS ITEM ID
Live	SML-4Z	C51L25	9387605	none
Elbow	SME-4Z	C51E25	9391375	

CROSSARM, FIBERGLASS

Heavy duty, 8-foot length, medium brown/bronze or light gray in color.



DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
Deadend Arm	C76D	9306206	9201847
Tangent Arm	C76T	9306208	9201845

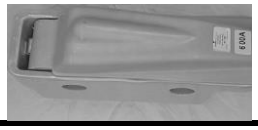
COVER, BOLLARD

Yellow plastic cover for 6” bollards. 7 1/8” inner diameter, 60” long. White reflective tape. Alternate green plastic cover available, Std Item C80G.

STD ITEM	SAP ITEM ID	PS ITEM ID
C80	9308350	9201995
C80G	9307831	9202305

SWITCH, DISCONNECT, 5 kV ENCLOSED

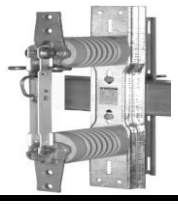
600A, polymer enclosed, single stick operated solid blade primary distribution switch; includes crossarm mounting bracket.



STD ITEM	SAP ITEM ID	PS ITEM ID
D1C	9311737	2027117

SWITCH, DISCONNECT, OPEN

Open-type, single stick operated, loadbuster disconnect switches per NG MS2761.



VOLTAGE	CURRENT (RATED)	STD ITEM	SAP ITEM ID	PS ITEM ID
15KV	600A	D5D	9311735	2027120
35KV	600A	D5F	9302650	5671712

SWITCH, LOADBREAK

Gang-operated side-break load break switch with grey polymer post insulators, fiberglass interface shaft, vertical operating rod (includes 7’ FRP insulated section), lockable operator handle and NEMA two hole terminal pads. Switch shall comply with latest ANSI Std. C37.30 and NG MS2776 & MS2778.
Note: See 22-TSXX section for Loadbreak switches for Sub Transmission.

VOLTAGE	CURRENT	STYLE	STD ITEM	SAP ITEM ID
15KV	600A	Horizontal	D7D	9314777
15KV	600A	Vertical	D7E	9314407
15KV	900A	Horizontal (Hook-Stick)	D7L	9307838
15KV	900A	Vertical (Hook-Stick)	D7M	9390880
35KV	600A	Horizontal	D7F	9314410
35KV	1200A	Horizontal	D7G	9302569[E]
35KV	600A	Vertical	D7H	9314409
35KV	600A	Phase-over-phase	D7J	9314408[Y]

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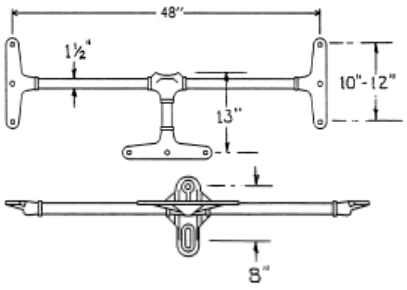
EQUIPMENT MOUNT – 3Ø

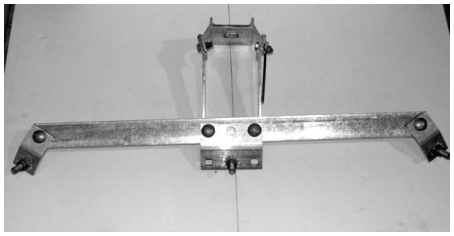
48" Three phase fiberglass equipment mount with aluminum or ferrous end fittings for mounting three cutouts and arresters to a wood pole. Approx. 26 lbs. Shall include (installed) (6) ½" X 2" captive carriage bolts, lock washers and hex nuts (galvanized or equivalent).



STD ITEM	SAP ITEM ID	PS ITEM ID
E12M	9311768	2023525

EQUIPMENT MOUNT – 3Ø

36" Three phase aluminum equipment mount for mounting three terminators and arresters to a wood pole.



DO NOT ORDER
OK to use up
Replaced by E12M

STD ITEM	SAP ITEM ID	PS ITEM ID
E12M1		5695740[E]

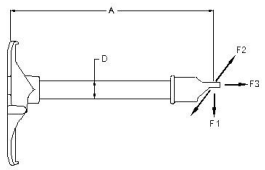
EQUIPMENT MOUNT – 1Ø

18" single phase fiberglass equipment mount with aluminum or ferrous end fitting for mounting a cutout and arrester or a terminator and arrester to a wood pole. Approximately 5.3 lbs. and shall include (installed) (2) ½" X 2" captive carriage bolts, lock washers and hex nuts (galvanized or equivalent).

STD ITEM	SAP ITEM ID	PS ITEM ID
E13M	9308444	9201484

MOUNT, EQUIPMENT - 1Ø, 1-POSITION

18” single phase fiberglass equipment mount with a polymer protective coating. Includes 1 ½” carriage bolt, ½” hex nut, and ½” lock washer.



STD ITEM	SAP ITEM ID	PS ITEM ID
E13N	9308421	9202021

FUSE, LINKS – 15KV TYPE "K"

Universal type 'K' expulsion fuse links per ANSI C37.42 shall have a normal length of 23" with a fuse tube length of 5" and have a removable button head. TCC No. 165-6.

FUSE TUBE RATING	FUSE RATINGS	STD ITEM	SAP ITEM ID	PS ITEM ID
100A	3A	F1K03	9314512	0811167
	6A	F1K06	9314511	0811168
	10A	F1K10	9316322	2009710
	15A	F1K15	9316320	2009715
	*20A	F1K20	9316319	2009720
	25A	F1K25	9316318	2009725
	*30A	F1K30	9316317	2009730
	40A	F1K40	9316316	2009740
	*50A	F1K50	9316315	2009750
	65A	F1K65	9316314	2009765
	*80A	F1K80	9316313	2009780
	100A	F1K100	9316312	2009781
200A	140A	F1K140	9316207	2009784
	200A	F1K200	9316206	2009792

* Identified as "non-preferred" sizes.
- Fuse 100A fuse holders with 3A thru 100A links only
- Fuse 200A fuse holders with 140A and 200A links only.
- 140A and 200A links shall have double pigtail.

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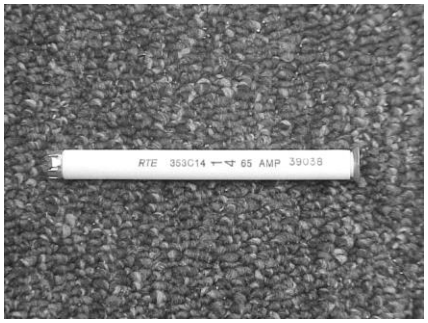
FUSE, BAY-O-NET, 35 kV ONLY

Dual Sensing Bay-O-Net fuse only for use in select 35 kVA pad-mounted transformers. For all other transformers, use standard item F3B.

35 kV TRANSFORMER MVA		CURRENT RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
1Φ	3Φ				
25, 50	75, 150	3	F3A03	9316905[E]	5905983[E]
75		8	F3A08	9311512	2019008
167		15	F3A15	9311511	2019015
	750, 1000	25	F3A25	9311493	2019025
	1500	50	F3A50	9311492	2019050
	2000	65	F3A65	9311491	2019065

FUSE, BAY-O-NET, 4 kV THRU 25 kV

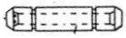
Current Sensing Bay-O-Net fuse for use in 1 and 3 phase pad-mounted and subsurface transformers, and subsurface switches. For all transformers 5-25 kV and 35 kV units single phase 100 kVA; 35 kV three phase 300 & 500 kVA. Other 35 kV transformers use standard item F3A.



CURRENT RATING (AMPS)	TD ITEM	SAP ITEM ID	PS ITEM ID
6	F3B6	9310845	5105688
10	F3B10	9316904	5905984
15	F3B15	9309434	5905987
25	F3B25	9316901	5905997
40	F3B40	9316900	5905998
65	F3B65	9316899	5905999
100	F3B100	9316902	5905996
140	F3B140	9316898	5906003

FUSE, BAY-O-NET, CARTRIDGE

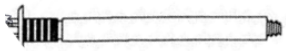
Cartridge holder for bayonet fuses F3__.



STD ITEM	SAP ITEM ID
F3C	9321461

FUSE, BAY-O-NET, INNER CARTRIDGE

Inner cartridge holder for bayonet fuses F3__.



STD ITEM	SAP ITEM ID
F3CH	9393695

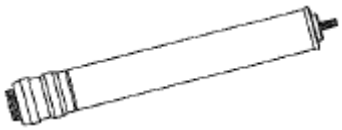
FUSE, BAY-O-NET, CARTRIDGE END PLUG

End plug for bayonet fuse cartridge F3C.

STD ITEM	SAP ITEM ID
F3CP	9321468

FUSE, POWER, SM – 4, 14.4kV

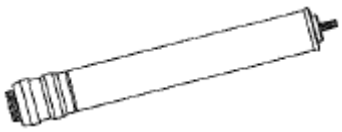
S&C type SM-4, 14.4 kV power fuses for use with SM-4 power fuse holder, standard item C49B, C49B1 or C49B2. Units to be standard speed TCC 153-4 unless noted as 'Slow' which are TCC 119-4.



FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
10E	F4E10	9312439	2018532
15E	F4E15	9314971	2018536
25E	F4E25	9312519	2018430
40E	F4E40	9312455	2018550
50E	F4E50	9312516	2018442
65E	F4E65	9312452	2018561
80E	F4E80	9312451	2018563
100E	F4E100	9313909	2018572
125E	F4E125	9312513	2018450
150E	F4E150	9313479	2018452
175E	F4E175	9313480[Y]	2018467[Y]
200E	F4E200	9312509	2018472
200E (slow)	F4S200	9319349[E]	5908367[E]

FUSE, POWER, SM – 5, 14.4kV

S&C type SM-5, 14.4 kV power fuses for use with SM-5 power fuse holder, standard item C50B. Units to be standard speed TCC 153-4 unless noted as 'Slow' which are TCC 119-4.



FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
10E	F5E010	9319329[E]	5908275[E]
40E(slow)	F5S040	9319365[E]	5908375[E]
65E	F5E065	9319330[E]	5908237[E]
100E	F5E100	9313908	2018573
125E	F5E125	9312445	2018581
150E	F5E150	9313478	2018451
200E	F5E200	9313497	2018470
200E(slow)	F5S200	9319361[E]	5908395[E]
250E	F5E250	9312507	2018485
300E	F5E300	9312505	2018490
300E(slow)	F5S300	9309447[E]	5908371[E]
400E	F5E400	9319366	5908373

FUSE, POWER, SMU – 20, 14.4kV

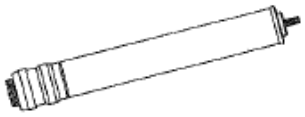
S&C type SMU-20, 14.4 kV power fuses for use with type SMD-20 power fuse mounting, standard item C47A and US36. To be used with end fittings, standard item C51 and C51E. Standard item F6E to be ANSI "E" standard-speed T.C.C. No. 153-2, standard item F6K to be ANSI "K" fast-speed T.C.C. No. 165-2.

FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
20E	F6E020	9318875[E]	5908844[E]
30E	F6E030	9308177[E]	9201523[E]
50E	F6E050	9318847[E]	5908847[E]
65E	F6E065	9318873[E]	5908848[E]
80E	F6E080	9318872[E]	5908851[E]
100E	F6E100	9318888	5908866[E]
125E	F6E125	9316329	2009125
150E	F6E150	9316328	2009150
175E	F6E175	9316327	2009175
200E	F6E200	9314995	2009201
10K	F6K10	9316297	2009010
15K	F6K15	9316296	2009015
25K	F6K25	9316295	2009025
30K	F6K30	9316294[Y]	2009030[Y]
40K	F6K40	9316293	2009040
50K	F6K50	9316292[Y]	2009050[Y]
65K	F6K65	9316291	2009065
80K	F6K80	9316308	2009080
100K	F6K100	9316310	2009100
140K	F6K140	9316311	2009140
200K	F6K200	9316326[Y]	2009200[Y]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

FUSE, POWER, SM – 5, 34.5 kV

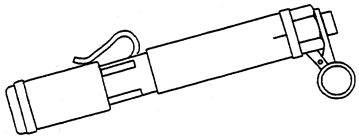
S&C type SM-5, 34.5 kV power fuses, 300A max., for use with type SM-5 power fuse holder, standard item F7H.



FUSE RATING (AMPS)	T.C.C. CURVE	STD ITEM	SAP ITEM ID	PS ITEM ID
5E	153-4 (Std)	F7E5	9313913[Y]	2018332[Y]
40E	153-4 (Std)	F7E40	9311488[Y]	2023232[Y]
50E	153-4 (Std)	F7E50	9312446[Y]	2018829[Y]
100E	153-4 (Std)	F7E100	9315204	0808053
100E	119-4 (Slow)	F7E10S	9311602[Y]	2018866[Y]
125E	153-4 (Std)	F7E125	9315203	0808054
150E	153-4 (Std)	F7E150	9311440	2018880
150E	119-4 (Slow)	F7E15S	9312461[Y]	2018417[Y]
175E	153-4 (Std)	F7E175	9315202	0808056
175E	119-4 (Slow)	F7E18S	9319110[E]	5907555[E]
200E	153-4 (Std)	F7E200	9315187	0808051
250E	153-4 (Std)	F7E250	9315201	0808057
300E	153-4 (Std)	F7E300	9314364	0810429

FUSE HOLDER, INDOOR STYLE, POWER, SM-5, 34.5 kV

S&C type SM-5, 34.5 kV power fuse holder, for use with type SM-5 power fuses, standard item F7E. For use in switchgear Std. item US38F

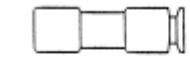


	STD ITEM	SAP ITEM ID	PS ITEM ID
With snuffler	F7H	9311487[Y]	2023234[Y]
Without snuffler	TF2A	9311486	2023305

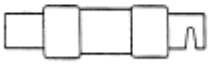
[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

FUSE, CARTRIDGE, 250V

Dual element, 250 volt, class RK5, current limiting fuse with an interrupting rating of 200,000 amps. RMS.



FERRULE TYPE 0-60A



KNIFE BLADE TYPE 61-600A

FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
1.0	F8A1.0	9321626	8026500
1.4	F8A1.4	9321625[Y]	8026501[Y]
2.8	F8A2.8	9321624[Y]	8026502[Y]
3.5	F8A3.5	9321623[Y]	8026503[Y]
5.0	F8A5.0	9317043[E]	5901877[E]
6.2	F8A6.2	9321480[Y]	8026506[Y]
10	F8A10	9321872[Y]	8026510[Y]
15	F8A15	9321871	8026515
20	F8A20	9321870	8026520
30	F8A30	9321869	8026530
35	F8A35	9321868[Y]	8026535[Y]
40	F8A40	9321875[Y]	8026540[Y]
50	F8A50	9321885[Y]	8026550[Y]
60	F8A60	9321886	8026560
80	F8A80	9321887[Y]	8026580[Y]
100	F8A100	9321904	8026600
150	F8A150	9321903[Y]	8026615[Y]
200	F8A200	9321902	8026620
300	F8A300	9321901[Y]	8026630[Y]
400	F8A400	9321900[Y]	8026640[Y]
600	F8A600	9321899[Y]	8026660[Y]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

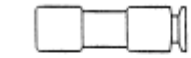
25kV POWER FUSES – SMU – 20

Power fuses for use with S&C type SMD-20 outdoor power fuse mounting (STD ITEM C47B). STD ITEM F8K to be ANSI "K" fast-speed T.C.C. No. 165-2. STD ITEM F8E to be ANSI "E" standard-speed T.C.C. No. 153-1.

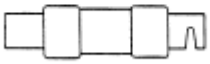
FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
100E	F8E100	9318871[E]	5908864[E]
125E	F8E125	9318878[E]	5908865[E]
3K	F8K3	9309581[E]	5908860[E]
10K	F8K10	9318907[E]	5908872[E]
15K	F8K15	9318955[E]	5908876[E]
25K	F8K25	9318954[E]	5908877[E]
40K	F8K40	9321503[E]	5908878[E]
65K	F8K65	9318971[E]	5908879[E]
80K	F8K80	9309580[E]	5908863[E]
100K	F8K100	9318958[E]	5908873[E]
140K	F8K140	9318988[E]	5908892[E]

FUSE, CARTRIDGE, 600V

Dual element, 600 volt, 15A, class RK5, current limiting fuse with an interrupting rating of 200,000 amps. RMS.



FERRULE TYPE 0-60A



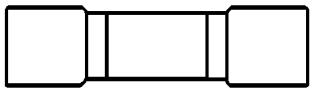
KNIFE BLADE TYPE 61-600A

FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
10	F9A10		
15	F9A15	9309411[Y]	8026715[Y]
50	F9A50		
70	F9A70		
80	F9A80		
100	F9A100	9321898[Y]	8026800[Y]
600	F9A600	9321899[Y]	8026660[Y]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

FUSE, CARTRIDGE, 600V

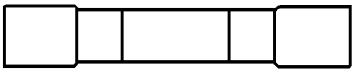
600V current limiting fuse with an interrupting rating of 100,000A RMS. For use with in-line fuse holder HEB, item F50B.



FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
6	F10A06	9321402	8026186[Y]
10	F10A10	9321460	8026190[Y]
15	F10A15	9321458	8026195
30	F10A30	9321457	8026200[Y]

FUSE, CARTRIDGE, 300V

300V, Class G, current limiting fuse with an interrupting rating of 100,000A RMS. For use with in-line fuse holder HEJ, item F50JD.



FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
60	F11A60	9321370	8026160[Y]

FUSE, AMP TRAP, 600V

Fuse, amp trap, 600V, 1.2 KA, knife blade, 2-1/2" DIA x 11" L, Class L, 200KA interrupting rating, with standard mounting end. Fuses to be installed on wall-mounted amp trap fuse chamber used on network services.

FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
600	F11B1	9387240	
800	F11B2	9387285	
1000	F11B3	9387277	
1200	F11B4	9317056	
1600	F11B5	9387275	
2000	F11B6	9309470	
2500	F11B7	9387266	
3000	F11B8	9317046	
3500	F11B9	9387265	
4000	F11B10	9317045	

FUSE, BAY-O-NET

Full range current limiting clip style fuse. NX Style.

Fuse Design (kV)	Current Rating (Amps)	Mounting Code Number	Dimensions (Inches)			STD ITEM	SAP ITEM ID	PS ITEM ID
			Length (A)	Diameter (B)	Stud (C)			
2.8/4.3	18 C	4	10	1-1/8	1	F12C1	9318973	5908880[E]
2.8/4.3	35 C	4	10	1-1/8	1	F12C2	9309579[E]	5908881[E]
2.8/4.3	50 C	4	10	2	1	F12C3	9318992[E]	5908882[E]
2.8/4.3	65 C	4	10	2	1	F12C4	9309583[E]	5908834[E]
2.8/4.3	100 C	4	10	2	1	F12C5	9321649[E]	5903560[E]
5.5	10 C	4	10	1-1/8	1	F12C6	9309578[E]	5908883[E]
5.5	18 C	4	10	1-1/8	1	F12C7	9309577[E]	5908884[E]
5.5	25 C	4	10	2	1	F12C8	9318974[E]	5908885[E]
5.5	40 C	4	10	2	1	F12C9	9318991[E]	5908886[E]
8.3	8 C	4	10	1-1/8	1	F12C10	9309576[E]	5908887[E]
8.3	12 C	4	10	1-1/8	1	F12C11	9318990[E]	5908888[E]
8.3	18 C	4	10	2	1	F12C12	9309575[E]	5908889[E]
8.3	25 C	4	10	2	1	F12C13	9318989[E]	5908890[E]
8.3	40 C	4	10	2	1	F12C14	9309574[E]	5908891[E]
8.3	50 C	5	14-11/16	3-7/16	1-3/16	F12C15	9316866[E]	5903565[E]
8.3	80 C	5	14-11/16	3-7/16	1-3/16	F12C16	9318726[E]	5908818[E]
8.3	100 C	5	14-11/16	3-7/16	1-3/16	F12C16A	9309826[E]	NA
15.5	20 C	5	14-5/16	2	1	F12C17	9309573[E]	5908895[E]
15.5	40 C	5	14-5/16	2	1	F12C18	9316865	5903569[E]
15.5	65 C	6	17-1/2	3-7/16	1-3/16	F12C21	9307614	9202938
15.5	80 C	6	17-1/2	3-7/16	1-3/16	F12C19	9317304[E]	5900265[E]
15.5	100 C	6	17-1/2	3-7/16	1-3/16	F12C20	9310202[E]	9201301[E]
15.5	125 C	6	17-1/2	3-7/16	1-3/16	F12C22	9388846	NA

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

FUSE, CURRENT LIMITING WITH ARC STRANGLER

Fuse (kV)	Amps	Mtg. Code #	Fuse Dia. Inches	Dimensions (Inches)				STD ITEM	SAP ITEM ID	PS ITEM ID
				A	B	C	D			
4.3	18 C	1	1-1/8	14	8-7/8	1-3/8	3/8	F13C1	9316832[E]	5903553[E]
4.3	25 C	1	1-1/8	14	8-7/8	1-3/8	3/8	F13C2	9316849[E]	5903554[E]
4.3	50 C	1	2	14	8-5/16	2-1/4	1-7/16	F13C3	9316851[E]	5903555[E]
5.5	20 C	1	2	14	8-5/16	2-1/4	1-7/16	F13C4	9318786[E]	5908823[E]
5.5	25 C	1	2	14	8-5/16	2-1/4	1-7/16	F13C5	9318732[E]	5908807[E]
5.5 *	35 C	1						F13C6	9318731[E]	5908808[E]
5.5	40 C	1	2	14	8-5/16	2-1/4	1-7/16	F13C7	9318728[E]	5908815[E]
5.5	75 C	1	2	14	8-5/16	2-1/4	1-7/16	F13C8	9318727[E]	5908816[E]
8.3	8 C	1	1-1/8	14	8-7/8	2-3/8	3/8	G13C9	9316870[E]	5903556[E]
8.3	10 C	1	1-1/8	14	8-7/8	2-3/8	3/8	F13C10	9316852[E]	5903557[E]
8.3	18 C	1	2	14	8-5/16	2-1/4	1-7/16	F13C11	9316869[E]	5903558[E]
8.3	25 C	1	2	14	8-5/16	2-1/4	1-7/16	F13C20	9301991[E]	5106522[E]
8.3	30 C	1	2	14	8-5/16	2-1/4	1-7/16	F13C12	9316868[E]	5903559[E]
8.3	40 C	1	2	14	8-5/16	2-1/4	1-7/16	F13C13	9316833[E]	5903551[E]
15.5	8 C	2	2	18-1/2	8-5/16	2-1/4	1-7/16	F13C14	9318730	5908811
15.5	12 C	2	2	18-1/2	8-5/16	2-1/4	1-7/16	F13C15	9318725[E]	5908820[E]
15.5	18 C	2	2	18-1/2	8-5/16	2-1/4	1-7/16	F13C16	9318764[E]	5908822[E]
15.5	25 C	2	2	18-1/2	8-5/16	2-1/4	1-7/16	F13C17	9309584[E]	5908824[E]
15.5 *	35 C							F13C18	9318729[E]	5908814[E]
15.5	40 C	2	2	18-1/2	8-5/16	2-1/4	1-7/16	F13C19		

* = No longer manufactured.

FUSE, BAY-O-NET TYPE EL CURRENT LIMITING

Cooper type EL current limiting Bay-O-Net fuses are used in some 35 kV three phase pad-mounted transformer applications. Type EL links will fit only on type EL Bay-O-Net assemblies and are not interchangeable with non-current limiting Bay-O-Net links.

TRANSFORMER kVA	CURRENT RATING (AMPS)	STD ITEM	SAP ITEM ID	PS ITEM ID
750, 1000	20	F14A20	9305294[E]	5152551[E]
1500	25	F14A25	9309572[E]	5908903[E]

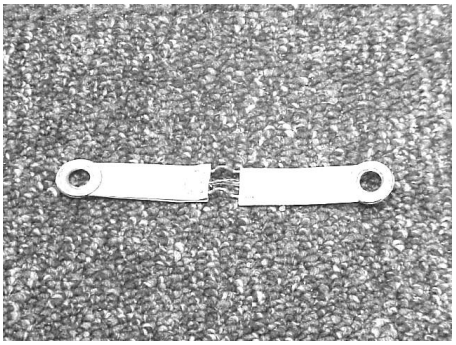
FUSE, OFC LINK

Fuse link for GE Oil Fuse Cutouts.

CURRENT RATING (AMPS)	STD ITEM	SAP ITEM ID	PS ITEM ID
10	F15A10	9316749[E]	5905110[E]
15	F15A15	9309444[E]	5905115[E]
25	F15A25	9316839[E]	5905125[E]
40	F15A40	9317808[E]	5905140[E]
50	F15A50	9317825[E]	5905150[E]
65	F15A65	9317824[E]	5905165[E]
75	F15A75	9317823	5905175
100	F15O10	9317822	5905200
125	F15O12	9317821[E]	5905225[E]
150	F15O15	9317820[E]	5905250[E]
200	F15O20	9317819[E]	5905260[E]
250	F15O25	9309436[E]	5905270[E]
300	F15O30	9317818[E]	5905280[E]
SOLID	F15OS	9309479[E]	5900090[E]

FUSE, OFC LINK

Fuse link for G&W Oil Fuse Cutouts



CURRENT RATING (AMPS)	STD ITEM	SAP ITEM ID	PS ITEM ID
10	F16A10	9309438[E]	5904910[E]
15	F16A15	9316758[E]	5904915[E]
25	F16A25	9316757[E]	5904925[E]
50	F16A50	9316756[E]	5904950[E]
65	F16A65	9316755[E]	5904965[E]
100	F16O10	9316754[E]	5904980[E]
140	F16O14	9309437[E]	5904990[E]
150	F16O15	9317820[E]	5905250[E]
200	F16O20	9316753[E]	5904995[E]

SLEEVE, OFC

Replacement Cable Entrance for Oil Fuse Cutouts.

CABLE INSULATION	CURRENT RATING (AMPS)	STD ITEM	SAP ITEM ID	PS ITEM ID
Solid Dielectric	100	F17A	9317336[E]	5909851[E]
Solid Dielectric	200	F17B	9317337[E]	5909850[E]
PILC	200	F17C	9317335[E]	5909855[E]

EXPANSION TANK, OFC

Replacement Expansion Tank for Oil Fuse Cutouts.

STD ITEM	SAP ITEM ID	PS ITEM ID
F18	9321100[E]	5900200[E]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

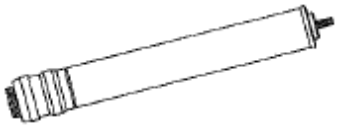
FUSE, POWER, SM – 4, 25 kV

S&C type SM-4, 25 kV power fuses for use with SM-4 power fuse holder, standard item C49C, C49C1, C51E25 or C51L25. Units to be standard speed TCC 153-4, unless noted as 'Slow' which are TCC 119-4.

FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
3E	F19E03	9319096[E]	5908407[E]
5E	F19E05	9319098[E]	5908408[E]
10E	F19E10	9318787[E]	5908410[E]
20E	F19E20	9309461[E]	5908420[E]
25E	F19E25	9318845[E]	5908425[E]
30E	F19E30	9318843[E]	5908430[E]
40E	F19E40	9392269[E]	5908440[E]
50E	F19E50	9318812[E]	5908455[E]
65E	F19E65	9321479[E]	5908465[E]
80E	F19E80	9318808[E]	5908480[E]
100E	F19E11	9309459[E]	5908500[E]
125E	F19E12	9319260[E]	5908510[E]
150E	F19E15	9319259[E]	5908511[E]
175E	F19E75	9319256[E]	5908531[E]
200E	F19E19	9309458[E]	5908532[E]
15E(slow)	F19S15	9319254[E]	5908540[E]
65E(slow)	F19S65	9309460[E]	5908466[E]
80E(slow)	F19S80	9319036[E]	5908486[E]
100E(slow)	F19S11	9319326[E]	5908499[E]
125E(slow)	F19S12	9319261[E]	5908509[E]
175E(slow)	F19S75	9319257[E]	5908530[E]
200E (slow)	F19S19	9319255[E]	5908533[E]

FUSE, POWER, SM – 5, 4.16 kV

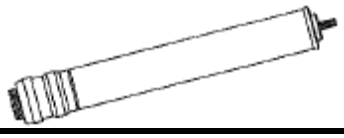
S&C type SM-5, 4.16 kV power fuses. Units to be standard speed TCC 153-4.



FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
150	F20E15	9319106[E]	5907712[E]

FUSE, POWER, SM – 4, 7.2 kV

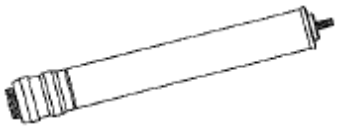
S&C type SM-4, 7.2 kV power fuses for use with SM-4 power fuse holder, standard item C49A. Units to be standard speed TCC 153-4.



FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
150	F21E15		

FUSE, POWER, SM – 5, 7.2 kV

S&C type SM-5, 7.2 kV power fuses for use with SM-5 power fuse holder, standard item C50A. Units to be standard speed TCC 153-4, unless noted as 'Slow' which are TCC 119-4.



FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
200	F22E20	9319332[E]	5908160[E]
300	F22E30	9319331[E]	5908170[E]
300 (slow)	F22S30	9309455[E]	5908167[E]
400	F22E40		

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

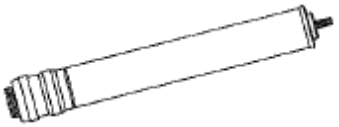
FUSE, POWER, SM – 5, 25 kV

S&C type SM-5, 25 kV power fuses for use with SM-5 power fuse holder, standard item C50C or C50l . Units to be standard speed TCC 153-4, unless noted as 'Slow' which are TCC 119-4.

FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
5E	F23E05	9319117[E]	5908409[E]
13E	F23E13	9309462[E]	5908414[E]
25E	F23E25	9318844[E]	5908426[E]
40E	F23E40	9319253[E]	5908546[E]
50E	F23E50	9318811[E]	5908456[E]
65E	F23E65	9319252[E]	5908548[E]
80E	F23E80	9319250[E]	5908553[E]
100E	F23E11	9309457[E]	5908554[E]
125E	F23E12	9319249[E]	5908555[E]
125E (slow)	F23S12	9319251[E]	5908550[E]
150E	F23E15	9309585[E]	5908570[E]
150E (slow)	F23S15	9318986[E]	5908565[E]
250E (slow)	F23S26	9306335	9202045
175E	F23E75	9310452	5908576
200E	F23E20	9318982[E]	5908580[E]
200E (slow)	F23S20	9318984[E]	5908577[E]
250E	F23E26	9318981[E]	5908585[E]
300E	F23E30	9318980[E]	5908590[E]

FUSE, POWER, SM – 4, 34.5 kV

S&C type SM-4, 34.5 kV power fuses for use with SM-4 power fuse holder, standard item C49D. Units to be standard speed TCC 153-4.



FUSE RATING (AMPERES)	STD ITEM	SAP ITEM ID	PS ITEM ID
40E	F24E40	9318979[E]	5908600[E]
125E	F24E25	9318737[E]	5908608[E]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

FUSE HOLDER, IN-LINE

Molded plastic in-line, watertight, dis-connectable fuse holder with crimp type terminals for copper cable.

Note: For standard item P50BA, use Nicopress 53XPJ crimps in "X" groove.

CU CABLE SIZE (AWG)	MAX. VOLTAGE RATING (VOLTS)	FUSE RATING (AMPS)	USE WITH FUSE (ITEM NO.)	L	Y34A		Y35	STD ITEM	SAP ITEM ID	PS ITEM ID
					IND.	NEST				
#14-#8	600	30 Max.	F10A	4.25	--	--	--	F50BA	9321403	8026185
#2	600	30 Max.	F10A	5.13	Y34R	A25D	U25RT	F50BD	9321551[Y]	8026182[Y]
#2	300	35-60	F11A 60	6.13	Y34R	A25D	U25RT	F50JD	9321405[Y]	8026183[Y]

FUSE 38kV 40KA

Fuse 38kV 40KA current limiting, type 1E, for use on S&C metal clad switchgear.

STD ITEM	SAP ITEM ID	PS ITEM ID
F25	9390255 [E]	NA

FLUID, DIELECTRIC

Dielectric insulating fluid for transformers and circuit breakers. Common name 10C oil.

STD ITEM	SAP ITEM ID	PS ITEM ID
F60	9309490[E]	5594640[E]

Old item F61 moved to UC74

FLUID, SILICONE

Dielectric silicone insulating fluid for network transformers and high side switches on the network transformer. Common name DOW Xiameter PMX-561. This is stocked as a five gallon pail.

STD ITEM	SAP ITEM ID	PS ITEM ID
F62	9390096	NA

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards

[3]This item has a CU with labor/material and a CU with material only

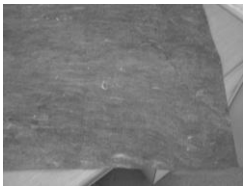
FLUID, NATURAL ESTER

Dielectric insulating fluid for network transformers and high side switches on the network transformer. Common name FR3. This is stocked as a five gallon pail.

STD ITEM	SAP ITEM ID	PS ITEM ID
F64	9391767	NA

FABRIC – GEOTEXTILE – OIL CONTAINMENT FOR TRANSFORMERS

Fabric, Geotextile, 16 OZ., oil containment for padmount transformers, fabric weight = 16 OZ per square yard, 175 mils thick, color: GRAY / BLACK



STD ITEM	SAP ITEM ID	PS ITEM ID
F70	9306294	9201867

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CONNECTOR, GROUND ROD

High strength corrosion resistant copper alloy ground rod connector with a square or hex head bolt. Connector shall accommodate #8 AWG solid - #1/0 AWG stranded. Copper conductor on a ⅝" diameter ground rod. Connector shall be permanently stamped / marked "Direct Burial" and "UL".

STD ITEM	SAP ITEM ID	PS ITEM ID
G2A2	9313446	3503328

CONNECTOR, GROUND ROD

High strength corrosion resistant copper alloy ground rod connector with silicone bronze hardware. Connector shall accommodate #2/0 AWG solid to 250 KCMIL stranded copper conductor parallel or at right angles to a ⅝" diameter ground rod.

STD ITEM	SAP ITEM ID	PS ITEM ID
G4	9313417	3503390

GREASE, ANTI-OXIDE

Anti-Oxide compound grease for all aluminum to aluminum or aluminum to copper electrical connections. Synthetic, non-petroleum base with conductive grit. Not for use on fastener threads. Furnished in 8 oz. plastic squeeze bottle.

STD ITEM	SAP ITEM ID	PS ITEM ID
G9B	9321951	8010034

HEATER

Replacement heaters for S&C metal clad switchgear

STD ITEM	SAP ITEM ID	PS ITEM ID
H	9390211 E	NA

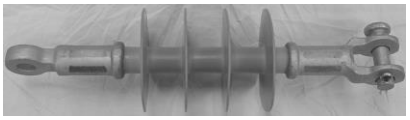
INSULATOR, PIN TYPE, HDPE

Non-ceramic (HDPE) insulators for support of covered primary conductors through 15KV and 35KV. ANSI C29.5 “F” neck, class 55-6. 1” pin thread, sky grey, 3000 lb. cantilever strength.

RATING	SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
15KV	5¼”HT. X 5½” DIA	I6P	9311407	2021610
35KV	7⅛” HT. X 7½” DIA.	I6PA	9319931	5991076

INSULATOR, STRAIN TYPE, POLYMER

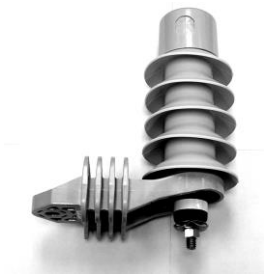
Polymer insulator for primary distribution dead end installations. Per latest CEA LWIWG-01, IEEE 1024, AND ANSI C29.13 specifications.



VOLTAGE	STD ITEM	SAP ITEM ID	PS ITEM ID
15KV	I7PA	9311905	2021572
35KV	I7PB	9319918E	5991820E

SURGE ARRESTER – RISER TYPE

Distribution class riser type polymer housed MOV surge arresters used to protect underground equipment and circuits at riser poles. Shall comply with latest revision of ANSI C62.11 and PPL MS 2608. Includes insulating top cap and yellow bottom isolator.



RATING	MCOV	CREEP	STD ITEM	SAP ITEM ID	PS ITEM ID
10 kV	8.40 kV	Standard	L3DR	9308923	5100681
12 kV	10.2 kV	Standard	L3ER	9308922	5100682
12 kV (added creep)	10.2 kV	21" min.	L3ERN	9306415	9200974
15 kV	12.7 kV	Standard	L3FR	9308921	5100683
21 kV	17.0 kV	Standard	L3GR	9308920[E]	5100684[E]
27 kV	22.0 kV	Standard	L3JR	9308919[E]	5100685[E]

SURGE ARRESTER, CUBICLE

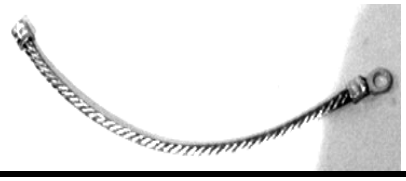
Heavy duty distribution class, metal oxide type surge arrester, polymer housed, with wildlife protector, upper and lower terminals sized to accommodate #6 solid through #3 stranded leads. In accordance with PPL Material Specification Standard MS-2608.

NOMINAL VOLTAGE	STD ITEM	SAP ITEM ID	PS ITEM ID
12 kV	L3EC	9308918[E]	5100686[E]
15 kV	L3FC	9308897[E]	5100687[E]
21 kV	L3GC	9308896[E]	5100688[E]
27 kV	L3JC	9308895	5100689

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

GROUND LEAD, ARRESTER

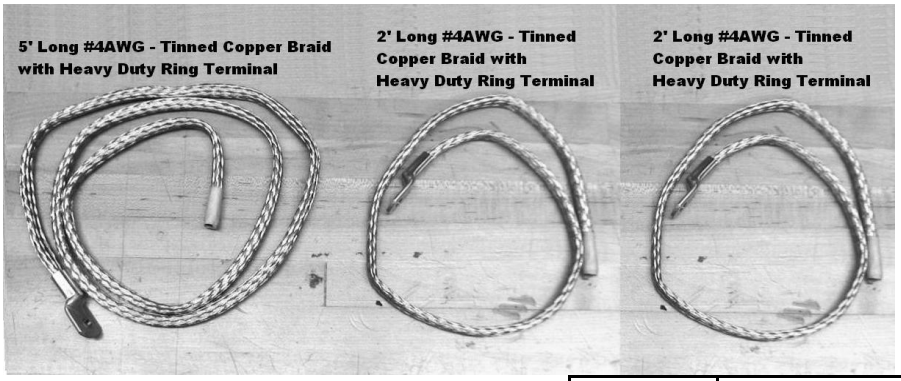
Bare rope lay, stranded, tinned, copper conductor. 7 X 85 strands of #32 wire, with a ⅜" hole tinned copper ring terminal at one end and ½" min. to 1" max. length, solder dipped or ferrule crimped (⅜" min. 0.D.) on the other. Used for lightning arrester ground lead.



	STD ITEM	SAP ITEM ID	PS ITEM ID
12" length	L6	9316058	2006158
24" length	L6L	9306499	9201962

LEAD – GROUNDING FOR MAINTENANCE USE

Lead, grounding, flexible lead lit for vault ladder, 2-24" #4 flat braids with a heavy duty terminal at one end and 1-60" #4 flat braids with a heavy duty terminal at one end. Terminal ends to be tin plated cu. With a 3/8" hole. The 3 leads come in one package for use with STD Items L14V and L18V.



STD ITEM	SAP ITEM ID	PS ITEM ID
L8	9306794	9202150

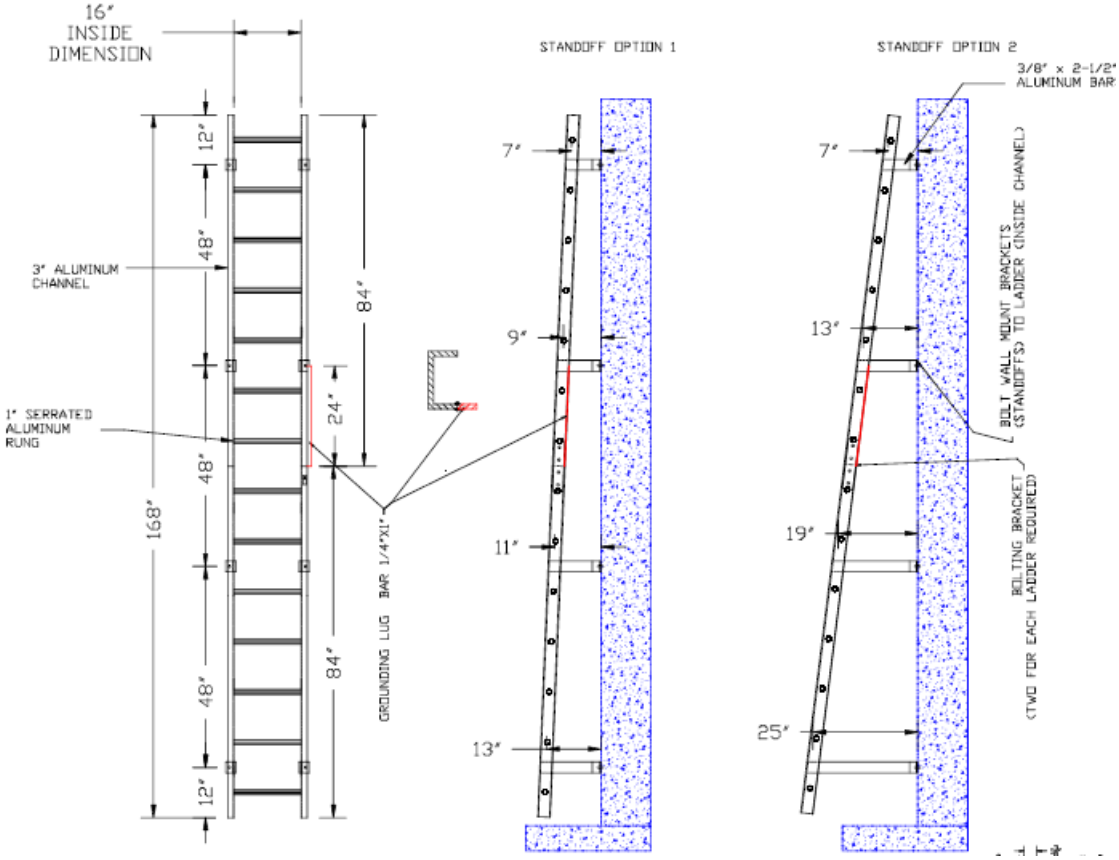
LOCKNUTS

Galvanized steel palnut or MF type.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
⅜"	L10A	9322019	7024164
½"	L10B	9322020	7024159
⅝"	L10C	9322021	7024158
¾"	L10D	9322023	7024155
⅞"	L10E	9322022	7024156

LADDER

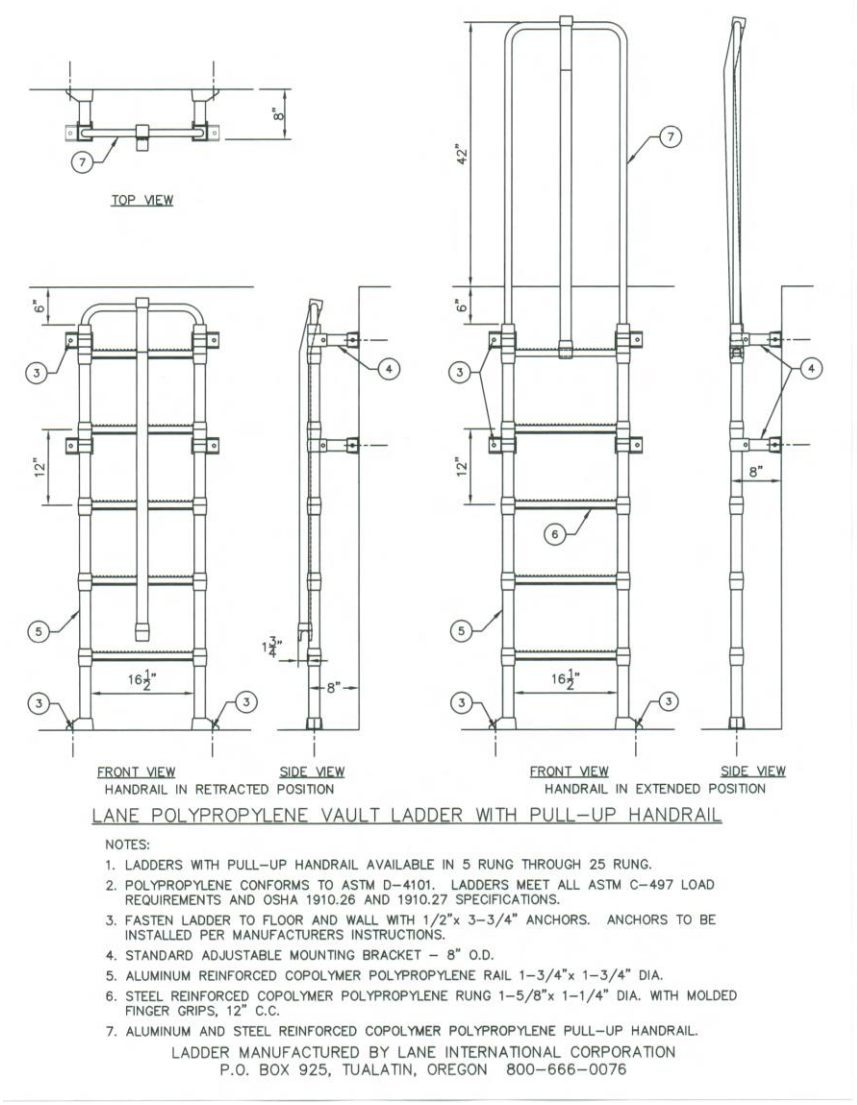
Ladder, aluminum for vault installation, comes in 2 pieces with brackets kits for mounting options shown below.



LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
14’	L14A	9388488	NA
18’	L18A	9388496	NA

LADDER FOR MAINTENANCE USE

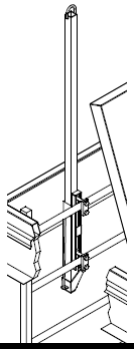
Ladder, polypropylene covered aluminum & steel, for vault installation, pull-up handrail with ¼" pin, 12" wall mounting brackets and foot brackets, handrail & side rails to have bonding brackets for bond wire attachments.



LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
14'	L14V	9306793	9202151
18'	L18V	9306792	9202152

LADDER ASSIST PULL UP HANDLE

Aluminum handle to attach to vault ladder. Handle extends for support to enter and exit vault.



DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
HANDLE EXTENDS 42 INCHES, INCLUDES STAINLESS STEEL CLAMPS AND MOUNTING BOLTS	LU	9386968	NONE

CLIP, BONDING

Steel construction.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
1" WD X 1½" LG For use with a 5/8" bolt	NC22	9320450	5987955
For use with a ¾" bolt	NC23	9313173	5987950

COMPOUND, ELECTRICAL JOINT

8 oz. tube for use on aluminum-to-aluminum and aluminum-to-copper connections.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
For flat-to-flat surfaces such as bus-to-bus, terminal pad-to-dead-end, and terminal pad-to-bus.	NG9D	9303776	5591772

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PIN, INSULATOR

For installation of 15kV standard top groove pin insulator (STD ITEM I6) on standard 4½" wood cross arm (C31). Galvanized steel with standard 1" nylon top thread. Includes 2" square washer, square nut and locknut. ANSI C135.17 Item No. 3.

LENGTH	DIAMETER	STD ITEM	SAP ITEM ID	PS ITEM ID
10¾"	⅝"	P1A	9312032	3502434

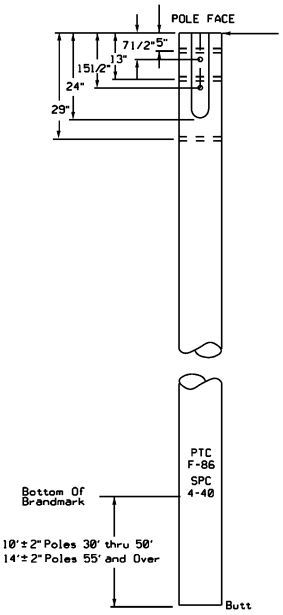
PIN, INSULATOR

For use with top groove insulator (STD ITEM. I6). Galvanized steel with No. 22 X 2¼" wood screw and 1" lead or nylon thread per ANSI C135.17.

STD ITEM	SAP ITEM ID	PS ITEM ID
P3	9311949	3502148

POLES, WOOD

Full length penta-treated Southern Yellow Pine per PPL MS2005 and latest ANSI Std. 05.1.



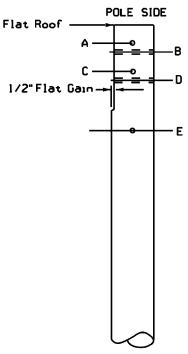


TABLE 1- Required Pretreatment Framing

Required Framing	Pole Length -- Feet					
	30'	35'	40'	45'	50'	50' & Over
24" Gain 1/2" Slash	X	X	X	X	X	X
Hole A		X	X	X	X	X
B	X	X	X	X	X	X
C		X	X	X	X	X
D		X	X	X	X	X
E	X	X	X	X	X	X

LENGTH /CLASS	STD ITEM	SAP ITEM ID	PS ITEM ID
35'-1	P11A1	9302893	5970351
35'-2	P11A2	9311618	3501352
35'-3	P11A3	9311617	3501353
35'-4	P11A4	9302892	5970354
35'-5	P11A5	9311616	3501355
40'-H1	P11BH1	9388196	9388196
40'-1	P11B1	9302891	5970401
40'-2	P11B2	9311615	3501402
40'-3	P11B3	9311614	3501403
40'-4	P11B4	9311613	3501404
45'-H1	P11CH1	9388197	9388197
45'-1	P11C1	9311612	3501451
45'-2	P11C2	9311611	3501452
45'-3	P11C3	9311610	3501453
50'-H1	P11DH1	9388195	9388195
50'-1	P11D1	9311609	3501501
50'-2	P11D2	9311587	3501502
50'-3	P11D3	9311586	3501503
55'-1	P11E1	9311584	3501551
55'-2	P11E2	9311691	3501552
55'-3	P11E3	9309166	3501553
60'-1	P11F1	9311708	3501601
60'-2	P11F2	9311707	3501602
60'-3	P11F3	9311706	3501603
65'-1	P11G1	9311703	3501651
65'-2	P11G2	9312398	3501652
65'-3	P11G3	9312530	3501653
70'-1	P11J1	9311699	3501701
70'-2	P11J2	9311698	3501702
70'-3	P11J3	9311697	3501703

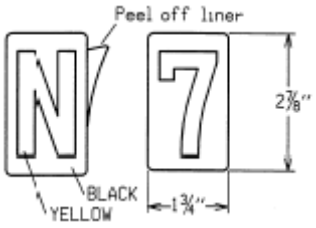
SIGN – NOTICE SUPPLEMENTAL PPE REQUIRED

Sign, notice, supplemental PPE required when switching operations is performed from the ground, switchman shall wear EH overshoes rated at 15kv or greater, 5inx7in.

STD ITEM	SAP ITEM ID	PS ITEM ID
P23S	9390983	N/A

NUMBER OR LETTER, 2⅞" REFLECTIVE VINYL

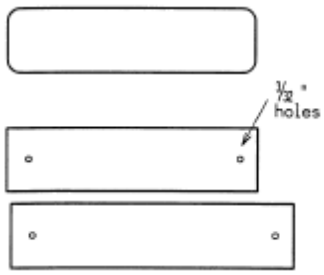
1 ¾" x 2⅞" reflective vinyl markers for switch identification. Self adhesive high-intensity grade encapsulated-lens sheeting with liner. Yellow characters on black backing.



LETTERS	STD ITEM	SAP ITEM ID	PS ITEM ID
A	P21L	9319855	8002601
B	P21L	9319854	8002602
C	P21L	9319853	8002603
D	P21L	9319852	8002604
E	P21L	9321576	8002605
F	P21L	9321593	8002606
G	P21L	9309331	8002607
H	P21L	9321595	8002608
I	P21L	9319971	8002609
J	P21L	9319969	8002610
K	P21L	9319968	8002611
L	P21L	9319967	8002612
M	P21L	9319966	8002613
N	P21L	9321610	8002614
O	P21L	9321609	8002615
P	P21L	9321608	8002616
Q	P21L	9321607	8002617
R	P21L	9321606	8002618
S	P21L	9321605	8002619
T	P21L	9321604	8002620
U	P21L	9321603	8002621
V	P21L	9321602	8002622
W	P21L	9321601	8002623
X	P21L	9321600	8002624
Y	P21L	9321599	8002625
Z	P21L	9321598	8002626
PHRASE			
A PHASE	P21L	9389766	
B PHASE	P21L	9389765	
C PHASE	P21L	9389755	
NUMBERS			
0	P21N	9319866	8002700
1/2	P21N	9308115	9202206
1	P21N	9309423	8002701
2	P21N	9321689	8002702
3	P21N	9321688	8002703
4	P21N	9321687	8002704
5	P21N	9321686	8002705
6	P21N	9321685	8002706
7	P21N	9321684	8002707
8	P21N	9321683	8002708
9	P21N	9321682	8002709
- (DASH)	P21N	9306266	9201878

LABEL MOUNTING PANEL

For mounting self sticking numbers and letters.



DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
3” X 11½” X 0.011” Black vinyl, self adhesive with liner.	P21M	9319772	8002402
Non-adhesive XP laminated phenolic with two mounting holes.			
3” X 12” X 0.0625"	P21R12	9319766	8002420
3” X 15” X 0.0625"	P21R15	9315136	0810186
3” X 19” X 0.0625"	P21R19	9310709	9200633

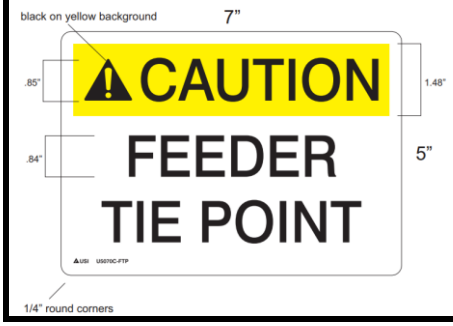
SIGN, - “WARNING - TIE POINT – NOT IN PHASE”

Magnetic, 5” x 7” x 0.32”, white with warning hi-lited in orange, bold black lettering, direct print on magnetic surface.

STD ITEM	SAP ITEM ID	PS ITEM ID
P22P1	9307611	9202444

SIGN, - "CAUTION – FEEDER TIE POINT"

Magnetic, 5" x 7" x 0.32", white with caution hi-lited in yellow, bold black lettering, direct print on magnetic surface.



STD ITEM	SAP ITEM ID	PS ITEM ID
P22P2	9307610	9202445

SIGN, PERMANENT LOCATION

Permanent location sign for underground electric cables. Marker to be in accordance with PPLPPL Material Specification Standard MS-0107.

	STD ITEM	SAP ITEM ID	PS ITEM ID
Permanent Location Sign	P22R1	9309187	5100138
Installation Tool – Post Driver	P22R2	9309186	5100139
Installation Tool – Pilot Hole Driver	P22R3	9309185	5100140

LABEL, TRANSFORMER VENT

2" X 7" polyester self-sticking label; "VENT TANK BEFORE OPENING FUSE", yellow printing and border on a black background. For use on subsurface, subway and padmount transformers that have replacable fuses.

STD ITEM	SAP ITEM ID	PS ITEM ID
P22T	9319769[Y]	8002412[Y]

SIGN, ELECTRICAL SAFETY

"Danger – High Voltage Within – Keep Out" sign. 8" x 18" high intensity reflective, black letters on silver background. Used on building vaults.

MOUNTING	STD ITEM	SAP ITEM ID	PS ITEM ID
RIGID	P23A1	9314269	0810029
ADHESIVE	P23A2	9302816	5483454

SIGN, ELECTRICAL SAFETY

"Dangerous – Hazardous Voltage Above – Keep Away" sign. 8" x 18" high intensity reflective, black letters on silver background. Used on poles and structures in Right of Ways in Massachusetts only.

MOUNTING	STD ITEM	SAP ITEM ID	PS ITEM ID
RIGID	P23B1	9302619[E]	5483458[E]
SEMI RIGID	P23B2	9302633[E]	5483462[E]
ADHESIVE	P23B3	9302632[E]	5483466[E]

SIGN, ELECTRICAL SAFETY

"Danger – High Voltage Above – Keep Off" sign. 8" x 18" high intensity reflective, black letters on silver background. Used on poles and structures in Right of Ways in all states other than Massachusetts.

MOUNTING	STD ITEM	SAP ITEM ID	PS ITEM ID
RIGID	P23C1	9302631	5483470
SEMI RIGID	P23C2	9302630	5483474
ADHESIVE	P23C3	9302629	5483478

SIGN, NO TRESPASSING

No Trespassing sign, 10" H X 14" W with 6 – ¼" holes for mounting on the fences of all PPLPPL substations.

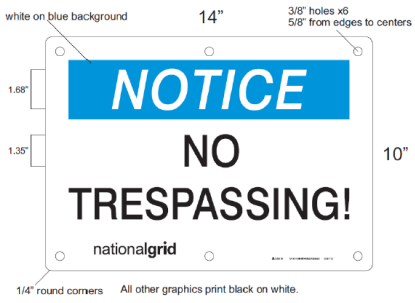


Figure 12

STD ITEM	SAP ITEM ID	PS ITEM ID
P25NT	9318592[E]	5483190[E]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

LABEL, WARNING

Warning label to be mounted on the outside of all pad-mounted equipment. In accordance with PPLPPL Material Specification Standard MS-0108.

STD ITEM	SAP ITEM ID	PS ITEM ID
P25P	9306908	9200408

LABEL, CAUTION OIL BARRIER

Warning label to be mounted on the outside of all pad-mounted transformers which have an oil containment barrier installed.

STD ITEM	SAP ITEM ID	PS ITEM ID
P25PC	9306317	9201596

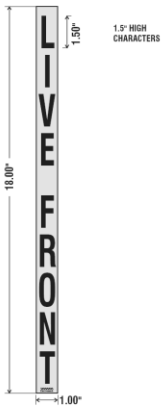
LABEL, DANGER

Danger label for mounting on the inside of padmounted equipment. In accordance with PPLPPL Material Specification Standard MS-0108.

STD ITEM	SAP ITEM ID	PS ITEM ID
P25PD	9318594	5483164

LABEL, LIVEFRONT LABEL

Label, livefront label, 1”x18”, reflective yellow background, 1 ½” letters in black, for use on livefront padmounted transformers in channel area of primary compartment door.



STD ITEM	SAP ITEM ID	PS ITEM ID
P25PL	9306315	9201866

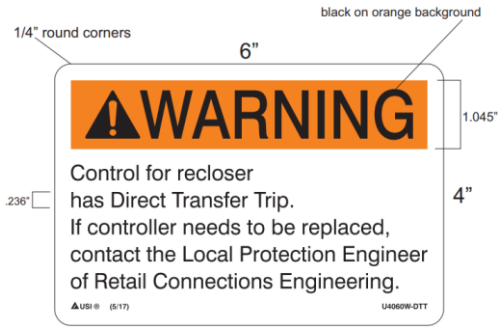
DECAL – "NORMAL OPEN"

N.O. Normal Open, 3" x 6" green with bold yellow letters, Decal to have peel off backing for installation, item used on the outside of padmounted equipment with normal open points such as in a loop feed URD.

STD ITEM	SAP ITEM ID	PS ITEM ID
P25PNO	9307606	9202449

DECAL – "WARNING – RECLOSER WITH DTT"

Decal, warning, for Recloser with Direct Transfer Trip. 4" x 6", Black lettering on a white background, "Warning" on orange background.

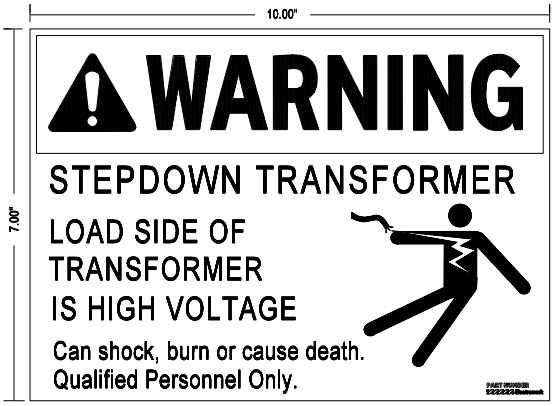


All other graphics print black on white background.

STD ITEM	SAP ITEM ID	PS ITEM ID
P25PR	9307756	9202987

LABEL, WARNING

Warning label to be mounted on the outside of all pad-mounted step down transformers.



STD ITEM	SAP ITEM ID	PS ITEM ID
P25ST	9306909	9200407

LABEL, PADMOUNTED TRANSFOMER

Label to be affixed on the outside, right access door, of all pad-mounted transformers with secondary voltage rated 480Y/277V or 600V. Size is 9” x 3”. Black lettering with yellow background.

TMP13307

	STD ITEM	SAP ITEM ID	PS ITEM ID
480Y/277V	P25T1	9389596	n/a
600V	P25T2	9389579	n/a

CABLE TIE, STAINLESS STEEL

Self-locking, 2” maximum diameter range, 3/16” wide x 7.9” long, stainless steel.

STD ITEM	SAP ITEM ID	PS ITEM ID
P27T	9302905	5487434

CABLE TIE, NYLON

Self locking, 3-1/2” maximum diameter, 9/32” wide X 13-3/4” length. Black, weather resistant nylon. Tensile unlocking strength 120 lbs minimum.

STD ITEM	SAP ITEM ID	PS ITEM ID
P27T1	9302910[E]	5487442[E]

CABLE TIE, NYLON

Self locking 18” long. Black, weather resistant nylon. Tensile unlocking strength 175 lbs minimum.

STD ITEM	SAP ITEM ID	PS ITEM ID
P27T2	9391746	N/A

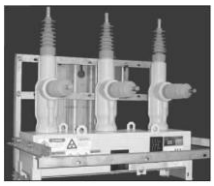
CABLE TIE, NYLON

Self locking, 5” maximum diameter, 1/2” wide X 20 1/8” length. Black, weather resistant nylon. Tensile unlocking strength 120 lbs minimum.

STD ITEM	SAP ITEM ID	PS ITEM ID
P27TA	9316394	2013102

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material onl

RECLOSER, THREE PHASE WITH CONTROL & CABINET (800A)



800A continuous rated microprocessor controlled recloser. Rated 12.5kA symmetric fault interrupting. Includes pole mounting hardware and stainless steel control cabinet. Per latest Spec. PPL MS2750.

VOLTAGE	CONTROL	APPLICATION	STD ITEM	SAP ITEM ID	PS ITEM ID
*15kV	SEL651R	Radial	R50AA	9306582	9201979
**12.47kV w/ PT's	SEL651R	Radial	R50A1	9306588[E]	9201973[E]
**13.2kV w/ PT's	SEL651R	Radial	R50A2	9306586	9201974
**13.8kV w/ PT's	SEL651R	Radial	R50A3	9306585[E]	9201975[E]
*15kV	SEL651R	Loop Scheme	R50EE	9306581	9201980
***12.47kV w/ Sensing & PT's	SEL651R	Loop Scheme	R50E1	9306525[E]	9201970[E]
***13.2kV w/ Sensing & PT's	SEL651R	Loop Scheme	R50E2	9306524	9201971
***13.8kV w/ Sensing & PT's	SEL651R	Loop Scheme	R50E3	9306523[E]	9201972[E]
*35kV	SEL651R	Radial	R50FF	9306580	9201981
*35kV (SubT)	SEL651R	Radial	R50FS	9306447[Y]	9201809[Y]
*35kV	SEL651R	Loop Scheme	R50GG	9306583	9201978
*35kV (SubT)	SEL651R	Loop Scheme	R50GS	9306446[Y]	9201810[Y]
35 kV (SubT) w/ Line and Load voltage Sensing	SEL651R	Sectionalizer	R50HA	9386620[Y]	9203061[Y]

**Requires 120V supply (+3% /-20%).*

***Includes voltage specific instrument PT's to meet control power supply requirements. Use a 3K fuse link for primary fuses feeding PT's.*

****Includes integrated voltage sensing in Source 1 bushings and voltage specific instrument PT's to meet control power supply requirements*

MOLDING, POLYETHYLENE

Black UV resistant plastic molding for use with S33B staples over bare or covered down ground wires.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
½" X 0.100" X 8'6"	S1	9313613	3503053

COMPOUND, SEALING

Silicone rubber, multiple-purpose, sealing and caulking compound, clear in color, inert with high adhesive and shape retention. For use in sealing openings between the base of electrical, pad-mounted equipment and the top of the foundation. Furnished in 11 oz. foil cartridges.

STD ITEM	SAP ITEM ID	PS ITEM ID
S2	9320468	8010311

COMPOUND, DUCT SEAL

Moldable, non-hardening, multi-purpose sealing and caulking compound. Grey in color, completely inert with high adhesion and shape retention. For use in sealing openings in conduit, etc.

	STD ITEM	SAP ITEM ID	PS ITEM ID
5 x 1 lb bricks	S3	9320377	8010262

SEALANT

Sealant, kit, water stop foam kit for cables in conduit, 2 part foam sealant cures with in an hour, kit come complete with sealant, 2 foam damming strips, 3 mixing nozzles, gloves, positioning rod, wipes and sealing cap.

STD ITEM	SAP ITEM ID	PS ITEM ID
S4	9307925	9202331

SEALANT, CONCRETE ADHESIVE, GREY

Sealant, concrete repair, adhesive for use in manholes, grey, two part resin mixture, apply with caulking gun, 8.4 oz.

STD ITEM	SAP ITEM ID	PS ITEM ID
S5	9387663	none

CONNECTORS – STANDARD COMPRESSION TAP

Aluminum tap connector for aluminum, ACSR, & steel to same or to Copper. Do not use for Copper to Copper. Individually boxed & compound filled. ANSI C119/4; Class A, Class 3.

CONDUCTOR RANGE								TOOL						
RUN				TAP				Y35/Y45		MD6				
ACSR	STR.	SOL.	STR STEEL / WIRE DIA	ACSR	STR.	SOL.	STR. STEEL / WIRE DIA	DIE	CRIMPS	DIE	CRIMPS	STD ITEM	SAP ITEM ID	PS ITEM ID
#4 - #6	#3	#6		#4 - #6	#3	#6		U-O	2	W-O	4	S13B	9312301	3507102
#4 - #6	#2 - #6				#8	#14				BG	3	S13D	9312300[Y]	3507104[Y]
1/0 - #2	2/0 - #1				#8	#14		U-O	2	W-O	4	S13E	9312299[Y]	3507105[Y]
1/0 - #3	2/0 - #2		4/16" – 7/16"	#2 - #6	#2	#6 - #4		U-O	2	W-O	5	S13H	9312298	3507108
2/0 – 1/0	2/0 – 1/0		.477" - .365"	#2 - #4	#1 - #3	#2	.332" – .236"	U-D3	2	D3	5	S13HD	9315227[Y]	0804299[Y]
1/0	2/0 – 1/0		3/8" – 7/16"	1/0	2/0 – 1/0		3/8" – 7/16"	U-D3	2	D3	5	S13J	9314950	3507110
397 – 266	477 – 250			4/0 – 2/0	4/0 – 2/0			U-N	3			S13K	9312297	3507111
4/0 – 3/0	4/0 – 3/0			4/0 – 3/0	4/0 – 3/0			U-D3	3	D3	7	S13KI	9315733	3507117
4/0 – 3/0	4/0			2/0 - #1	2/0 – 1/0			U-D3	3			S13L	9312296	3507112
4/0 – 3/0	4/0			#2 - #6	#1 - #6	1/0 - #6		U-D3	2	D3	5	S13LI	9312295	3507113
397 – 266	400 – 250			1/0 - #6	2/0	#6		U-N	2			S13N	9312315	3507120
477 – 4/0	500 – 4/0			477 – 4/0	500 – 4/0			U-N	4			S13P	9312333[Y]	3507119[Y]
477 - 795	600 – 900		.879" – 1.108"	1/0 - 336	2/0 - 350	2/0 - 350	.398" - .684"	U-R*	3			S13R	9315734[Y]	3507115[Y]
#2 - #6	#2 - #6	#2-#4			#8	#14		U-BG	1	BG	2	S13D6	9312081[Y]	3507304[Y]
2/0 - #2	2/0 - #1				#8	#14		U-O	1	W-O	2	S13E6	9312080[Y]	3507305[Y]
397 – 266	477 – 250			4/0 – 2/0	4/0 – 2/0			U-N	3			S13K6	9312314[Y]	3507311[Y]
4/0 – 3/0	4/0 – 3/0	4/0		4/0 – 2/0	4/0 – 2/0	4/0		U-D3	2			S13KI6	9312584[Y]	3507317[Y]
4/0 – 1/0	4/0 – 1/0			4/0 – 1/0	2/0 - #4	2/0 - #3		U-D3	2			S13L3	9312559[Y]	3507412[Y]
397 – 266	400 – 250			397 – 266	400 – 250			U-N	3			S13M6	9312583[Y]	3507318[Y]
397 - 266	400 - 250			1/0 - #6	2/0	#6		U-N	2			S13N6	9312582[Y]	3507320[Y]
1/0 - #3	2/0 - #2			#2 - #6	#2	1/0 - #6		U-O	1		4	S13G	9312312[Y]	3507306[Y]

NOTE: For hard drawn solid conductor, roughen up contact surface prior to placing it into the connector by abrading with pliers or scraping with a hacksaw blade.

* - Y45

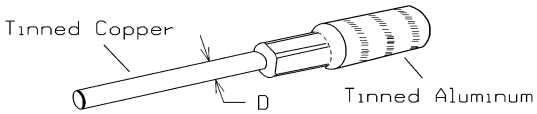
CONNECTOR, COMPRESSION C

Copper range-taking compression; C-type tap connector for use with copper conductors only. Un-plated and without inhibitor. Approximately 100 per box.

CONDUCTOR RANGE AWG / kcmil									
RUN	TAP	MD6	CRIMP	Y35 or Y39 or Y46	CRIMP	STD ITEM	SAP ITEM ID	PS ITEM ID
6 Sol. – 4 Str.	6 Sol. – 6 Str.	BG				S14E	9313033[E]	5960407[E]
6 Sol. – 4 Str.	8 Sol. – 8 Str.	W-BG	1	U-BG	1	S14A	9312168[Y]	3507129[Y]
	4 Sol. – 4 Str.	B-BG	1	U-BG	1	S14B	9314949	3507126
2 Sol. – 2 Str.	8 Sol. – 4 Str.	W-C	2	U-C	1	S14C	9312169	3507128
	2 Sol. – 2 Str.	W-C	2	U-C	1	S14D	9312328	3507127
1/0 Sol. – 2/0 Str.	8 Sol. – 2 Str.	–		U-O*	1	S14F	9313031	5960411
1/0 Sol. – 2/0 Str.	1/0 Sol. – 2/0 Str.	–		U-O	1	S14G	9313030	5960412
3/0 Str – 4/0 Str.	6 Sol. – 2 Str.	–		U-D3	1	S14H	9315824	3506644
	1/0 Str. – 2/0 Str.	–		U-D3	1	S14J	9315822	3506654
	3/0 Str. – 4/0 Str.	–		U-D3	1	S14K	9315825	3506643
3/0 Str – 250 Str.	3/0 Str – 250 Str.			U997 -1		S14L	9313861	5960428

CONNECTOR, TERMINAL PIN

Aluminum compression connector with a solid, smooth, tinned copper 6” pin. ANSI C119.4, Class A, Class 2 min. Connectors shall be compound filled and capped.



CABLE SIZE AWG	D. (In.)	L. (In.)	CRIMPING TOOL / DIE / # OF CRIMPS						STD ITEM	SAP ITEM ID	PS ITEM ID
			BCT500		Y34A	Y34PR	Y35 OR Y39				
			DIE	#/C R.	NEST	INDENT	DIE	#/C R.			
#2	.257	8.7	W243	3	A243	3	U243	2	S27F	9313642	2015382
1/0	.32	10.1	W243	3	A243	3	U243	2	S27H	9311799	

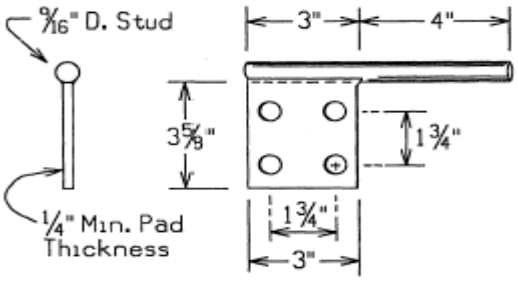
STAPLES, GALVANIZED STEEL

Galvanized, rolled diamond-point staples for wood poles. Per latest ANSI C135.14.

APPLICATION	LENGTH	INSIDE WIDTH	STD ITEM	SAP ITEM ID	PS ITEM ID
Anti-Theft		⅜"	S33A1	9388968	N/A
Ground Wire	1¾"	⅜"	S33A	9313388	3503451
Ground Wire Molding	2"	⅝"	S33B	9314525	0811201
1" Conduit	3"	1 1/16"	S33C	9313387	3503453

CONNECTOR, TERMINAL FLAG

Tinned copper stud connector for hot line or grounding clamp connection at riser switch terminals. 1 ¾" standard NEMA hole spacing.



STD ITEM	SAP ITEM ID	PS ITEM ID
S30B	9313877	3504018
* Ampacity of 4/0 Cu. Is 360A @ 75° C, 405A @ 90° C.		

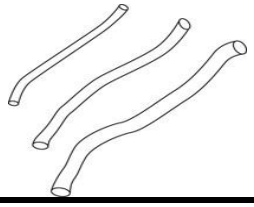
SEALANT, GREY

Sealant, polyurethane sealant, gray, 20 oz. sausage package, used for sealing vault roof sections. Item applied over backer-rod sealant.

STD ITEM	SAP ITEM ID	PS ITEM ID
SBR	9307832	9202304

SEALANT

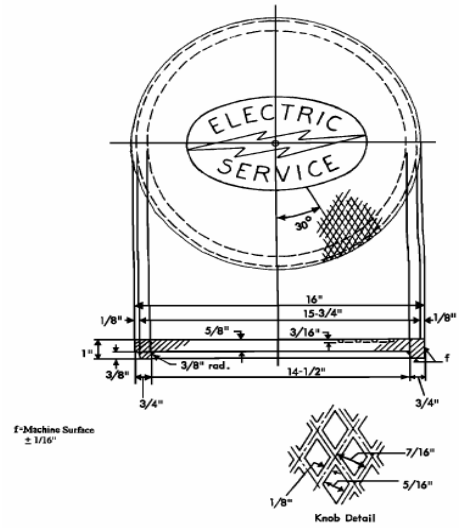
Backer rod, round, used for a joint filler for concrete vault roof sections.



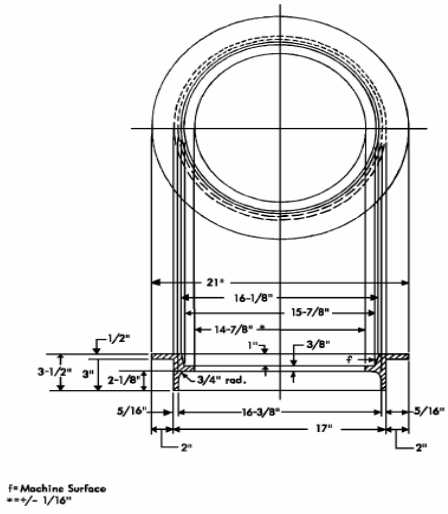
	STD ITEM	SAP ITEM ID	PS ITEM ID
3/8"	SBR1	9308118	9202203
1/2"	SBR2	9308117	9202204
3/4"	SBR3	9308116	9202205

HANDHOLE, COVER & FRAME. 16”-- MAINTENANCE USE ONLY

Cast Iron frame with solid cover designed for use with light duty precast handhole. To be in accordance with PPL Material Specification Standards MS-3712 (16” cover), MS-3711 (16” frame).



16” HH Cover



16” HH Frame

	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
16” HH Frame		SH1A		5644325[E]
16” HH Cover		SH1B		5644314[E]

TAPE, FRICTION

General purpose friction tape, black, for cable terminations and splices, consisting of a cotton fabric that has been thoroughly impregnated and evenly coated on both sides with a tacky adhesive insulating compound. ASTM D69.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
¾" x 0.015" x 82½' Roll	T1A	9316053	2005503

TAPE, COTTON

General Purpose non-adhesive electrical insulating bedding tape consisting of a white plain weave carded and combed cotton fabric. Tape to be in accordance with the current ASTM Specification D-335, Type A-2

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
1" x 0.007" x 108' Roll	T1C	9316115	2005659

TAPE, FIRE PROOF

Arc and fire proofing electrical tape consisting of a non-adhesive, heat resistant, organic fabric coated on one side with a flame retardant elastomer.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
1 ½" x 0.030 x 20' Roll	T1F2	9301841	5486565
3" x 0.030" x 20' Roll	T1F3	9316229	2005673

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

TAPE, GLASS CLOTH

High temperature woven glass cloth electrical tape with a thermosetting pressure sensitive adhesive. For use as a binder wrap for arc and fire proofing tape, item T1F

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
½" x 0.007" x 66' Roll	T1G5	9316057	2005289

TAPE, VARNISHED POLYESTER GLASS, OIL

Oil packed varnished polyester-glass tape. Furnished in cans.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
1" x 0.010"x 54' Roll	T1P1	9316228[Y]	2005677[Y]

TAPE, SEMICONDUCTING

High voltage electrical EPR based semiconducting tape, furnished with a liner. Tape to be continuously imprinted with the word "conducting" or "semiconducting". Do not use on PILC cables.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
¾" x 0.030" x 15' Roll	T1S	9316267	2005679

BRAID, GROUNDING

Flat tinned copper wire woven braid for grounding of cable splices.

DESCRIPTION	Equal Size	STD ITEM	SAP ITEM ID	PS ITEM ID
¾" x 50' Roll	#4	T1T4	9306691	9201911
½" x 15' Roll	#6	T1T5	9316288	2005681

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

TAPE, SHIELDING BRAID

Tinned copper shielding braid. Rolls to be furnished in individual labeled boxes or bags.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
1” x 100’ Roll	T1U1	9316290	2005684
2” x 16’ Roll	T1U25	9316349	2005685

TAPE, VARNISHED CAMBRIC

Oil packed varnished cambric tape consisting of a non-adhesive, seamless, bias cut cotton cambric fabric, impregnated with a black electrical insulating varnish. Rolls to be furnished in one gallon cans.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
1” x 0.012" x 12’ Roll	T1V1	9314976	2005523
½" x 0.012" 12’ Roll	T1V5	9306372	9200556

TAPE, ANTI-SLIP

Heavy duty, black, aluminum-backed. 2” wide x 60’ long. Extra course grit. Used to add traction to diamond plated covers.

STD ITEM	SAP ITEM ID	PS ITEM ID
T2A	9306799	9202155

TAPE, COPPER FOIL

Copper foil tape with an electrically conductive pressure sensitive adhesive; furnished with a liner

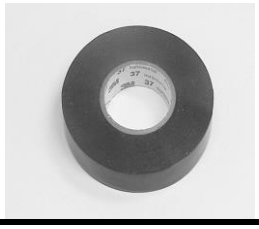
DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
½” x 0.0035” x 54’ Roll	T2C	9316071[Y]	2005618[Y]

TAPE, BLACK TEFLON

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
½” x 0.0035” x 15’ Roll	T2T	9302519[E]	5487104[E]

TAPE, VINYL PLASTIC

General purpose electrical insulating tape consisting of a black elastomeric backing made from vinyl chloride plastic coated on one side with a pressure sensitive adhesive. Tape to be in accordance with the current A.S.T.M. Specification D 3005.



DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
¾" X .0085" X 66' Roll	T2W1	9316070	2005620
1½" X .0085" X 66' Roll	T2W2	9314120	0810652

TWINE, NYLON

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
#18 Nylon, ¼ pound spool, 268 feet	T3N		5488210[E]

TAPE, PAPER

Kraft paper tape gummed on one side, for limiting the length of the lead wipe on lead sheathed cable terminations and splices.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
2" x 0.04" x 60' Roll	T3P	9316045	2005560

TWINE, FLAX

Pure flax twine saturated with high melting point wax for temporarily securing factory applied insulation and shielding for PILC terminations and splices. To be furnished in 100 ft. lengths on a spool.

STD ITEM	SAP ITEM ID	PS ITEM ID
T3T	9316076	2005570

TAPE, VARNISHED POLYESTER GLASS, DRY

Dry packed varnished polyester glass tape consisting of a non-adhesive, polyester glass fabric, impregnated with an electrical insulating varnish.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
¾" x 0.010 x 108' Roll	T3V	9316348	2005689
3" x 0.010 x 54' Roll	T3V3	9388395	NA

TAPE, CABLE PULLING

¾" polyester cable pulling tape with footage markings, 2500lb tensile strength, 3000' spool, for cable installation in conduits. (Muletape)

STD ITEM	SAP ITEM ID	PS ITEM ID
T4A	9306240	9202062

TAPE, HV RUBBER INSULATING

High voltage ozone, U.V. and weather resistant linerless EPR rubber insulating electrical tape. Self-amalgamating, black.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
1" X 0.030" X 30' Roll	T5B	9316047	2005547
1½" X 0.030" X 30' Roll	T5B6	9316067	2005656

TAPE, PLASTIC SEALER

Plastic sealer compound tape or pads, grey in color; furnished with a liner. Sealer permanently bonds to itself, not to conductors, connectors or insulation.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
4" X .125" X 10' Roll	T5D4	9316052[Y]	2005515[Y]
2.5" X 4" Pads – 20/Box	T5D4P	9304262	5646215

TAPE, INSULATING AND SEALING

Low-Voltage insulating and sealing mastic tape furnished with a liner. For insulating sealing and/or encapsulating low-voltage electrical connections and for moisture sealing outer jackets on high voltage splices. Permanently bonds to itself and all other materials.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
3.75" x 0.125" x 10' Roll	T5M	9316066	2005657

TAPE, SILICONE RUBBER

High voltage, weather and tracking resistant, non-contaminating, self-cleaning, terminating electrical tape. Lt. grey, non-adhesive self-amalgamating.

DESCRIPTION	STM ITEM	SAP ITEM ID	PS ITEM ID
1" X .020" X 30' Roll	T5S1	9316069	2005621

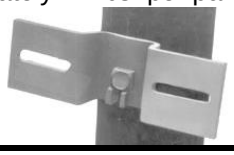
ABRASIVE CLOTH

Aluminum oxide, 120 grit, closed coat.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
1" x 75' Roll	T5U1	9316253	2005531

PLATES, TRANSFORMER ADAPTER – ONE PAIR

Heavy galvanized steel adapter plates for modifying ANSI Type C equipment lugs (i.e. transformers over 167KVA). Each plate is 4½" X 16" X ½" with a 3" 'offset'. Includes (2) ⅝" equipment mounting bolts. Approximately 22 lbs. per pair.



STD ITEM	SAP ITEM ID	PS ITEM ID
T10	9314026	3012553

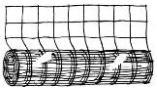
GROUND ROD

5/8" x 8' solid copperweld ground rod, conically pointed at one end 60 degrees, cut square and chamfered at the other end, 75,000 PSI minimal high strength steel core, 10 mils minimal copper plating thickness. Rods shall meet ANSI UL 467 and GR-1 specifications.

STD ITEM	SAP ITEM ID	PS ITEM ID
TG20	9313616	3503013

GRID, 8" X 8" POTENTIAL EQUALIZING

8" X 8" mesh fabricated of #6 AWG copperweld. 30% conductivity mesh with brazed joints supplied in 6' wide X 100' long rolls.



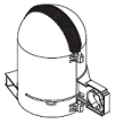
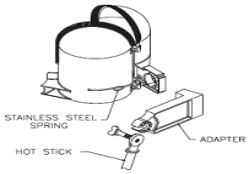
STD ITEM	SAP ITEM ID	PS ITEM ID
TG21	9313614	3503039

GUARD, ANIMAL - BUSHINGS

Primary bushing animal guards / covers for overhead line equipment. Light grey polypropylene, or equivalent, UV resistant, (1) piece hinged bushing covers retrofit to insulate energized bushings from animal contact. Install over the top bushing skirt.





DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
Hotstick application for transformer/terminator bushings	T22A	9314091	0810616
Full profile for most transformers and #2 - 4/0 terminators	T22B	9314474	0811154
Full profile for recloser/regulator and pot-head bushings.	T22C	9314397	0811157
Short profile for arrester/capacitor bushings	T22D	9314398	0811156
Full profile.	T22E	9314514	0811165
Full profile, can be applied easily with hotstick or shotgun. Spring-loaded.	T22F	9307868	9202268
Hotstick adapter for T22F	T22F1	9307813	9202281

WASHER, SQUARE FLAT, STANDARD

Galvanized steel, for normal loadings on wood; standard ⅝" or ¾" bolts (B13 or B14) per EEI Std. TDJ-10.

DIMENSION			STD ITEM	SAP ITEM ID	PS ITEM ID
O.D.	DIA. OF HOLE	THK.			
2 ¼"	13⁄16"	3⁄16"	W1	9319833	7006014
3"	13⁄16"	¼"	W1A	9319618	5997740
4"	13⁄16"	½"	W1B	9319619	5997745

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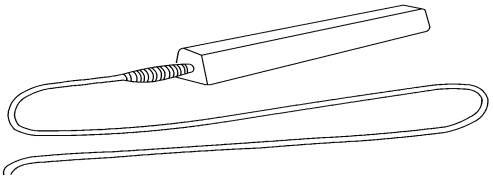
ANODE, MAGNESIUM

17 lb, 3-1/2" x 4" x 25-1/4" long. For corrosion protection in manholes.



STD ITEM	SAP ITEM ID	PS ITEM ID
UA17	9314469	0811217

SPLICEBOARD

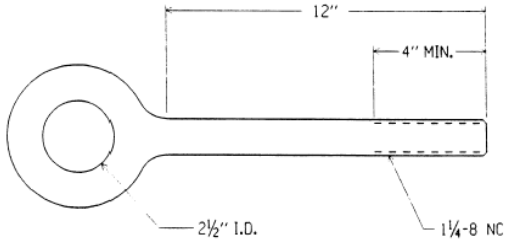
Track resistant, flame retardant, red polyester glass mat laminate, NEMA grade GPO-3. All corners shall be rounded.

THICKNESS (INCHES)	WIDTH (INCHES)	LENGTH (INCHES)	STD ITEM	SAP ITEM ID	PS ITEM ID
⅝	12 ± 3/16	48	UB4A1	9316102	2001314
¾	16 ± 3/16	48	UB4B	9316100	2001313

BOLT, EYE

Galvanized steel drop-forged, pulling/lifting eyebolt with a 1¼" diameter, 12" long shank with 4" minimum NC thread. Round eye 2½" I.D., 5" O.D. and having a minimum ultimate strength of 76,000 lbs. To be furnished with a galvanized steel hex or square nut. For use in manholes.

Note: Maximum working load 15,200 lbs.



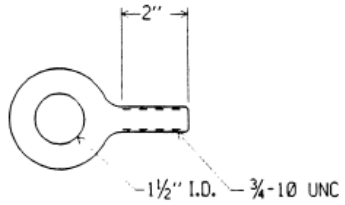
STD ITEM	SAP ITEM ID	PS ITEM ID
UB10	9319750	7002765

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

BOLT, EYE

Steel drop-forged, lifting eyebolt with a ¾" diameter, 2" long shank with full UNC thread. Round eye 1½" I.D. and having a minimum ultimate strength of 36,000 lbs. For use with manholes.

Note: Maximum working load 5,140 lbs.

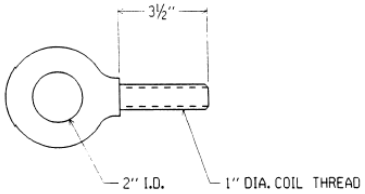


STD ITEM	SAP ITEM ID	PS ITEM ID
UB11	9312608[Y]	6512107[Y]

BOLT, EYE

Steel, drop-forged, shoulder pattern, lifting eyebolt with a 1" diameter, 3½" long shank with a 3" minimum coil thread. Round eye 2" I.D. and having a minimum ultimate strength of 36,000 lbs. For use with reinforced concrete flat pad, item UF8.

Maximum working load: straight pull = 7,500 lbs.; 45º pull = 1,500 lbs.; 90º pull = 1,500 lbs



STD ITEM	SAP ITEM ID	PS ITEM ID
UB12	9312671[Y]	6512120[Y]

WIRE, BARE, COPPER

Single conductor #12 AWG bare tinned solid round copper wire in accordance with the current ASTM Standard B 3. The conductor temper shall be tinned soft or annealed drawn in accordance with the current ASTM Standard B 33. The standard shipping quantity shall be 5 lbs. (approximately 253 feet) and shipped on a metal non-returnable spool approximately 4½" O.D. flange and 3¼" inside traverse.

		STD ITEM	SAP ITEM ID	PS ITEM ID
*To be indicated on purchase order.	5 lb. spool*	UC2V	9316522	4015004

CABLE, 600 V, COPPER, 1/C

600 Volt, soft drawn copper conductor, standard concentric round or compressed, thermosetting black cross linked polyethylene, for use as underground neutrals, secondaries, and services, direct buried or in duct at 600 volts or less. Cables furnished shall be in accordance with PPL Material Specification Standard MS-4144.

NOTE: Do not use #2 conductor in direct buried applications.

Single Conductor – Reel Length 1000'

AWG / KCMIL	STR	Insulation Thickness (inches)	Cond. O.D. (inches)	Weight / 1000'	STD ITEM	SAP ITEM ID	PS ITEM ID
2	7	.060	.42	245	UC5B	9313028	5948216
1/0	19	.080	.54	390	UC5C	9312789[E]	5948417[E]
2/0	19	.080	.58	490	UC5D	9312788[E]	5948420[E]
4/0	19	.080	.69	745	UC5E	9310406	9201033
350	37	.095	.88	1210	UC5F	9312783[E]	5948800[E]
500	37	.095	1.01	1700	UC5G	9302666	5949290
750	61	.110	1.23	2545	UC5H	9302664[E]	5949406[E]

CABLE, 600V, COPPER, 3/C

600 Volt, soft drawn copper conductor, standard concentric round or compressed, thermosetting black cross linked polyethylene, for use as underground neutrals, secondaries, and services, direct buried or in duct at 600 volts or less. Cables furnished shall be in accordance with PPL Material Specification Standard MS-4144.

Three Conductor – Reel Length 1000' circuit feet.

AWG / KCMIL	STR	Insulation Thickness (inches)	Cond. O.D. (inches)	Weight / 1000'	STD ITEM	SAP ITEM ID	PS ITEM ID
1/0	19	.080	.54	1170	UC5C1	9312790[E]	5948415[E]
2/0	19	.080	.58	1470	UC5D1	9312787	5948422
4/0	19	.080	.69	2235	UC5E1	9312786[E]	5948755[E]
350	37	.095	.88	3630	UC5F1	9312782[E]	5948801[E]
500	37	.095	1.01	5100	UC5G1	9302584	5949288
750	61	.110	1.23	7635	UC5H1	9302665[E]	5949404[E]

CABLE, 600V, COPPER, 4/C

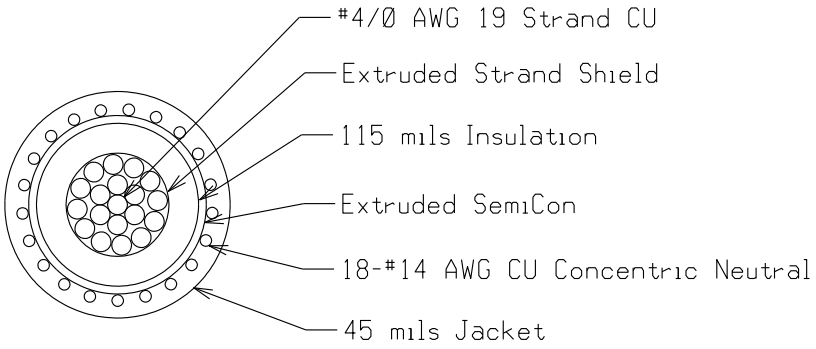
600 Volt, soft drawn copper conductors, standard concentric round or compressed, thermosetting black cross linked polyethylene jacket, for use as underground secondaries and services, direct buried or in duct at 600 volts or less. Reels are parallel wound with three phase conductors and one neutral conductor. Cables furnished shall be in accordance with PPL Material Specification Standard MS-4144.

Four Conductor – Reel Length 1000' circuit feet.

PHASE CONDUCTOR AWG / KCMIL	Insulation Thickness (inches)	STR	NEUTRAL CONDUCTOR AWG/KCMIL	Insulation Thickness (inches)	STR	Weight / 1000'	STD ITEM	SAP ITEM ID
3 - 500	.095	37	1 - 4/0	0.080	19	5845	UC5J1	9393149

CABLE, 5 kV, COPPER

4/0 AWG single conductor, shielded, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.



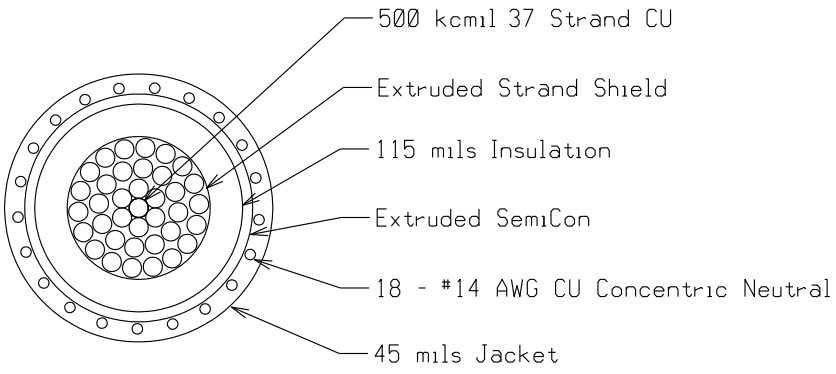
Max. Reel Size	54" W x 70" D
Preferred Splice	UR51A
Preferred Termination	UR43

CONDUCTOR		O.D.		REEL				
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
4/0 Cu	3-1/C	0.80"	1.12"	1000’	3300	UC7E	9308979[E]	5107137[E]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 5 kV, COPPER

500 kcmil single conductor, shielded, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.



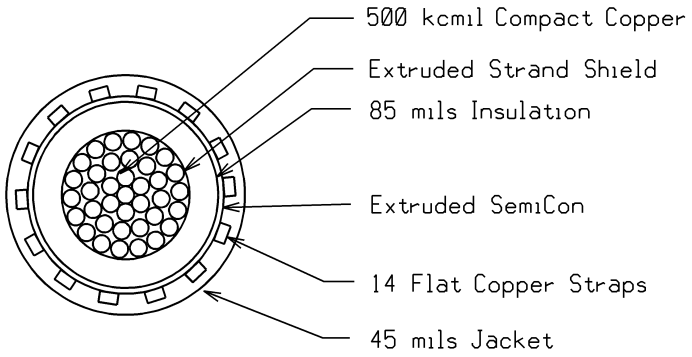
Max. Reel Size	60" W x 96" D
Preferred Splice	UR51A
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
500 Cu	3-1/C	1.09"	1.43"	1000’	6600	UC7G	9309013[E]	5107235[E]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 5 kV, COPPER, REDUCED DIAMETER

500 kcmil single conductor, shielded, solid dielectric insulated, copper power cable with flat strap neutral wires and polyethylene jacket. Cable is designed with compact conductor, reduced insulation (85 mils) and 14 flat strap neutrals. This cable to be used where standard dimension cable will not fit in ducts. Cable shall be in accordance with PPL specification MS 4166 latest edition.



Max. Reel Size	60" W x 96" D
Preferred Splice	UR51A
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS. (min)	JACKET (Max)	CKT. FT	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
500 Cu	3-1/C	0.935"	1.250"	1000’	6600	UC7G1	9309889	5106003

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 600V, URD, ALUMINUM

600 Volt, 60 Hz., single conductor triplexed aluminum power cable with type USE/RHH/RHW cross-linked-thermosetting polyethylene (XLP) insulation for URD secondary applications. Cable furnished shall be in accordance with the current IPCEA Standard S-66-524 (NEMA Standard WC 7) and PPL Material Specification Standard MS-5011.

PHASE CABLE		NEUTRAL CABLE					
SIZE OF CONDUCTOR (AWG OR KCMIL)	AVG. INSUL. THICK-NESS (INCHES)	SIZE OF CONDUCTOR (AWG OR KCMIL)	AVG. INSUL. THICK-NESS (INCHES)	STANDARD LENGTH PER REEL (FEET)	STD ITEM	SAP ITEM ID	PS ITEM ID
#4/0	0.080	#1/0	0.080	2000	UC8JR	9314545	0811016
350	0.095	#4/0	0.080	1000	UC8L	9316524	4008350

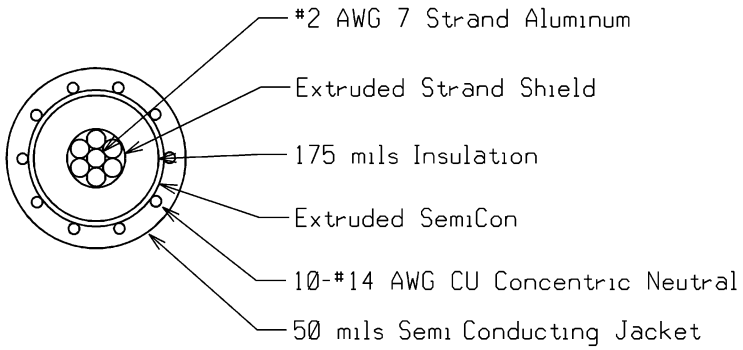
CABLE, 600V, NETWORK, COPPER

600 Volt, 60 Hz, single conductor copper low-voltage power cable with USE/RHH/RHW/VW–1, flame retardant filled EAM (FR-EAM) or flame retardant filled ethylene-propylene-rubber (FR-EPR) insulation and a low-smoke zero-halogen (LSZH) jacket for low-voltage network secondary applications. Phase and neutral cables are identical. Cables furnished shall be in accordance with PPL Material Specification Standard MS-4141 latest version.

SIZE OF CONDUCTOR (AWG OR KCMIL)	AVG. INSUL. THICKNESS (INCHES)	AVG. JACKET THICKNESS (INCHES)	STANDARD LENGTH PER REEL (FEET)	STD ITEM	SAP ITEM ID	PS ITEM ID
2 (1-1/C)	0.045	0.030	1000	UC9B	9312553	4002112
2 (3-1/C)	0.045	0.030	1000	UC9B3	9388886	n/a
4/0 (3-1/C)	0.055	0.045	1000 CKT. FT.	UC9E3	9314499	0811208
4/0 (4-1/C)	0.055	0.045	1000 CKT. FT.	UC9E4	9314498	0811209
300 (4-1/C)	0.065	0.065	1000 CKT. FT.	UC9F4	9312784[E]	5948785[E]
500 (1-1/C)	0.065	0.065	1000	UC9G	9312551	4002150
500 (4-1/C)	0.065	0.065	1000 CKT. FT.	UC9G4	9312550	4002450

CABLE, 15 kV, ALUMINUM, URD PRIMARY

#2 AWG, single conductor, shielded, solid dielectric, insulated aluminum power cable with concentric neutral wires and semi conducting polyethylene jacket. For URD applications only. Suitable for random lay direct burial installations or for duct installation. Cables shall be in accordance with PPL specification MS 5013 latest edition.

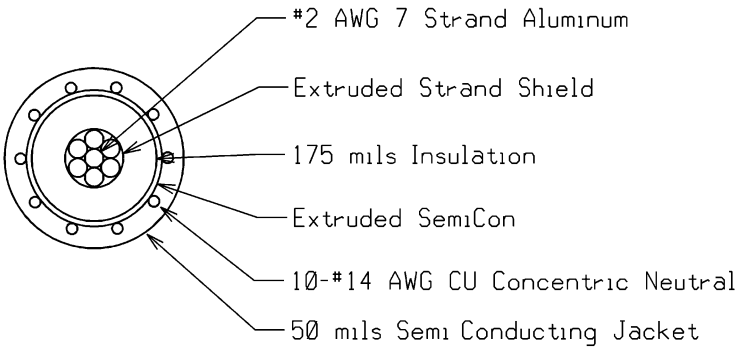


Max. Reel Size	54" W x 70" D
Preferred Splice – URD Application	UR50
Preferred Splice – Duct & Manhole Application	UR51A
Preferred Termination	UR42

CONDUCTOR		O.D.		REEL				
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
2 Al	1/C	0.695"	1.015	3000’	1500	UC11BC	9313027	5948279

CABLE, 15 kV, ALUMINUM, URD CABLE-IN-CONDUIT

#2 AWG, single conductor, shielded, solid dielectric, insulated aluminum power cable with concentric neutral wires and semi conducting polyethylene jacket installed in a 2-inch schedule 80 high density polyethylene duct and spooled on a reel. For URD applications only. Cables shall be in accordance with PPL specification MS 5015 latest edition.



Max. Reel Size	54" W x 70" D
Preferred Splice – URD Application	UR50
Preferred Splice	UR51A
Preferred Termination	UR42

CONDUCTOR		O.D.		REEL				
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
2 Al	1/C	0.695"	1.015	3000’	1500	UC11BH	9391788	---------

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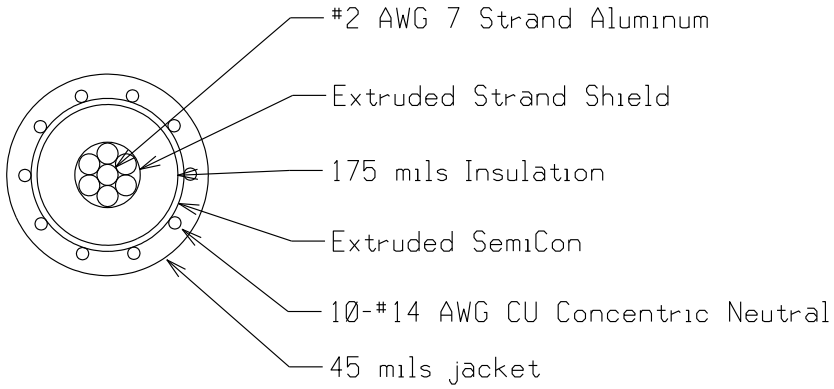
CABLE, 15 kV, ALUMINUM

#2 AWG, single conductor, shielded, solid dielectric, insulated aluminum power cable with concentric neutral wires and polyethylene jacket. Cables shall be in accordance with PPL specification MS 4168 latest edition.



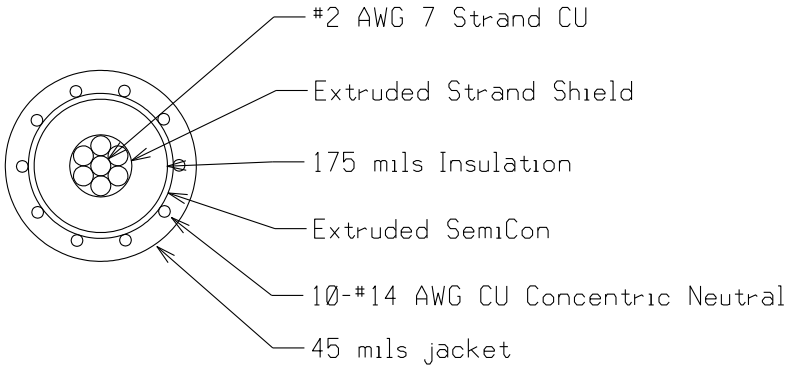
Max. Reel Size	44" W x 72" D
Preferred Splice	UR51A
Preferred Termination	UR42

CONDUCTOR		O.D.		REEL				
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
2 Al	3-1/C	0.695"	1.015	2000’	3360	UC11BJ	9315698	4026122

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 15 kV, COPPER

#2 AWG, single conductor, shielded, solid dielectric, insulated copper power cable with concentric neutral wires and polyethylene jacket. Cables shall be in accordance with PPL specification MS 4168 latest edition



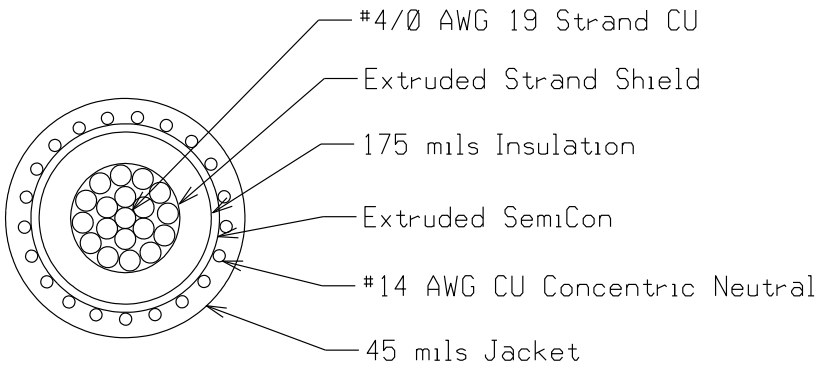
Max. Reel Size	54" W x 70" D
Preferred Splice	UR51A
Preferred Termination	UR42

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS			
2 Cu	1/C	0.695"	1.015	2000’	1200	UC11BK	9301804	5430350
2 Cu	3-1/C	0.695"	1.015	2000’	3600	UC11BL	9309888	5106006

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 15 kV, COPPER

#4/0 AWG, single conductor, shielded, solid dielectric, insulated copper power cable with concentric neutral wires and polyethylene jacket. Cables shall be in accordance with PPL specification MS 4168 latest edition



Max. Reel Size	54" W x 72" D
Preferred Splice	UR51A
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL				
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
4/0 Cu	3-1/C	0.92"	1.24"	1500’	6750	UC11E	9314217	0809935

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

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CABLE, 15 kV, ALUMINUM, SUBMARINE, LAKE USE

#2 AL, single conductor, shielded, solid dielectric, insulated aluminum power cable with concentric neutral wires and polyethylene jacket. The concentric neutral wires are high strength aluminum and also provide armor protection. For use in lakes and ponds where water currents are not present.

Preferred Splice: UR85B2 Item ID 9305182
Preferred Termination: UR44C Item ID 9303963

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT			
2	1-1/C	1.08"	1.42"	1000’	5400	UC12BL	9315917[Y]	4026002[Y]

CABLE, 15 kV, ALUMINUM, SUBMARINE, RIVER USE

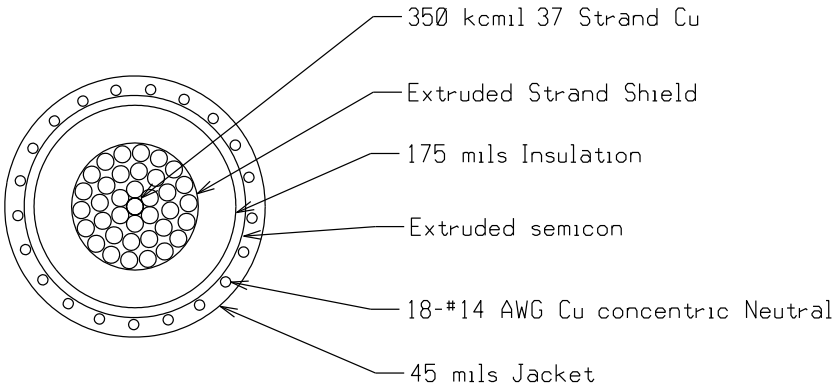
#2 AL, single conductor, shielded, solid dielectric, insulated aluminum power cable with concentric neutral wires, armor wires, polyethylene jacket and a layer of jute to provide protection. For use in river streams where water currents are present.

Preferred Splice: UR85B2 Item ID 9305182
Preferred Termination: UR44C Item ID 9303963

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT			
#2	1-1/C	1.08"	1.42"	1000’	5400	UC12BR	9315325[Y]	0808442[Y]

CABLE, 15 kV, COPPER

350 kcmil, single conductor, shielded, solid dielectric, insulated copper power cable with concentric neutral wires and polyethylene jacket. Cables shall be in accordance with PPL specification MS 4168 latest edition



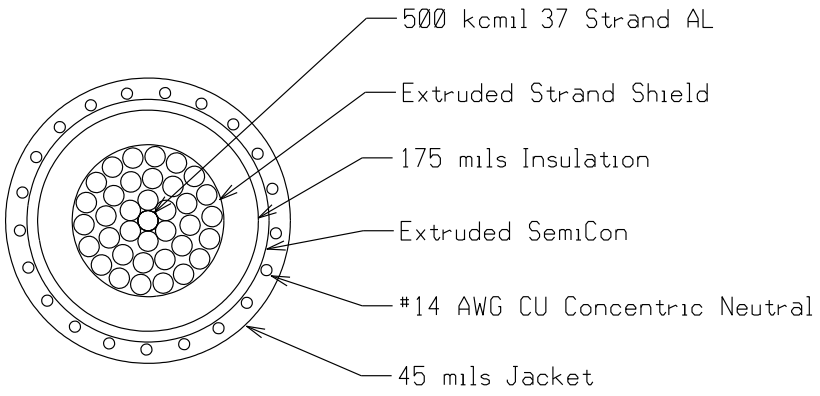
Max. Reel Size	60" W x 96" D
Preferred Splice	UR51B
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT			
350	3-1/C	1.08"	1.42"	1000’	5400	UC12F	9308986	5107155

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 15 kV, ALUMINUM

500 kcmil, single conductor, shielded, solid dielectric, insulated aluminum power cable with concentric neutral wires and polyethylene jacket. Cables shall be in accordance with PPL specification MS 4168 latest edition



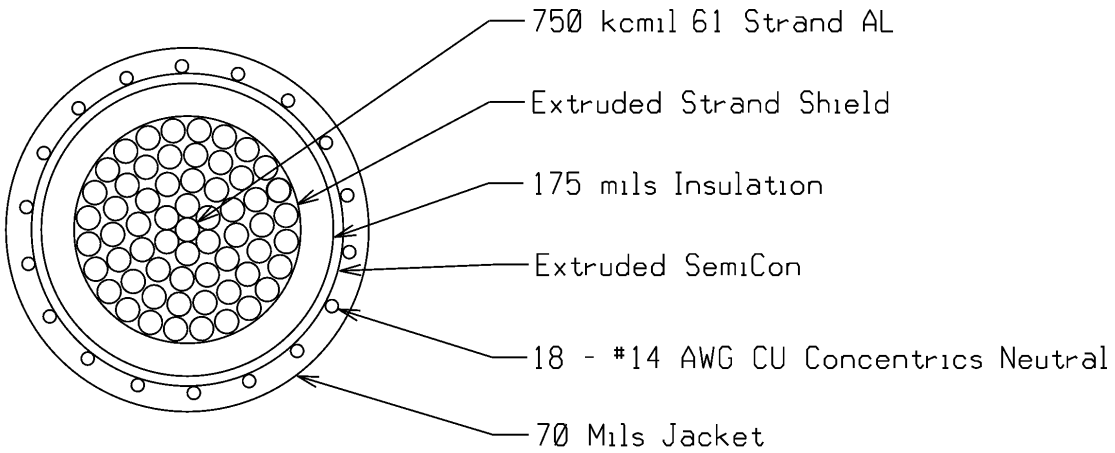
Max. Reel Size	60" W x 96" D
Preferred Splice	UR51B or UR51F
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
500	3-1/C	1.21"	1.55"	1500’	6750	UC12GG	9314218	0809922

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 15 kV, ALUMINUM

750 kcmil, single conductor, shielded, solid dielectric insulated aluminum power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.



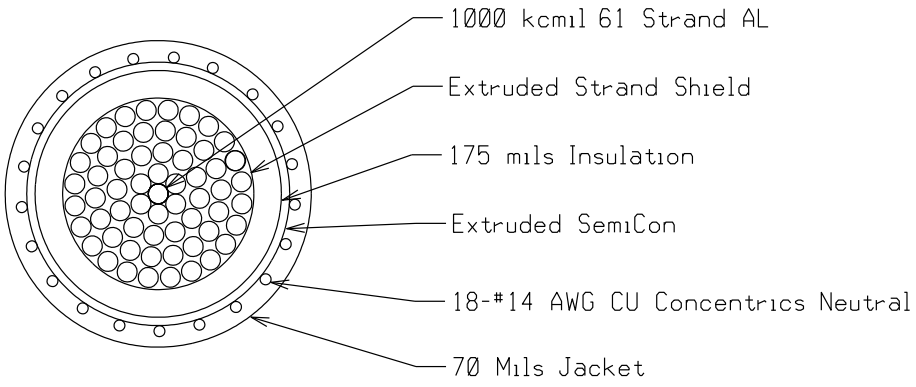
Reel Size	44" W x 78" D
Preferred Splice	UR51C
Preferred Termination	UR44D

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
750	3-1/C	1.40"	1.74"	900’	5940	UC12HG	9314216[Y]	0809923[Y]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 15 kV, ALUMINUM

1000 kcmil, single conductor, shielded, solid dielectric insulated aluminum power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.



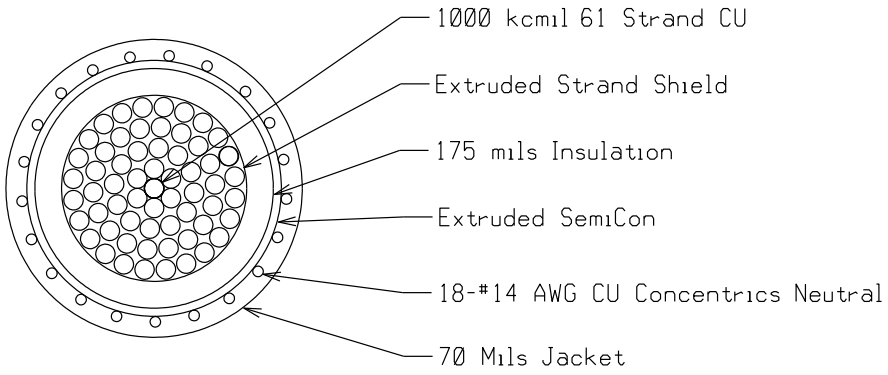
Reel Size	60" W x 96" D
Preferred Splice	UR51C
Preferred Termination	UR44D

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
1000	3-1/C	1.545"	1.98"	1000’	8100	UC12TA	9308997	5107173
1000	1/C	1.545"	1.98"	3000’	8100	UC12TB	9310595[E]	9200995[E]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 15 kV, COPPER

1000 kcmil, single conductor, shielded, solid dielectirc, insulated copper power cable with concentric neutral wires and polyethylene jacket. Cables shall be in accordance with PPL specification MS 4168 latest edition



Max. Reel Size	60" W x 96" D
Preferred Splice	UR51C
Preferred Termination	UR44D

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	Ckt. Ft.	Weight Lbs	STD ITEM	SAP ITEM ID	PS ITEM ID
1000	3-1/C	1.545"	1.98"	900’	11340	UC12TC	9309012	5107262
1000	1-1/C	1.545”	1.98”	2700’	11340	UC12TD	9389825[E]	N/A

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 15 kV, 1/C PILC

Single conductor, solid-type, impregnated paper-insulated, lead-covered, PE-jacketed copper power cable. Cable furnished shall be in accordance with the current AEIC Standard CS1-90 and PPL specification MS 4111 latest edition. Three parallel cables to be furnished on a reel.

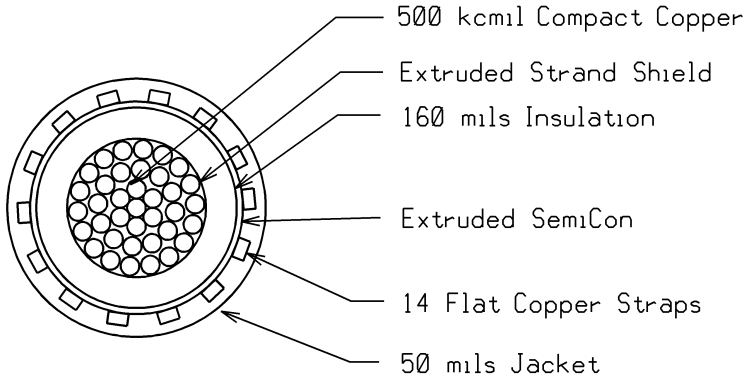
To be used for leads on Network Transformers which have lead wipe cable entrances.

Note: These cables have been discontinued. Use items UC11BK or UC11E to build network transformer leads. Heat shrink transition splices may be required when cable section is not replaced.

SIZE AWG	THICKNESS			O.D. JACKET	CKT. FT.	STD ITEM	SAP ITEM ID	PS ITEM ID
	INSUL.	LEAD	JACKET					
1/0	0.165	0.075	0.080	1.07		UC14CJ	9309651[E]	5812410[E]
4/0	0.165	0.075	0.080	1.24	1000	UC14EJ	9315936	4032343

CABLE, 15 kV, COPPER, REDUCED DIAMETER

500 kcmil single conductor, shielded, solid dielectric insulated, copper power cable with flat strap neutral wires and polyethylene jacket. Cable is designed with compact conductor, reduced insulation (160 mils) and 14 flat strap neutrals. This cable to be used where standard dimension cable will not fit in ducts. Cable shall be in accordance with PPL specification MS 4166 latest edition.

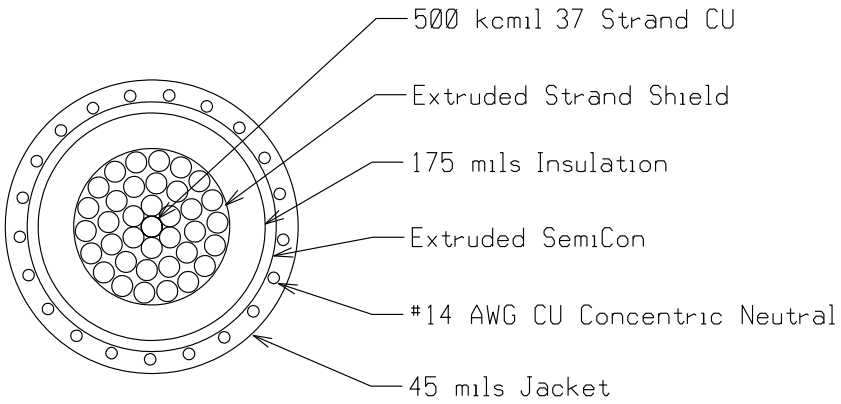


Max. Reel Size	60" W x 96" D
Preferred Splice	UR51B or UR51F
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE kcmil	PACKAGE	INS. (min)	JACKET (Max)	CKT. FT	WEIGHT			
500 Cu	3-1/C	1.085"	1.426"	1000’	6700	UC16G	9309362	5106004

CABLE, 15 kV, COPPER

500 kcmil, single conductor, shielded, solid dielectric, insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.



Max. Reel Size	60" W x 96" D
Preferred Splice	UR51B or UR51F
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT			
500	3-1/C	1.21"	1.55"	1100	9240	UC17	9314186	0810376

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

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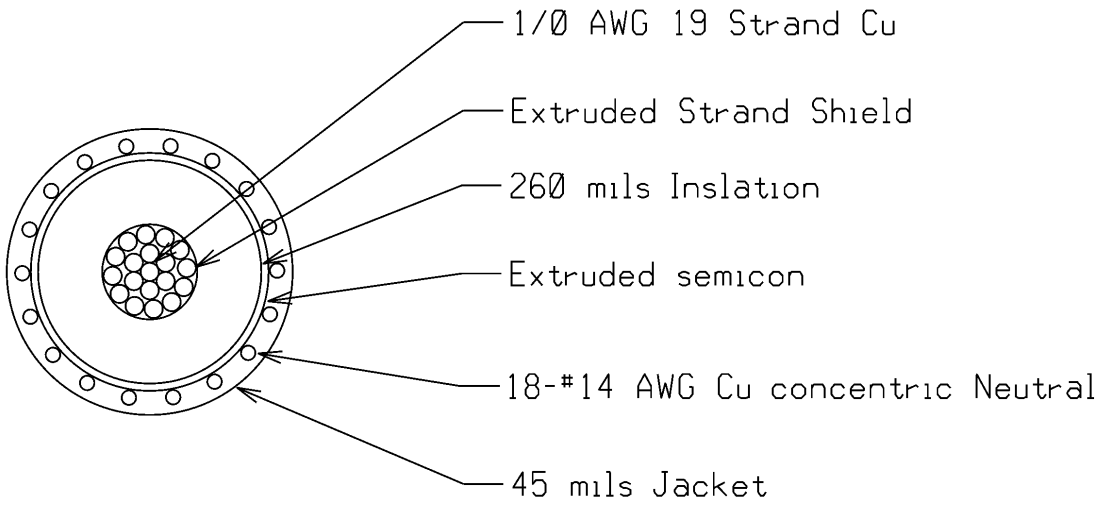
CABLE, 25 kV, COPPER

1/0 AWG, single conductor, shielded, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.



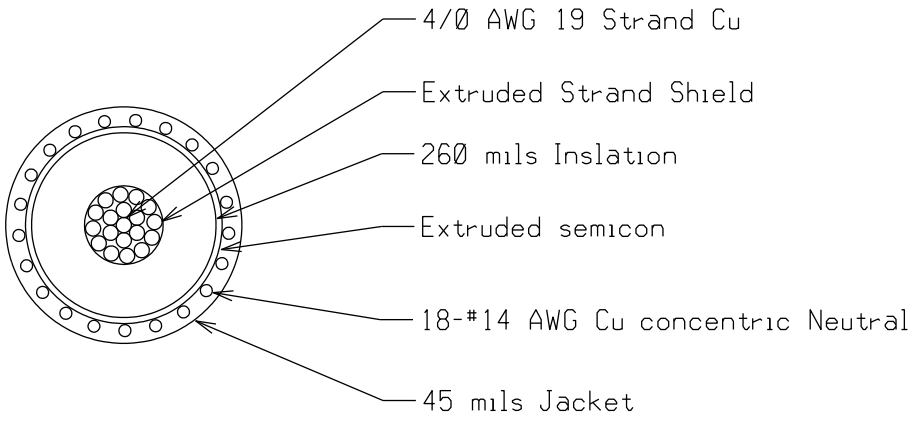
Reel Size	45" W x 80" D
Preferred Splice	UR51B
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS			
1/0	3-1/C	0.94"	1.25"	1000	2910	UC23CJ	9316006[Y]	4033356[Y]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 25 kV, COPPER

4/0 AWG, single conductor, shielded, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.



Reel Size	54" W x 70" D
Preferred Splice	UR51B
Preferred Termination	UR44D

CONDUCTOR		O.D.		REEL				
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
4/0	3-1/C	1.09"	1.43"	1000	4500	UC23EC	9308996[E]	5107164[E]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 25 kV, COPPER, REDUCED DIAMETER

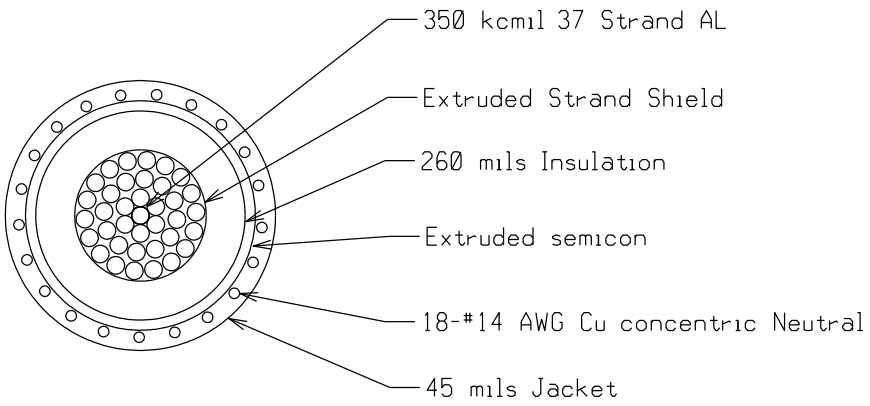
3/0 AWG single conductor, shielded, solid dielectric insulated, copper power cable with flat strap neutral wires and polyethylene jacket. Cable is designed with compact conductor, reduced insulation (245 mils) and 21 flat strap neutrals. This cable to be used where standard dimension cable will not fit in ducts. Cable shall be in accordance with PPL specification MS 4166 latest edition.

Max. Reel Size	56" W x 78" D
Preferred Splice	UR51B
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS. (min)	JACKET (Max)	CKT. FT	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
3/0 Cu	3-1/C	0.935	1.280	1000’	3960	UC23ED	9307923[E]	9202333[E]

CABLE, 25 kV, ALUMINUM

350 kcmil, single conductor, shielded, solid dielectric insulated aluminum power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.



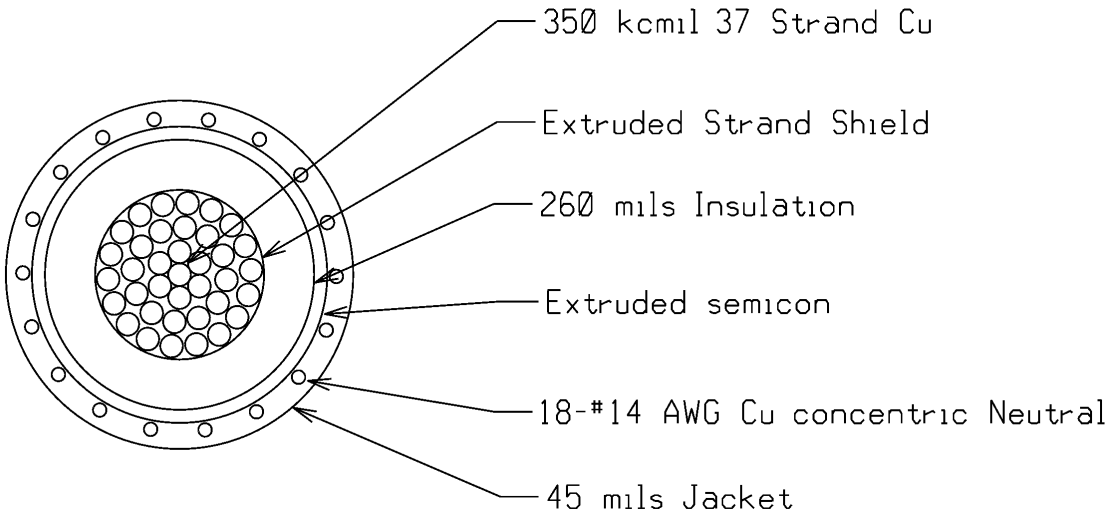
Reel Size	60" W x 96" D
Preferred Splice	UR51B
Preferred Termination	UR44D

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
350	3-1/C	1.26"	1.60"	1500	6300	UC23FA	9308980[E]	5107128[E]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

CABLE, 25 kV, COPPER

350 kcmil, single conductor, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition



Max. Reel Size	56" W x 78" D
Preferred Splice	UR51B
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
350	3-1/C	1.26"	1.58"	1000'	6600	UC23FJ	9316005[Y]	4033357[Y]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

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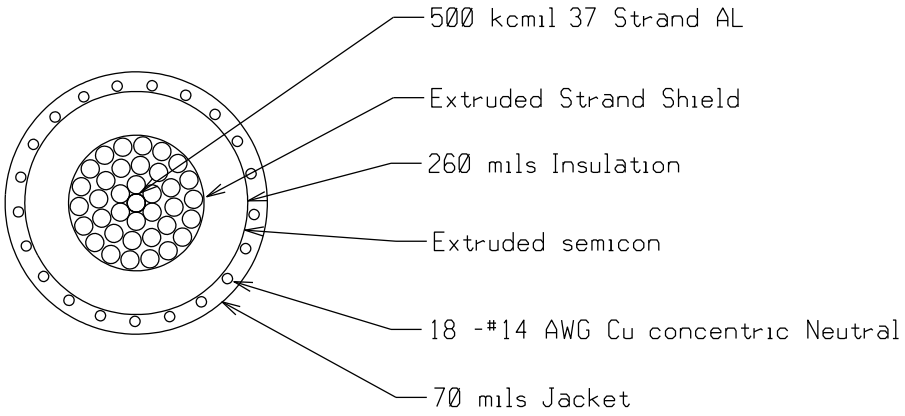
CABLE, 25 kV, ALUMINUM

500 kcmil, single conductor, shielded, solid dielectric insulated aluminum power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.

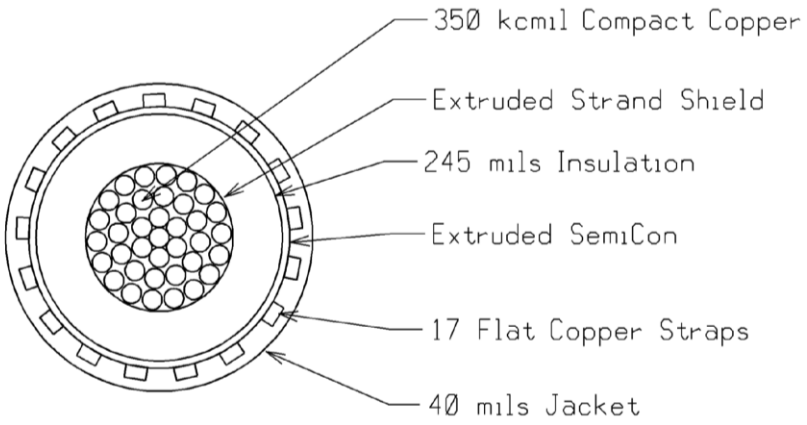


Reel Size	60" W x 96" D
Preferred Splice	UR51C or UR51F
Preferred Termination	UR44D

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
500	3-1/C	1.39"	1.795"	1000	5400	UC23GA	9308998[E]	5107182[E]

CABLE, 25 kV, COPPER, REDUCED DIAMETER

350 kcmil single conductor, shielded, solid dielectric insulated, copper power cable with flat strap neutral wires and polyethylene jacket. Cable is designed with compact conductor, reduced insulation (245 mils) and 17 flat strap neutrals. For replacement of 3/C PILC cable in small size ducts. Cable shall be in accordance with PPL specification MS 4166 latest edition.

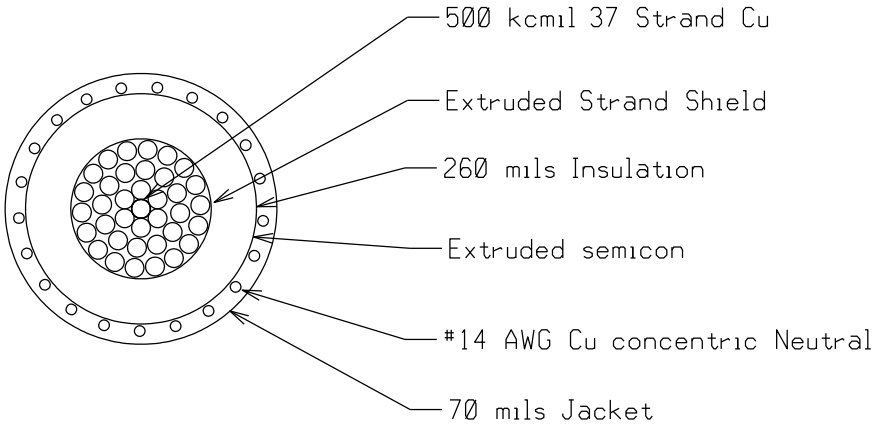


Reel Size	60" W x 96" D
Preferred Splice	UR51B
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
350	3-1/C	1.14”	1.41"	1000	7100	UC23GG	9306279	9201374

CABLE, 25 kV, COPPER

500 kcmil, single conductor, shielded, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.

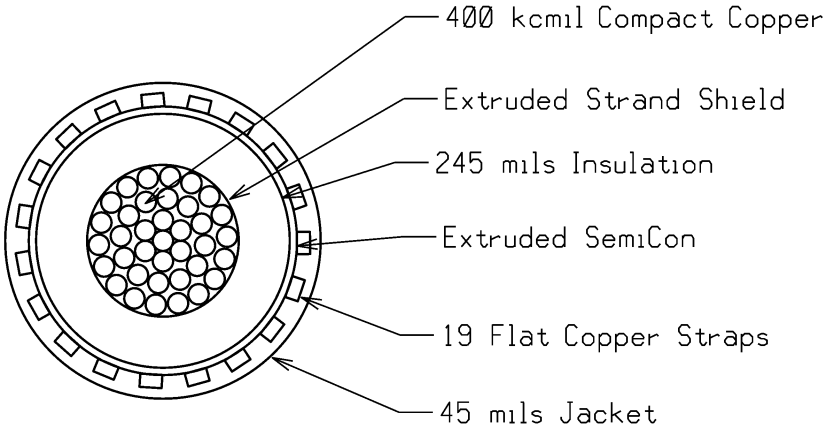


Reel Size	60" W x 96" D
Preferred Splice	UR51C or UR51F
Preferred Termination	UR44E

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
500	3-1/C	1.39"	1.665"	1000	9300	UC23GJ	9314170	0810924
500	1-1/C	1.39”	1.665”	3000	9300	UC23GJ1	9393027	----------

CABLE, 25 kV, COPPER

400 kcmil single conductor, shielded, solid dielectric insulated, copper power cable with flat strap neutral wires and polyethylene jacket. Cable is designed with compact conductor, reduced insulation (260 mils) and 19 flat strap neutrals. For replacement of 3/C PILC cable in 4" round ducts. Cable shall be in accordance with PPL specification MS 4166 latest edition.

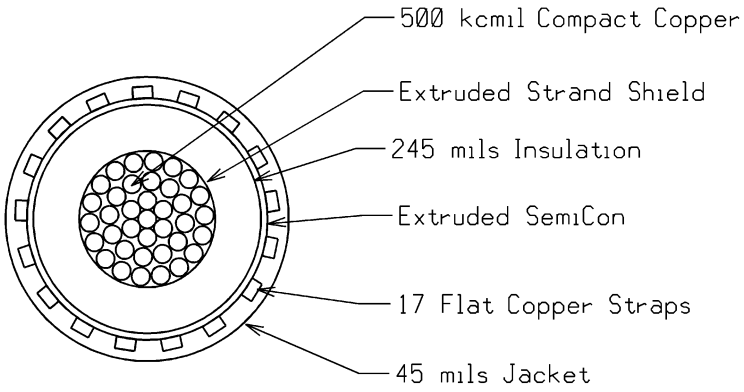


Preferred Splice	UR51B
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT (pounds)	STD ITEM	SAP ITEM ID	PS ITEM ID
400	3-1/C	1.22	1.47	1000	7000	UC23GK	9306449	9201807

CABLE, 25 kV, COPPER, REDUCED DIAMETER

500 kcmil single conductor, shielded, solid dielectric insulated, copper power cable with flat strap neutral wires and polyethylene jacket. Cable is designed with compact conductor, reduced insulation (245 mils) and 17 flat strap neutrals. For replacement of 3/C PILC cable in 4" round ducts. Cable shall be in accordance with PPL specification MS 4166 latest edition.



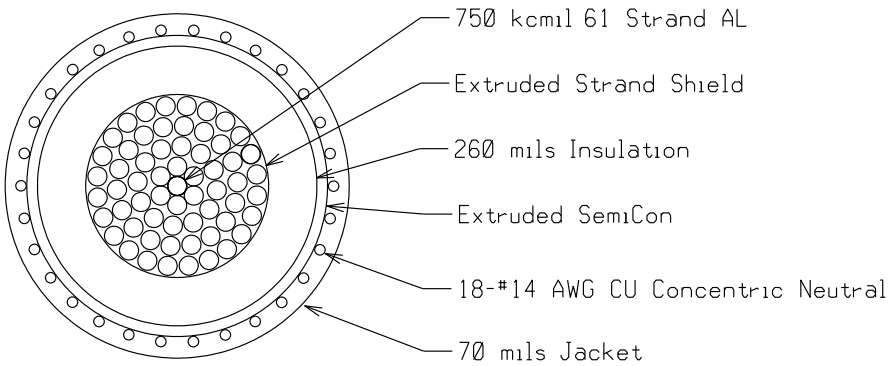
Max. Reel Size	55" W x 78" D
Preferred Splice	UR51B or UR51F
Preferred Termination	UR44C

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
500	3-1/C	1.32"	1.58"	1000'	7800	UC23GL	9307169	9200116

CABLE, 25 kV, ALUMINUM

750 kcmil, single conductor, shielded, solid dielectric insulated aluminum power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.

DO NOT ORDER. Use up existing stock.

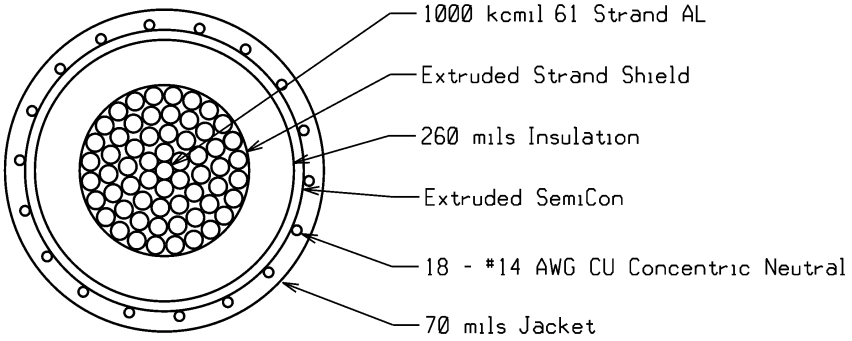


Reel Size	45" W x 82" D
Preferred Splice	UR51C
Preferred Termination	UR44D

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
750	3-1/C	1.56"	1.93"	900	5500	UC23HJ		4033359[Y]

CABLE, 25 kV, ALUMINUM

1000 kcmil, single conductor, shielded, solid dielectric insulated aluminum power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.

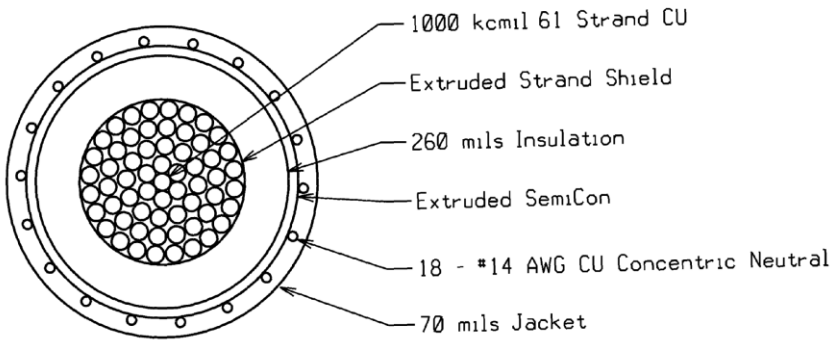


Reel Size	60" W x 96" D
Preferred Splice	UR51C
Preferred Termination	UR44E

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
1000	3-1/C	1.725"	2.16"	1000	9000	UC23TA	9309015	5107191

CABLE, 25 kV, COPPER

1000 kcmil, single conductor, shielded, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.



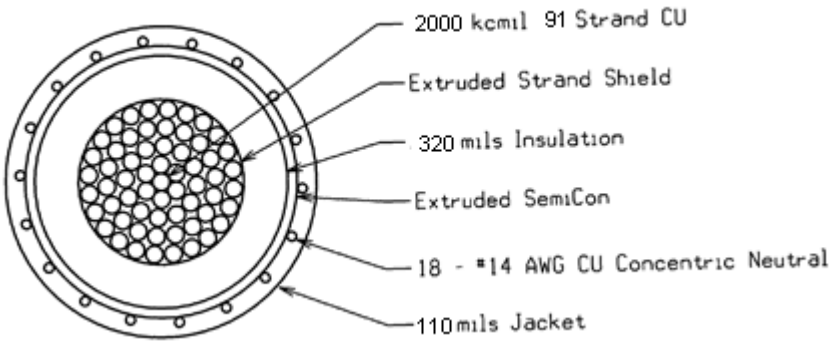
Reel Size	60" W x 96" D
Preferred Splice	UR51C
Preferred Termination	UR44E

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
1000	3-1/C	1.725"	2.16"	850	13770	UC23TC	9306707	9201889

CABLE, 25 kV, COPPER (133% INSULATION LEVEL)

2000 kcmil, single conductor, shielded, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. This cable is to be used in substation transformer leads. Cable shall be in accordance with PPL specification MS 4170 latest edition.

NOTE: This cable has been discontinued. Use up remaining stock. Replaced by Item UC35TK 35 kV 2000 kcmil CU



Reel Size 60" W x 96" D
Preferred Splice
Preferred Termination

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT.	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
2000	1-1/C	2.33"	2.70"	650	8,400	UC23TE	9389425	N/A

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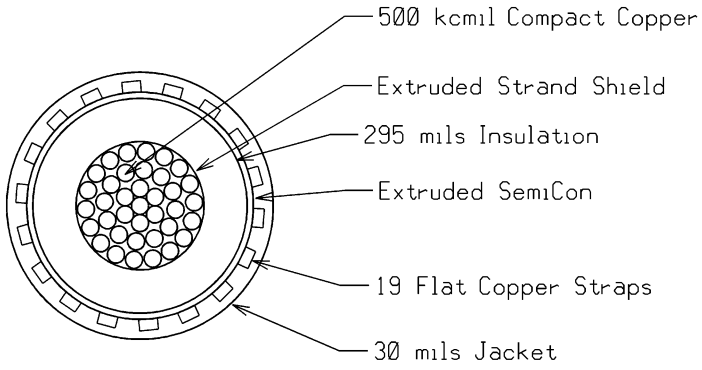
CABLE, 35 kV, COPPER, REDUCED DIAMETER

500 kcmil, single conductor, shielded, solid dielectric insulated, copper power cable with flat strap neutral wires and polyethylene jacket. Cable is designed with compact conductor, reduced insulation (295 mils) and 19 flat strap neutrals. This cable to be used where standard dimension cable will not fit in ducts. Cable shall be in accordance with PPL specification MS 4166 latest edition.

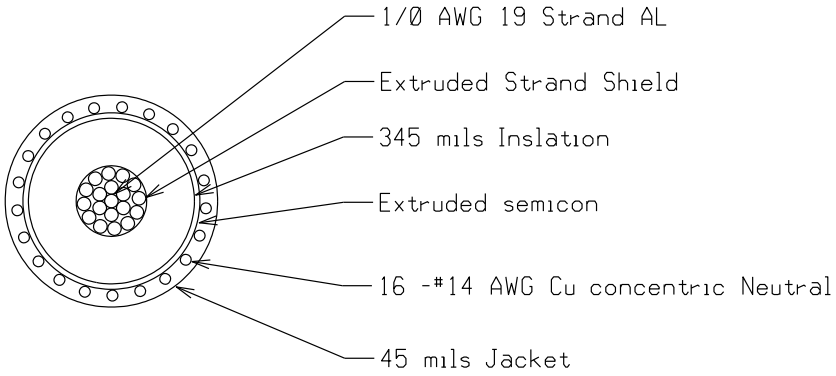


Reel Size	45" W x 80" D
Preferred Splice	UR51C or UR51F
Preferred Termination	UR45C3

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT			
500	3-1/C	1.37"	1.70"	1100	4500	UC33GJ	9314176	0810917

CABLE, 35 kV, ALUMINUM

1/0 AWG, single conductor, shielded, solid dielectric insulated, aluminum power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.

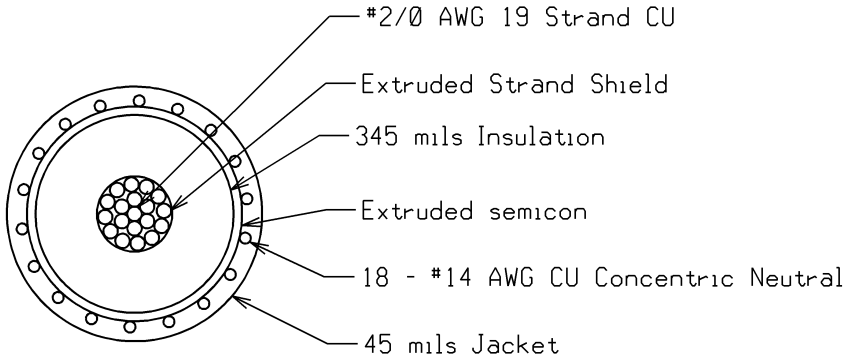


Reel Size	54” W x 70” D
Preferred Splice	UR51D
Preferred Termination	UR45B1

CONDUCTOR		O.D.		REEL				
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
1/0	1/C	1.11"	1.45"	3000	2880	UC35C1	9321948[E]	5948318[E]
1/0	3-1/C	1.11"	1.45"	1500	4320	UC35C3	9312773	5948319

CABLE, 35 kV, COPPER

2/0 AWG, single conductor, shielded, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL Specification MS 4168 latest edition.

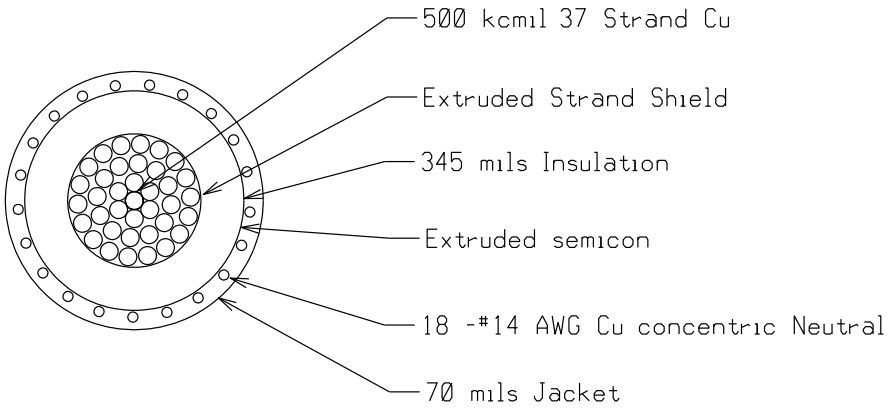


Max. Reel Size	42" W x 75" D
Preferred Splice	UR51D
Preferred Termination	UR45B1

CONDUCTOR		O.D.		REEL				
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
2/0	3-1/C	1.20"	1.53"	1000	4050	UC35DJ	9316002[Y]	4034002[Y]

CABLE, 35 kV, COPPER

500 kcmil, single conductor, shielded, solid dielectric insulated, copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.

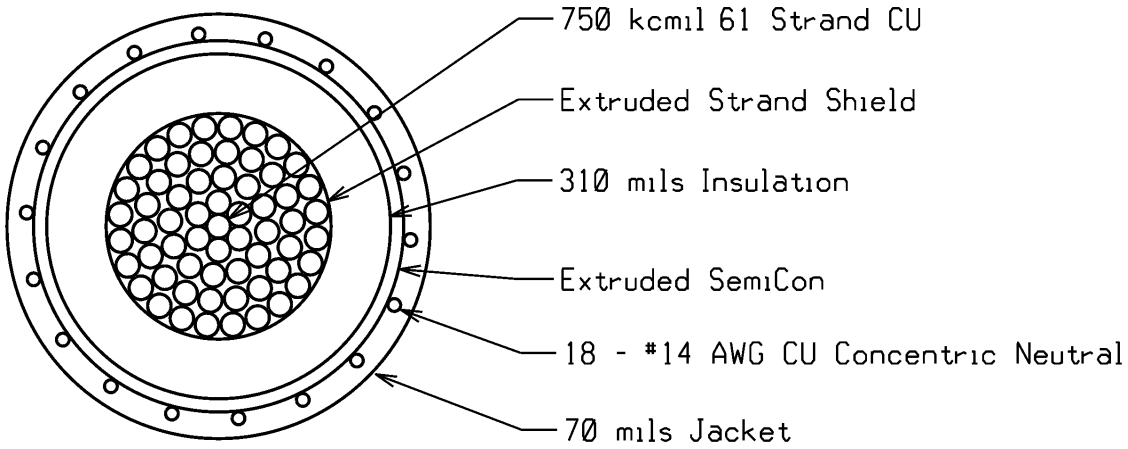


Max. Reel Size	55” W x 78” D
Preferred Splice	UR51E
Preferred Termination	UR45C3

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
500	3-1/C	1.56"	1.96"	1000	10200	UC35GJ	9306942	9200387

CABLE, 35 kV, COPPER

750 kcmil, single conductor, shielded, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.

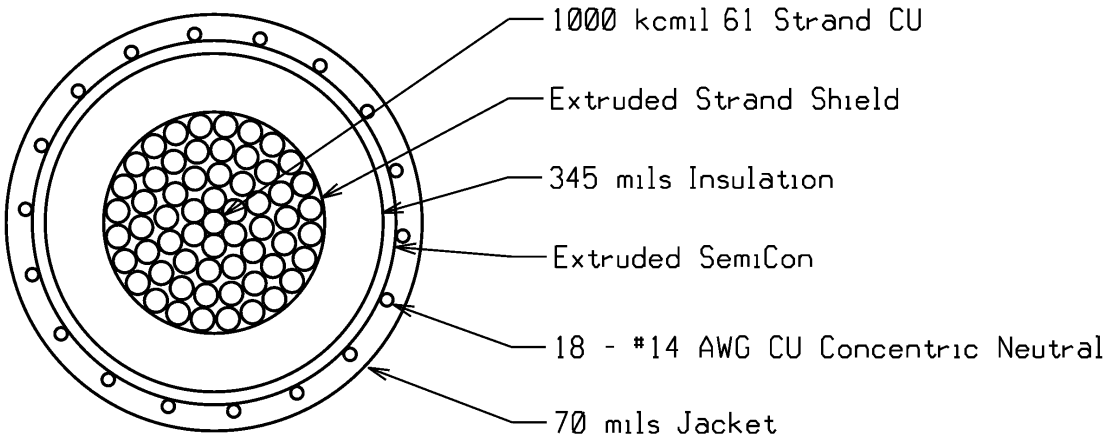


Max. Reel Size	55" W x 84" D
Preferred Splice	UR51E
Preferred Termination	UR45H

CONDUCTOR		O.D.		REEL				
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT LBS	STD ITEM	SAP ITEM ID	PS ITEM ID
750	3-1/C	1.73"	2.09"	900	12420	UC35HJ	9316001[Y]	4034075[Y]

CABLE, 35 kV, COPPER

1000 kcmil, single conductor, shielded, solid dielectric insulated, copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.

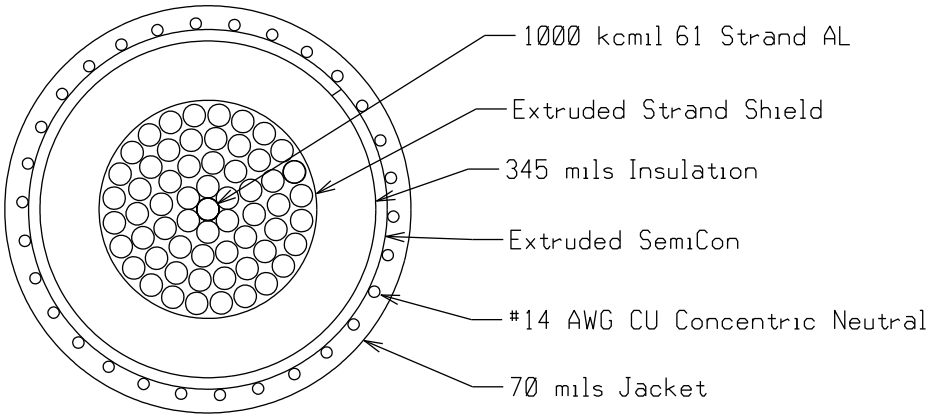


Reel Size	60" W x 96" D
Preferred Splice	UR51E
Preferred Termination	UR45H

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT LBS			
1000	3-1/C	1.95"	2.31"	800	13680	UC35TC	9302670[E]	5949570[E]
1000	1/C	1.95"	2.31"	2000	11400	UC35TD	9306247	9201830

CABLE, 35 kV, ALUMINUM

1000 kcmil, single conductor, shielded, solid dielectric insulated, aluminum power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL specification MS 4168 latest edition.

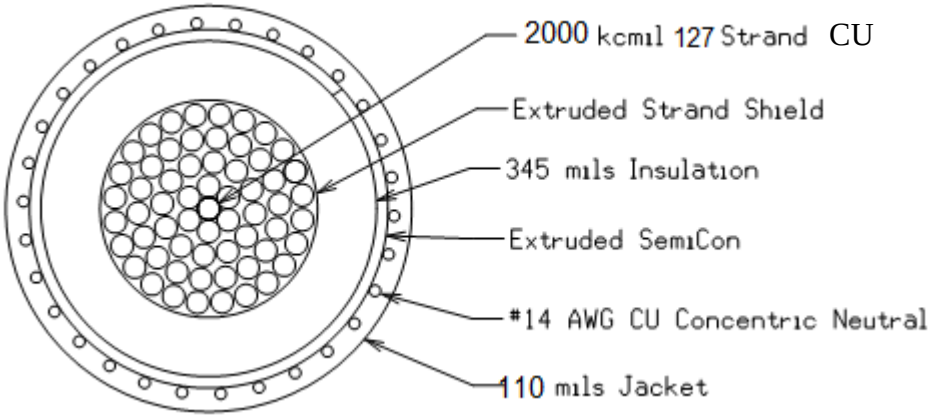


Reel Size	50" W x 84" D
Preferred Splice	UR51E
Preferred Termination	UR45H

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT			
1000	3-1/C	1.95"	2.31"	1000	9900	UC35TJ	9309014	5107208
1000	1-1/C	1.95	2.31	1000	3300	UC35TK	9390355	n/a

CABLE, 35 kV, COPPER (100% EPR INSULATION)

2000 kcmil, single conductor, shielded, solid dielectric insulated, copper power cable with concentric neutral wires and polyethylene jacket. This cable is to be used in substation transformer leads and other special applications determined by standards engineering. Cable shall be in accordance with PPL specification MS 4170 latest edition.

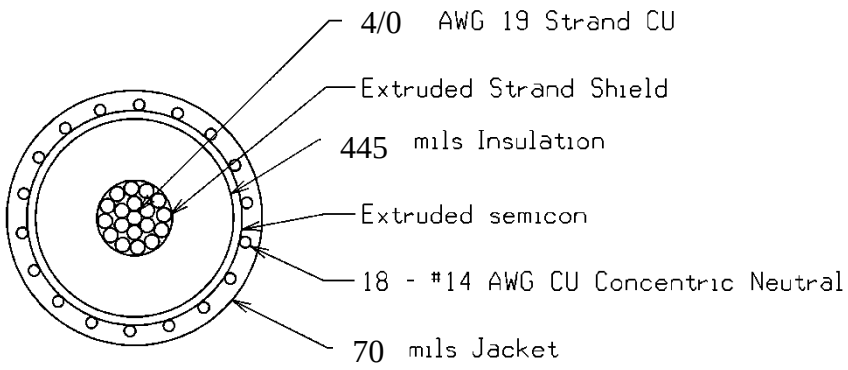


Reel Size 90" W x 60" D
Preferred Splice
Preferred Termination

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE kcmil	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT LBS			
2000	1-1/C	2.43"	2.92"	650	5590	UC35TL	9392347	n/a

CABLE, 46 kV, COPPER

4/0 AWG, single conductor, shielded, solid dielectric insulated copper power cable with concentric neutral wires and polyethylene jacket. Cable shall be in accordance with PPL Specification MS 4169 latest edition.



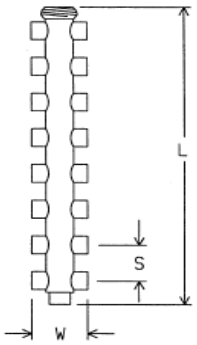
Max. Reel Size	60" W x 96" D
Preferred Splice	
Preferred Termination	UR46

CONDUCTOR		O.D.		REEL		STD ITEM	SAP ITEM ID	PS ITEM ID
SIZE AWG	PACKAGE	INS.	JACKET	CKT. FT	WEIGHT LBS *			
4/0	3-1/C	1.46"	1.788"	1000	6210	UC46	9390798[Y]	n/a

Approximate weight of cable does not include weight of reel.

MOLE, INSULATED BUS for NETWORK SECONDARY, 2000A

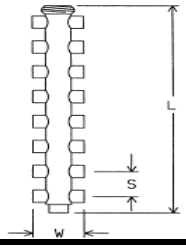
Insulated 2000 amp secondary network connector designed for connecting multiple secondary network cables. The connector housing has an end outlet for future expansion by use of a mole coupler, item UC55. Unused side openings plugged with item UC54A. Unused end opening plugged with item UC54B.



NUMBER OF CABLE OUTLETS	DIMENSIONS (INCHES)			STD ITEM	SAP ITEM ID	PS ITEM ID
	L	S	W			
4	9½	3½	4½	UC50A1	9313385	2015353
6	13	3½	4½	UC50A2	9313410	2015370
8	16	3½	4½	UC50A3	9313414	2015360
10	20	3½	4½	UC50A4	9313412	2015363
12	23	3½	4½	UC50A5	9311800	2015377
16	30	3½	4½	UC50A6	9313397	2015359

MOLE, INSULATED BUS, 1500A

Insulated 1500 amp secondary network connector designed for connecting multiple secondary network cables. Unused openings plugged with item UC54A.



NUMBER OF CABLE OUTLETS	DIMENSIONS (INCHES)			STD ITEM	SAP ITEM ID	PS ITEM ID
	L	S	W			
4	7	3½	4½	UC50B1	9304967[E]	5106834[E]
6	10	3½	4½	UC50B2	9304966[E]	5106835[E]
8	13	3½	4½	UC50B3	9305558[E]	5106836[E]
12	19	3½	4½	UC50B4	9305557[E]	5106837[E]

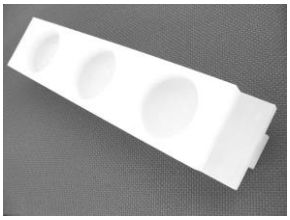
MOLE, INSULATED BUS, THREADED STUD MOUNTING

Insulated secondary network connector designed for mounting on the threaded stud terminal of the network protector. Allows connecting multiple secondary network cables. Unused openings plugged with item UC54A. CAUTION: Mole ampacity must equal or exceed transformer ampacity.

NUMBER OF CABLE OUTLETS	STYLE	STUD SIZE	AMPS	STD ITEM	SAP ITEM ID	PS ITEM ID
6	1 arm, 1 side	1.5 X 12	1600	UC50C1	9305480[E]	5106839[E]
8	2 arms, 1 side	1.5 X 12	2000	UC50C2	9320553	5962321
10	1 arm, 2 sides	3 X 12	2500	UC50C3	9305152[E]	5106960[E]
8	2 arms, 1 side	3 X 12	3000	UC50C6	9306608	9201994

HOLDER - MOLE, FOR USE IN UNI-STRUT

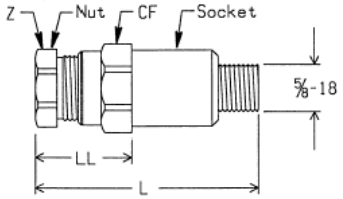
Holder, Mole, for securing mole units to a uni-strut rack, 3-position, polypropolyne.



STD ITEM	SAP ITEM ID	PS ITEM ID
UC50H3	9307978	9202664

MOLE, SOCKET & NUT ASSEMBLY

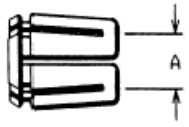
High conductivity cable receptacle for securing copper secondary network cables mechanically and electrically in the cable outlet positions of a mole network connector, item UC50. The assembly consists of a socket and a nut. Use with cone item UC52 and insulating sleeve item UC53.



MAXIMUM CABLE SIZE AWG / kcmil	USE WITH CONE	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
4/0	UC52A__	3-7/16"	UC51A	9311797	2015268
250	UC52B__	3-9/16"	UC51B	9310393	9201193
300	UC52D__	3-5/8	UC51D	9306599[E]	9201985[E]
500	UC52C__	3-11/16"	UC51C	9311796	2015269

MOLE, COMPRESSION CONE

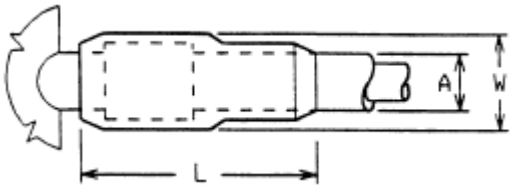
Tapered compression cone for use with copper cable. Use with the correct mole socket & nut assembly, item UC51__.



CABLE SIZE AWG / kcmil	USE WITH SOCKET	STD ITEM	SAP ITEM ID	PS ITEM ID
2	UC51A	UC52A1	9311814	2015274
4/0	UC51A	UC52A2	9311813	2015271
250	UC51B	UC52B1	9305499	5106657
2	UC51C	UC52C1	9305520	5106653
2/0	UC51C	UC52C2	9305519	5106655
4/0	UC51C	UC52C3	9305518	5106656
250	UC51C	UC52C4	9305497[E]	5106658[E]
350	UC51C	UC52C5	9305496[E]	5106681[E]
300	UC51C	UC52C7	9306615[E]	9201986[E]
500	UC51C	UC52C6	9311815	2015275
300	UC51D	UC52D1	9306613[E]	9201988[E]

MOLE, INSULATING SLEEVE

Insulating sleeve designed for use over a socket & nut assembly, item UC51__, providing a watertight seal between the mole and cable with minimum taping. Choose according to socket used.

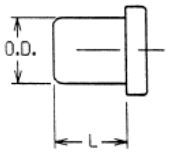


SOCKET ASSEMBLY	STD ITEM	SAP ITEM ID	PS ITEM ID
UC51A, UC51B, UC51D	UC53A	9313411	2015364
UC51C	UC53B	9313413	2015362

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

MOLE, OUTLET PLUG

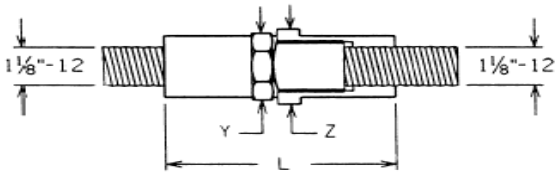
Insulating plugs for use with the mole connectors, item UC50, to insulate and waterseal cable outlet or end coupler positions not being used



POSITION	DIMENSIONS		STD ITEM	SAP ITEM ID	PS ITEM ID
	O.D.	LENGTH			
Cable Outlet	1.1”	0.75 – 1.13	UC54A	9311722	2015267
Mole Coupler	1.6”	0.75 – 1.25	UC54B	9311803	2015270

MOLE, COUPLER

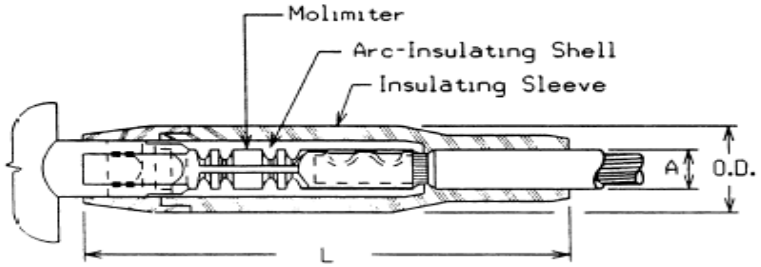
Coupler for joining two mole connectors, item UC50A, end-to-end.



STD ITEM	SAP ITEM ID	PS ITEM ID
UC55	9314974	2015361

MOLE, LIMITER ASSEMBLY

Limiter assembly for use on 208Y/120V network system and designed for protecting network low-voltage power cables terminated in a mole connector, item UC50_, 30,000 amps interrupting rating. The assembly consists of a molimiter, arc-insulating shell and insulating sleeve.



CABLE SIZE AWG / kcmil	USE WITH		Y34A		INDENTS	Y35	CRIMPS	Y46	CRIMPS	STD ITEM	SAP ITEM ID	PS ITEM ID
	SOCKET	CONE	IND	NEST								
4/0	UC51A	UC52A2	Y34PR	A28D	1	U28RT	2	✳	2	UC56A	9313395	2015355
250	UC51B	UC52B1	Y34PR	A29D		U29RT	2	✳	2	UC56B	9305146	5106975
300	UC51D	UC52D1	Y34PR	A30D	2	U30RT	2	✳	2	UC56D	9306614[E]	9201987[E]
500	UC51C	UC52C6	Y34PR	A34D	2	U34RT	4	✳	4	UC56C	9313379	2015344

✳ Use Y35 die with “P” adapter (Bundy Cat No. P-UADP)

CONNECTOR, NETWORK CRAB

Connector, network crab, 600V, 4/0 copper with pigtails (2)#2 and (2)#6. EPDM rubber. For connecting services and streetlights.

STD ITEM	SAP ITEM ID	PS ITEM ID
UC57A	9389045	----------

CONNECTOR, NETWORK CRAB

Connector, network crab, 600V, copper block, EPDM rubber molded, 4 copper tails on each side for connecting multiple cables in one junction.

PORTS	STD ITEM	SAP ITEM ID	PS ITEM ID
500 kcmil 4/0 awg	UC57B[E] UC57B1[E]	9390298 9391731	n/a n/a

CONNECTOR, NETWORK CRAB

Connector, network crab, 600V, copper block, EPDM rubber molded, 6-500 MCM copper tails, for connecting multiple cables in one junction.

STD ITEM	SAP ITEM ID	PS ITEM ID
UC57C	9390320[E]	----------

CONNECTOR, SHEAR BOLT, COPPER

Connector, copper, shear bolt, range taking, oil/water stop, removable copper inserts, to be used in underground cable cold shrink joints. The bolt heads will shear off when proper torque is applied.
NOTE: These connectors are discontinued. Use up remaining stock in CU to CU cable splices. Use Std. Items UC59_ as replacement.

RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
2 - 250	UC58A	9389898	N/A
2/0 - 500	UC58B	9389904	N/A
500 - 1000	UC58C	9389966	N/A

CONNECTOR, SHEAR BOLT, ALUMINUM

Connector, tin plated aluminum, shear bolt, range taking, oil/water stop, to be used in underground cable cold shrink joints. The bolt heads will shear off when proper torque is applied, Connectors can be used with copper and aluminum cables. Bolts have an Allen Set Screw.

CONDUCTOR RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
#5 – 300	UC59A	9389955	N/A
1/0 - 600	UC59B	9391872	N/A
350-800	UC59D	9391015	N/A
500 - 1000	UC59C	9389965	N/A

CONNECTOR, COMPRESSION, COPPER

Tinned copper compression connector with center oil / water stop. Designed for joining copper conductors end to end. These connectors are selected to meet the dimensional requirements of all high voltage splice kits used in the company. Splice shall be in accordance with ANSI C119.4, Class A, Class 2 min.

WIRE SIZE AWG / kcmil	BCT 500 PATMD6814V		Y35		Y46		DIE INDEX	STD ITEM	SAP ITEM ID	PS ITEM ID
	Die	Crimp	Die	Crimp	Die	Crimp				
4	W4CRT	2	U4CRT	2			8	UC60A	9310127	9201222
2	W2CRT	2	U2CRT	2	*	2	10	UC60B	9310128	9201220
1/0	W25RT	4	U25RT	2	*	2	12	UC60C	9310125	9201223
2/0	W26RT	4	U26RT	2	*	2	13	UC60D	9310123	9201225
4/0	W28RT	4	U28RT	2	*	2	15	UC60E	9310121	9201227
250 / 250 comp	W29RT	4 4	U29RT	2	*	2	16	UC60F	9310119	9201229
300 / 300 comp	W30RT	2	U30RT	4	*	4	17	UC60H	9310096	9201234
350 / 350 comp	W31RT	2	U31RT	4	*	4	18	UC60K	9310094	9201235
400 comp	W32RT	2	U32RT	4	*	4	19	UC60L	9310092	9201237
500 / 500 comp	W34RT	2	U34RT	4	*	4	20	UC60M	9310088	9201241
750			U39RT	4	P39RT	4	24	UC60P	9310095	9201242
1000				4	P44RT	4	27	UC60R	9310087	9201243

* Use P-UADP-1 Adapter with “U” dies in Y-46 Hypress
Note: Crimps are defined as per end / side of connector

CONNECTOR, COMPRESSION, ALUMINUM

Tinned aluminum compression connector with center oil / water stop. Designed for joining 2 aluminum conductors or copper to aluminum conductors end to end. These connectors are selected to meet the dimensional requirements of all high voltage splice kits used in the company. Splice shall be in accordance with ANSI C119.4, Class A, Class 2 min.

WIRE SIZE AWG / kcmil	BCT 500 PATMD6814V		Y35		Y46		DIE INDEX	STD ITEM	SAP ITEM ID	PS ITEM ID
	Die	Crimp	Die	Crimp	Die	Crimp				
#2	W241	2	U25ART	2	*	2	296	UC61A	9310390	9201196
1/0	W241	2	U25ART	2	*	2	296	UC61B	9310388	9201198
4/0	W660	4	U28ART	2	*	2	298	UC61C	9310387	9201199
350	W31ART	4	U31ART	4	*	4	299	UC61D	9310386	9201200
500	**		U34ART	4	*	4	300	UC61E	9310385	9201201
750	**		U39ART2	4	P39ART	4	936	UC61F	9310384	9201202
1000	**				P39ART	4	936	UC61G	9310383	9201203

* Use P-UADP-1 Adapter with “U” dies in Y-46 Hypress
** Do Not use BCT500 on aluminum conductor 350 and larger
Note: Crimps are defined as per end / side of connector

CONNECTOR, COMPRESSION, COPPER REDUCING

Tinned copper compression connector with center oil / water stop. Designed for joining two different size copper conductors end to end. These connectors are selected to meet the dimensional requirements of all high voltage splice kits used in the company. Splice shall be in accordance with ANSI C119.4, Class A, Class 2 min.

WIRE SIZE AWG / kcmil	BCT 500 PATMD6814V		Y35		Y46		DIE INDEX	STD ITEM	SAP ITEM ID	PS ITEM ID
	Die	Cmp	Die	Cmp	Die	Cmp				
2str to 3sol	W2CRT	2					10	UC62A1	9310340	9201182
2 to 1/0	W25RT	2	U25RT	1	*	2	12	UC62A2	9310329	9201170
2 to 4/0	W28RT	2	U28RT	1	*	2	15	UC62A3	9310341	9201183
2 to 350	W31RT	4	U31RT	2	*	2	18	UC62A4	9310358	9201184
2 to 500	W34RT	2	U34RT	2	*	2	20	UC62A5	9310357	9201185
1/0 to 4/0	W28RT	2	U28RT	1	*	2	15	UC62B1	9310356	9201186
1/0 to350	W31RT	4	U31RT	2	*	2	18	UC62B2	9310399	9201187
2/0 to 4/0	W28RT	2	U28RT	1	*	2	15	UC62C1	9310397	9201189
2/0 to 350	W31RT	4	U31RT	2	*	2	18	UC62C2	9310396	9201190
3/0 to 4/0	W28RT	2	U28RT	1	*	2	15	UC62D1	9310395	9201191
4/0 to 250	W29RT	4	U29RT	2	*	2	16	UC62E1	9310394	9201192
4/0 to 300	W30RT	4	U30RT	2	*	2	17	UC62E2	9310392	9201194
4/0 to 350	W31RT	4	U31RT	2	*	2	18	UC62E3	9310239	9201211
4/0 to 450	W33RT	4	U33RT	2	*	2	326	UC62E4	9310130	9201218
4/0 to 500	W34RT	4	U34RT	2	*	2	20	UC62E5	9310129	9201219
250 to 350	W31RT	4	U31RT	2	*	2	18	UC62F1	9310135	9201221
250 to 500	W34RT	4	U34RT	2	*	2	20	UC62F2	9310084	9201245
300 to 500 comp.	W34RT	4	U34RT	2	*	2	20	UC62G1	9310124	9201224
350 to 500/ 500 comp	W34RT	4	U34RT	2	*	2 2	20	UC62H1	9310122	9201226
350 to 750			U39RT	2	P39RT	2	24	UC62H2	9306209[Y]	9201581[Y]
450 to 500 comp.	W34RT	4	U34RT	2	*	2	20	UC62J1	9310120	9201228
500/500 comp to 750			U39RT	2	P39RT	2	24	UC62K2	9310091	9201238
500/500 comp to 1000					P44RT	2	27	UC62K4	9310090	9201239
750 to 1000					P44RT	2	27	UC62L1	9310339	9201181

* Use P-UADP-1 Adapter with “U” dies in Y-46 Hypress

CONNECTOR, COMPRESSION, ALUMINUM REDUCING

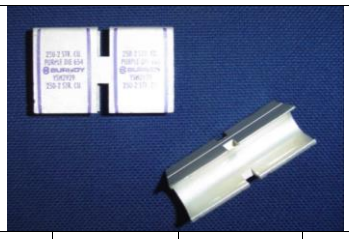
Tinned aluminum compression connector with center oil / water stop. Designed for joining 2 aluminum conductors or copper to aluminum conductors end to end. These connectors are selected to meet the dimensional requirements of all high voltage splice kits used in the company. Splice shall be in accordance with ANSI C119.4, Class A, Class 2 min.

WIRE SIZE AWG / kcmil	BCT 500 PATMD6814V		Y35		Y46		DIE INDEX	STD ITEM	SAP ITEM ID	PS ITEM ID
	Die	Crimp	Die	Crimp	Die	Crimp				
2 str to 3 sol.	W241	2	U25ART	2	*	2	296	UC63A	9310361	9201206
2 to #6	W241	2	U25ART	2	*	2	296	UC63B	9310359	9201207
2 to 1/0	W241	2	U25ART	2	*	2	296	UC63C	9310362	9201204
2 to 4/0	W660	2	U28ART	2	*	2	298	UC63D	9310400	9201205
1/0 to 2/0	W245	2	U26ART	2	*	2	297	UC63N	9306283	9201370
1/0 to 4/0	W660	2	U28ART	2	*	2	298	UC63E	9310337	9201209
1/0 to 350	W31ART	4	U31ART	2	*	2	299	UC63F	9310240	9201210
4/0 to 350	W31ART	4	U31ART	2	*	2	299	UC63G	9310238	9201212
4/0 to 500			U34ART	4	*	4	300	UC63H	9310157	9201213
350 to 500			U34ART	4	*	4	300	UC63J	9310134	9201214
500 to 750			U39ART2	4	*	4	936	UC63K	9310133	9201215
500 to 1000			U39ART2	4	*	4	936	UC63L	9310132	9201216
750 to 1000			U39ART2	4	*	4	936	UC63M	9310131	9201217

* Use P-UADP-1 Adapter with "U" dies in Y-46 Hypress
Note: Crimps are defined as per end / side of connector

CONNECTOR, COMPRESSION, COPPER H TAP

Tinned copper H Tap connector for making a Y splice in solid dielectric cables. For Copper Conductors Only



Conductor Size							
Run	Tap	Crimper	Dies	Crimps	STD ITEM	SAP ITEM ID	PS ITEM ID
#2 – 250	#2 – 250	Y750	U654	4	UC65A	9309357	5105997
		Y46	U654 P654	4 2			
250 - 500	#4/0 - 500	Y750	U1104	4	UC65B	9309356	5105998
		Y46	U1104 P1104	4 2			

CONNECTOR, BRANCH SHEAR BOLT

Tinned AL shear bolt branch connector for making a Y splice in solid dielectric cables range 1/0-500

STD ITEM	SAP ITEM ID	PS ITEM ID
UC65C	9392936	----------

EXPANDER, RANGE

Adapters to allow smaller cable sizes to fit into compression connector Std Item UC65B.

DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
To use #2 Cu in the Tap side of the connector	UC65E1	9309353	5106019
To use 1/0 Cu in the Tap side of the connector	UC65E2	9309214	5106020

FLUID, DIELECTRIC FLUSHING

Dielectric flushing oil for cable termination compartments on network transformers and oil fuse cutouts. 1 gallon containers.

STD ITEM	SAP ITEM ID	PS ITEM ID
UC74	9320460	8013170

LUBE, CABLE PULLING

Ready-Mix cable pulling lubricant. 2.5 Gallon Jug.

STD ITEM	SAP ITEM ID	PS ITEM ID
UC75A	9387156	none

COMPOUND, PETROLATUM

Medium consistency insulating petrolatum compound, NF grade, yellow (amber) in color for use in 23kV or below cable terminal chambers of network equipment. Item ID 8010183 to be furnished in 400 lb. drums (7 lb. per gallon) Item ID 5591960 to be furnished in ½ pint cans.

***** MAINTENANCE ONLY*****

***** NOT FOR NEW CONSTRUCTION*****

Characteristics:

Melting Point 130ºF – 140ºF
Consistency 180 – 215
Viscosity 11.6 – 18.0

STD ITEM	SAP ITEM ID	PS ITEM ID
UC76 UC76	9309495[E]	5591960[E] 8010183[Y] (Buffalo Only)

LUBE, ANTI-SEIZE

1-pound can.

STD ITEM	SAP ITEM ID	PS ITEM ID
UC77	9303868	5591802

OIL – TRANSFORMER, SILICONE

55 Gallon drum. GE # SF97-50

STD ITEM	SAP ITEM ID	PS ITEM ID
UC78	9303878	5594060

CLEANER, CABLE, SPRAY BOTTLE

Cable and splice cleaner. For cleaning high voltage cables in preparation of splicing and terminating.

	STD ITEM	SAP ITEM ID	PS ITEM ID
32 oz Bottle 1 Gallon Can	UC80B UC80B1	9314894 9388647	0808538 n/a

CLEANER, CABLE, TOWELETTE

Towelette, 12” x 12” lint free, non-woven, wiping towelette for use with cable cleaner, item UC80B, when preparing a cable splice or termination. Furnished 100 per box.

STD ITEM	SAP ITEM ID	PS ITEM ID
UC80D	9315319	0808540

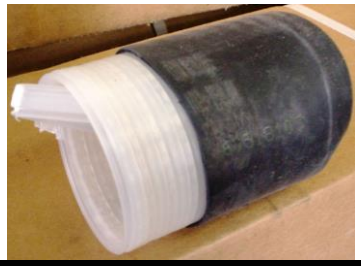
CLEANER, CABLE, CAN

Cable Cleaning kit, with 3 lint free, non woven, solvent saturated towelettes in a re-sealable can. Includes one 28” strip of 120 grit aluminum oxide sand paper wrapped around the outside of the can.

STD ITEM	SAP ITEM ID	PS ITEM ID
UC80F	9305779	5643847

END CAP, CABLE, COLD SHRINK

Cable end cap intended for use on solid dielectric cable at all voltages to prevent the ingress of moisture during storage and installation.



OUTER JACKET O.D.		STD ITEM	SAP ITEM ID	PS ITEM ID
MIN	MAX			
0.46	0.86	UC90C	9306242	9201844
0.63	1.18	UC90E	9309862	5102002
1.02	1.94	UC90H	9304341	5641118
1.79	3.32	UC90J	9304340	5641119

END CAP, CABLE, HEAT SHRINK

Cable end cap intended for use on solid dielectric cable at all voltages to prevent the ingress of moisture during storage and installation.

OUTER JACKET O.D.		STD ITEM	SAP ITEM ID	CABLE SIZE
MIN	MAX			
0.31	0.71	UC91A	9390642	#6 – 3/0
0.65	1.25	UC91B	9390643	4/0 - 750
1.08	1.94	UC91C	9390641	750 - 1500

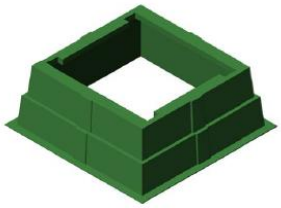
END CAP, CABLE, SELF-SECURING

Cable end cap, self-securing, Class 2, Type II

WIRE RANGE	ID	STD ITEM	SAP ITEM ID	PS ITEM ID
#4/0 - 500	1.38”	UC95A	9307949	9202824
#4 - #4/0	0.81	UC95B	9307948	9202825
350 - 750	2.25”	UC95C	9307947	9202826
800 - 1000	3.19”	UC95D	9307946	9202827

SWITCHGEAR VAULT PAD, FIBERGLASS

Fiberglass reinforced plastic vault pad (76”X75”X36”) color: green, for use with three phase pad mounted switchgear, STD items US45, US45A, US45B and US45C. Can be used for STD Items US36H, US36HS, US36J, US36K and US36L.. Note adaptor cover STD Item UF3D is needed to be installed over pad for STD Items US36__. Std Item UF3S is a 6 inch high spacer that fits on top of UF3 where additional height is needed.



STD ITEM	SAP ITEM ID	PS ITEM ID
UF3	9316388	2012198
UF3S	9388785	NA

COVER, SWITCHGEAR VAULT PAD, FIBERGLASS

Cover for fiberglass switchgear vault pad with recessed penta-head bolts. Color: GREEN, weight = 120 pounds.

	DIMENSIONS	STD ITEM	SAP ITEM ID	PS ITEM ID
MAINTENANCE ONLY	68” x 64” x 0.5” high	UF3A	9306201	9201573
MAINTENANCE ONLY	66.5” x 58.5” x 0.5” high	UF3B	9306747	9202168
COVER FOR UF3	74” X 73” X 0.5” high	UF3C	9386973	NONE

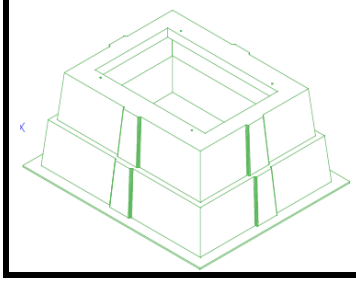
ADAPTOR COVER, SWITCHGEAR VAULT PAD, FIBERGLASS

Adaptor cover for fiberglass switchgear vault pad with recessed penta-head bolts. Color: green, Adaptor to be used for installation of Std Items US36H, US36HS, US36J, US36L and US36L. Adaptor installed on top of vault pad.

	DIMENSIONS	STD ITEM	SAP ITEM ID	
	76” x 75” x 1.75” high	UF3D	9387008	

SWITCHGEAR VAULT PAD, FIBERGLASS

Fiberglass reinforced plastic vault pad (60”X48”X36”) color: green, for use with three phase pad mounted switchgear, STD items US45E

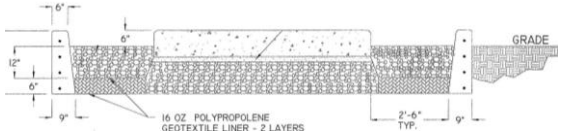


STD ITEM	SAP ITEM ID	PS ITEM ID
UF4	9392472	NA

CURBING, OIL CONTAINMENT

Precast concrete curbing reinforced with steel, 2 feet tall.

NOTE: Both items are ‘Profiled Items’. They are not stocked and a material request must be completed when needed.

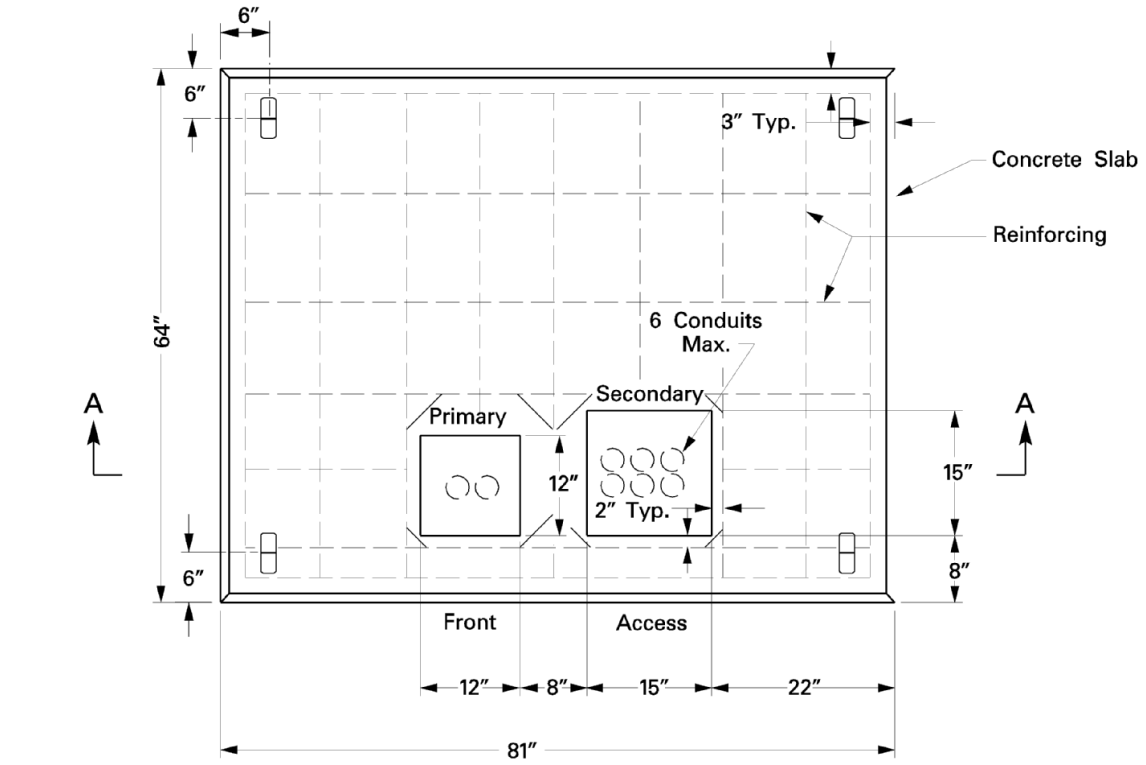


SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
13’-4” x 11’-10” -- to be used with Std Item UF8A & UF8C	UF7A	1000313	9202153
14’-6” x 13’-6” -- to be used with Std Item UF8B & UF8D	UF7B	1000314	9202154

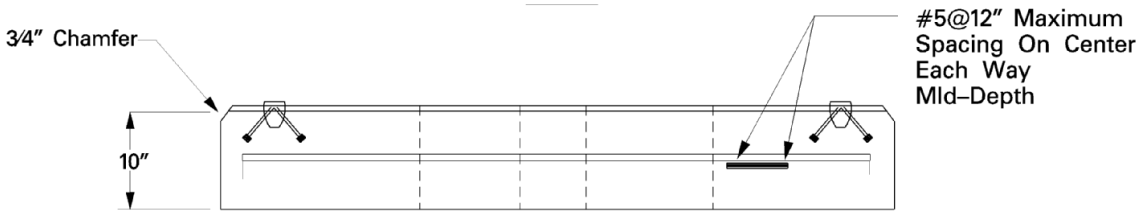
[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

TRANSFORMER FOUNDATION, 3-PHASE PADMOUNT

Precast concrete. 64” x 81” x 10”. For use with three-phase, pad mounted transformers, 15kV, 75-500 KVA. In accordance with PPL Material Specification Standard MS-2582.



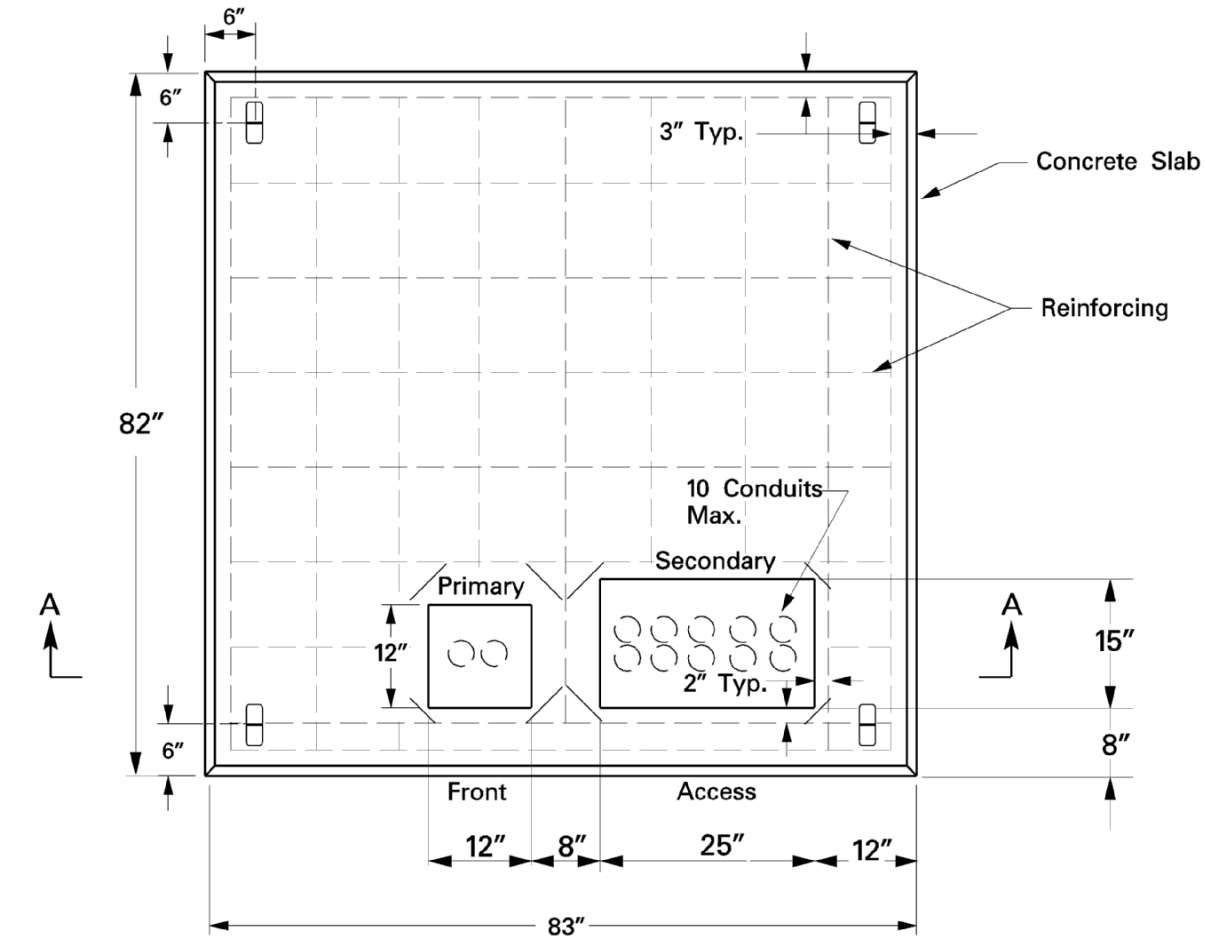
PLAN



STD ITEM	SAP ITEM ID	PS ITEM ID
UF8A	9307163	9200896

TRANSFORMER FOUNDATION, 3-PHASE PADMOUNT

Precast concrete. 82” x 83” x 10”. For use with three-phase, pad mounted transformers, 15kV, 750-2500 KVA. In accordance with PPL Material Specification Standard MS-2583.

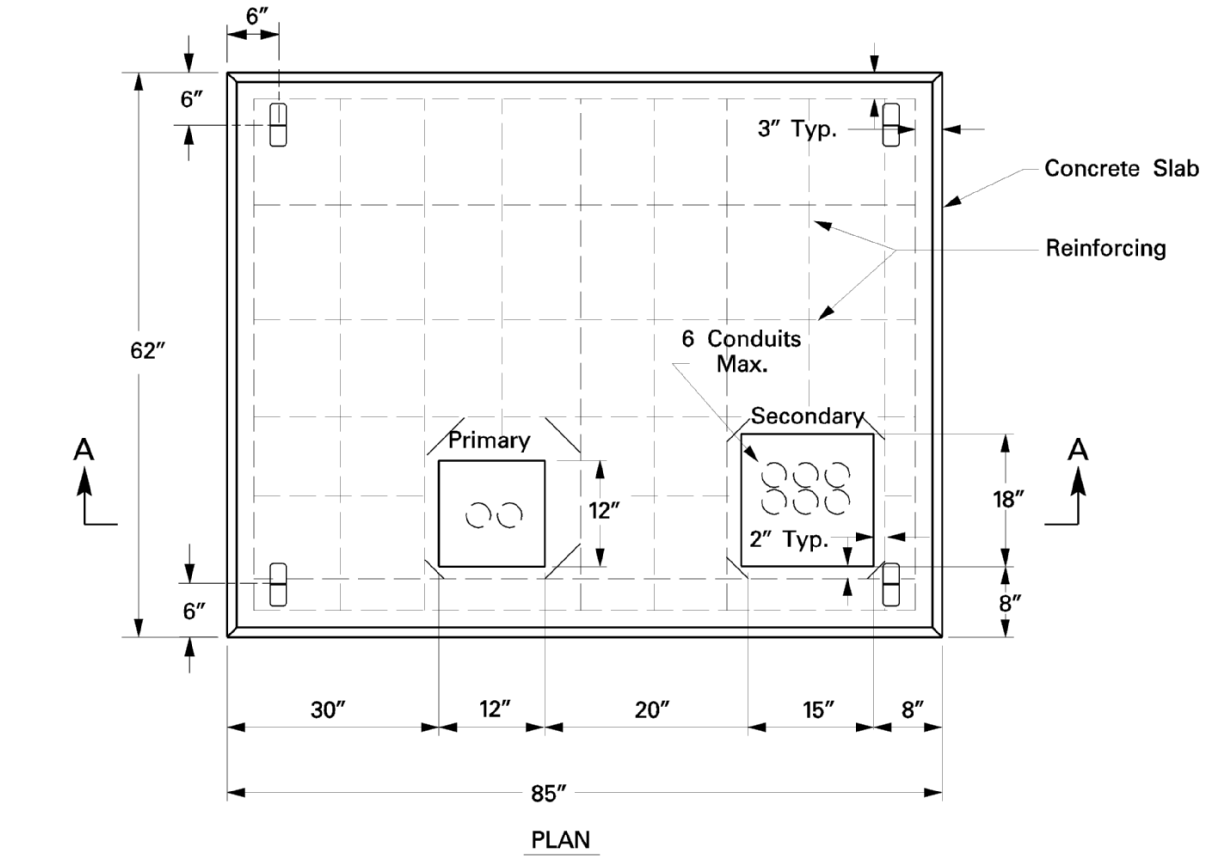


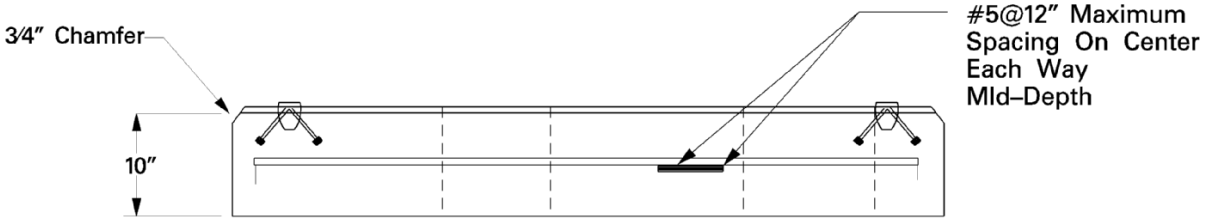
STD ITEM	SAP ITEM ID	PS ITEM ID
UF8B	9307162	9200897

TRANSFORMER FOUNDATION, 3-PHASE PADMOUNT

Precast concrete. 62” x 85” x 10”. For use with three-phase, pad mounted transformers, 25kV & 35kV / 75-300 KVA. In accordance with PPL Material Specification Standard MS-2584.

NOTE: This is a ‘Profiled Item’. It is not stocked and a material request must be completed when needed.



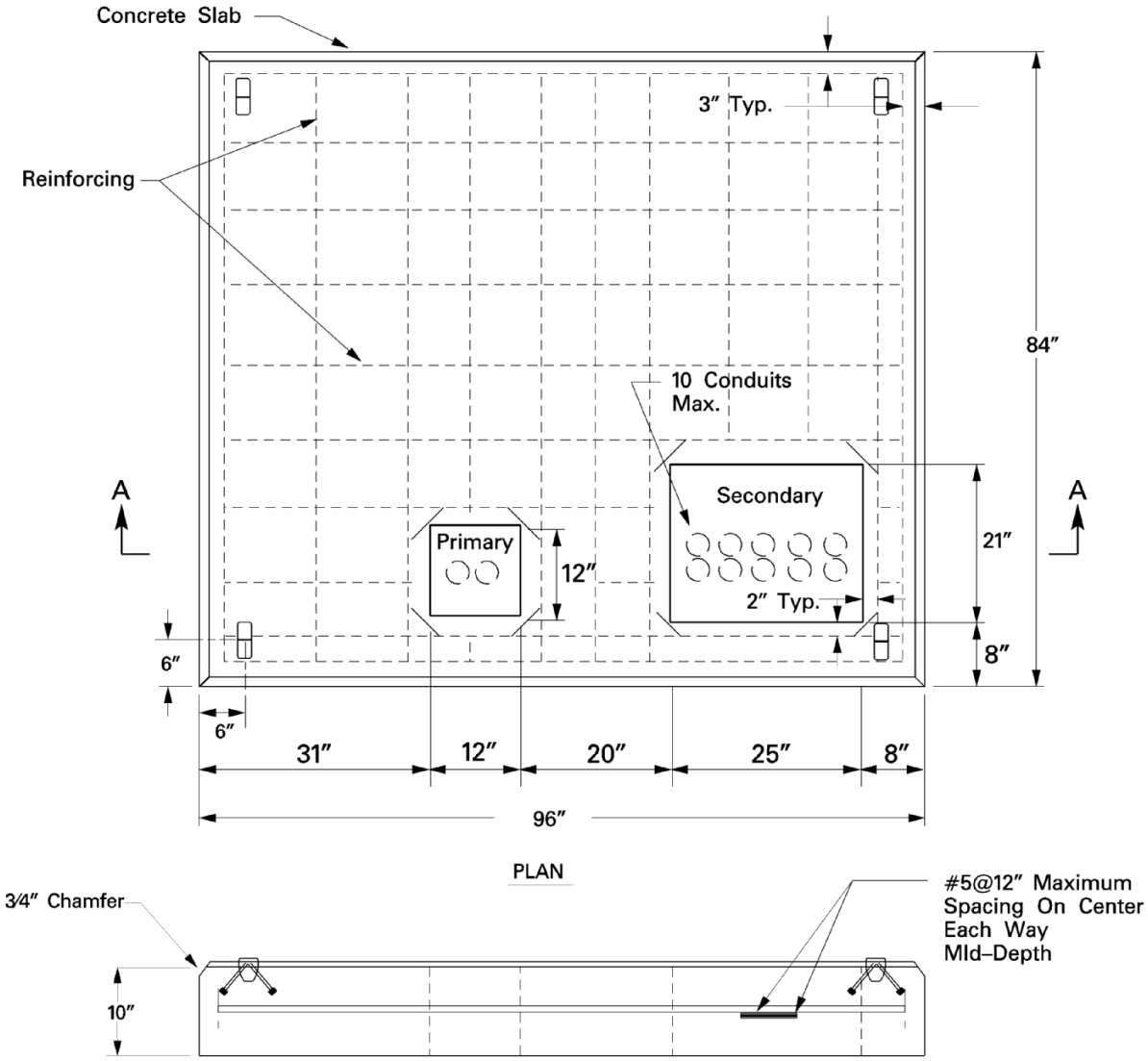


STD ITEM	SAP ITEM ID	PS ITEM ID
UF8C	1000202	9200898

TRANSFORMER FOUNDATION, 3-PHASE PADMOUNT

Precast concrete. 84” x 96” x 10”. For use with three-phase, pad mounted transformers, 25kV & 35kV / 500-2500 KVA. In accordance with PPL Material Specification Standard MS-2585.

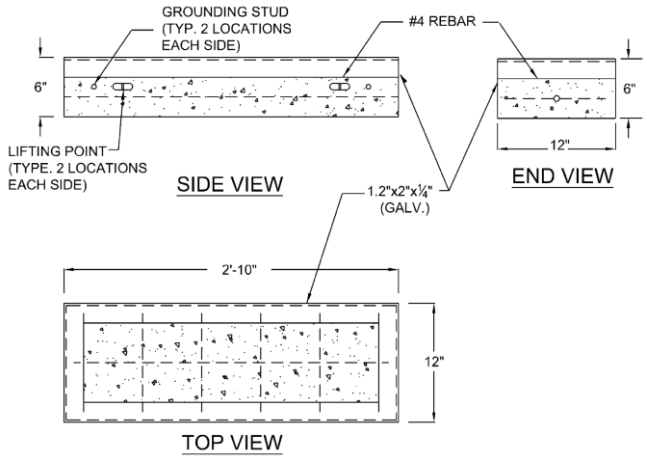
NOTE: This is a ‘Profiled Item’. It is not stocked and an material request must be completed when needed.



STD ITEM	SAP ITEM ID	PS ITEM ID
UF8D	1000201	9200895

NETWORK TRANSFORMER FOUNDATION, 300-1500kVA

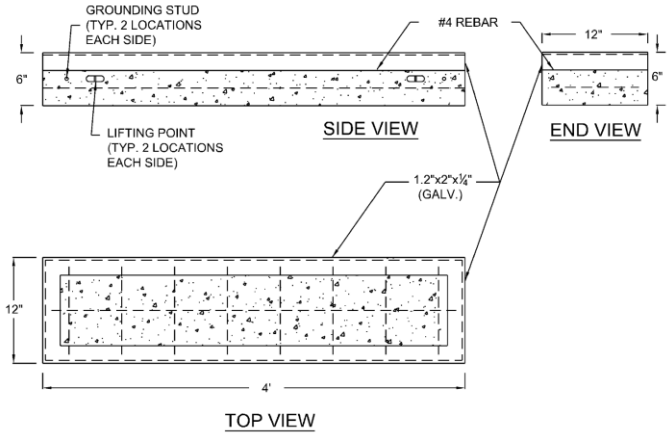
Precast concrete foundation 34” x 12 “ x 6”. For use with underground submersible network transformers 300kVA to 1,500kVA.
In accordance with PPL Material Specification Standard MS-2587.



STD ITEM	SAP ITEM ID	PS ITEM ID
UF8E	9307965	9202219

NETWORK TRANSFORMER FOUNDATION, 2000-2500kVA

Precast concrete foundation 48” x 12 “ x 6”. For use with underground submersible network transformers 2,000kVA to 2,500kVA.
In accordance with PPL Material Specification Standard MS-2587.

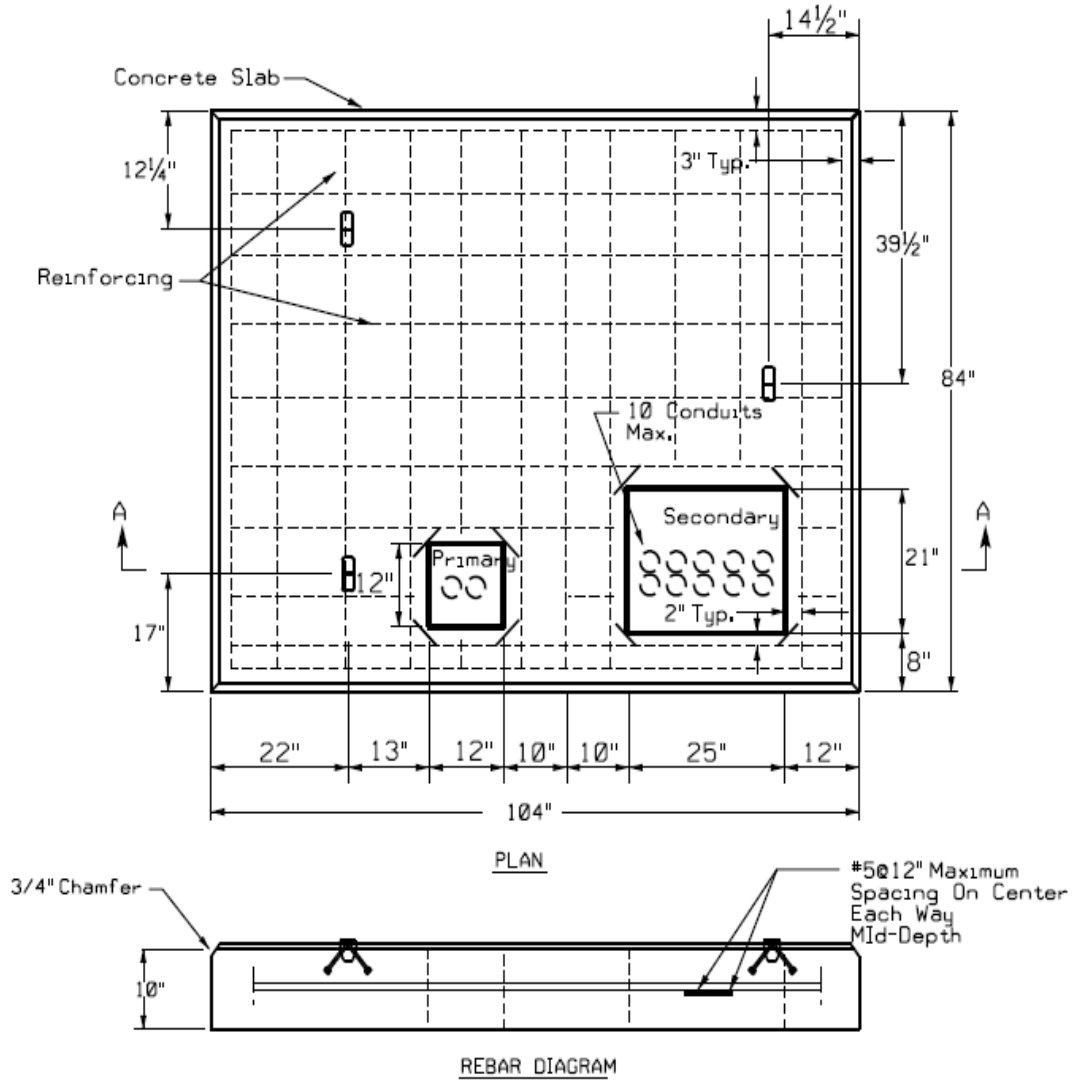


STD ITEM	SAP ITEM ID	PS ITEM ID
UF8F	9307966	9202218

TRANSFORMER FOUNDATION, 3-PHASE PADMOUNT

Precast concrete. 84” x 104” x 10”. For use with three-phase, pad mounted transformers, 25kV & 35kV 5000 KVA. In accordance with PPL Material Specification Standard MS-2585.

NOTE: This is a ‘Profiled Item’. It is not stocked and a material request must be completed when needed.



STD ITEM	SAP ITEM ID	PS ITEM ID
UF8G	1002228	n/a

FOAM, EXPANDING

Expanding foam, for sealing conduits on riser poles and transformer pads. With nozzle. UV Resistant.

	STD ITEM	SAP ITEM ID	PS ITEM ID
Can w/ Nozzle	UF10	9305542	5106645

FOAM, FIREPROOF

Foam, fireproof, for use in UG conduit systems, fire rated polyurethane expanding foam, 10oz can with spray type nozzle applicator, foam expands two to three times its size when dispensed, pink, cures fully in 12 hours. 24oz cans have been discontinued okay to use up existing stock..

	STD ITEM	SAP ITEM ID	PS ITEM ID
24 Oz can 10 Oz can	UF20 UF20	9307975 9387426	9202670 none

STYRAFOAM

Extruded Polystrene (XPS) rigid foam insulation, Formular 250. Closed cell for moisture resistant and to meet ASTM E 119 for fire resistance assemblies. Stocked in 24”x96”x2” sheets.

	STD ITEM	SAP ITEM ID	PS ITEM ID
	UF30	9393194	

MAGNET, FAULT INDICATOR RESET

Magnet for manual testing and reset of Fault Indicators, Item UF50BB and UF50HG. Can be used with a shotgun stick.

STD ITEM	SAP ITEM ID	PS ITEM ID
UF50A	9306321	9201593

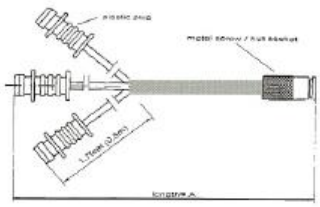
INDICATOR, FAULT

Fault indicator for shielded underground cable. Flashing LED indicates fault beyond detector. Automatic reset with load current or in 8 hours. Manual reset with magnet, item UF50R. LED indicator extendable to outside of enclosure with fiber optic extensions, item UF50C and UF50CC. Maximum operating voltage = 46kV.
Note: In delta system, use time reset style (STD Item UF50T_) to minimize false tripping

CABLE DIAMETER	STD ITEM	SAP ITEM ID	PS ITEM ID
0.85” – 1.57”	UF50BB	9314955	3506167
1.00” – 2.52”	UF50HG	9314902	3506168

FIBER OPTIC EXTENSION CABLE, FAULT INDICATOR

Fiber optic extension cable for viewing the fault indicator LED from outside an enclosure. Clips into the LED port of the fault indicator. Single phase (1 indicator, 1 output – 6” long. Three phase (3 indicators, 1 output – 8’ long.



Phase	STD ITEM	SAP ITEM ID	PS ITEM ID
Single	UF50C	9306320	9201594
Three	UF50CC	9306319	9201595

INDICATOR, FAULT

Fault indicator, UG fault, Load tracking, 8-hour time reset, LED indicator. Maximum operating voltage = 46kV.

CABLE DIAMETER	STD ITEM	SAP ITEM ID	PS ITEM ID
1.00” – 2.52”	UF50TL	9316246	9202639
0.85” – 1.57”	UF50TS	9316247	9202638

FILTER SOX KIT

	STD ITEM	SAP ITEM ID	PS ITEM ID
Filter Sox Kit - 5 Gallon Container, 2” Coupling, 4 layer filter sox 4”X67”	UF70	9306596	9201734
4 layer filter sox 4”X67”	UF70A	9306589	9201733

FILTER SOCK, HIGH VOLUME

Filter sock, high volume, 8” x 60”, consisting of 2 layers. Inner and outer layers are lipophilic (oil absorbing). For use with gas powered sump pumps. Install with zip ties.

STD ITEM	SAP ITEM ID	PS ITEM ID
UF70B	9387166	none

GREASE, SILICONE

Silicone lubricating grease for assembling molded rubber cable accessories. To be furnished in 5 oz. tubes.

STD ITEM	SAP ITEM ID	PS ITEM ID
UG2	9320471	8013230

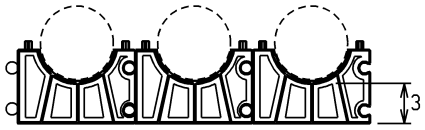
CLIP, GALVANIZED CONDUIT

Galvanized steel, 2-hole pipe strap. For fastening rigid galvanized steel conduit to a riser pole. In accordance with PPL Material Specification MS-3255.

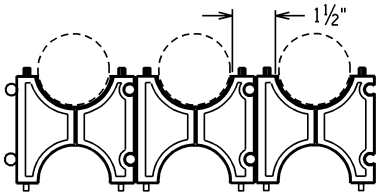
CONDUIT SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	UK3B	9309510	5641200
3”	UK3C	9309509	5641205
4”	UK3D	9310459	5641210
5”	UK3E	9309516	5641215
6”	UK3F	9309527	5641216

SPACER, PVC CONDUIT

Molded high-impact polystyrene conduit spacer suitable for encasement in concrete or direct burial. Spacers slide together horizontally and snap together vertically, providing a 1-1/2” horizontal and vertical spacing between conduits for conduits up to 5” diameter. There is a 2” spacing between conduits with a 6” diameter. These spacers provide 3” of space between the surface of the duct and the bottom of the ductbank. Suitable for temperature range of -20°F to 170°F. For use with PVC conduit, item UK6A, and galvanized steel conduit, item UK30.



BASE SPACER



INTERMEDIATE SPACER

Base Spacers

COND SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
3”	UK4E	9304252	5646958
4”	UK4F	9304249	5646963
5”	UK4G	9304248	5646964
6”	UK4H	9316087	2010319

Intermediate Spacers

COND SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
3”	UK5E	9304236	5646956
4”	UK5F	9304251	5646960
5”	UK5G	9304250	5646961
6”	UK5H	9316088	2010318

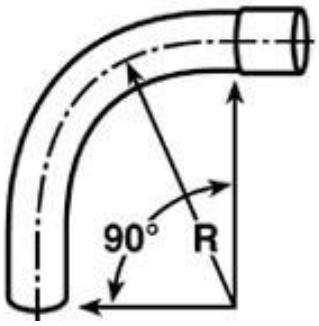
CONDUIT, PVC, TYPE DB

Polyvinyl-chloride (PVC) type DB conduit. Designed for direct burial without encasement in concrete; also suitable for concrete encasement. One belled end per length, solvent welded.

SIZE	MIN WALL	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	.060”	20’	UK6A2	9316084	2010402
3”	.092”	20’	UK6A3	9317764	5692158
4”	.121”	20’	UK6A4	9314994	2010404
5”	.152”	20’	UK6A5	9316083	2010405
6”	.182”	20’	UK6A6	9316185	2010406

SWEEP, PVC, 90°

Sweep for type DB conduit, one belled end per sweep, solvent welded.

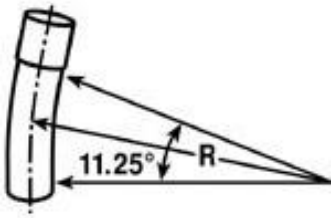


SIZE	RADIUS	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	18”	UK6B2	9316204	2010412
2”	24”	UK6B2A	9320992	5690425
2”	36”	UK6B2B	9316186	2010413
3”	36”	UK6B3	9320993	5690419
3”	48”	UK6B3A	9320767	5690485
4”	48”	UK6B4	9316203	2010414
5”	48”	UK6B5	9316202	2010415
6”	48”	UK6B6A	9320741	5690495
6”	60”	UK6B6	9316201	2010416

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

SWEEP, PVC, 11.25°

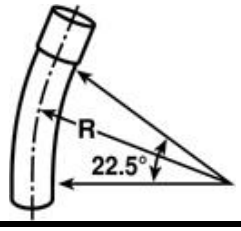
Sweep for type DB conduit, one belled end per sweep, solvent welded.



SIZE	RADIUS	STD ITEM	SAP ITEM ID	PS ITEM ID
4”	48”	UK6BA4	9315318[Y]	0808559[Y]
5”	48”	UK6BA5	9315317	0808560

SWEEP, PVC, 22.5°

Sweep for type DB conduit, one belled end per sweep, solvent welded.



SIZE	RADIUS	STD ITEM	SAP ITEM ID	PS ITEM ID
4”	48”	UK6BB4	9315316[Y]	0808561[Y]
5”	48”	UK6BB5	9315315[Y]	0808562[Y]

SWEEP, PVC, 45°

Sweep for type DB conduit, one belled end per sweep, solvent welded.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
4”	UK6BC4	9307495	9202439
5”	UK6BC5	9307554	9202441

COUPLING, PVC

Female coupling for type DB conduit, solvent welded. Sizes 2” and smaller also suitable for use with Schedule 40 conduit.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
¾”	UK6C0	9316135[Y]	2010457[Y]
1¼”	UK6C1	9316134	2010458
2”	UK6C2	9316140	2010452
3”	UK6C3	9316139	2010453
4”	UK6C4	9316138	2010454
5”	UK6C5	9316137	2010455
6”	UK6C6	9316136	2010456

COUPLING, PVC, 5°

Angle coupling for type DB conduit, solvent welded. Bell x Spigot (Female x Male) and Bell x Bell (Female x Female).

Bell x Spigot

Bell x Bell

STYLE	SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
Bell x Spigot	2”	UK6D2	9316323[Y]	2010442[Y]
Bell x Spigot	3”	UK6D3S	9317479	5693356
Bell x Bell	3”	UK6D3	9308872	5100696
Bell x Spigot	4”	UK6D4S	9317477	5693359
Bell x Bell	4”	UK6D4	9309174	2010444
Bell x Spigot	5”	UK6D5S	9317476	5693367
Bell x Bell	5”	UK6D5	9316164	2010445
Bell x Spigot	6”	UK6D6S	9317661	5693368
Bell x Bell	6”	UK6D6	9316163	2010446

END BELL, PVC, FEMALE

Female End Bell for type DB conduit, solvent welded. Sizes 4” and smaller also suitable for use on Schedule 40 conduit.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	UK6E2	9316141[Y]	2010462[Y]
3”	UK6E3	9316133	2010463
4”	UK6E4	9316131	2010464
5”	UK6E5	9316130	2010465
6”	UK6E6	9316129	2010466

ADAPTER, PVC, FEMALE

Adapter for type DB or Schedule 40 conduit. Female solvent welded to female threads. For transition from PVC conduit to threaded steel conduit.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
¾"	UK6F0	9320824[E]	5690060[E]
2"	UK6F2	9316195	2010432
3"	UK6F3	9316194	2010433
4"	UK6F4	9316193	2010434
5"	UK6F5	9316192	2010435
6"	UK6F6	9316191	2010436

PLUG, PVC

For temporary capping of PVC and steel ducts.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
2"	UK6G2	9316200	2010422
3"	UK6G3	9304253[E]	5645682[E]
4"	UK6G4	9316198	2010424
5"	UK6G5	9316197	2010425
6"	UK6G6	9316196	2010426

CEMENT, PVC CONDUIT

PVC solvent cement, all weather, clear, medium bodied, for use with PVC conduit and fittings. Furnished in pint cans with applicator.

STD ITEM	SAP ITEM ID	PS ITEM ID
UK6S	9320383	8010168

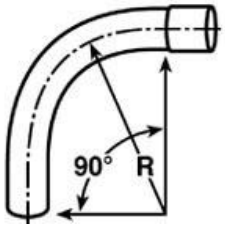
CONDUIT, PVC, SCHEDULE 40

Polyvinyl-chloride (PVC) schedule 40 conduit. For installations where conduit will remain exposed. For buried installations, use type DB conduit, standard item UK6A. One belled end per length.

SIZE	MIN. WALL	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
¾"	0.113"	10'	UK7A0	9316557	2011155
1¼"	0.140"	10'	UK7A1	9316549	2011156
2"	0.154"	20'	UK7A2	9316596	2011028
3"	0.216"	20'	UK7A3	9316543	2011169
4"	0.237"	20'	UK7A4	9316545	2011167
5"	0.258"	10'	UK7A5	9316560	2011185
6"	0.280"	10'	UK7A6	9317747[E]	5692130[E]

BEND/SWEEP, PVC, 90º

Bend/sweep for Schedule 40 conduit, one belled end per bend/sweep, solvent welded.



SIZE	RADIUS	STD ITEM	SAP ITEM ID	PS ITEM ID
¾"	4½"	UK7B0	9316098[Y]	2010169[Y]
1¼"	7¼"	UK7B1	9316097[Y]	2010170[Y]
2"	18"	UK7B2	9316096	2010171
4"	36"	UK7B4	9320743	5690493
5"	36"	UK7B5	9320742	5690494
4"	24"	UK7B6	9307496	9202438
5"	24"	UK7B7	9307552	9202440

NOTE: UK7B6 and UK7B7 are for network services ONLY.

COUPLING, SPLIT, PVC

Split coupling for type DB conduit, solvent welded.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
3"	UK7CC3	9309993[E]	5105218[E]
4"	UK7CC4	9317994[E]	5693373[E]

COUPLING, PVC, SWEDGE REDUCER

Reducer for type DB conduit, male x male, solvent welded.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
4" x 3"	UK7E	9321294[E]	5696970[E]

ADAPTER, MALE, SCHEDULE 40 PVC CONDUIT

Adapter for type DB or Schedule 40 conduit. Female solvent welded to male threads. For transition from PVC conduit to threaded steel conduit or outlet boxes.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
¾	UK7M0	9316190	2010437
1¼	UK7M1	9316189[Y]	2010438[Y]
3	UK7M3	9321562[E]	5690087[E]

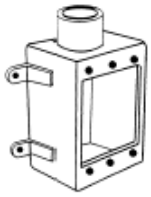
TEE, PVC

Tee for Schedule 40 conduit, solvent welded.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
3/4	UK7T0	9316085	2010325

BOX, PVC, SINGLE GANG

PVC molded, single ¾" entrance, Type FS single gang, conduit box for use with receptacle item, UK8R, and switch item UK8C.



STD ITEM	SAP ITEM ID	PS ITEM ID
UK8B	9311821	2030350

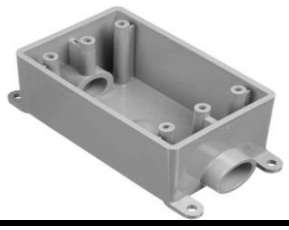
BOX, PVC SWITCH COVER

PVC molded, waterproof toggle switch cover for use with box, item UK8B. Furnished with mounting screws and gasket.

STD ITEM	SAP ITEM ID	PS ITEM ID
UK8C	9311820	2030351

BOX, PVC, RECEPTABLE/SWITCH

Box. PVC, conduit, ¾" double entrance, single gang, for use with receptable item # UK8R and switch item # UK8C



SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
3/4	UK8BD	9387415	none

FITTING, PVC, TYPE LB

For Schedule 40 conduit, ¾", with cover and gasket.

STD ITEM	SAP ITEM ID	PS ITEM ID
UK8G	9317574	5693770

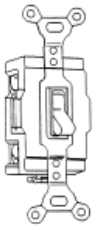
RECEPTACLE AND COVER ASSEMBLY

Weatherproof receptacle assembly consisting of mounting plate, mounting screws, single 20A, 125V NEMA 5-20R rubber-covered, corrosion-resistant receptacle and a corrosion-resistant, hinged lift cover for use with receptacle box, item UK8B.

STD ITEM	SAP ITEM ID	PS ITEM ID
UK8R	9311819[Y]	2030352[Y]

SWITCH, TOGGLE

Heavy duty specification grade, 15A, 120-277V AC switch with toggle type handle, side and back wired.



TYPE	COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
Single Pole	Brown	UK8SB1	9311816[Y]	2030357[Y]
Single Pole	Ivory	UK8SI1	9312376[Y]	2030360[Y]
Three Way	Brown	UK8SB3	9311986[Y]	2030361[Y]
Three Way	Ivory	UK8SI3	9314964[Y]	2030362[Y]

WEATHERHEAD, 3/4" PVC

Molded PVC weatherhead for 3/4" PVC conduit (UK7A0), solvent welded, 3-wire, light gray.

STD ITEM	SAP ITEM ID	PS ITEM ID
UK8W	9311822[Y]	2030348[Y]

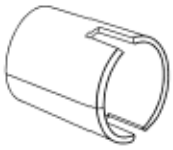
SPLIT DUCT, PVC

PVC Loc-Duct conduit straight sections with an interlocking design allowing the half sections to butt together and form a locking joint. For use in repairing existing PVC conduit. Furnished in 10 foot lengths.

COND. SIZE	OD	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	2.38”	UK9A2	9314787	0801090
4”	4.35”	UK9A4	9317784	5692168
5”	5.56”	UK9A5	9316125	2010481

COUPLING, PVC CONDUIT, SPLIT SLEEVE

PVC split sleeve coupling for joining PVC Loc-Duct, item UK9A together with existing PVC conduits.



COND. SIZE	OD	STD ITEM	SAP ITEM ID	PS ITEM ID
2	2.38	UK9C2	9314786[Y]	0801092[Y]
4	4.35	UK9C4	9316132	2010483
5	5.56	UK9C5	9316142[Y]	2010484[Y]

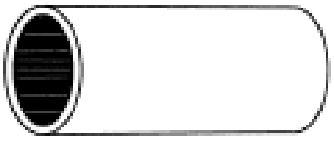
STRAP, PVC SPLIT DUCT

Heavy duty plastic strap designed with a buckle and ratchet type locking system. For use with Loc-Duct PVC conduit, item UK9A. One size fits all conduits.

STD ITEM	SAP ITEM ID	PS ITEM ID
UK9S	9316143[Y]	2010486[Y]

CONDUIT, INNERDUCT

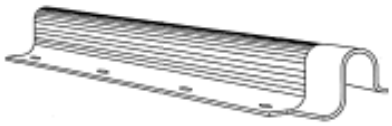
High density polyethylene (HDPE) 1 1/4", SDR-13.5 with 3/8" muletape for use with fiber optic cable in existing duct systems. Furnished 4,000 ft. (1,040 lbs.) per reel.



COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
BLUE	UK9NB	9314332[Y]	0810791[Y]
GRAY	UK9TG	9314375[Y]	0810792[Y]
WHITE	UK9SW	9314665[Y]	0810793[Y]

GUARD, RISER, U-DUCT HDPE

High Density Polyethylene furnished in 5' lengths. Attach to pole with item B10B.



COND. SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
2"	UK11D	9310574	9201325
3”	UK11E	9306271	9201880
4"	UK11F	9306263	9201881
5"	UK11G	9306261	9201882
6”	UK11H	9306713	9201883

GUARD, RISER, GALVANIZED STEEL

Galvanized steel, U-Guard, furnished in 8’ lengths, to protect cables. This item shall only be used on risers built to old NiMo standard, not for new construction.

Type	INSIDE DIA	STD ITEM	SAP ITEM ID	PS ITEM ID
Guard	3.7”	UK12	9389845	N/A
Strap		UK12A	9389846	N/A

GUARD, RISER, REDUCER

PVC/ acrylic reducer, for use with riser guard Std Item UK11 and for connecting riser guard Std Item UK11 to steel conduit (Std Item UK31).

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
6” x 4”	UK14GF	9316156	2010545

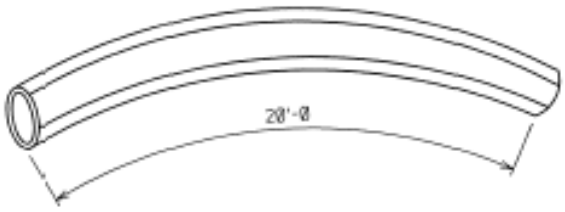
CONDUIT, PVC, SCHEDULE 80

Polyvinyl-chloride (PVC) schedule 80 conduit. For use on secondary riser installations (Schedule 80 PVC is optional - galvanized steel conduit is preferred). For buried installations, use type DB conduit (Std Item UK6A). One belled end per length.

SIZE	MIN. WALL	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	0.218”	10’	UK15A	9318574	9202863
3”	0.300”	10’	UK15B	9322032	9202864
4”	0.337”	10’	UK15C	9307519	9202865
5”	0.375”	10’	UK15D	9307518	9202866
6”	0.432”	10’	UK15E	9307517	9202867

CONDUIT, FLEXIBLE

High Density Polyethylene, smooth wall, Standard Dimension Ratio (SDR), in accordance with ASTM D-2447, ASTM D-3035 and NEMA TC7. Color shall be black with three red striped longitudinally at 120 degree intervals along the length of the conduit. Furnished in 20' lengths.



SIZE (INCHES)	ID (INCHES)	OD (INCHES)	MIN. WALL (INCHES)	WEIGHT PER/FT (LBS)	STD ITEM	SAP ITEM ID	PS ITEM ID
2	2.01	2.36	0.18	0.52	UK20A	9315314[Y]	0808584[Y]
4	3.80	4.47	0.33	1.90	UK20B	9314912[Y]	0808585[Y]
6	5.61	6.625	0.49	4.03	UK20C	9314331[Y]	0810506[Y]

COUPLING, FLEXIBLE CONDUIT

Straight coupling to join Flexible Conduit Item UK20

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
2	UK21A	9315129[Y]	0810198[Y]
4	UK21B	9315128[Y]	0810199[Y]

CONDUIT, HDPE COILABLE

Conduit, smooth wall, high density polyethylene, schedule 80 supplied in 500-foot coils. Conduit is used in cable replacement projects using directional drilling

SIZE INCH	STD ITEM	SAP ITEM ID	PS ITEM ID
2	UK22A	9392289	----------

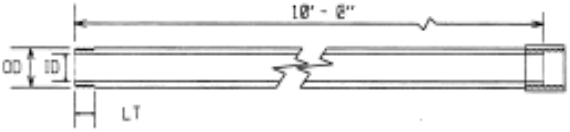
CONDUIT, HDPE COILABLE REELS

Conduit, smooth wall, high density polyethylene, SDR 13.5. Black with 3 red stripes. Conduit is used in cable replacement projects using directional drilling. The 2" conduit has pull rope installed.

SIZE INCH	STD ITEM	SAP ITEM ID	REEL LENGTH
2	UK22B	9393545	3000 ft
3	UK22C	9393535	1000 ft
4	UK22D	9393416	766 ft

CONDUIT, GALVANIZED STEEL

Hot-dip galvanized mild rigid steel in accordance with Underwriters' Laboratories Standard UL6, Federal Specification WW-C-581d, and ANSI C80. Threads shall be galvanized, threaded both ends, supplied with 1 coupling.



SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
¾"	UK30A	9316148	2011016
1"	UK30B	9316147	2011017
1¼"	UK30C	9316146	2011018
2"	UK30D	9316330	2011020
3"	UK30E	9317751	5692107
4"	UK30F	9316663	2011024
5"	UK30G	9316374	2011025
6"	UK30H	9316597	2011027

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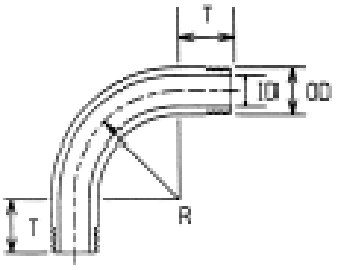
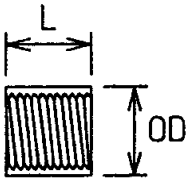
SWEEP, GALVANIZED CONDUIT, 90°

Galvanized bend/sweep, threaded on both ends.



SIZE	R	T (Min)	STD ITEM	SAP ITEM ID	PS ITEM ID
¾"	4½"	2 ½"	UK31A	9316593[Y]	2011036[Y]
1"	5¾"	2 ½"	UK31B	9316592[Y]	2011037[Y]
1¼"	7¼"	2 ½"	UK31C	9316188[Y]	2011038[Y]
2"	24"	8"	UK31D	9321012[E]	5690424[E]
2"	9½"	4"	UK31D1	9316187	2011040
2"	36"	11"	UK31D2	9316598[Y]	2011026[Y]
3"	36"	11"	UK31E	9320771	5690436
4"	36"	11"	UK31F	9320770[E]	5690446[E]
4"	24"	11"	UK31F1	9316550	2011150
4"	42"	12"	UK31F2	9316587	2011044
5"	36"	12 ½"	UK31G	9320769[E]	5690456[E]
5"	24"	11"	UK31G1	9316547[Y]	2011164[Y]
5"	48"	12"	UK31G2	9314992	2011045
6"	60"	12	UK31H	9316602	2011070
6"	48"	12"	UK31H2	9306286	9202114

COUPLING, GALVANIZED CONDUIT



SIZE (in)	STD ITEM	SAP ITEM ID	PS ITEM ID
1	UK32B	9316586[Y]	2011057[Y]
1¼	UK32C	9316585[Y]	2011058[Y]
2	UK32D	9316583	2011060
3	UK32E	9317481	5693350
4	UK32F	9316599	2011064
5	UK32G	9316601	2011065
6	UK32H	9316620	2011067

PLUG, GALVANIZED

Galvanized steel plug for threaded rigid galvanized steel conduit (Std Item UK30).

SIZE (in)	STD ITEM	SAP ITEM ID	PS ITEM ID
2	UK34D	9307515	9202870
3	UK34E	9306819	9201659
4	UK34F	9316062	2011254
5	UK34G	9314990	2011255
6	UK34H	9315221[Y]	0803813[Y]

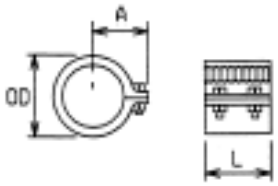
PLUG, CONDUIT

Used to temporarily plug conduits/riser pipes. Metal loop allows for muletape to be tied off to the plug.

PIPE ID	PLUG RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	1.83” - 2.36”	UK34J	9308104	9202199
3”	2.99” - 3.46”	UK34K	9308121	9202200
4”	3.94” - 4.17”	UK34K2	9316161	9202624
5”	5.00” - 5.35”	UK34L	9308120	9202201
6”	5.82” - 6.37”	UK34M	9308119	9202202

COUPLING, SPLIT, STEEL CONDUIT

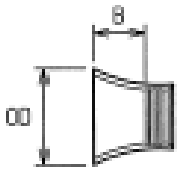
Cast malleable iron threaded split coupling, zinc coated for use with galvanized steel conduit, item UK30. Furnished with a neoprene gasket and two hex head bolts to provide a seal at the joint. Designed for direct burial or encasement in concrete.



SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	UK35D	9316578	2011121
2½”	UK35D1	9305413[E]	5642063[E]
3”	UK35E	9305414[E]	5642064[E]
3½”	UK35E1	9304533[E]	5642065[E]
4”	UK35F	9314991	2011125
5”	UK35G	9316556	2011126
6”	UK35H	9315220[Y]	0803815[Y]

END BELL, GALVANIZED CONDUIT

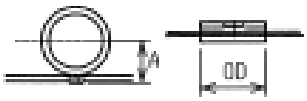
Hot dipped galvanized malleable iron threaded bell end for threaded rigid galvanized steel conduit, item UK30, to provide a smooth rounded pulling surface.



SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	UK36D	9316455[Y]	2011420[Y]
3”	UK36E	9306818	9201660
4”	UK36F	9316123	2011294
5”	UK36G	9316184	2011295
6”	UK36H	9316124[Y]	2011296[Y]

BUSHING, INSULATED GROUNDING

Plated malleable iron, threaded, insulated 150°C rated grounding bushing for threaded steel conduit, item UK30, to ground steel conduit. Furnished with stainless steel or bronze lay-in type mechanical cable connector and a steel set screw or bolt.



SIZE	GRD. WIRE RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
½”	#14-#4	UK37A1	9316553[Y]	2011137[Y]
¾”	#14-#4	UK37A2	9316552[Y]	2011138[Y]
1”	#14-#4	UK37B	9316609[Y]	2011097[Y]
1¼”	#14-#4	UK37C	9316608[Y]	2011098[Y]
2”	#8-#2/0	UK37D	9316607[Y]	2011099[Y]
4”	#8-#2/0	UK37F	9316606[Y]	2011100[Y]
5”	#8-#2/0	UK37G	9316588	2011210

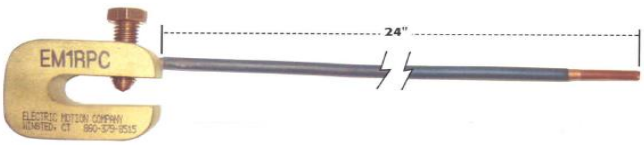
CLAMP, CONDUIT GROUND

Heavy duty corrosion-resistant ground clamp with silicone bronze hardware for galvanized steel conduit, item UK30, to ground steel conduit. Furnished with a mechanical grounding cable connector permitting the grounding cable to be attached either parallel with or at right angles to the steel conduit, with a cable range of #4 solid thru #4/0 stranded.

PIPE SIZE (IN)		STD ITEM	SAP ITEM ID	PS ITEM ID
IPS	OD			
1¼-2	1.6-2.3	UK38D	9313608	3503073
2.5-3.5	2.8-4.0	UK38E	9313606	3503075
4-5	4.5-5.5	UK38F	9313607	3503074
6	6.6	UK38H	9313611	3503067

CLAMP, RISER CONDUIT GROUND

Bronze clamp connector used to bond metallic conduit on riser poles to down ground. Clamp installs at the top of the metallic conduit, at open end. Connector comes with a 24" long #4 AWG insulated conductor brazed to the bronze clamp.



STD ITEM	SAP ITEM ID	PS ITEM ID
UK39	9387032	NONE

BUSHING - GROUNDING

Bushing, grounding, ¾” galv. Steel, for ¾” galvanized rigid conduit. Accommodates #14 AWG solid to #2/0 AWG stranded copper ground wire.

STD ITEM	SAP ITEM ID	PS ITEM ID
UK42A	9316610[Y]	2011096[Y]

LOCKNUT, GALVANIZED CONDUIT

Zinc-plated steel (1/2" thru 2") or malleable iron (3" thru 5") locknut for use with threaded conduit and conduit fittings.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
½”	UK43A1	9316572[Y]	2011225[Y]
¾”	UK43A2	9316571[Y]	2011226[Y]
1”	UK43B	9316570[Y]	2011227[Y]
1¼”	UK43C	9316569	2011228
2”	UK43D	9316568[Y]	2011230[Y]
3”	UK43E	9321121	5695407
4”	UK43F	9316567[Y]	2011234[Y]
5”	UK43G	9316063[Y]	2011236[Y]

STRAP, GALVANIZED CONDUIT

Malleable iron, single hole, pipe strap for use with rigid conduit. Use with conduit spacer, item UK46.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
½”	UK45A1	9316128	2010474
¾“	UK45A2	9316127	2010475
1”	UK45A3	9390066	N/A
1-¼ “	UK45A4	9390068	N/A
2”	UK45A5	9390099	N/A
3”	UK45A6	9390059	N/A
4”	UK45A7	9390090	N/A
5”	UK45A8	9390060	N/A
6”	UK45A9	9390095	N/A

SPACER, GALVANIZED CONDUIT

Galvanized steel conduit spacer suitable for ½ to 1 inch conduit. For use with conduit strap, item UK45.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
½”	UK46A1	9316126	2010476
¾“	UK46A2	9390074	N/A
1”	UK46A3	9390073	N/A
1-¼”	UK46A4	9390072	N/A
2”	UK46A5	9390071	N/A
3”	UK46A6	9390089	N/A
4”	UK46A7	9390088	N/A
5”	UK46A8	9390087	N/A
6”	UK46A9	9390085	N/A

FAIRLEADER, CONDUIT

Plastic or nylon conduit leader or “duct edge fairleader” for use with 2” thru 6” conduit.

COND. SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
2"-2½"	UK49A	9316538	2015106
3"-6"	UK49B	9311889	2015110

COMPOUND, FIRE STOP SEALING

Putty for creating a fire stop in conduits. UL 3 hour fire rating. Used in conjunction with filler, item UK51. Tan color, packaged in bars approximately 1” X 3” X 12”.

STD ITEM	SAP ITEM ID	PS ITEM ID
UK50	9321992[Y]	8008090[Y]

FILLER, FIRE STOP

Filler material for creating fire stop in conduits. Used in conjunction with compound, item UK50. Packaged in 2 lb bags.

STD ITEM	SAP ITEM ID	PS ITEM ID
UK51	9322011[Y]	8008091[Y]

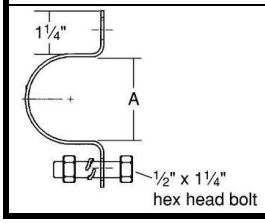
BRACKET, CONDUIT STANDOFF

Bracket used to attach riser conduits to a pole. Mounts to pole using two holes spaced 3 5/8” apart using 5/8” thrubolts and ½” lag (not included). Stands 6” away from the pole.

BRACKET LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
12”	UK60	9306797	9202147
24”	UK60A	9307865	9202271

KIT, CONDUIT STRAP

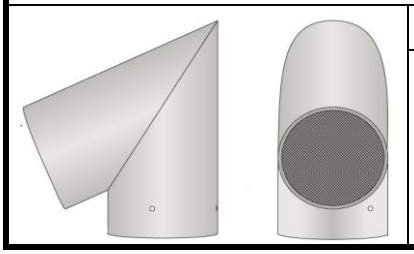
Conduit strap to be used with Std Item UK60 (Conduit Standoff Bracket). Includes strap, two hex-head bolts, two lockwashers, and two hex nuts. The bolt heads are sized to be able to slide into the standoff bracket.



CONDUIT SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	UK61A	9306738	9202142
3”	UK61B	9306739	9202143
4”	UK61C	9306740	9202144
5”	UK61D	9306741	9202145
6”	UK61E	9306798	9202146

CONDUIT, VENT CAP

Conduit vent cap, screened opening. aluminum with 2 mounting set screws. For use on spare risers.



CONDUIT SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
4”	UK63V4	9392051	
5”	UK63V5	9391655	
6”	UK63V6	9391649	

LIMITER, CURRENT LIMITING, CABLE-TO-MOLE

Cable-to-mole limiter, current limiting, 200,000 amps symmetrical interrupting rating, 600V. For use on network secondary services. Use insulating sleeve UL5S.

TOOL & DIE									
CU. CABLE SIZE	Y34A		Indents	Y35 or Y39	Crimps	Y45	Crimps	Y46	Crimps
	IND.	NEST.							
4/0	Y28PR	A28D	1	U28RT	1	✳	1	✳✳	1
500	Y34PR	A34D	2	U34RT	2	✳	2	✳✳	2

✳ Use Y35 die with “S” adapter (Burndy Cat. No. PT-6515)
✳✳ Use Y35 die with “P” adapter (Burndy Cat. No. P-UADP)

Cable Size	Socket	Cone	STD ITEM	SAP ITEM ID	PS ITEM ID
4/0 AWG	UC51A	UC52A2	UL3B	9306612	9201989
500 kcMil	UC51C	UC52C6	UL3E	9306610	9201991

LIMITER, CURRENT LIMITING, CABLE-TO-CABLE

Cable-to-cable limiter, current limiting, 200,000 amps symmetrical interrupting rating, 600V. For use on network secondary services.

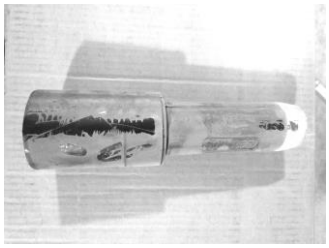
TOOL & DIE									
CU. CABLE SIZE	Y34A		Indents	Y35 or Y39	Crimps	Y45	Crimps	Y46	Crimps
	IND.	NEST.							
4/0	Y28PR	A28D	1	U28RT	1	✳	1	✳✳	1
500	Y34PR	A34D	2	U34RT	2	✳	2	✳✳	2

✳ Use Y35 die with “S” adapter (Burndy Cat. No. PT-6515)
✳✳ Use Y35 die with “P” adapter (Burndy Cat. No. P-UADP)

Cable Size	STD ITEM	SAP ITEM ID	PS ITEM ID
4/0 AWG	UL4D	9306609	9201992
Insulating Sleeve – 4/0	UL4DS	9306598	9201983
500 kcMil	UL4L	9313560	2015298
Insulating Sleeve - 500	UL4S	9313552	2015299

LIMITER, CURRENT LIMITING, CABLE-TO-OFFSET BUS

Cable-to-offset bus limiter current limiting, 200,000 amps symmetrical interrupting rating, 600V. For use on network secondary services.



TOOL & DIE									
CU. CABLE SIZE	Y34A		Indents	Y35 or Y39	Crimps	Y45	Crimps	Y46	Crimps
	IND.	NEST.							
4/0	Y28PR	A28D	1	U28RT	1	✳	1	✳✳	1
500	Y34PR	A34D	2	U34RT	2	✳	2	✳✳	2
✳ Use Y35 die with “S” adapter (Burndy Cat. No. PT-6515) ✳✳ Use Y35 die with “P” adapter (Burndy Cat. No. P-UADP)									

Cable Size	STD ITEM	SAP ITEM ID	PS ITEM ID
4/0 AWG	UL5D	9306616	9201993
Insulating Sleeve – 4/0	UL5DS	9306587	9201982
500 kcMil	UL5L	9314975	2015306
Insulating Sleeve - 500	UL5S	9313545	2015312

LIMITER, CABLE-TO-CABLE

Cable-to-cable non-replaceable limiter assembly, 30,000 amps interrupting rating, for use on 250 volt maximum network secondary systems. Includes shell and insulating sleeve. Choose according to conductor size and insulation type.

SIZE	INS. TYPE	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
4/0	RUBBER	STD	UL6CR	9321889	5961740
4/0	PAPER	LONG	UL6CPL	9313774[E]	5961748[E]
250	RUBBER	STD	UL6DR	9308055	9202713
250	PAPER	STD	UL6DPL	9308056[Y]	9202712[Y]
300	RUBBER	STD	UL6ER	9313777[E]	5961742[E]
500	RUBBER	STD	UL6GR	9313775	5961746
500	PAPER	LONG	UL6GPL	9313776	5961744

Use the following tooling for these limiters:

TOOL & DIE									
	Y34A								
STD ITEM	IND.	NEST	Indents	Y35 or Y39	Crimps	Y45	Crimps	Y46	Crimps
UL6C_	Y34PR	A28D	1	U28RT	1	*	1	**	1
UL6D_	Y34PR	A29D	1	U29RT		*	1	**	1
UL6E_	Y34PR	A30D	2	U30RT	2	*	2	**	2
UL6G_	Y34PR	A34D	2	U34RT	2	*	2	**	2

* Use Y35 die with “S” adapter (Burndy PT-6515)
** Use Y35 die with “P” adapter (Burndy P-UADP)

LIMITER, CABLE-TO-CABLE, REPLACEABLE

Cable-to-cable replaceable limiter assembly, 20,000 amps interrupting rating, for use on 250 volt maximum network secondary systems. For use on rubber and paper insulated cables. Includes limiter link, shell and insulating sleeve. Choose according to conductor size. Replacement limiter links are item UL8_

SIZE	LINK AMPS	STD ITEM	SAP ITEM ID	PS ITEM ID
2/0	150	UL7B	9305150[E]	5106969[E]
4/0	250	UL7C	9306611	9201990
250	250	UL7D	9305149[E]	5106972[E]
350	300	UL7F	9305148[E]	5106973[E]
500	400	UL7G	9305147[E]	5106974[E]

Use the following tooling for these limiters:

TOOL & DIE									
	Y34A								
STD ITEM	IND.	NEST	Indents	Y35 or Y39	Crimps	Y45	Crimps	Y46	Crimps
UL7B	Y34PR	A26D	1	U26RT	1	✳	1	✳✳	1
UL7C	Y34PR	A28D	1	U28RT	1	✳	1	✳✳	1
UL7D	Y34PR	A29D	1	U29RT	1	✳	1	✳✳	1
UL7F	Y34PR	A31D	2	U31RT	2	✳	2	✳✳	2
UL7G	Y34PR	A34D	2	U34RT	2	✳	2	✳✳	2

✳ Use Y35 die with “S” adapter (Burndy PT-6515)
✳✳ Use Y35 die with “P” adapter (Burndy P-UADP)

LIMITER, MOLE (MOLIMITER)

For molimiters, see standard item UC56_.

LIMITER LINK

Replacement links for cable to cable limiters, item UL7. 20,000 amps interrupting rating. For network secondary systems.

LINK AMPS	STD ITEM	SAP ITEM ID	PS ITEM ID
150	UL8B	9319395[E]	5106966[E]
200	UL8C	9316908[E]	5905908[E]
250	UL8D	9306607[E]	9201984[E]
300	UL8E	9305151[E]	5106968[E]
400	UL8F	9316907[E]	5905910[E]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

LIMITER LUG

Cable-to-lug non-replaceable limiter assembly, 30,000 amps interrupting rating, for use on 250 volt network secondary systems. For rubber insulated cables only. Includes shell and insulating sleeve. Choose according to conductor size.

SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
4/0	UL9C	9306742	9201396
250	UL9D	9308057[Y]	9202711[Y]
300	UL9E	9320538[E]	5962147[E]
500	UL9G	9320537	5962148
750	UL9H	9320536[E]	5962149[E]

Use the following tooling for these limiters:

TOOL & DIE									
	Y34A								
STD ITEM	IND.	NEST	Indents	Y35 or Y39	Crimps	Y45	Crimps	Y46	Crimps
UL9C	Y28PR	A28D	1	U28RT	1	✳	1	✳✳	1
UL9D	Y29PR	A29D	1	U29RT	1	✳	1	✳✳	1
UL9E	Y30PR	A30D	2	U30RT	2	✳	2	✳✳	2
UL9G	Y34PR	A34D	2	U34RT	2	✳	2	✳✳	2
UL9H	Y39PR	A39D	2	U39RT	2	✳	2	✳✳	2

✳ Use Y35 die with “S” adapter (Burndy PT-6515)
✳✳ Use Y35 die with “P” adapter (Burndy P-UADP)

LIMITER: CABLE TO NEMA (for maintenance use)

Cable limiter for network cable to NEMA spaced connector.

SIZE	STD ITEM	SAP ITEM ID	
4/0	UL10A	9390856	
300	UL10B	9390885	
500	UL10C	9390895	

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

LUG, TERMINAL, COPPER

Tinned copper lug with NEMA 2 or 4 hole pad (9/16" holes @ 1 3/4" spacing). Lugs are sealed to prevent water intrusion into the cable. For use on copper cable terminations. See Section 34 for die / crimping information.

SIZE AWG / kcmil	STD ITEM	SAP ITEM ID	PS ITEM ID
4	UL15A	9310081	9201248
2	UL15B	9310082	9201247
1/0	UL15C	9310080	9201249
2/0	UL15D	9310079	9201250
4/0	UL15E	9310086	9201251
350	UL15K	9310097	9201252
500 / 500 comp	UL15M	9310106	9201253
500 – 4 hole	UL15M4	9389616	n/a
500 Stackable Lug	UL15MS	9306510	9201699
600	UL15N	9310098	9201254
750	UL15P	9310114	9201255
1000 - 2 hole	UL15R	9310227	9201256
1000 - 4 hole	UL15R4	9310085	9201244

LUG, TERMINAL, ALUMINUM

Tinned aluminum lug with NEMA 2 or 4 hole pad (9/16" holes @ 1 3/4" spacing). Lugs are sealed to prevent water intrusion into the cable. For use on aluminum cable terminations. See Section 34 for die / crimping information.

SIZE AWG / kcmil	STD ITEM	SAP ITEM ID	PS ITEM ID
4	UL16A	9310225	9201258
2	UL16B	9310226	9201257
1/0	UL16C	9310224	9201259
2/0	UL16D	9310223	9201260
4/0	UL16E	9310222	9201261
350	UL16K	9310221	9201262
500	UL16M	9310220	9201263
600	UL16N	9310199	9201264
750	UL16P	9310198	9201265
1000 - 2 holes	UL16R	9310197	9201266
1000 - 4 hole	UL16R4	9310083	9201246

LUG TERMINAL ALUMINUM SHEAR BOLT

Tinned aluminum shear bolt lug, 2-hole NEMA (9/16” holes and 1 ¾” spacing) range taking. For use on copper and aluminum conductors in cable terminations.

CONDUCTOR RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
#5 - 300	UL16SB1	9392870	----
3/0 - 600	UL16SB2	9392861	----
500 – 1000	UL16SB3	9392868	----

WB DOOR LOCK ASSEMBLY

For use on all company doors requiring a WB lock.

	STD ITEM	SAP ITEM ID	PS ITEM ID
Mortise cylinder Rim cylinder	UL20CM UL20CR	9309803 9309802	5105875 5105876
WB Key	UL20K	9309804	5105874

PADLOCK

For use on all company equipment requiring a padlock. Use the 1/4" diameter shank only where the larger one does not fit.

SHANK DIAM.	SHANK LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
3/8"	Short	UL20S	9309806	5105872
3/8"	Long	UL20L	9309805	5105873
¼"	Long	UL20L1	9309487	5478028
Padlock Key		UL20K	9309804	5105874

LOCK, PIN STYLE FOR USE ONLY IN MANOLES AND VAULTS FOR UNDERGROUND EQUIPMENT

For use on underground company equipment located in manholes and vaults. Pin is 5/16" diameter x 3 1/16" long.

STDITEM	SAP ITEM ID	PS ITEM ID
UL22	9393193	

LUBRICANT, OFC

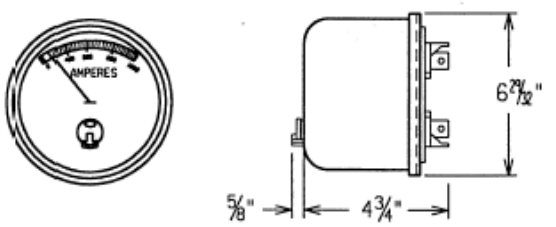
Spray lubricant for lubricating Oil Fused Cutouts, non flammable. 17 ounce can

STD ITEM	SAP ITEM ID	PS ITEM ID
UL25	9306661	9201641

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

METER, AMPERE DEMAND

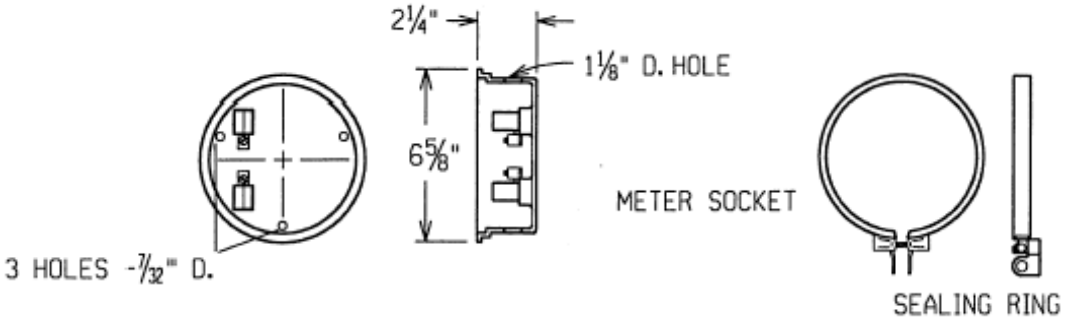
Single phase, two wire, 60 Hz., maximum indicating ampere demand meter (ammeter) with a full scale indication from 0 to 1000 amperes. Meter provides continuous (instantaneous) measurements and maximum demand of loading of network type distribution transformers supplying a low-voltage network system. Meter gives full scale deflection at the rated secondary current of the current transformer (5 amperes), but is scaled to read directly in primary amperes according to the current transformer ratio with which it is to be used. Designed for use with a split-core current transformer, item UT2, and meter socket, item UM3. The combined overall limit of error of the current transformer and the ampere demand meter, when properly installed will be within ±2% of full scale.



STD ITEM	SAP ITEM ID	PS ITEM ID
UM2B	9313674	3004190

METER SOCKET

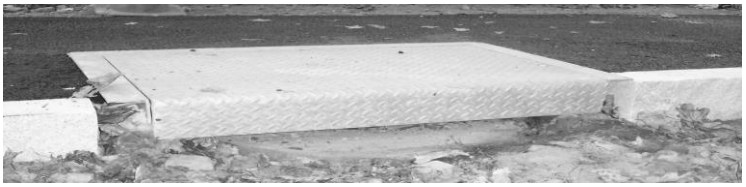
Single position, ring type, round, grey epoxiglass, flush mounted socket with two 100A rated jaw type terminals located on the left-hand side with associated lay-in wire connectors with a range of #6 solid to #14 stranded. Furnished with 1⅛ inch diameter hole for top entry provisions for ¾ inch conduit. For use with ampere demand meters, item UM2B and sealing ring, Item ID 3017047



	STD ITEM	SAP ITEM ID	PS ITEM ID
Meter Socket	UM3	9312658	3017125
Sealing Ring	UM4	9314001	3017047

COVER – MANHOLE – GALVANIZED STEEL

Cover, manhole, diamond plated galvanized steel, for use in sidewalk curb area, rated for 2,500 pounds wheel loading if set in concrete.

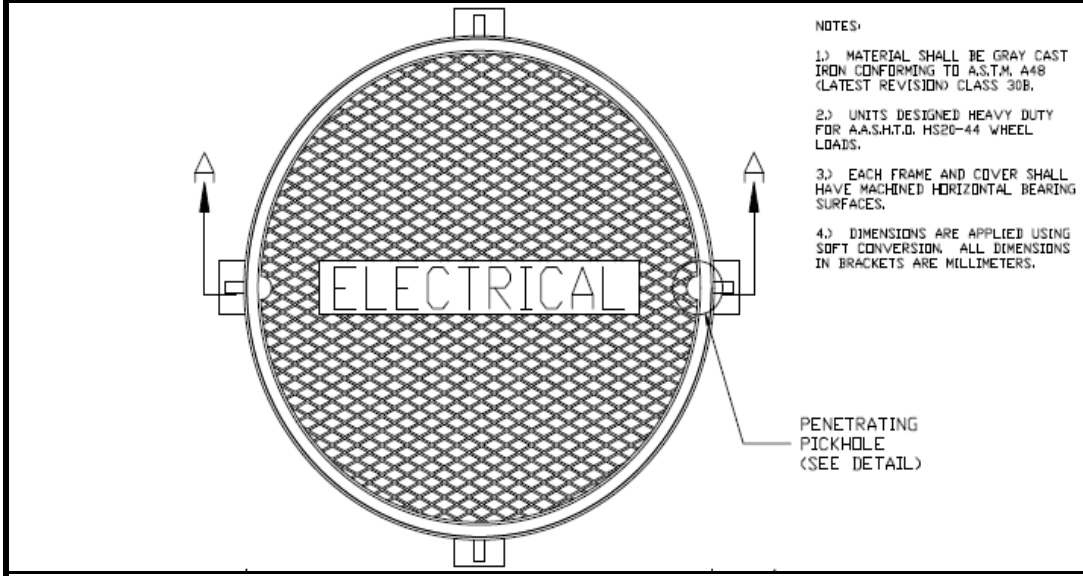


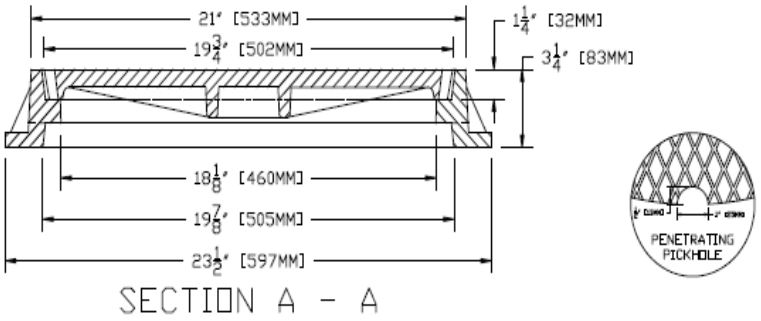
DIMENSIONS	STD ITEM	SAP ITEM ID	PS ITEM ID
28” x 47”, plate cover = 25” x 41” with a 6” side Weight = 250 pounds	UM10B	9308113	9202208
41” x 47”, plate cover = 38” x 41” with a 6” side Weight = 390 pounds	UM10B1	9308112	9202209

HANDHOLE, FRAME AND COVER 18”

FOR MAINTENANCE ONLY

Cast iron frame with cover designed for highway loading. Material shall conform to ASTM specification 48-36/CL 30B and System Specification C-1044





	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
18” Handhole Frame	44 Lbs	UM11A	9386631	2012048
18” Handhole Cover	74 Lbs	UM11B	9386753	2012098

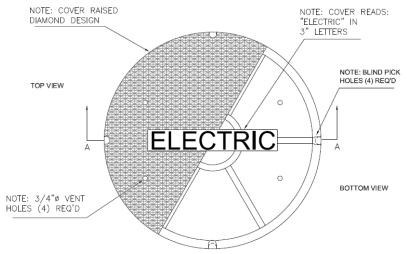
ADAPTOR, STEEL PLATE

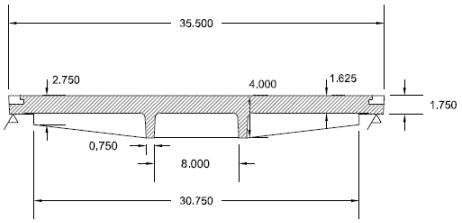
Steel adaptor plate 48”x48”x3/4” with 38” round opening for use on square manhole openings with round frames.

	STD ITEM	SAP ITEM ID	PS ITEM ID
	UM12	9387416	none

MANHOLE, COVER 35 1/2” **FOR MAINTENANCE ONLY**

Cast Iron cover designed for H20 highway loading, with 4 -3/4” vent holes.



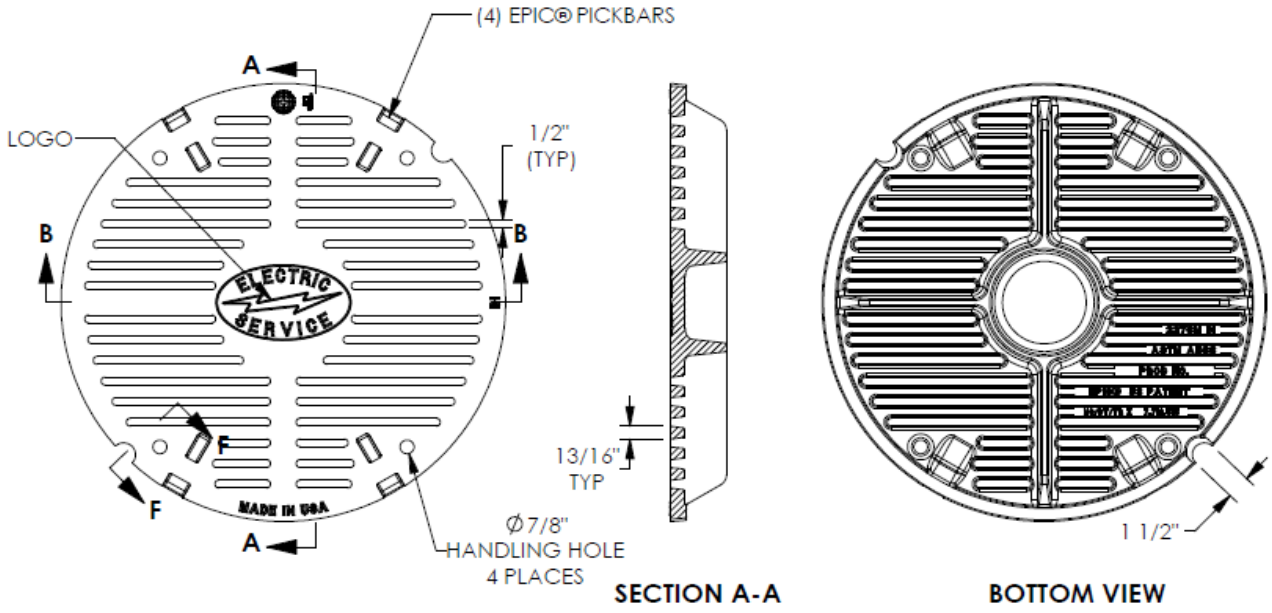


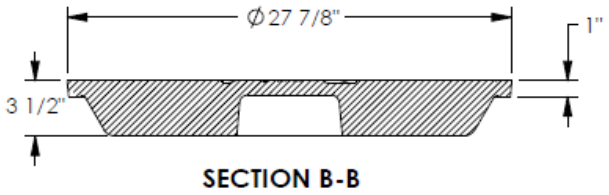
SECTION A - A

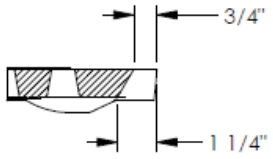
	WEIGHT (LBS)	STD ITEM	SAP ITEM ID	PS ITEM ID
Cover	525	UM12G	9307521[Y]	9202407[Y]

MANHOLE, COVER SLOTTED, 27 7/8” **FOR USE IN RHODE ISLAND**

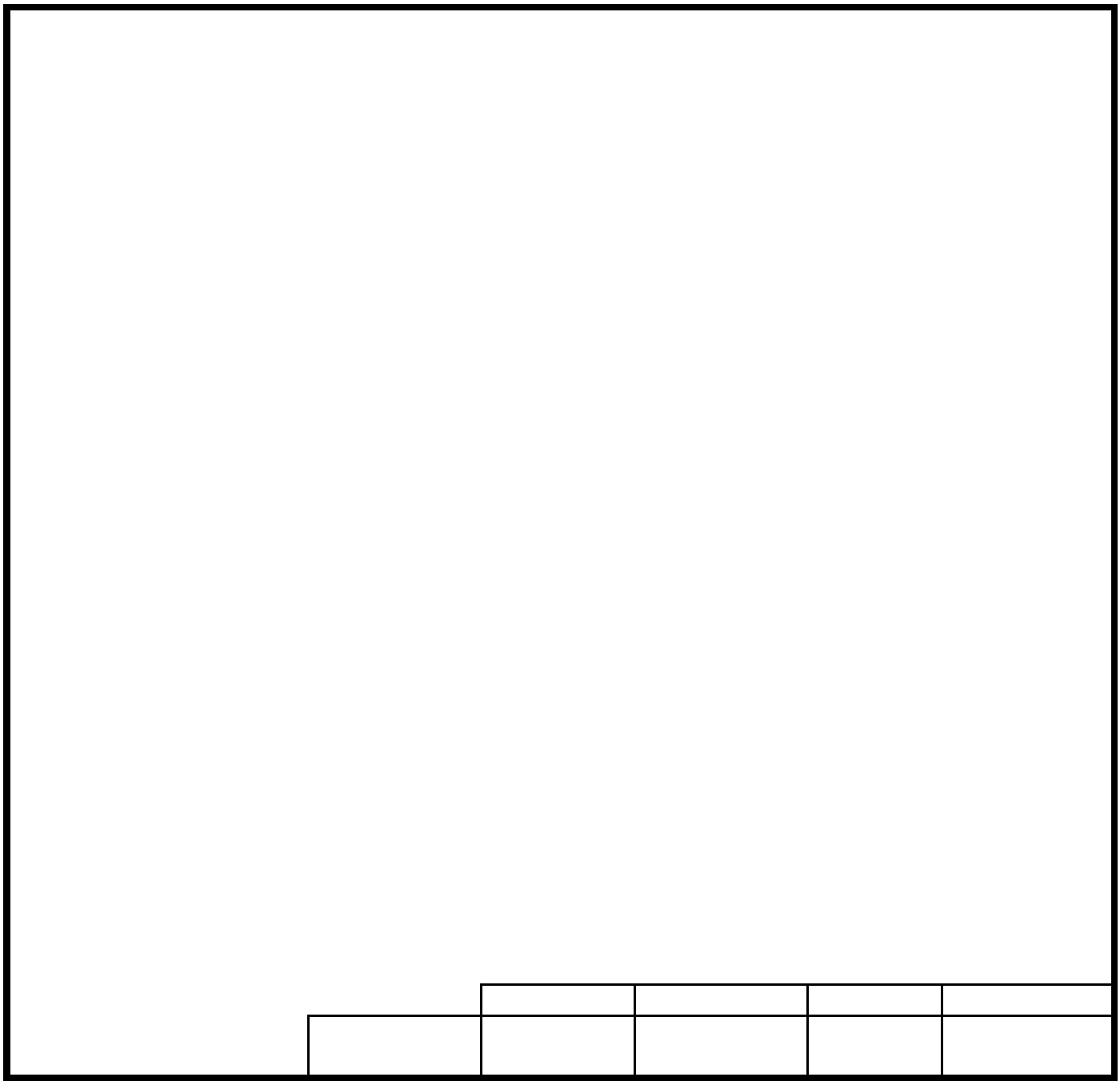
Cast Ductile Iron cover, slotted, for use in underground secondary networks. Cover will fit standard 36”-26” ring. Rated per AASHTO M 306.





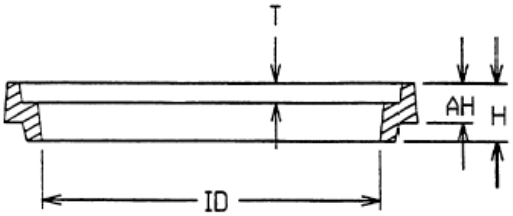


	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
Cover	131	UM12NE	9387035[E]	NONE



RING, ADJUSTING

Cast iron or steel for use with a street manhole frame and cover. Designed for highway loading and furnished with three equally spaced ⅜ inch tapped holes with ⅜ inch x 1 inch steel Allen head screws. Per PPL Specification MS 3760.



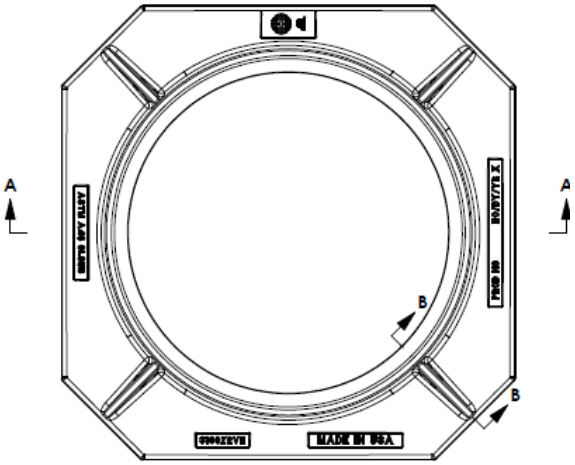
MANHOLE (ID)	AH	H	T	APPROX. WEIGHT (LBS.) CAST IRON	APPROX. WEIGHT (LBS.) STEEL	STD ITEM	SAP ITEM ID	PS ITEM ID
36	¾	2 ¼	1 ½			UM12S		
36	1	2½	1½	——	40	UM12T	9310170	9201274
36	1 ½	3	1 ½			UM12U		
36	2	3½	1½	125	——	UM12V	9310171	9201273
33	2	4	2		——	UM12W	9316439[Y]	2012053[Y]
26*	1	1½	1½	——	——	UM12X	9305784[E]	5644552[E]

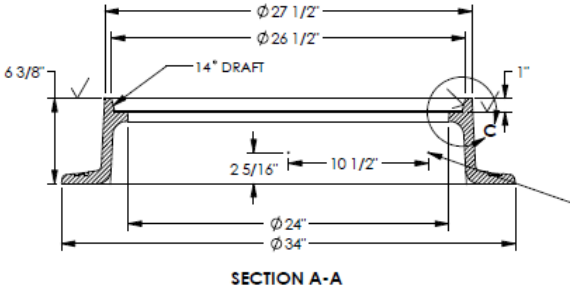
NOTE: All dimensions are in inches

* Maintenance work in Rhode Island

MANHOLE, COVER & FRAME. 24”

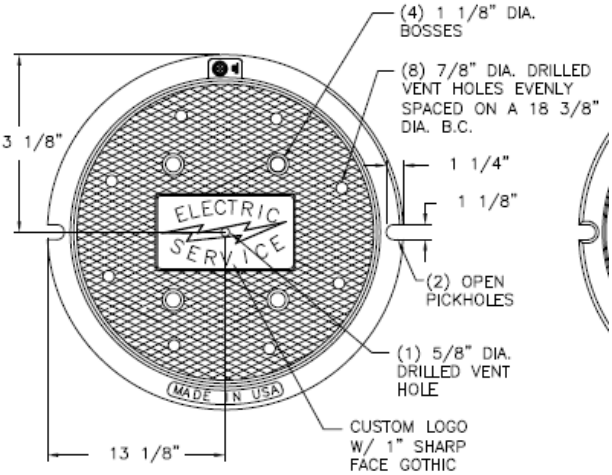
Cast Iron frame with solid cover designed for network vault access. These items to be used where the sidewalk must have no open gratings. To be in accordance with PPL Material Specification MS-3753 (34” cover) and MS-3744 (24” frame).

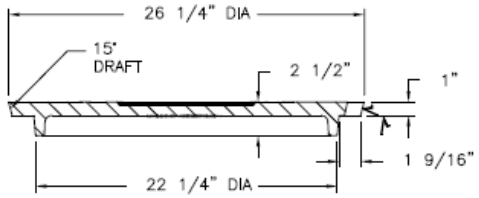




SECTION A-A

24” MH Frame





COVER SECTION

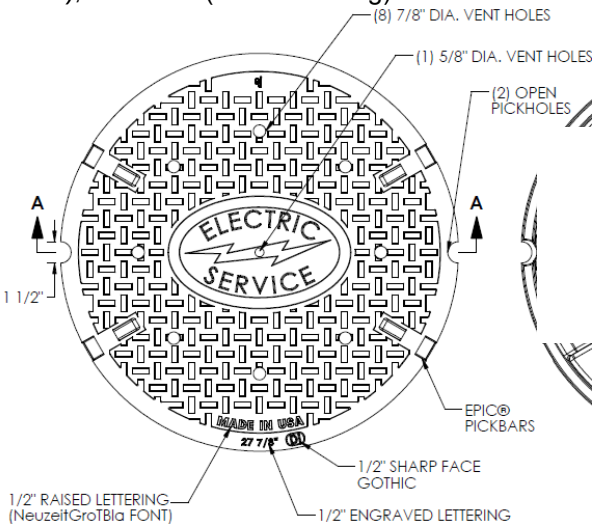
24” MH Cover

	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
24” MH Cover		UM13A	9305751	5644348
24” MH Frame		UM13B	9305767	5644450

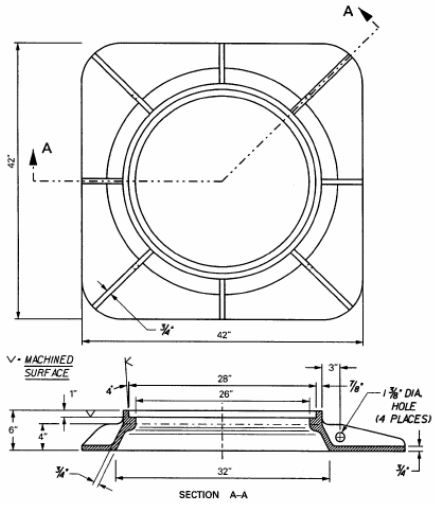
[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

MANHOLE, COVER & FRAME, 26”, 36”

Cast Iron frame with ductile iron solid cover and ring designed for highway loading. To be in accordance with PPL Material Specification MS-3755 (36” cover), MS-3746 (26” frame), MS-3748 (36” frame), MS-3757 (26” – 36” Ring).

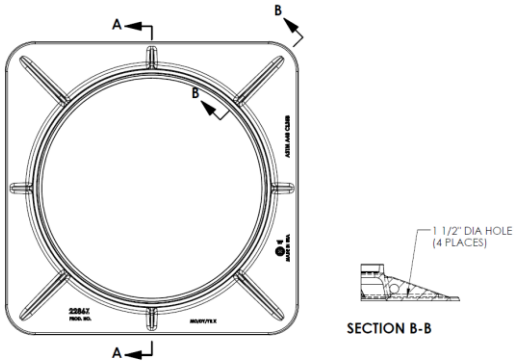


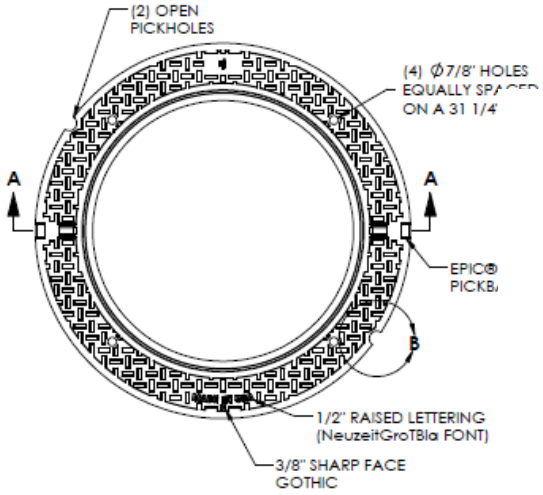
26” MH Cover



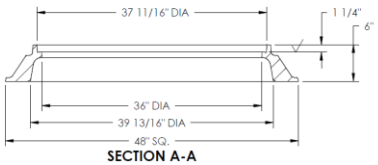
26” MH Frame

For Maintenance Only -





26” - 36” MH Ring

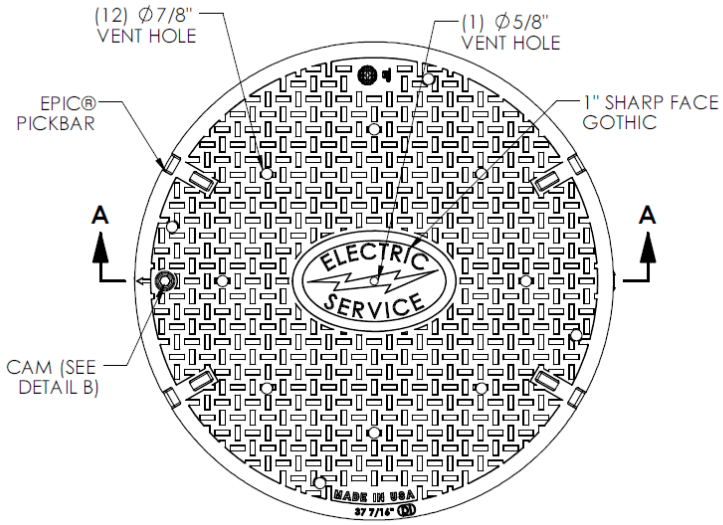


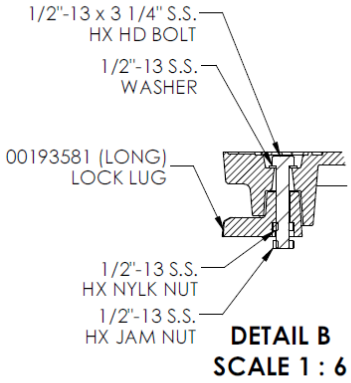
36” MH Frame

	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
26” MH Cover	125	UM14C	9319817	5644360
26” MH Frame		UM14F1	9305768[E]	5644458[E]
36” MH Frame		UM14F	9305769	5644514
26” to 36” MH Ring	150	UM14R	9305785	5644550

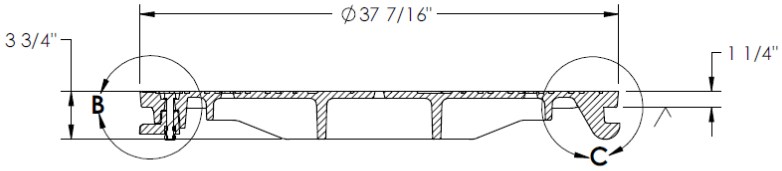
MANHOLE COVER, CAM-LOCK

Cam-Lock manhole cover, for us in **MASSACHUSETTS ONLY** on roadways with posted speed limit at or above 45 MPH. Cover locks by turning a hex head bolt 90 degrees which rotates the cam.

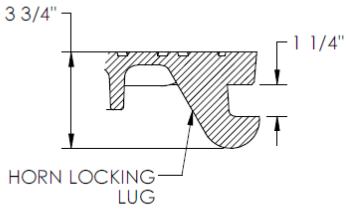




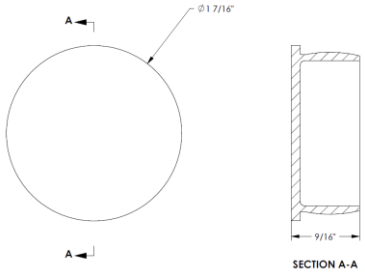
DETAIL B
SCALE 1 : 6



SECTION A-A



DETAIL C
SCALE 1 : 6



ITEM	STD ITEM	SAP ITEM ID
Cam-Lock Cover	UM14L	9391100
Replacement Cap	UM14LC	9391600

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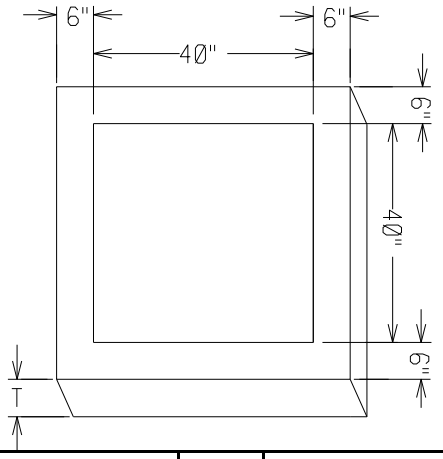
MANHOLE CHIMNEY COLLAR

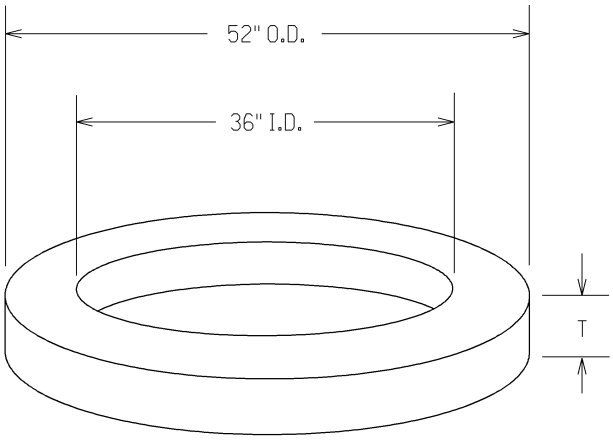
40” inside X 52” outside precast reinforced concrete collar, for the chimney on square manhole openings.



APPROX WEIGHT	T	STD ITEM	SAP ITEM ID	PS ITEM ID
250#	3”	UM15C	9315216	0804296
500#	6”	UM15F	9315226	0804297

MANHOLE CHIMNEY COLLAR

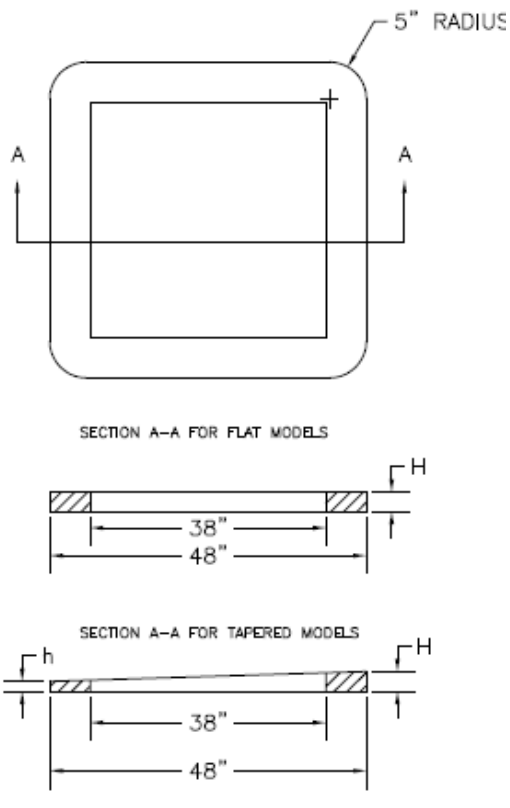
36” ID X 52” OD precast reinforced concrete collar, for the chimney on round manhole openings.

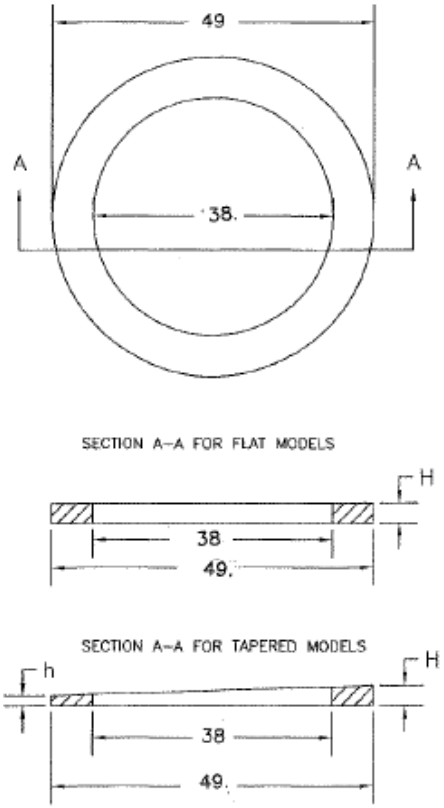


APPROX WEIGHT	T	STD ITEM	SAP ITEM ID	PS ITEM ID
250#	3”	UM15CR	9306669	9201628
500#	6”	UM15FR	9306667	9201629

RING – GRADING, RUBBER, SQUARE AND ROUND

Ring, Grading, Round, Rubber, for raising manhole openings. Rubber made from rubber fiber polyurethane prepolymer composite.



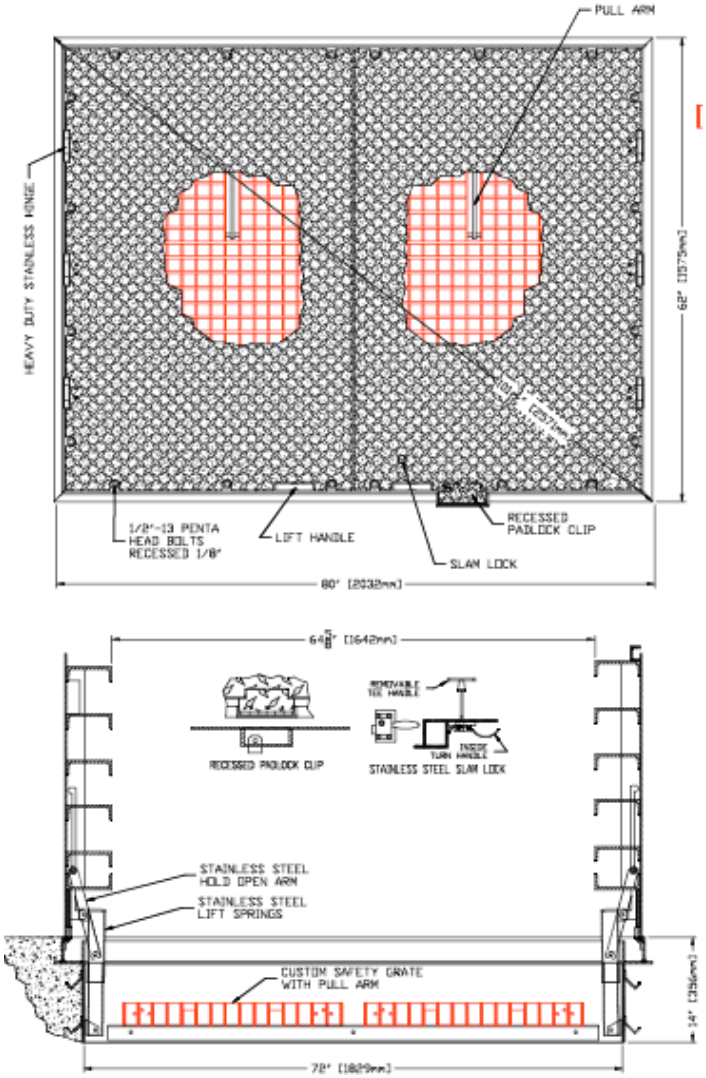


TYPE	SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
SQUARE	38” ID x 48” OD x ½” to 1” high tapered thickness	UM15DB	9316211	9202626
SQUARE	38” ID x 48” OD x 1” high	UM15DD	9316210	9202627
SQUARE	38” ID x 48” OD x 2” high	UM15DF	9316208	9202628
SQUARE	38” ID x 48” OD x 3” high	UM15DH	9316215	9202629
SQUARE	38” ID x 49” OD x ½” to 1” high tapered thickness	UM15DJ	9316222	9202630
ROUND	38” ID x 49” OD x 1” high	UM15DL	9316223	9202631
ROUND	38” ID x 49” OD x 2” high	UM15DN	9316221	9202632
ROUND	38” ID x 49” OD x 3” high	UM15DP	9316220	9202633
ROUND				

HATCH, USED FOR PRECAST SIDEWALK MANHOLE

6' X 4', bi-fold opening hatch, street rated, galvanized steel, for use on a sidewalk manhole opening. In accordance with PPL Material Specification Standards MS-3480.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.

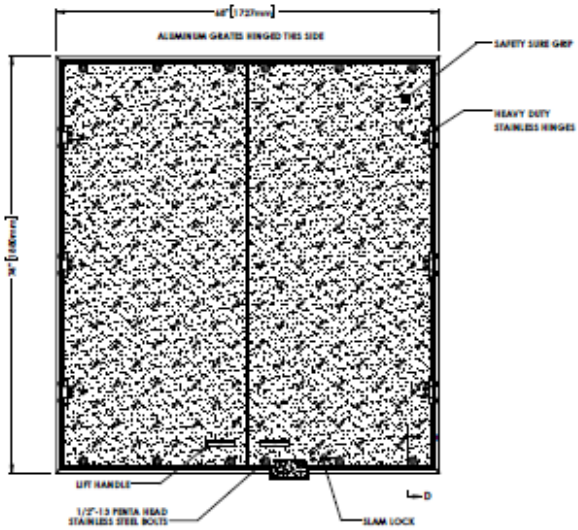


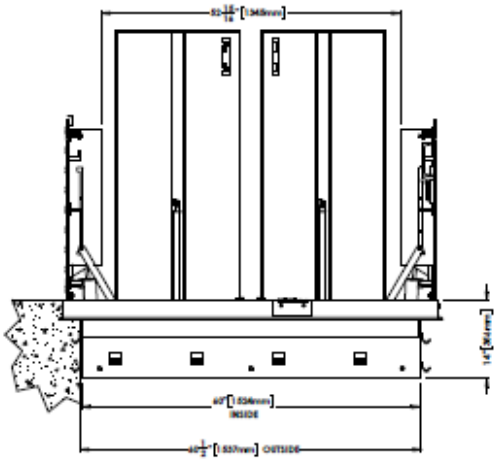
STD ITEM	SAP ITEM ID	PS ITEM ID
UM15H	**1000281**	9202102

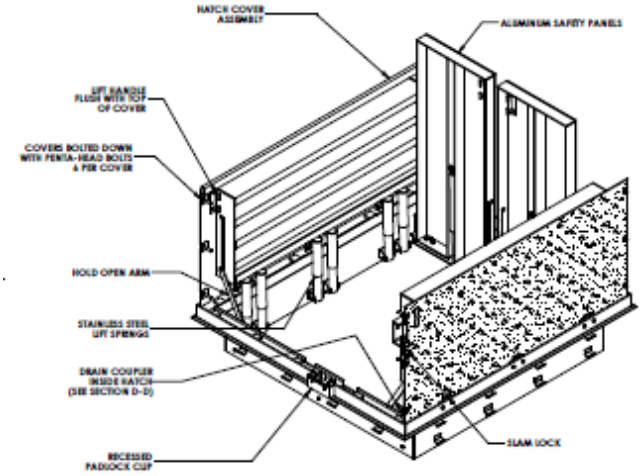
HATCH, USED FOR PRECAST SIDEWALK MANHOLE

5' X 5', bi-fold opening hatch, street rated, galvanized steel, for use on a double entry or switchgear manhole opening. In accordance with PPL Material Specification Standards MS-3482. Hatch is cast in a collar, see MS 3467 for collar details.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.





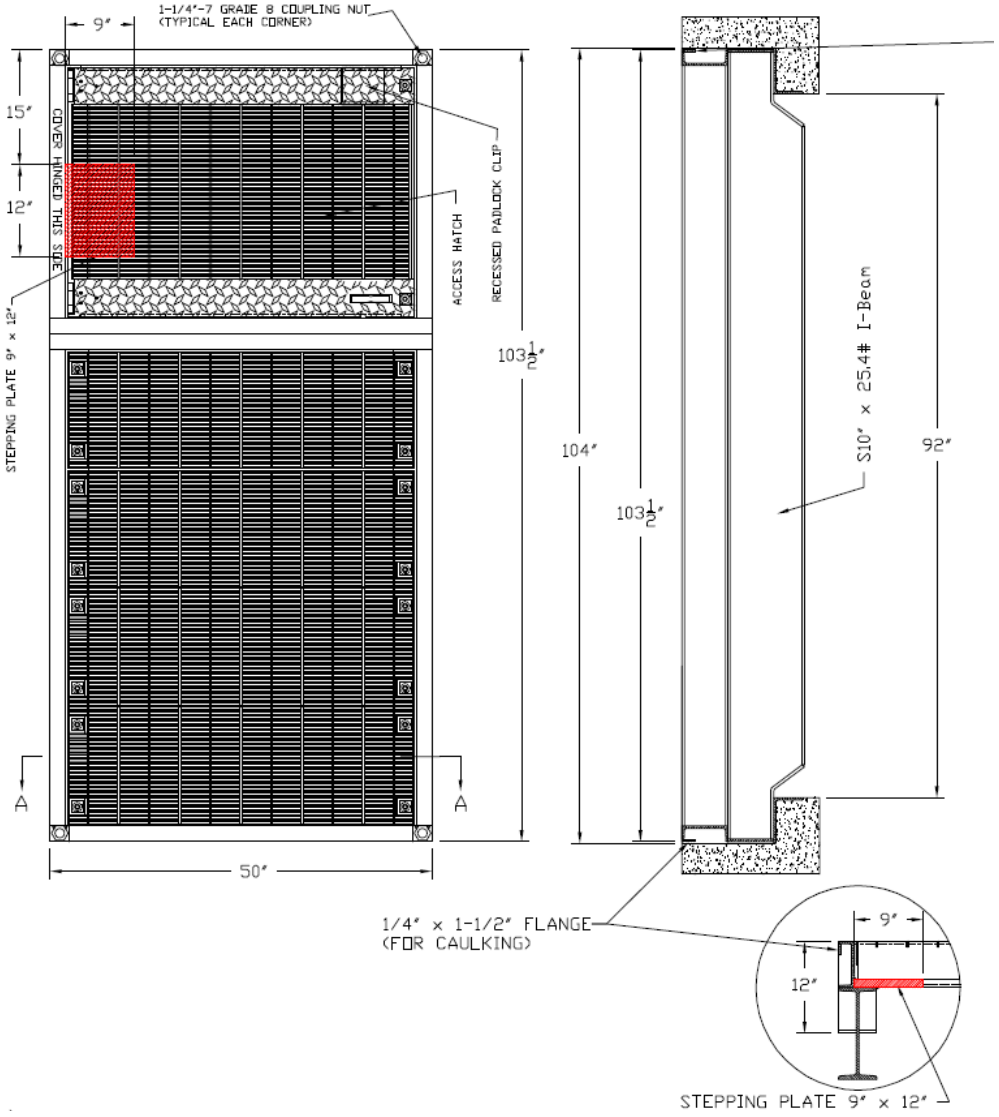


STD ITEM	SAP ITEM ID	PS ITEM ID
UM15HH	1000328	9202166

HATCH, USED FOR NETWORK TRANFORMER VAULT UP TO 1000Kva

103 ½" x 50" hatch, street rated, galvanized steel, for use on a network vault opening. Grating is heels and wheels compliant (1/4"spacing). In accordance with PPL Material Specification Standards MS-3491. Hatch is mounted to collar, see vault MS 3490 for collar details.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.

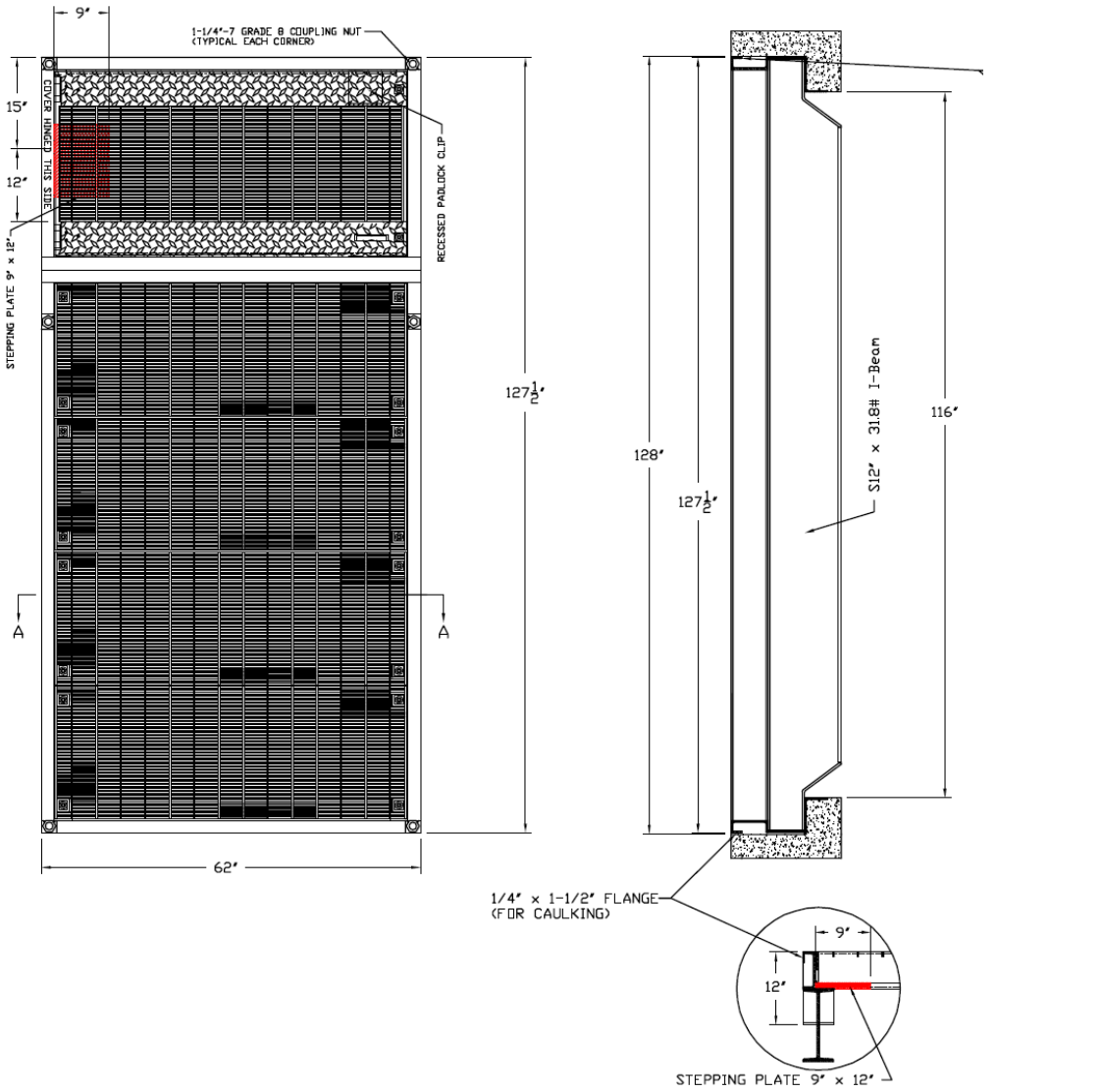


STD ITEM	SAP ITEM ID	PS ITEM ID
UM15J	1000453	9202452

HATCH, USED FOR NETWORK TRANFORMER VAULT OVER 1000kVA

127 ½" x 62" hatch, street rated, galvanized steel, for use on a network vault opening. Grating is heels and wheels compliant (1/4"spacing). In accordance with PPL Material Specification Standards MS-3493. Hatch is mounted to collar, see vault MS 3492 for collar details.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.

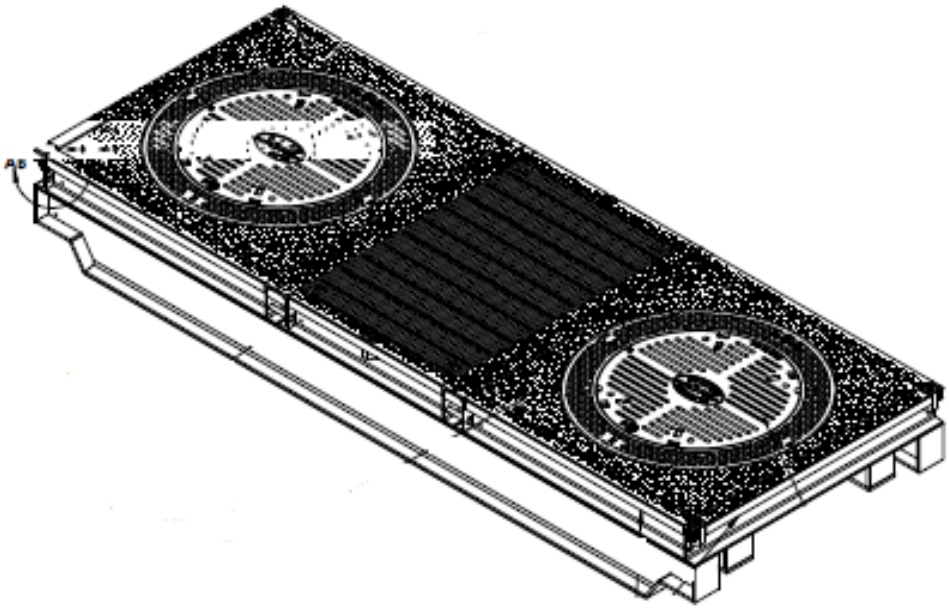


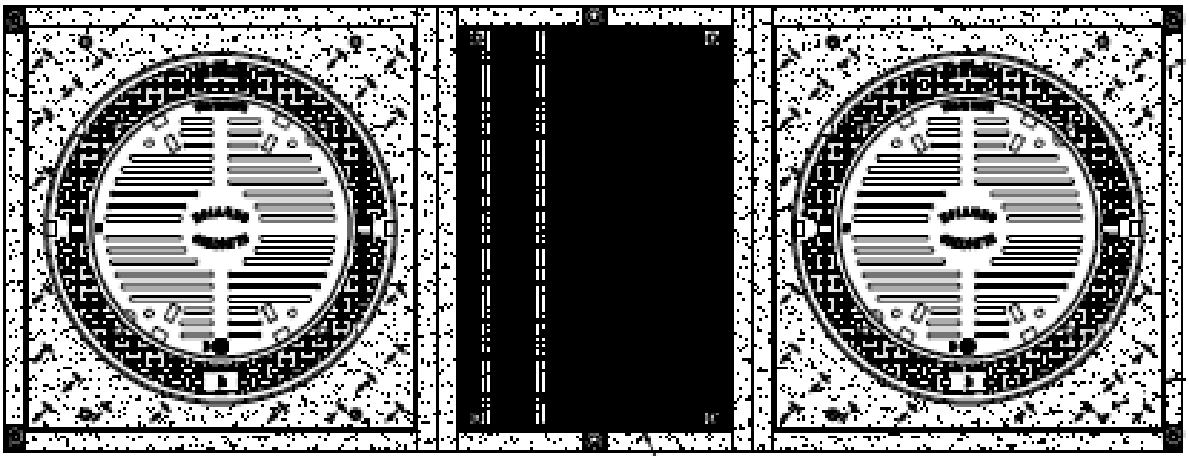
STD ITEM	SAP ITEM ID	PS ITEM ID
UM15K	1000454	9202453

HATCH, USED FOR RADIIAL TRANFORMER VAULT UP TO 500kVA

127 ½" x 48" hatch, street rated, galvanized steel, for use on a network vault opening. Grating is heels and wheels compliant (1/4" spacing) with sure grip anti slip treatment. In accordance with PPL Material Specification Standards MS-3496. Hatch is mounted into radial transformer vault US40

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.





STD ITEM	SAP ITEM ID	PS ITEM ID
UM15L	1003939	

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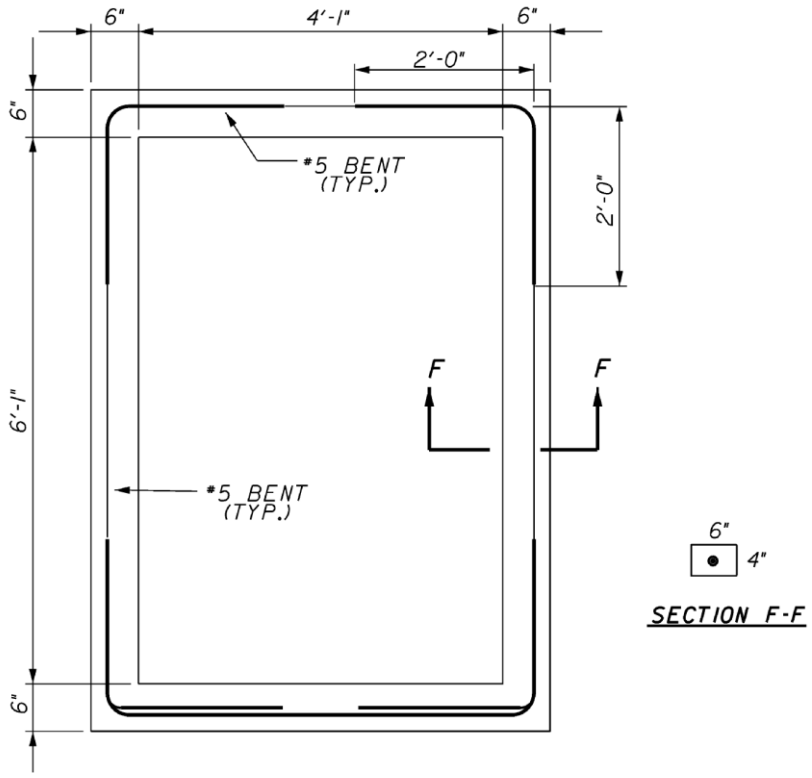
RING, GRADING, USED FOR PRECAST SIDEWALK MANHOLE HATCH

6' 1" X 4' 1" ID grading ring for setting hatch on a sidewalk manhole. In accordance with PPL Material Specification Standards MS-3424.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



STD ITEM	SAP ITEM ID	PS ITEM ID
UM15S	1000280	9202101

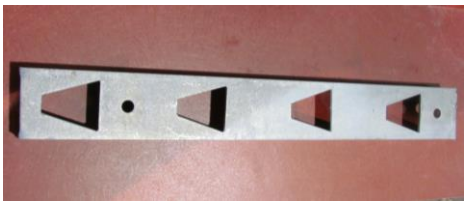
RACK, CABLE

	STD ITEM	SAP ITEM ID	PS ITEM ID
Light Duty (maintenance only)	UM16A		5645996[E]
Heavy Duty - 55” length – 13-hole	UM16B	9304062[E]	5645921[E]
Heavy Duty - 27” length – 5-hole	UM16C	9304046[E]	5645911[E]

CABLE SUPPORT ARM

	LENGTH	WIDTH	STD ITEM	SAP ITEM ID	PS ITEM ID
Light Duty	10”		UM17A	9303838[E]	5647443[E]
Light Duty	14”		UM17B1	9393830[E]	N/A
Heavy Duty	7-7/8”	1-31/32”	UM17C	9302718[E]	5647432[E]
Heavy Duty	11-7/8”	1-31/32”	UM17D	9303840[E]	5647433[E]
Heavy Duty	14-7/8”	1-31/32”	UM17E	9303839[E]	5647434[E]

CABLE SUPPORT STANCHIONS V NOTCH STYLE (for maintenance use)



	LENGTH	WIDTH	STD ITEM	SAP ITEM ID	PS ITEM ID
2 Notch	16”	4”	UM17I	9316376[Y]	2013033[Y]
4 Notch (shown)	32”	4”	UM17H	9316379[Y]	2013029[Y]
6 Notch	48”	4”	UM17G	9316378[Y]	2013030[Y]

CABLE SUPPORT ARM V NOTCH STYLE (for maintenance use)

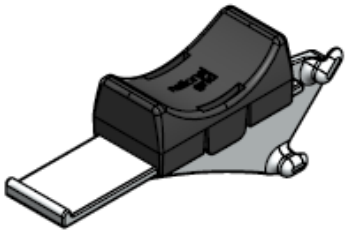
	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
Arm long	18”	UM17J	9316383[Y]	2013012[Y]
Arm short	10”	UM17K	9316381[Y]	2013013[Y]
Arm Long	23”	UM17_	9316380[Y]	

CABLE SUPPORT INSULATOR V NOTCH STYLE (for maintenance use)

	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
Insulator flat (shown)	18”	UM17L	9314997	2005596
Insulator curved	10”	UM17M	9316056[Y]	2005390[Y]

CABLE SADDLE

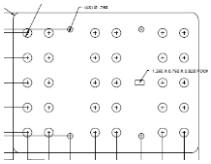
Cable saddles made of polymeric material with integrated zip tie to secure cable. To be mounted on cable support arm



USAGE	STD ITEM	SAP ITEM ID	PS ITEM ID
Cable Racks UM17A thru UM17E	UM17S	9392529	N/A

CABLE SUPPORT BOARD

Polypropylene board for supporting secondary cables with 1 ¼ inch holes for cables to pass through



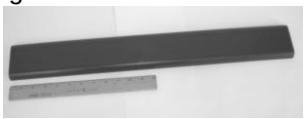
STD ITEM	SAP ITEM ID	PS ITEM ID
UM17V	9388487	NA

PORCELAIN CABLE SUPPORT INSULATOR

	LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
Heavy Duty	3”	UM18A	9304017[E]	5643520[E]
Heavy Duty	4”	UM18B	9304019[E]	5643560[E]

POLYETHYLENE SUPPORT COVER

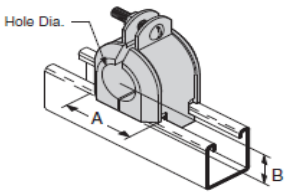
Cover for underground cable rack – 3-1/4-inches wide x 24-inches long. Plastic insulator.



STD ITEM	SAP ITEM ID	PS ITEM ID
UM18C	9304013[E]	5643515[E]

CLAMP, SUPPORT UNDERGROUND CABLE

Clamp, cable support, thermoplastic elastomer insulator attached to manhole unistrut by a zinc plated pipe strap and silicon bronze mounting hardware



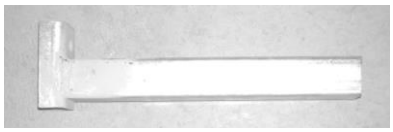
LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
2”	UM18CA	9386917	none
3”	UM18CB	9386932	none
4”	UM18CC	9386945	none

CLAMP, SUPPORT UNDERGROUND CABLE

Clamp, UG cable support, thermoplastic elastomer insulator attached to manhole unistrut elastomeric inserts to protect cable jacket, range taking. To be installed on switchgear high side compartment

CABLE DIAMETER RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
1.02”-1.5” (Sm)	UM18C1	9393302	none
1.5”-1.95”” (Med)	UM18C2	9393310	none
1.95”-2.36” (Lg)	UM18C3	9393400	none
2.68”-3.19” (XL)	UM18C4	9393940	none

ARM, CHANNEL, STRUT BRACKET, GALVANIZED



STD ITEM	SAP ITEM ID	PS ITEM ID
UM18D	9311964	2015129
UM18D1	9311963	2015130

PORCELAIN CABLE SUPPORT INSULATOR

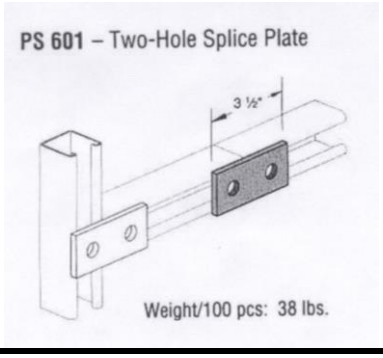
LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
3”	UM18D2	9314977	2015131
4”	UM18D3	9311962	2015132

CHANNEL, UNISTRUT, HOT DIPPED GALVANIZED STEEL

1-5/8-inch x 1-5/8-inch. 10-foot length

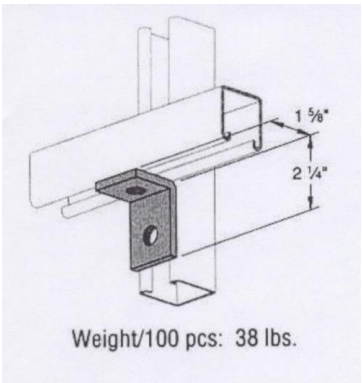
STD ITEM	SAP ITEM ID	PS ITEM ID
UM18D4	9311979	

PLATE, SPLICE, 2-HOLE



STD ITEM	SAP ITEM ID	PS ITEM ID
UM18D5	9311835	2015151

ANGLE, CORNER, CHANNEL, 90-DEGREE, 2-HOLE



STD ITEM	SAP ITEM ID	PS ITEM ID
UM18D6	9311834	2015154

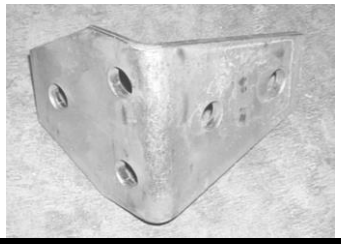
ANGLE, CORNER, CHANNEL, 90-DEGREE, 3-HOLE

STD ITEM	SAP ITEM ID	PS ITEM ID
UM18D7	9311833	2015155

SUPPORT, STANCHION, 3-HOLE, "Z" SHAPED

STD ITEM	SAP ITEM ID	PS ITEM ID
UM18D8	9311811	2015156

BRACKET, ANGLE, 5-HOLE, SHELF



STD ITEM	SAP ITEM ID	PS ITEM ID
UM18D9	9311810	2015159

CAP, END, PS-665 POWER STRUT

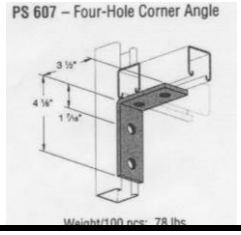
STEEL

PLASTIC

STD ITEM	SAP ITEM ID	PS ITEM ID
UM18E	9311809	2015160
UM18EV	9388851	NA

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

ANGLE, CORNER, CHANNEL, 90-DEGREE, 4-HOLE



STD ITEM	SAP ITEM ID	PS ITEM ID
UM18E1	9311808	2015161

NUT, CLAMPING, UNI-STRUT

Nut, galvanized steel, for use with 1-5/8” wide x 1-3/8” or 1-5/8” high channel. Nut locks by twisting into channel.

Twirl

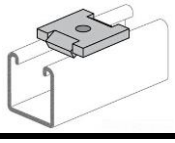
Spring

SIZE	THREAD	THICKNESS	STYLE	STD ITEM	SAP ITEM ID
1/2"	13 UNC	1/2"	Twirl	UM18F	9387621
3/8”	16 UNC	3/8”	Twirl	UM18F1	9387619
1/2”	13 UNC	1/2”	Spring	UM18FS	9311997

SCREW, CAP, HEX HEAD, 1/2-INCH x 1-INCH, ZINC PLATED

STD ITEM	SAP ITEM ID	PS ITEM ID
UM18F2	9321911	7011026

WASHER, 1/2-INCH, ZINC PLATED

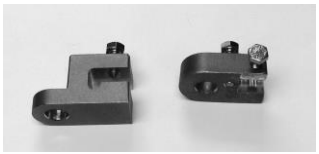


STD ITEM	SAP ITEM ID	PS ITEM ID
UM18G	9388475	NA

CLAMP, KIT, KNOB-HUB ATTACHMENT

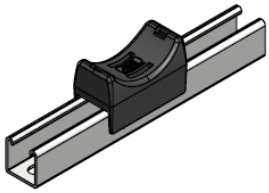
Clamp, kit, for blanket attachment to knob hub style bracket, Clamp aluminum bronze, bolts hardened steel grade 8 automotive.

STD ITEM	SAP ITEM ID	PS ITEM ID

	UM18K	9307988	9202678

CABLE SADDLE

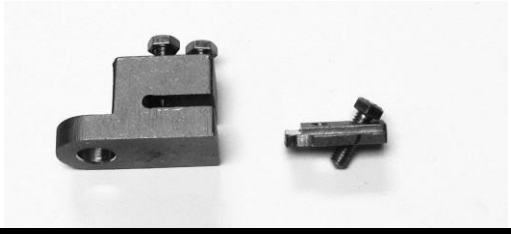
Clamp, kit, for blanket attachment to knob hub style bracket, Clamp aluminum bronze, bolts hardened steel grade 8 automotive.



USAGE	STD ITEM	SAP ITEM ID
Unistrut Arms UM18D and UM18D1	UM18S	9392545

CLAMP, KIT, TELEPHONE ATTACHMENT

Clamp, kit, for blanket attachment to telephone style bracket, Clamp aluminum bronze, bolts hardened steel grade 8 automotive.



STD ITEM	SAP ITEM ID	PS ITEM ID
UM18T	9307984	9202682

CLAMP, KIT, V-NOTCH ATTACHMENT

Clamp, kit, for blanket attachment to V-notch style bracket, Clamp aluminum bronze, bolts hardened steel grade 8 automotive.

STD ITEM	SAP ITEM ID	PS ITEM ID
UM18V	9307983	9202683

BAR, HATCH LOCK OPEN

Bar, for use on 42inch square style legacy vault bi fold entry grates. Bar locks into open hatch with tethered pins to prevent grates from closing. Bar is reversible for larger openings. Aluminum with reflecting striping. Weight 10 pounds.

STD ITEM	SAP ITEM ID	PS ITEM ID
UM18W	9391975	NA

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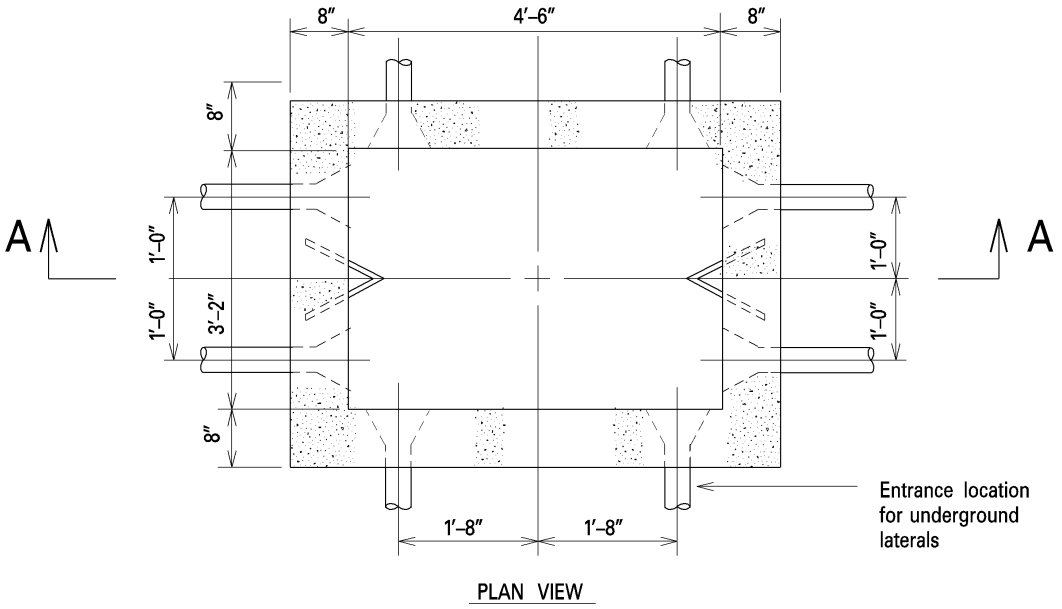
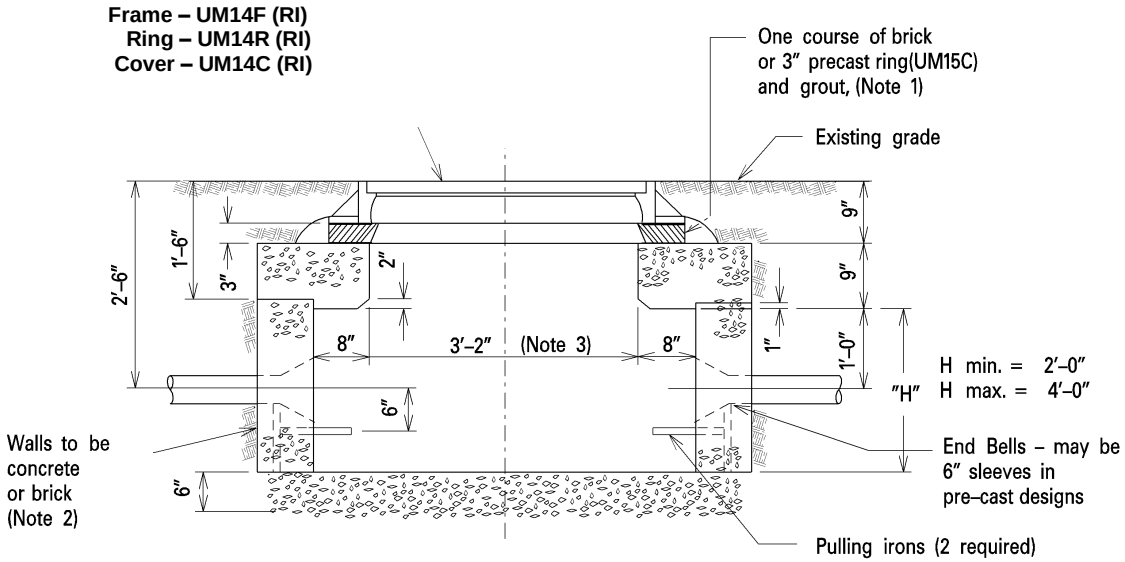
HANDHOLE, HEAVY DUTY

Precast concrete. In accordance with PPL Material Specification Standards MS-3334.
4'-6" x 3'-2"

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



PLAN VIEW



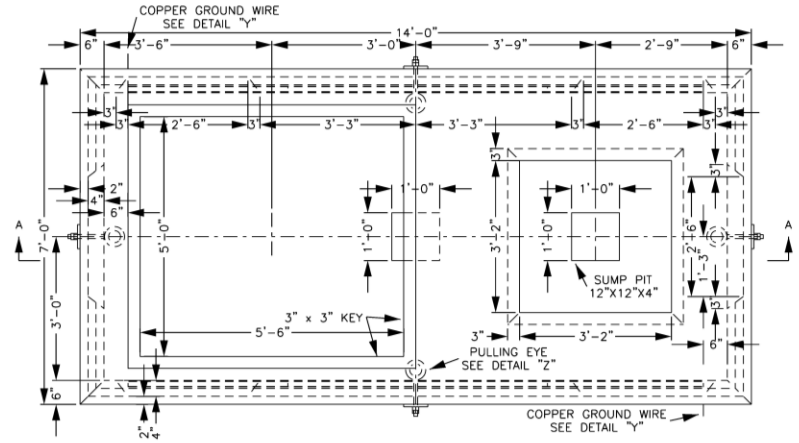
SECTION A–A

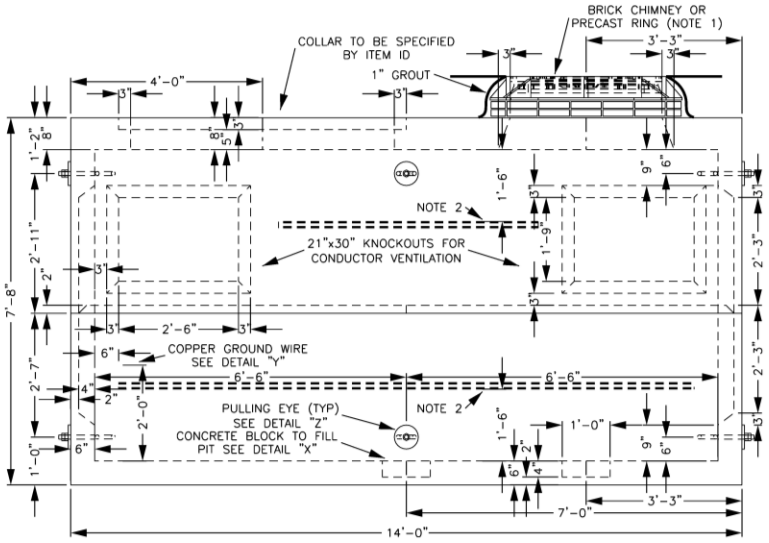
STD ITEM	SAP ITEM ID	PS ITEM ID
UM19	1000043	9201354

MANHOLE, SWITCHGEAR

Precast concrete. Two piece manhole, 13' x 6' x 6'-6" ID. In accordance with PPL Material Specification Standard MS-3467. For collar details see pages UM20-2 and UM20-3.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



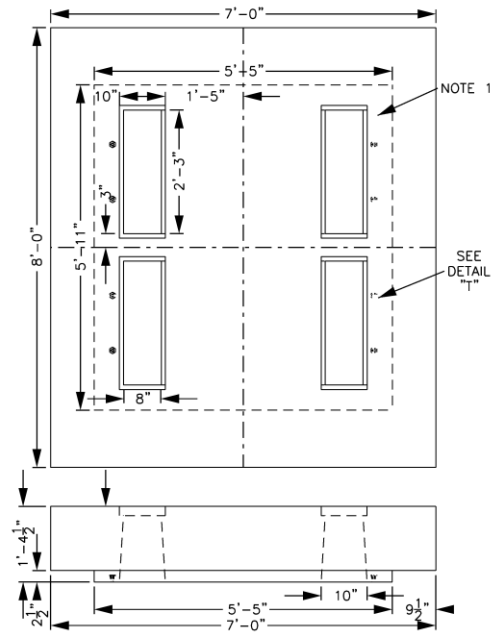


NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–$\frac{5}{8}$"X1–$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

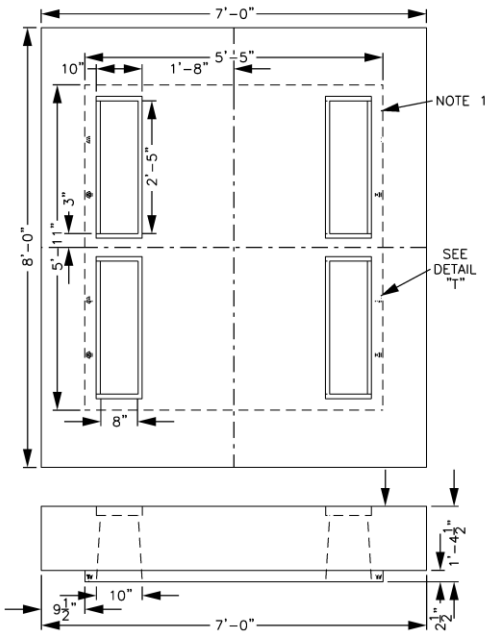
Designer	Drawing	Date
MPR	MS3467–1	10/30/20
	33–111	
	UM20	

	STD ITEM	SAP ITEM ID	PS ITEM ID
with collar "A"	UM20A	1000199	9200893
with collar "B"	UM20B	1000200	9200894
with collar "C"	UM20C	1000186	9200886
with collar "D"	UM20D	1003608	NA
with collar "E"	UM20E	1000312	9201917
with collar 'F"	UM20F	1003788	NA
with collar "M"	UM20M	1001128	NA

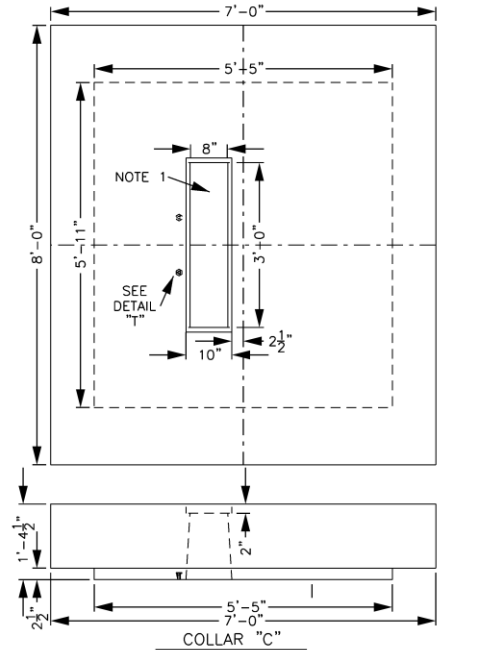
MANHOLE, SWITCHGEAR, COLLAR DETAILS



COLLAR "A"
15KV SWITCHGEAR



COLLAR "B"
25/35KV SWITCHGEAR

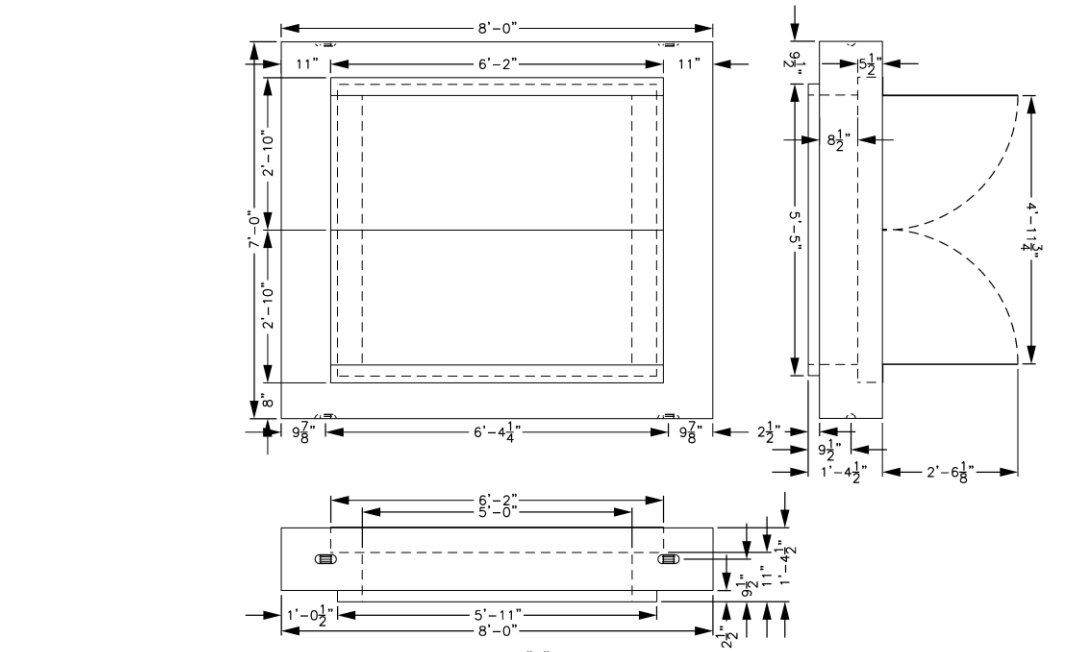


COLLAR "C"
CONVENTIONAL PADMOUNT RECLOSER 15/27KV CLASS
AND SWITCH PAD STANDARD US34A

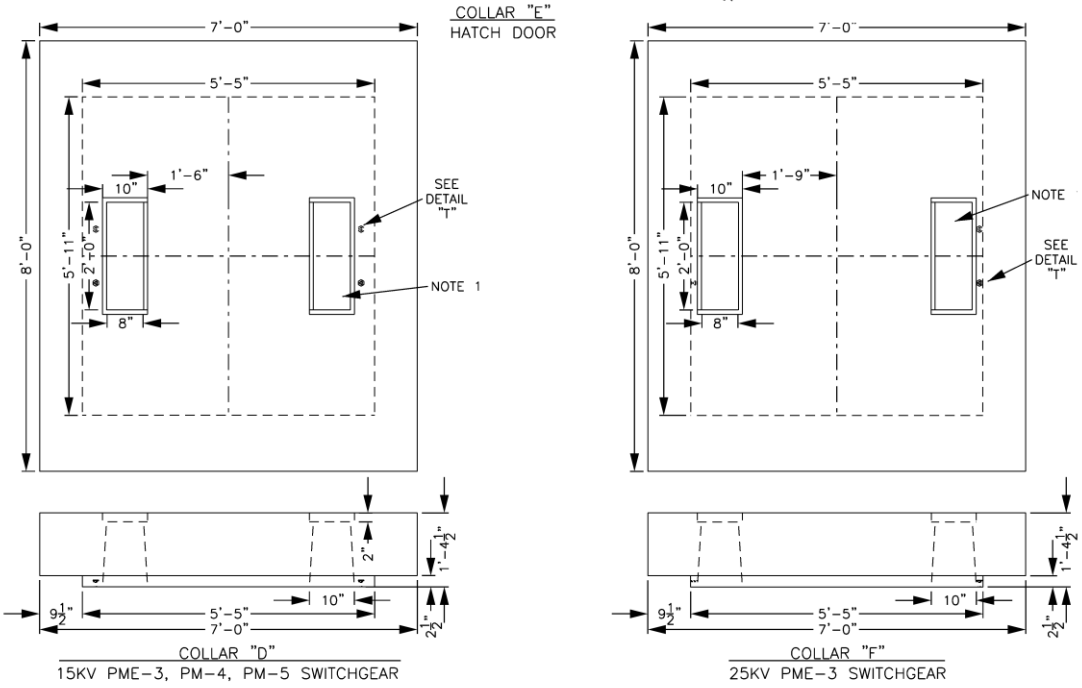
NOTE:
1. EXTRUDED POLYSTYRENE (XPS) RIGID FOAM INSULATION RECCESSED IN CABLE OPENING WHERE 1" X 1" KEY X 2" DEEP IS SHOWN. SEE SECTION 3 MATERIALS FOR FURTHER DETAILS.

Designer	Drawing	Date
MPR	MS3467-2	4/30/21
	33-112	
	UM20	

MANHOLE, SWITCHGEAR, COLLAR DETAILS cont.



COLLAR "E"
HATCH DOOR



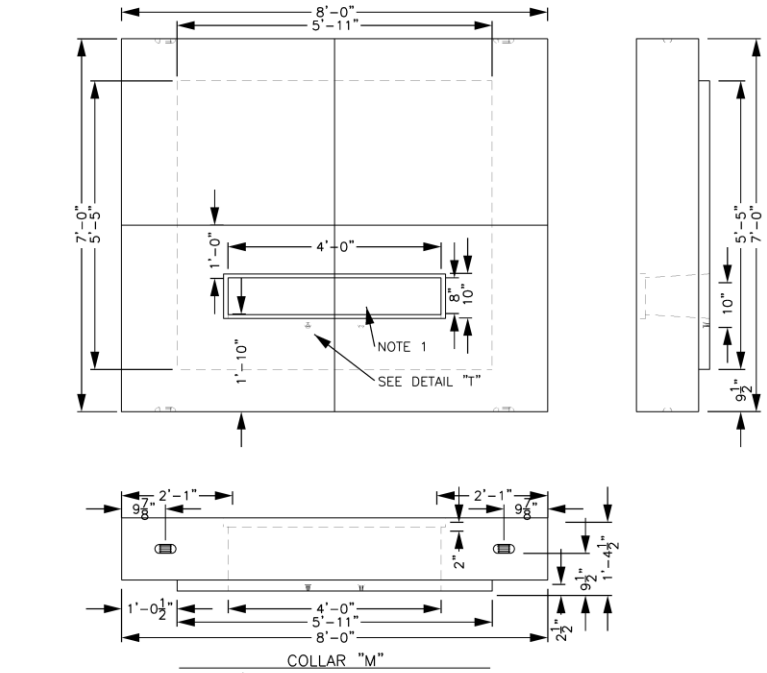
COLLAR "D"
15KV PME-3, PM-4, PM-5 SWITCHGEAR

COLLAR "F"
25KV PME-3 SWITCHGEAR

NOTE:
1. EXTRUDED POLYSTYRENE (XPS) RIGID FOAM INSULATION RECCESSED IN CABLE OPENING WHERE 1" X 1" KEY X 2" DEEP IS SHOWN. SEE SECTION 3 OF THE SPECIFICATION FOR FURTHER DETAILS.

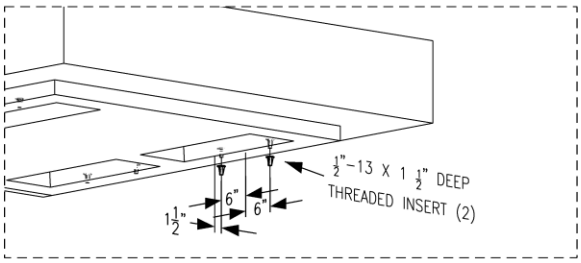
Designer	Drawing	Date
MPR	MS3467-3	4/30/21
	33-113A	
	UM20	

MANHOLE, SWITCHGEAR, COLLAR DETAILS



COLLAR "M"

FOR PRIMARY METERING 15/27KV CLASS AND HI DUTY RECLOSER 15KV CLASS



DETAIL "T"

NOTE:
1. EXTRUDED POLYSTYRENE (XPS) RIGID FOAM INSULATION RECCESSED IN CABLE OPENING WHERE 1" X 1" KEY X 2" DEEP IS SHOWN. SEE SECTION 3 MATERIALS FOR FURTHER DETAILS.

Designer	Drawing	Date
MPR	MS3467-4	11/24/21
	33-113B	
	UM20	

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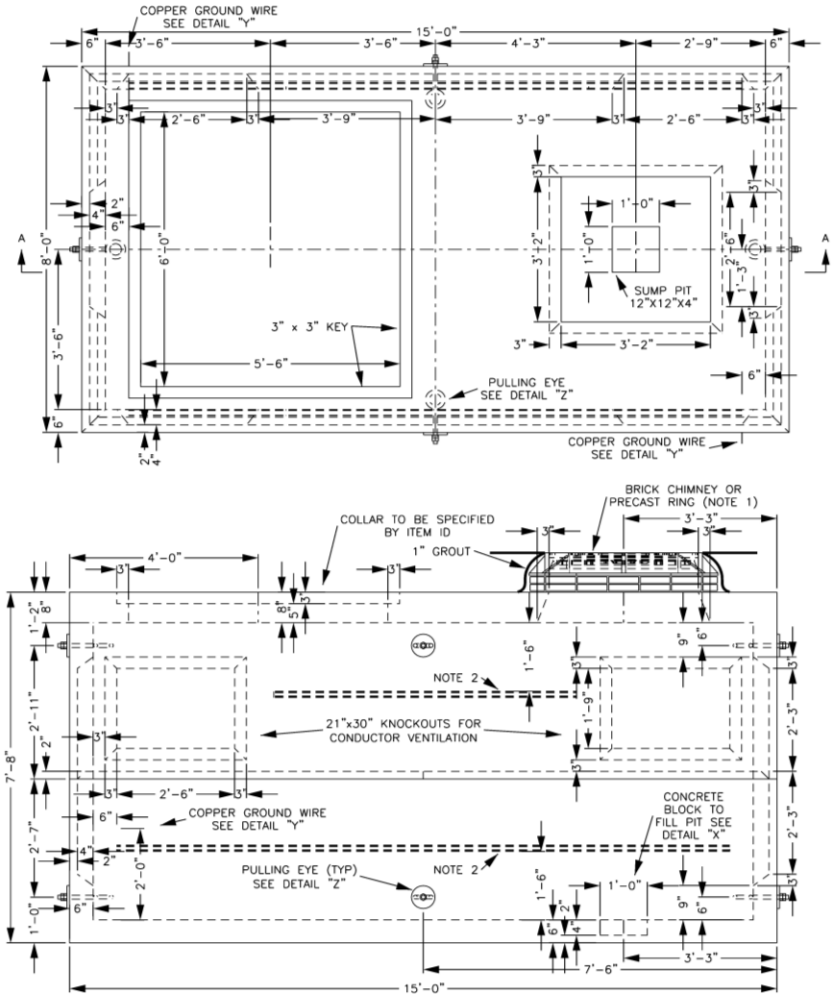
MANHOLE, DISTRIBUTION, SWITCHGEAR

Precast concrete. Two piece manhole, 14’ x 7’ x 6’-6” ID. In accordance with PPL Material Specification Standards MS-3474.

NOTE: This is a ‘Profiled Item’. It is not stocked and a material request must be completed when needed.

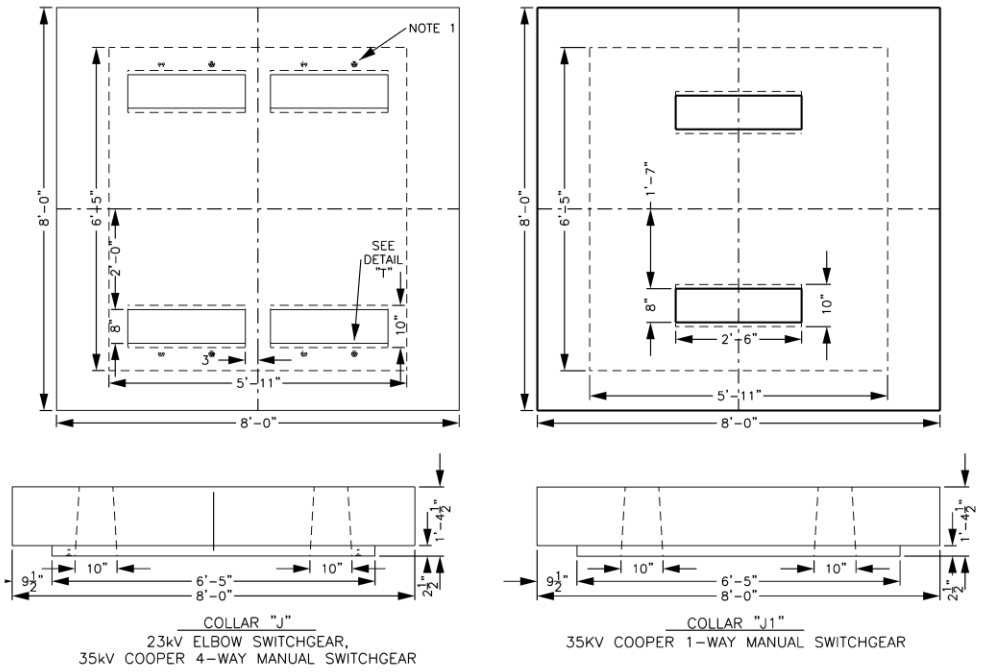


NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–$\frac{3}{8}$"X1–$\frac{3}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

Designer	Drawing	Date
MPR	MS3474–1	6/15/19
	33–126	
	UM21	

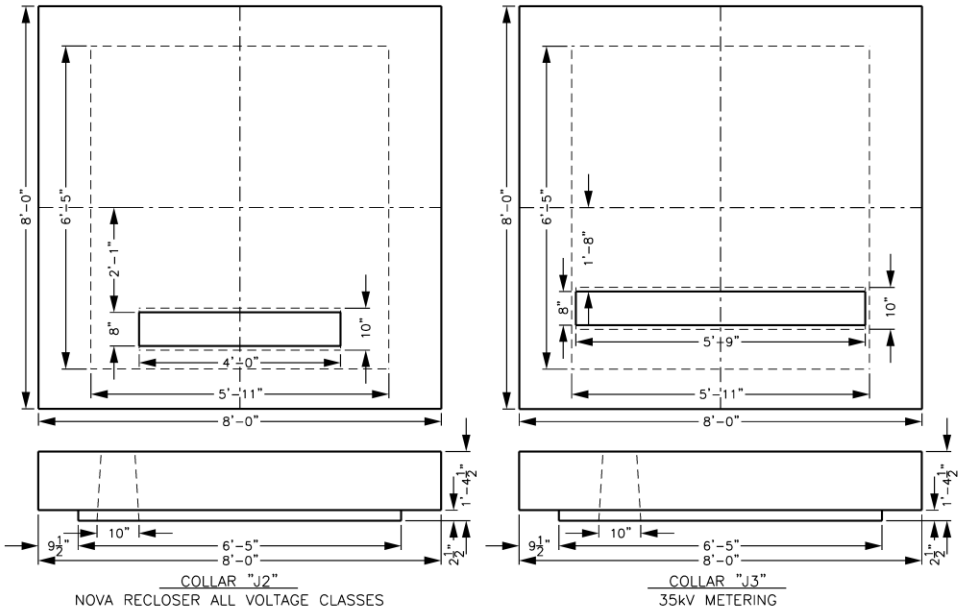
STD ITEM	SAP ITEM ID	
UM21J	1000858	with collar “J”
UM21J1	1004061	with collar “J1”
UM21J2	1004062	with collar “J2”
UM21J3	1004058	with collar “J3”

MANHOLE, SWITCHGEAR, COLLAR "J " DETAILS



COLLAR "J"
23kV ELBOW SWITCHGEAR,
35kV COOPER 4-WAY MANUAL SWITCHGEAR

COLLAR "J1"
35KV COOPER 1-WAY MANUAL SWITCHGEAR



COLLAR "J2"
NOVA RECLOSER ALL VOLTAGE CLASSES

COLLAR "J3"
35kV METERING

Designer	Drawing	Date
MPR	MS3474-2	10/18/21
	33-127A	
	UM21	

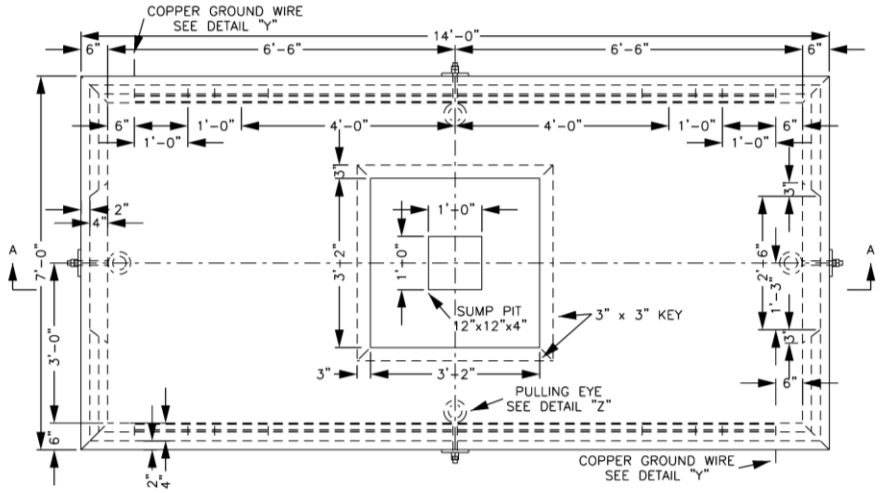
MATERIAL DESCRIPTION

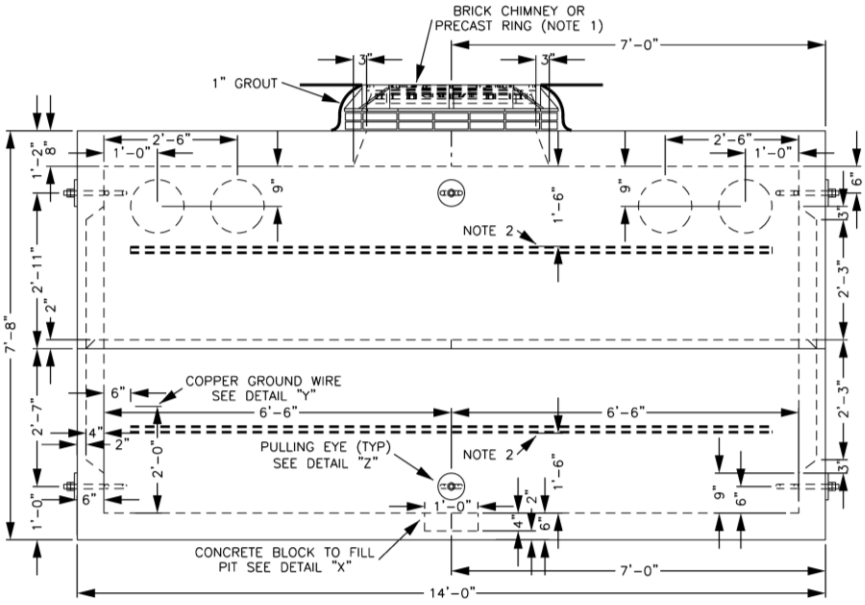
ISSUE	PAGE NUMBER	UNDERGROUND CONSTRUCTION STANDARD	ppl
7/22	50 – UM21-1		

MANHOLE, DISTRIBUTION, 2-WAY

Precast concrete. Two piece manhole, 6' x 13' x 6'-6" ID with square opening. In accordance with PPL Material Specification Standards MS-3462.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.





NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"-36" RING) AND UM14C(26" COVER).
2. INSTALL 1-$\frac{5}{8}$"X1-$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

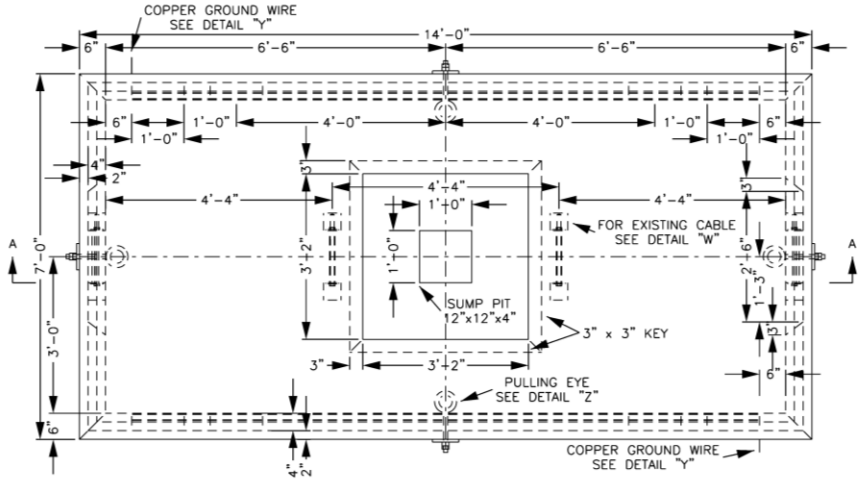
Designer	Drawing	Date
MPR	MS3462-1	10/30/20
	33-103	
	UM22	

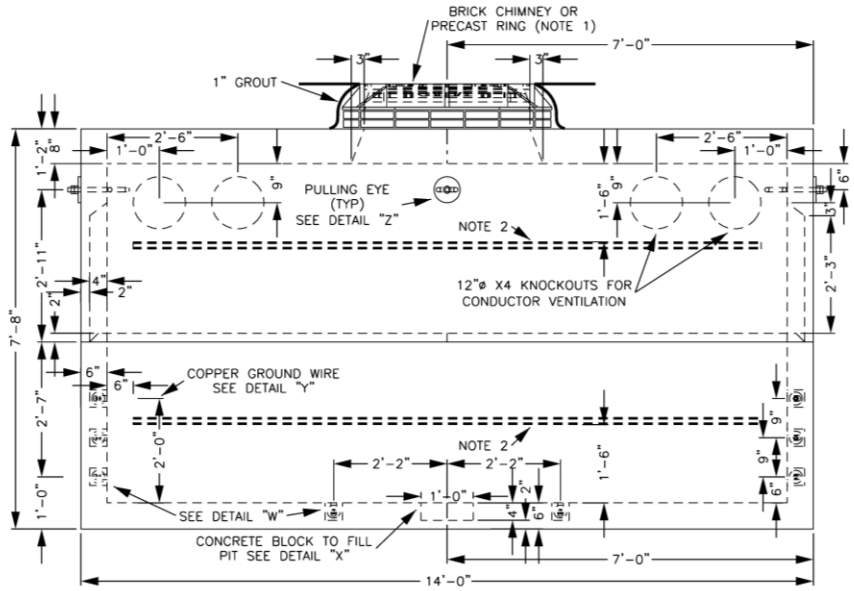
STD ITEM	SAP ITEM ID	PS ITEM ID
UM22	1000189	9200889

MANHOLE, DISTRIBUTION, 2-WAY

Precast concrete. Three piece, split bottom, manhole, 6' x 13' x 6'-6" ID with square opening. Designed for use around existing cables. In accordance with PPL Material Specification Standards MS-3466.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.





NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"-36" RING) AND UM14C(26" COVER).
2. INSTALL 1-⅝"X1-⅝" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

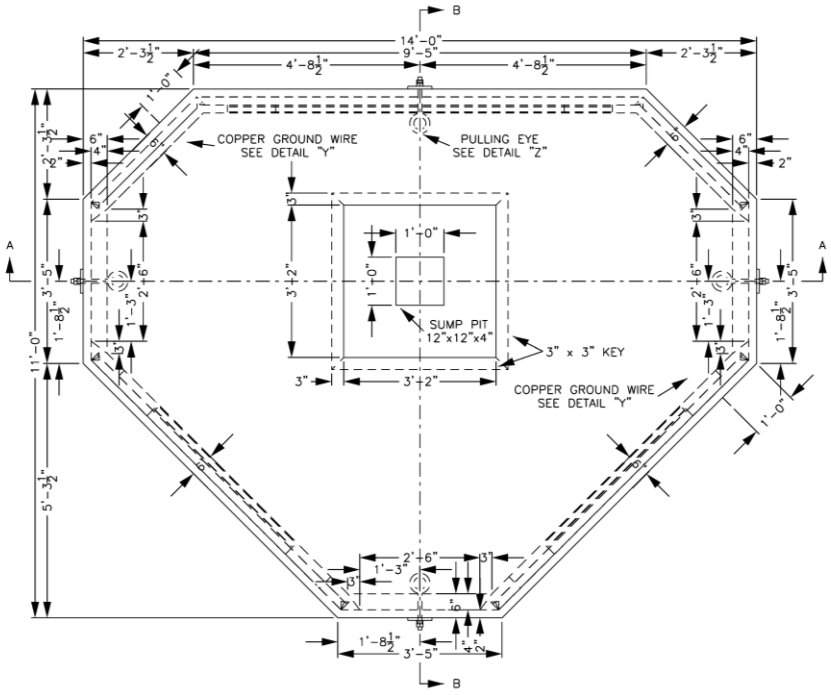
Designer	Drawing	Date
MPR	MS3466-1	10/30/20
	33-109	
	UM22S	

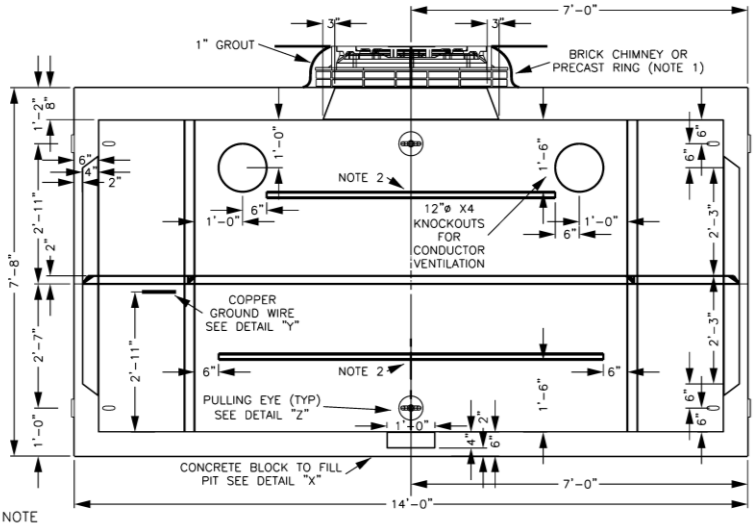
STD ITEM	SAP ITEM ID	PS ITEM ID
UM22S	1000192	9200892

MANHOLE, DISTRIBUTION, 3-WAY

Precast concrete. Two piece manhole, 10' x 13' x 6'-6" ID with square opening. In accordance with PPL Material Specification Standards MS-3464.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.





NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–⅝"X1–⅝" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

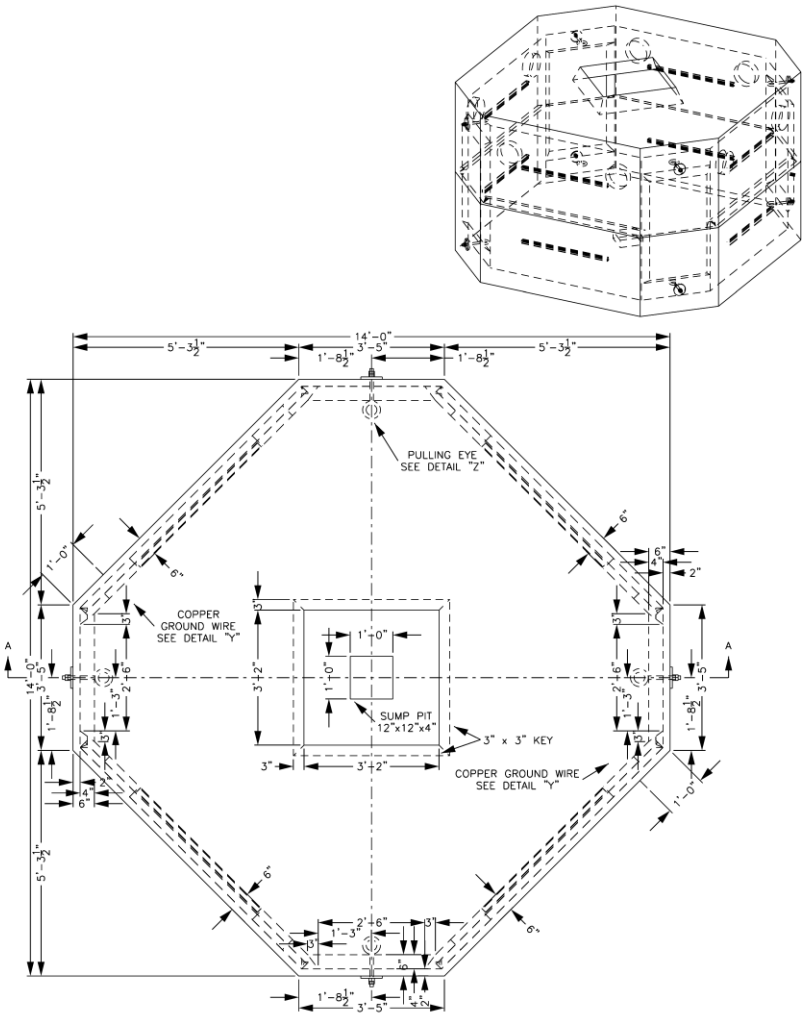
Designer	Drawing	Date
MPR	MS3464–1	10/30/20
	33–105	
	UM23	

STD ITEM	SAP ITEM ID	PS ITEM ID
UM23	1000190	9200890

MANHOLE, DISTRIBUTION, 4-WAY

Precast concrete. Two piece manhole, 13' x 13' x 6'-6" ID with square opening. In accordance with PPL Material Specification Standards MS-4365.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.

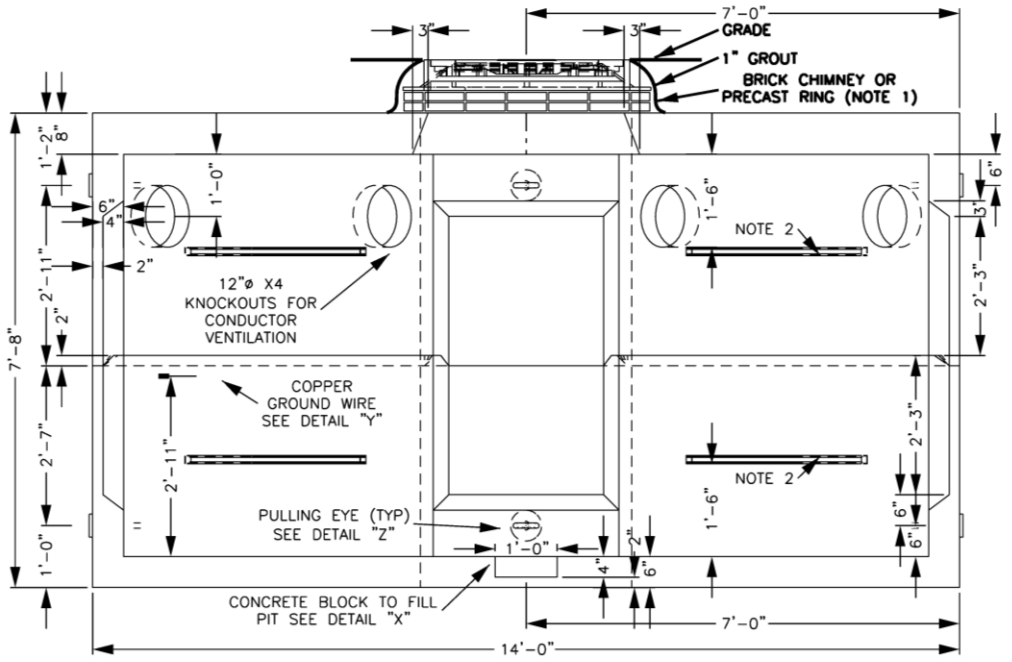


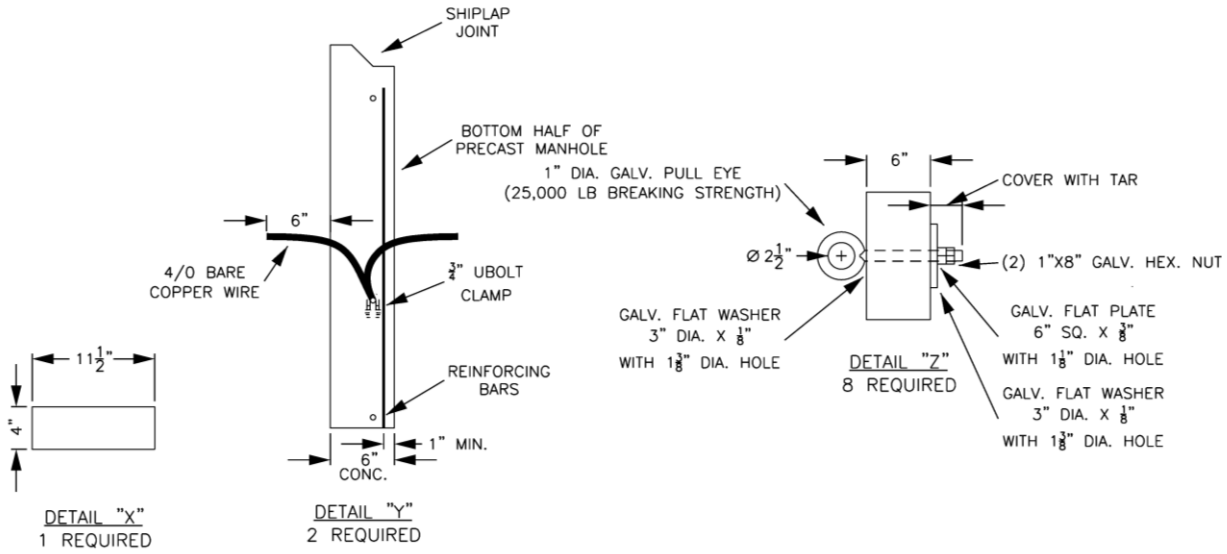
NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"-36" RING) AND UM14C(26" COVER).
2. INSTALL 1-$\frac{5}{8}$"X1-$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

Designer	Drawing	Date
MPR	MS3465-1	3/15/19
	33-107	
	UM24	

STD ITEM	SAP ITEM ID	PS ITEM ID
UM24	1000191	9200891

MANHOLE, DISTRIBUTION, 4-WAY (continued)





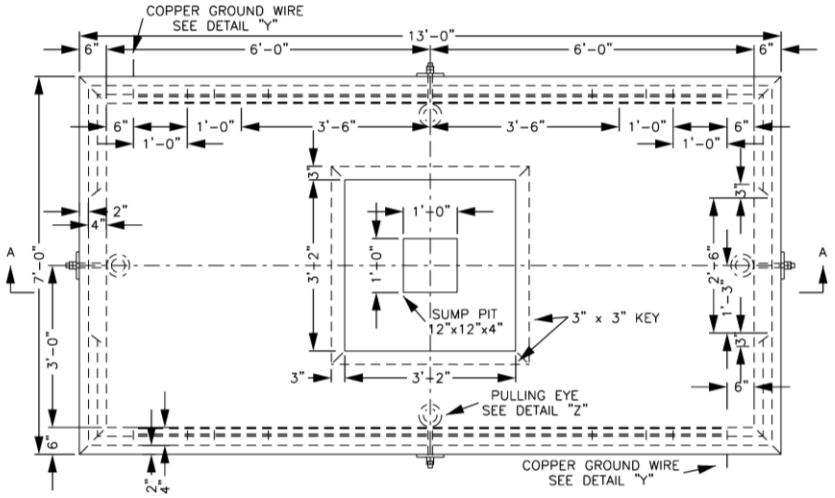
Designer	Drawing	Date
MPR	MS3465-2	10/30/20
	33-108	
	UM24	

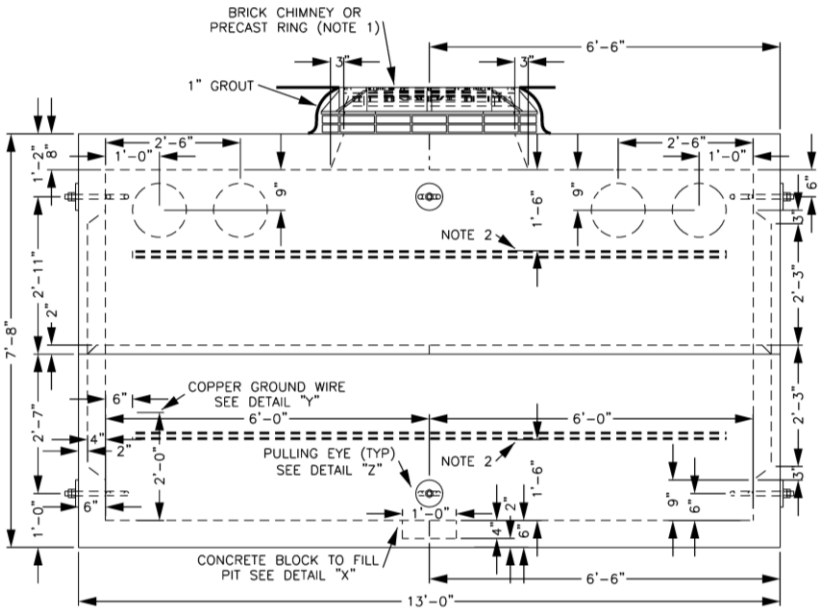
STD ITEM	SAP ITEM ID	PS ITEM ID
UM24	1000191	9200891

MANHOLE, DISTRIBUTION, 2-WAY

Precast concrete. Two piece manhole, 6' x 12' x 6'-6" ID with square opening. In accordance with PPL Material Specification Standards MS-3468.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.





NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–$\frac{5}{8}$"X1–$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

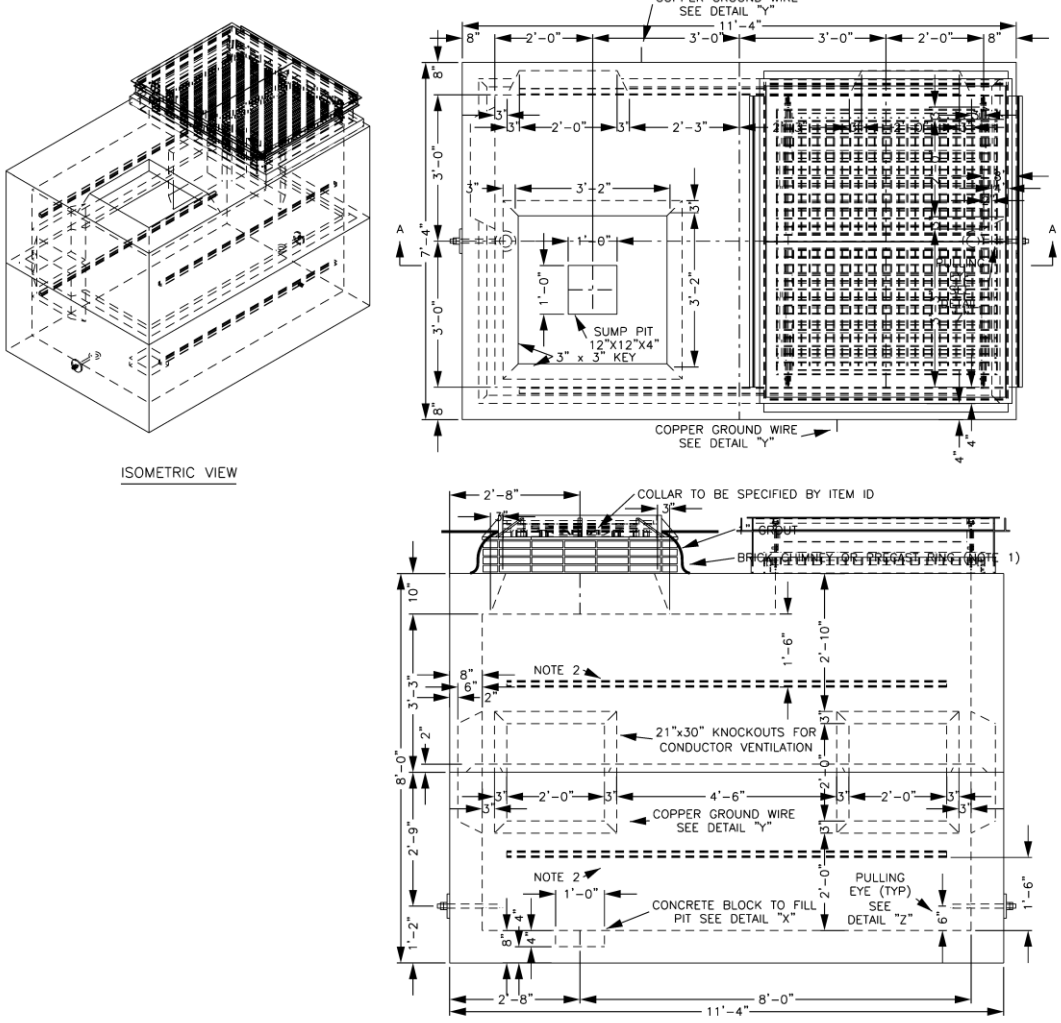
Designer	Drawing	Date
MPR	MS3468–1	10/30/20
	33–116	
	UM25	

STD ITEM	SAP ITEM ID	PS ITEM ID
UM25	1000473	9202182

MANHOLE, DISTRIBUTION, SIDEWALK

Precast concrete. Two piece manhole, 6' x 10' x 6'-6" ID with two openings. In accordance with PPL Material Specification Standards MS-3469.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–$\frac{5}{8}$"X1–$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

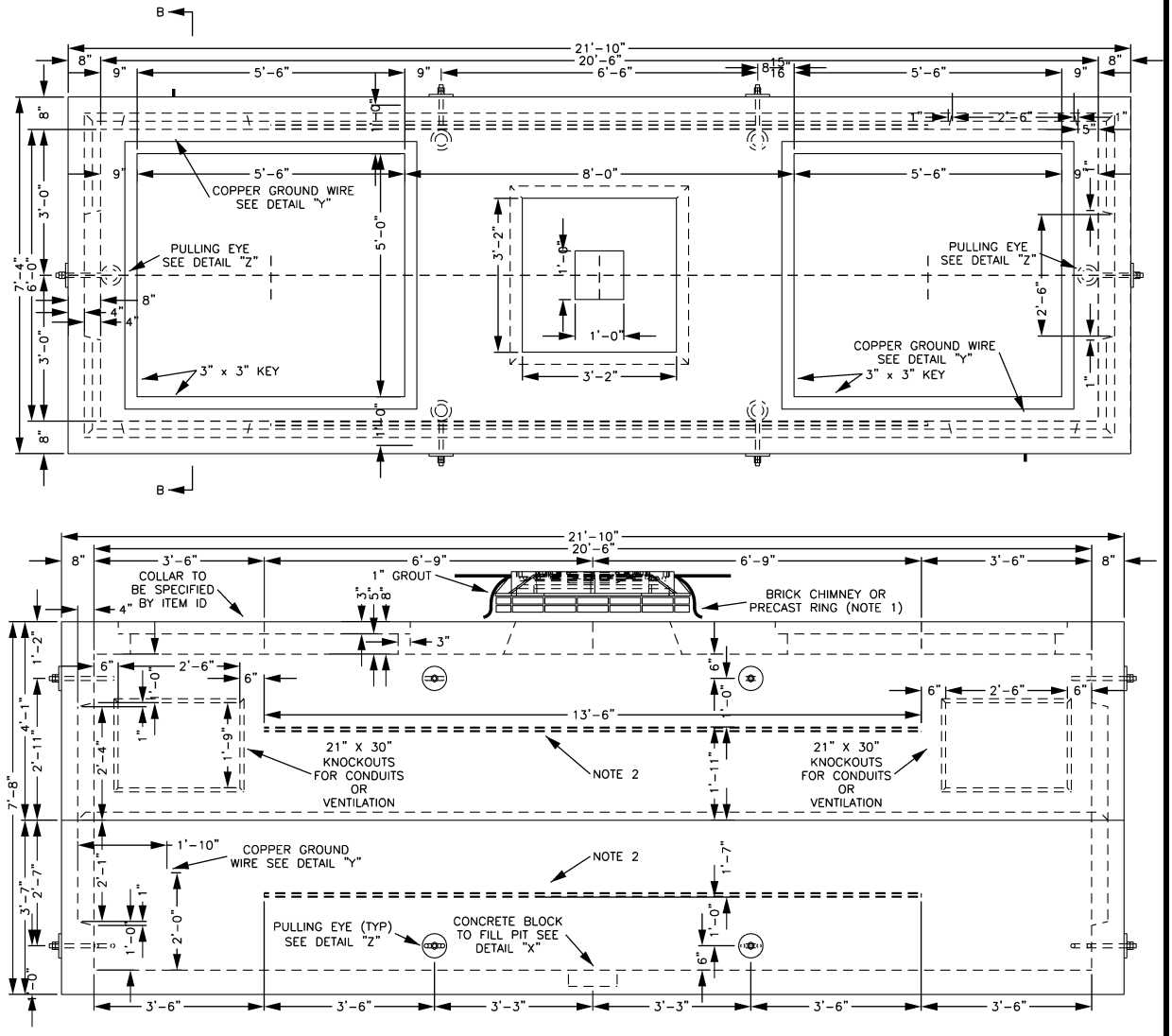
Designer	Drawing	Date
MPR	MS3469–1	10/30/20
	33–120A	
	UM28	

STD ITEM	SAP ITEM ID	PS ITEM ID
UM28	1000279	9202100

MANHOLE, DOUBLE SWITCHGEAR

Precast concrete. Two piece manhole, 6' x 20'-6" x 6'-6" ID with two openings for switchgear collars. In accordance with PPL Material Specification Standards MS-3473.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



STD ITEM	SAP ITEM ID	PS ITEM ID
UM30	1003818	N/A

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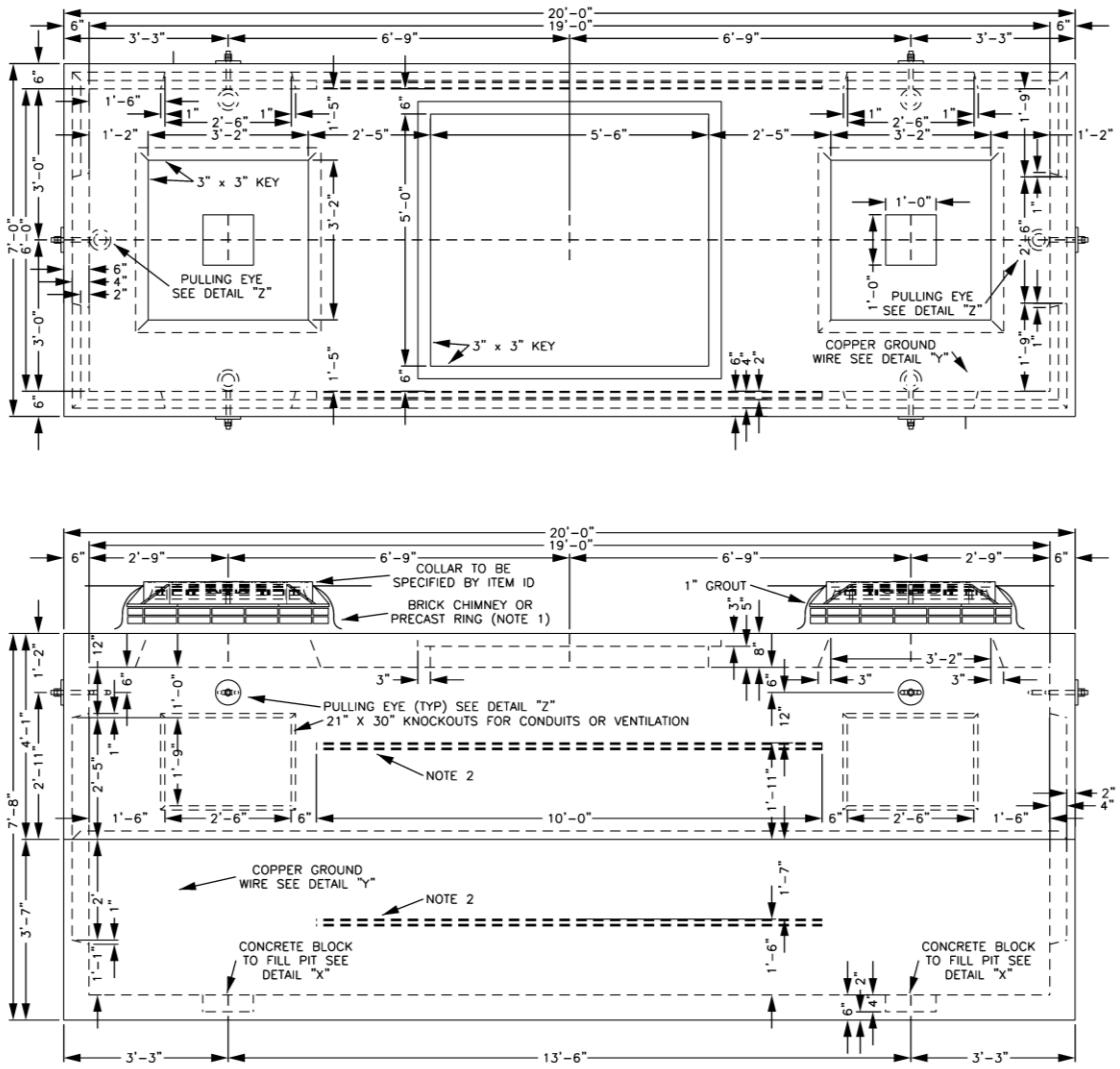
MANHOLE, DISTRIBUTION, DOUBLE ENTRY

Precast concrete. Two piece manhole, 19' x 6' x 6'-6" ID with two square openings and one hatchway opening. In accordance with PPL Material Specification Standards MS-3471.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–$\frac{5}{8}$"X1–$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

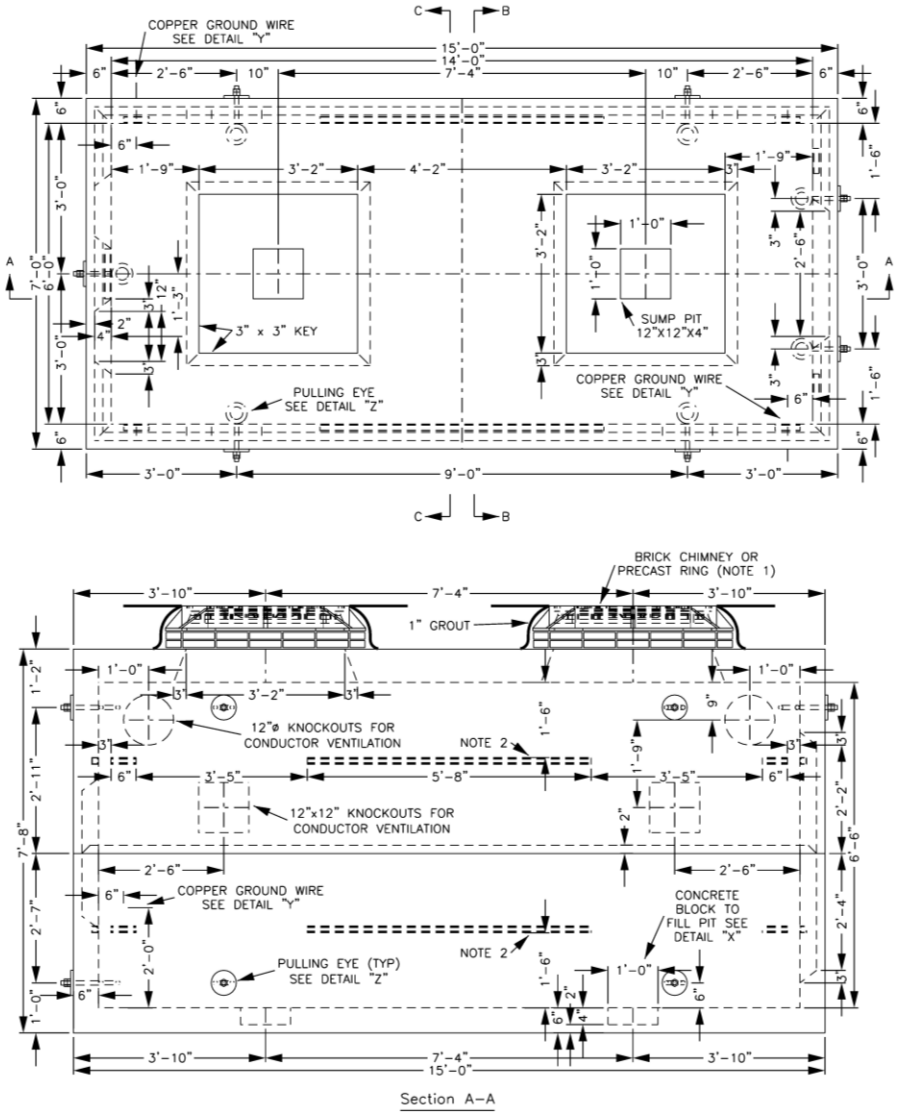
Designer	Drawing	Date
MPR	MS3471–1	10/30/20
	33–124	
	UM31	

STD ITEM	SAP ITEM ID	PS ITEM ID
UM31	1000329	9202167

MANHOLE, DISTRIBUTION, DOUBLE ENTRY

Precast concrete. Two piece, 14' x 6' x 6'-6" I.D. In accordance with PPL Material Specification Standards MS-3472.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"-36" RING) AND UM14C(26" COVER).
2. INSTALL 1-$\frac{5}{8}$"X1-$\frac{5}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

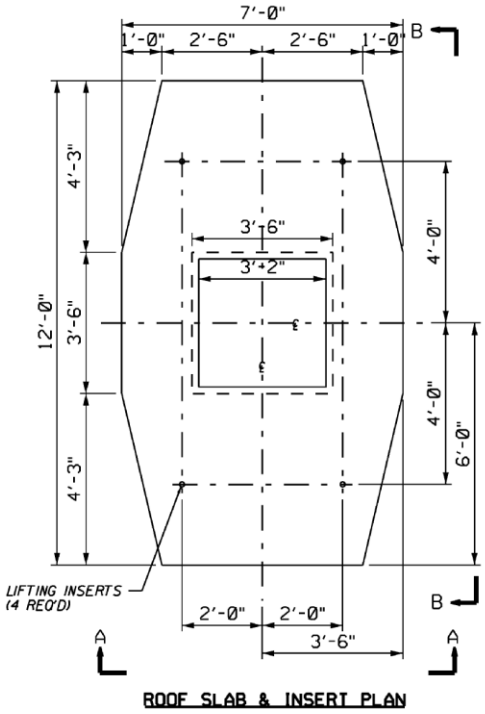
Designer	Drawing	Date
MPR	MS3472-1	10/30/20
	33-130	
	UM32	

STD ITEM	SAP ITEM ID	PS ITEM ID
UM32	1000474	9202674

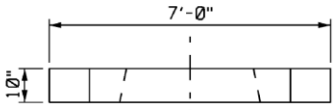
COVER, MANHOLE, DISTRIBUTION, BARREL SHAPE

Precast concrete. One piece manhole cover, 12' x 7' x 10" with one square opening. In accordance with PPL Material Specification Standards MS-3470.

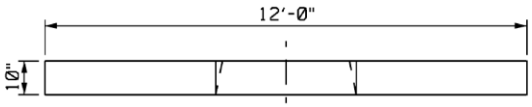
NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



ROOF SLAB & INSERT PLAN



SECTION A-A



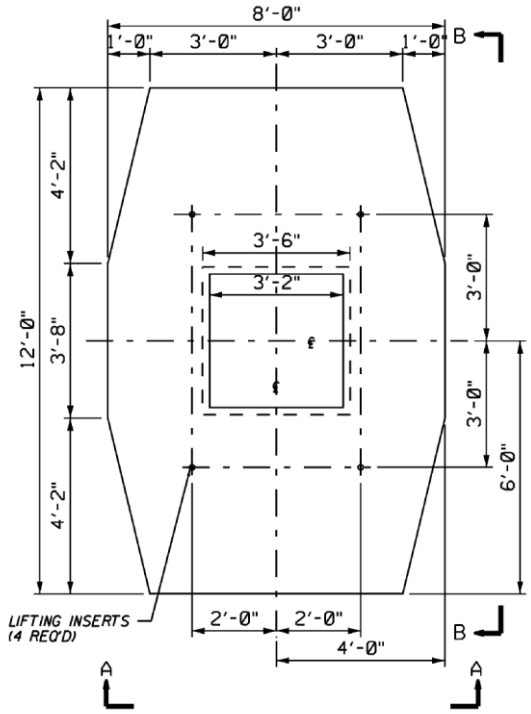
SECTION B-B

STD ITEM	SAP ITEM ID	PS ITEM ID
UM33	1000470	9202173

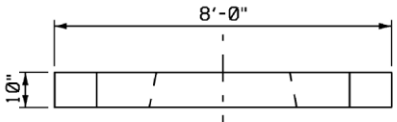
COVER, MANHOLE, DISTRIBUTION, BARREL SHAPE

Precast concrete. One piece manhole cover, 12' x 8' x 10" with one square opening. In accordance with PPL Material Specification Standards MS-3470.

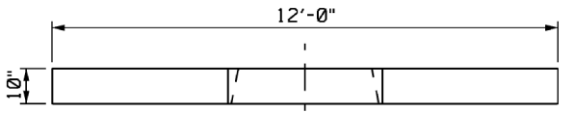
NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



ROOF SLAB & INSERT PLAN



SECTION A-A



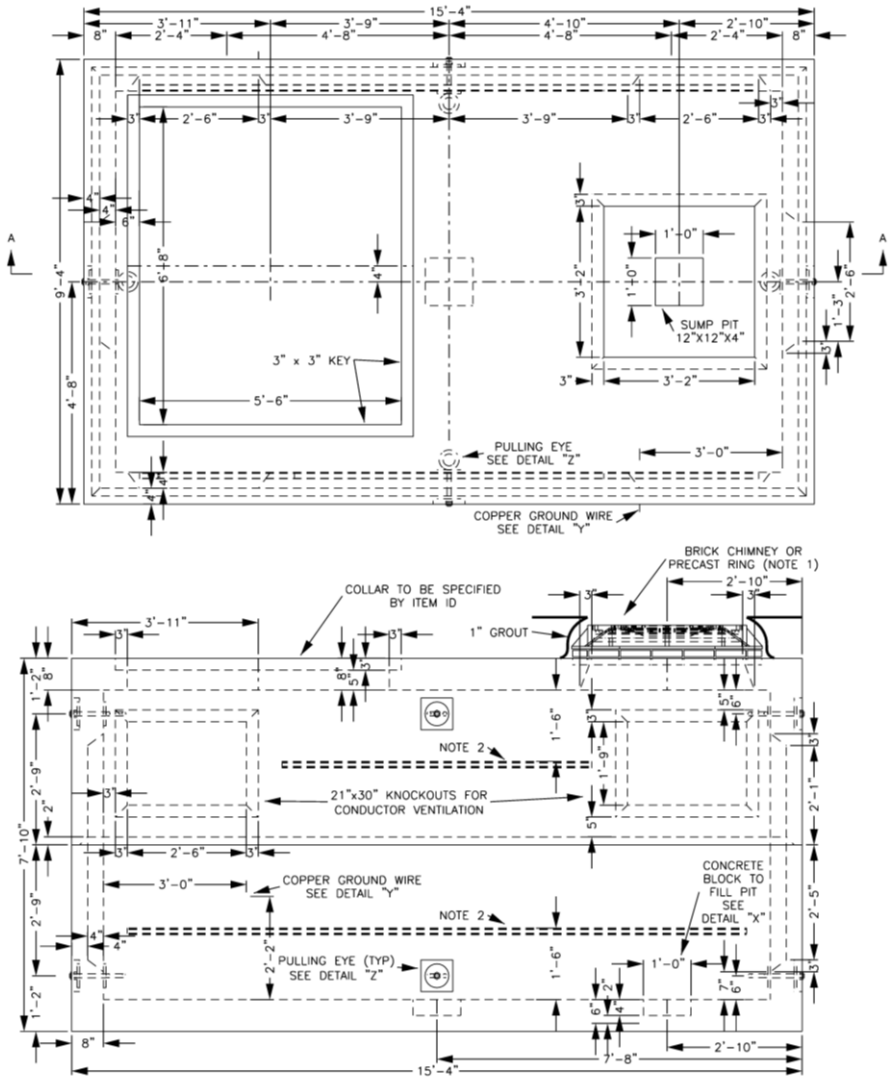
SECTION B-B

STD ITEM	SAP ITEM ID	PS ITEM ID
UM34	1000331	9202171

MANHOLE, DISTRIBUTION, SWITCHGEAR

Precast concrete. Two-piece manhole, 14' x 8' x 6'-8" ID. In accordance with PPL Material Specification Standards MS-3476.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.

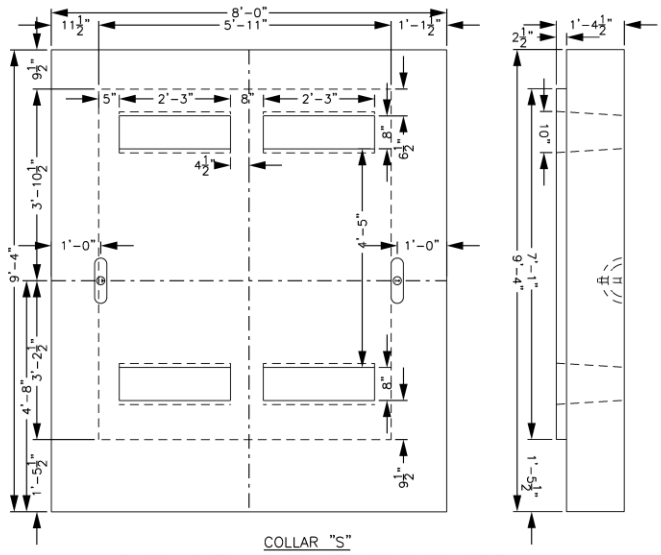


NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–$\frac{3}{8}$"X1–$\frac{3}{8}$" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH A TINNED CONNECTOR AND 4/0 CABLE.

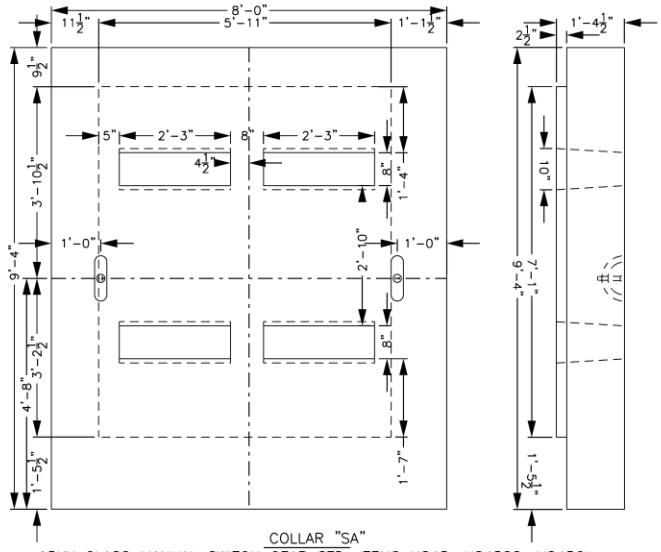
Designer	Drawing	Date
MPR	MS3476–1	10/30/20
	33–128	
	UM35	

STD ITEM	SAP ITEM ID	
UM35S	1001121	with collar "S"
UM35SA	1004068	with collar "SA"

MANHOLE, SWITCHGEAR, COLLAR "S " DETAILS



COLLAR "S"
15, 27 AND 38KV CLASS AUTOMATIC SWITCH GEAR
STD. ITEMS US39L, US39J AND US39K



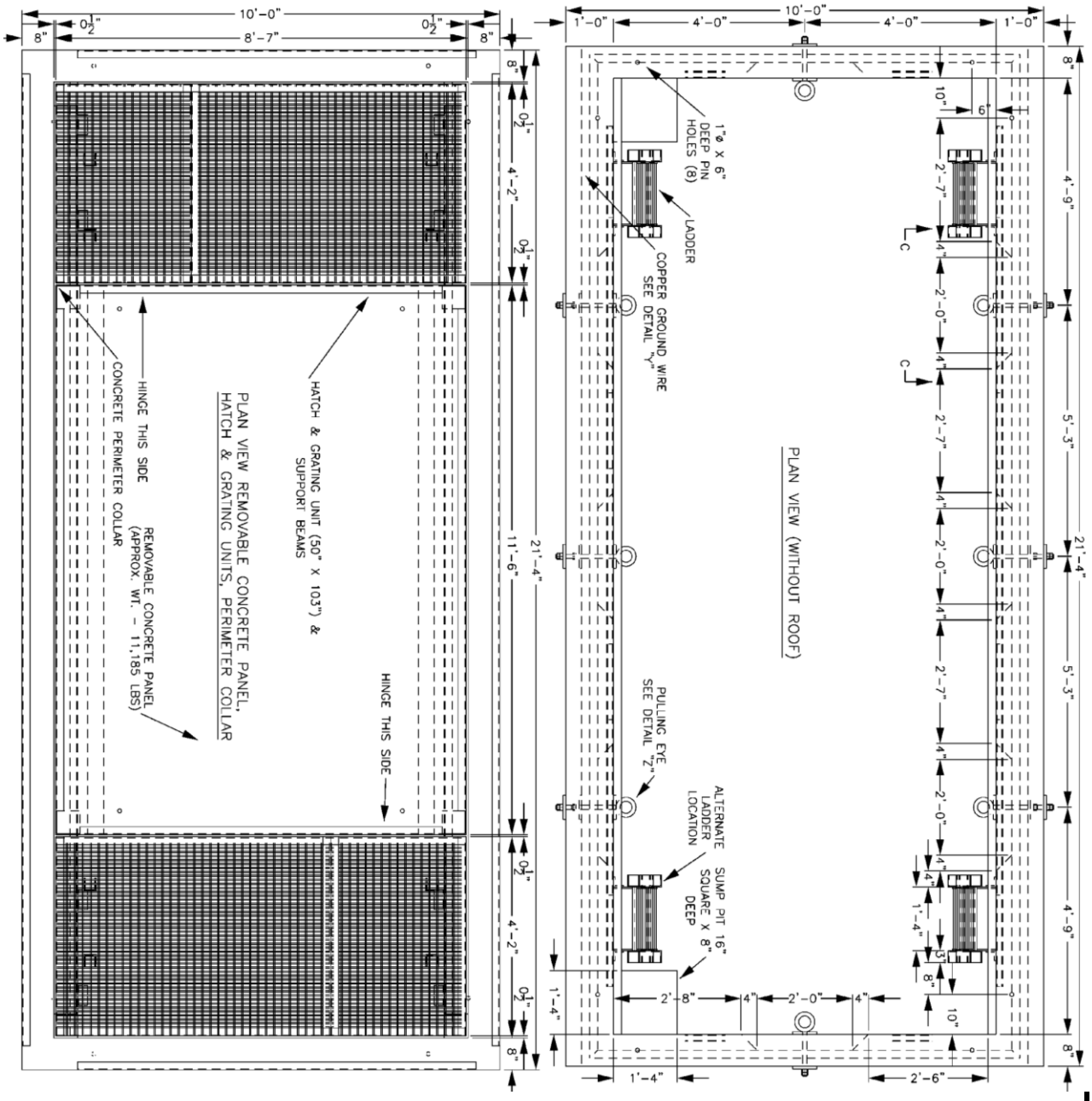
COLLAR "SA"
15KV CLASS MANUAL SWITCH GEAR STD. ITEMS US45, US45SS, US45CL,
US45A, US45ASS, AND US45C

Designer	Drawing	Date
MPR	MS3476-2	12/1/21
	33-129A	
	UM35	

VAULT, DISTRIBUTION,NETWORK TRANSFORMER UP TO 750kVA

Vault, precast concrete, 8’ x 20’ x 11’ ID, Roof to be H20 rated, See MS-3490 for complete specification.

NOTE: This is a ‘Profiled Item’. It is not stocked and a material request must be completed when needed.

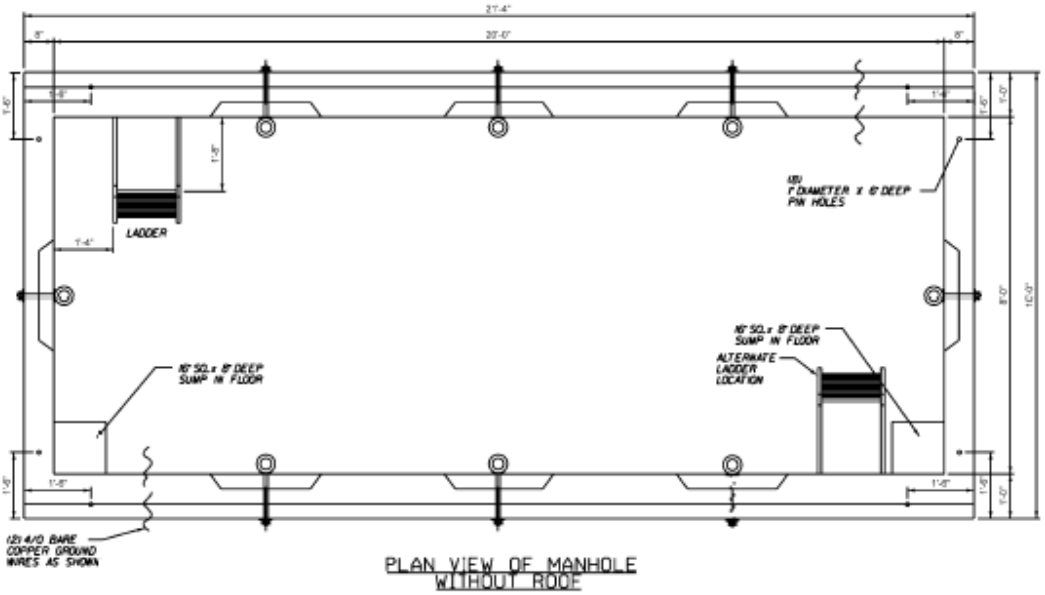


STD ITEM	SAP ITEM ID	PS ITEM ID
UM36	1000451	9202450

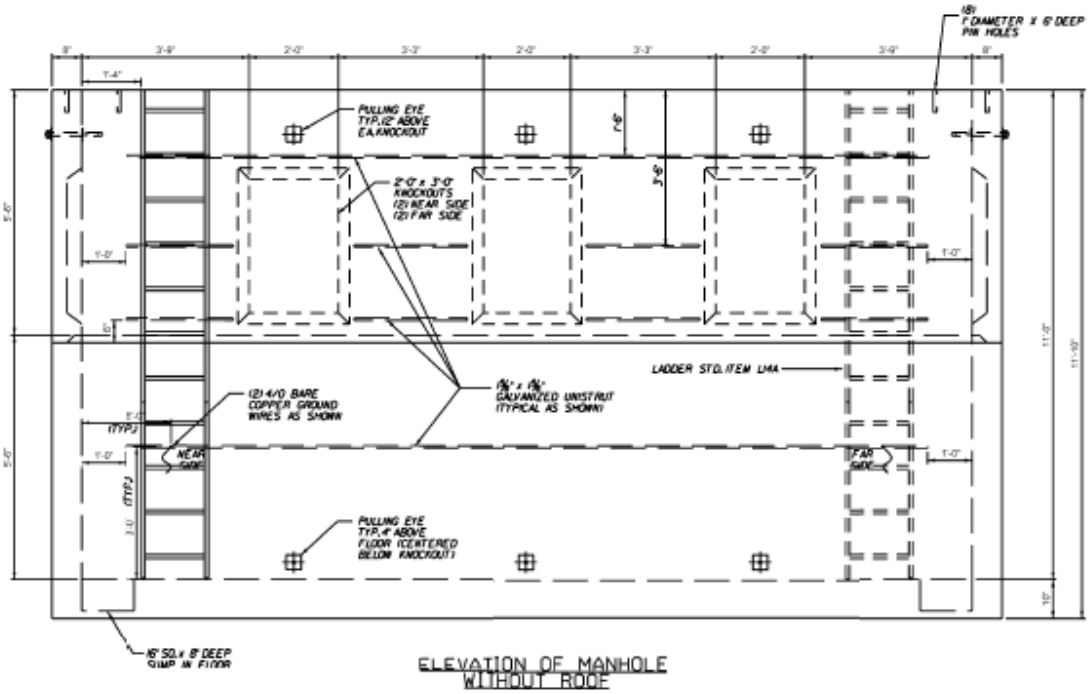
VAULT,DISTRIBUTION, RHODE ISLAND, NETWORK TRANSFORMER UP TO 750kVA

Vault, precast concrete, 8' x 20' x 11' ID, Roof to be H20 rated, See MS-3494 for complete specification. Vault uses forced ventilation.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



PLAN VIEW OF MANHOLE WITHOUT ROOF



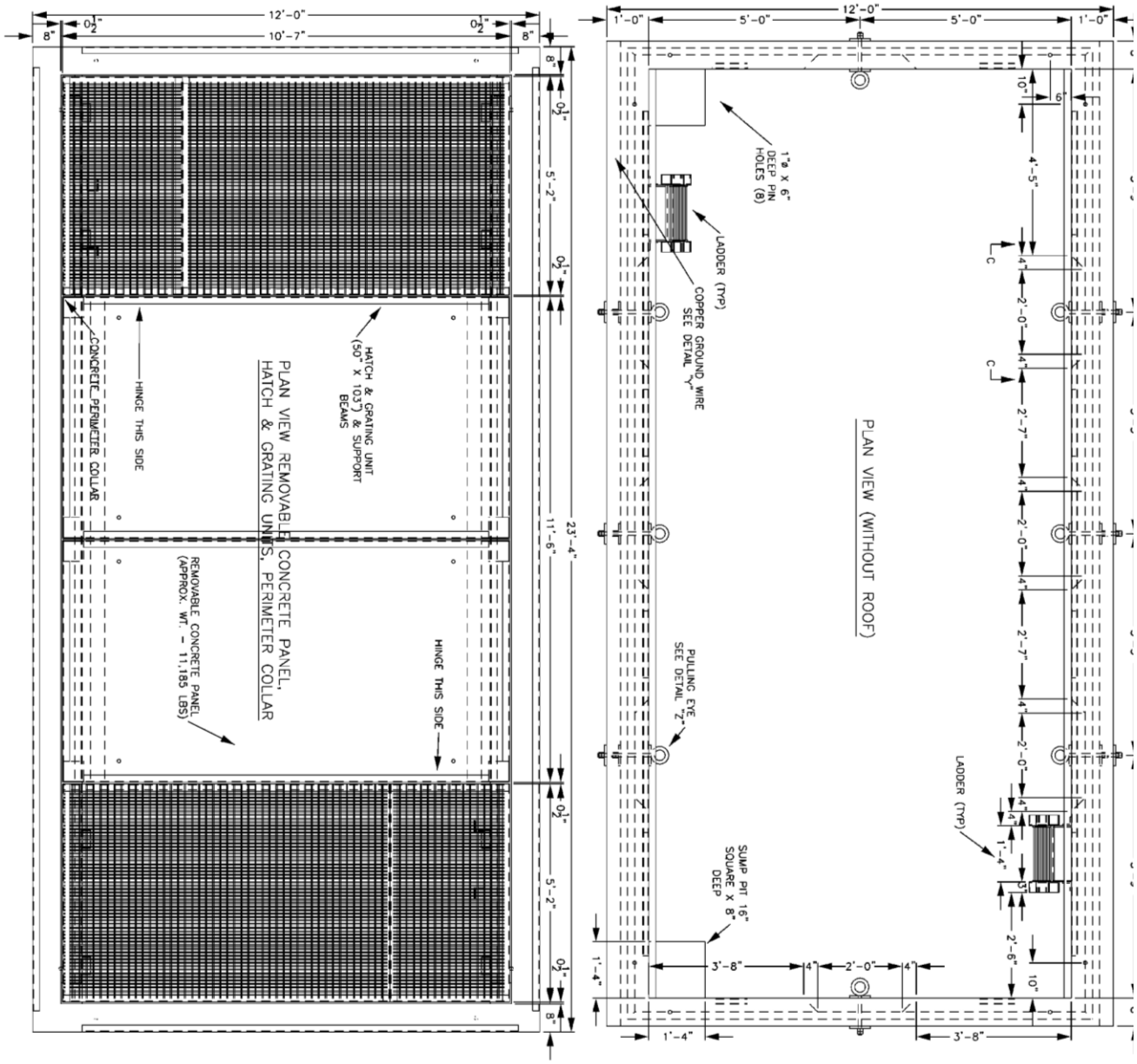
ELEVATION OF MANHOLE WITHOUT ROOF

STD ITEM	SAP ITEM ID	PS ITEM ID
UM37	1003158	NA

VAULT, DISTRIBUTION, NETWORK TRANSFORMER UP TO 2500kVA

Vault, precast concrete, 10’ x 22’ x 12’ ID, Roof to be H20 rated, See MS-3492 for complete specification.

NOTE: This is a ‘Profiled Item’. It is not stocked and a material request must be completed when needed.

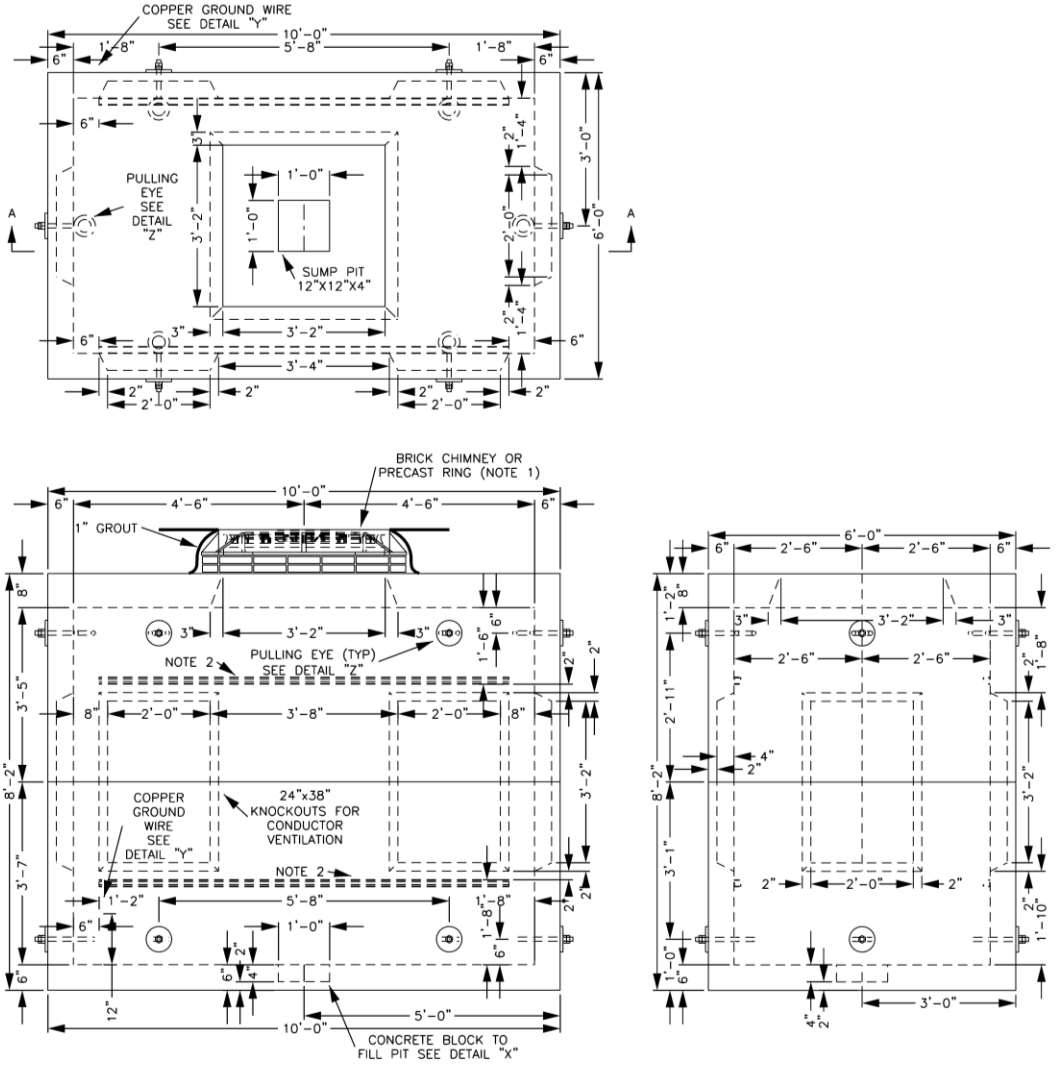


STD ITEM	SAP ITEM ID	PS ITEM ID
UM38	1000452	9202451

MANHOLE, DISTRIBUTION, MEDIUM SIZE, RECTANGULAR

Manhole, precast concrete, 5’ x 9’ x 7’ ID, 4-Way, Medium Size. See MS-3478 for complete specification.

NOTE: This is a ‘Profiled Item’. It is not stocked and a material request must be completed when needed.



NOTE
1. FOR MANHOLE CHIMNEY OR PRECAST RING SEE MS 3748, 3755 AND 3757. USE WITH UM14F(36" FRAME), UM14R(26"–36" RING) AND UM14C(26" COVER).
2. INSTALL 1–⅝"X1–⅝" HEAVY DUTY GALVANIZED UNISTRUT AND CABLE POSITIONING BRACKETS. UNISTRUT NEEDS TO BE PROPERLY BONDED TO THE GROUND GRID WITH

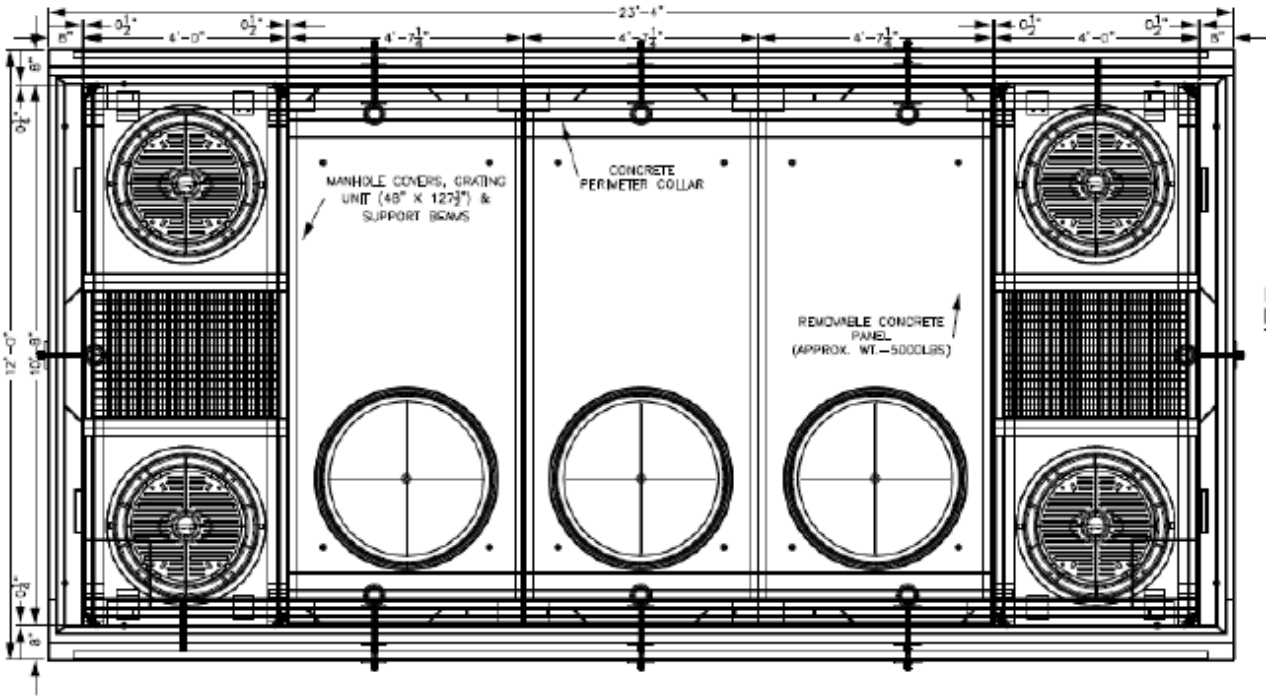
Designer	Drawing	Date
MPR	MS3478–1	3/15/19
	33–132	
	UM39	

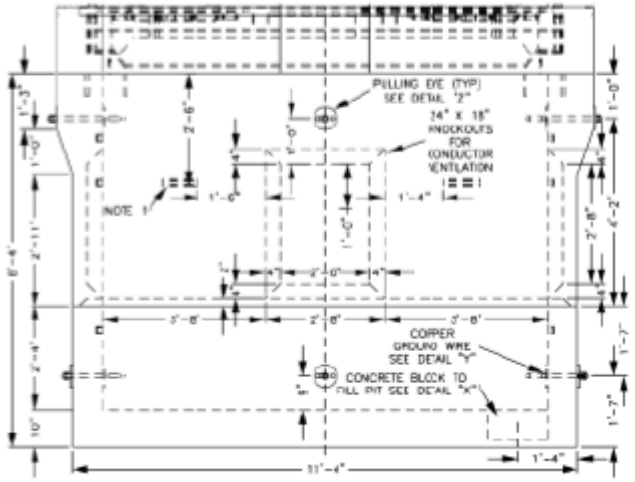
STD ITEM	SAP ITEM ID	PS ITEM ID
UM39	1001169	N/A

VAULT, DISTRIBUTION, RADIAL TRANSFORMER UP TO 500kVA

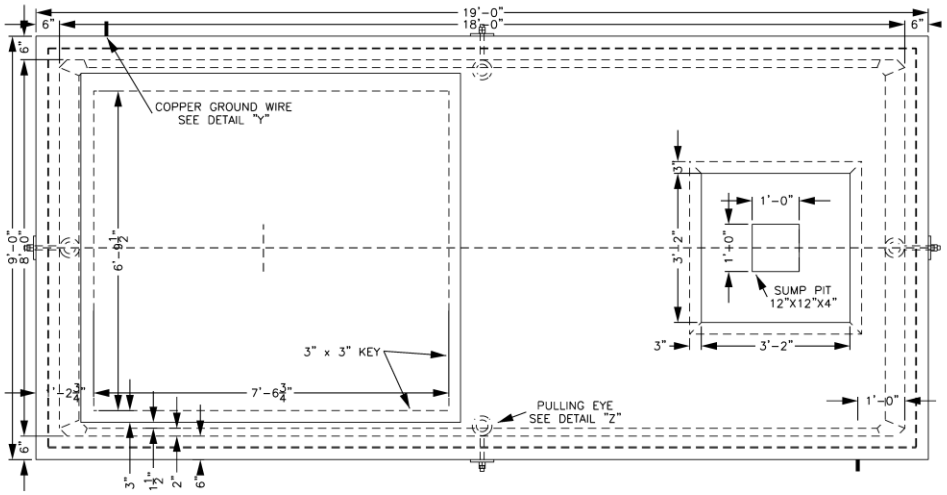
Vault, precast concrete, 10’ x 22’ x 12’ ID, Roof to be H20 rated, See MS-3495 for complete specification.

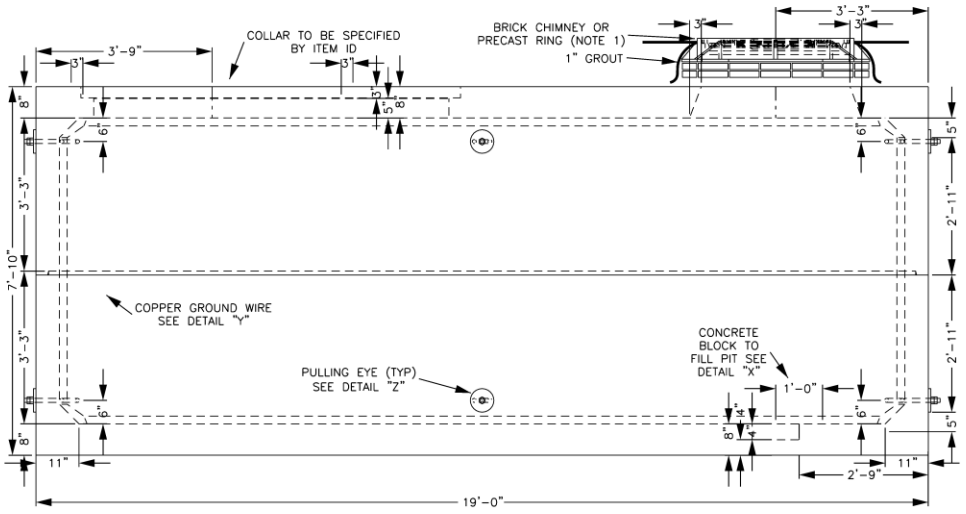
NOTE: This is a ‘Profiled Item’. It is not stocked and a material request must be completed when needed.



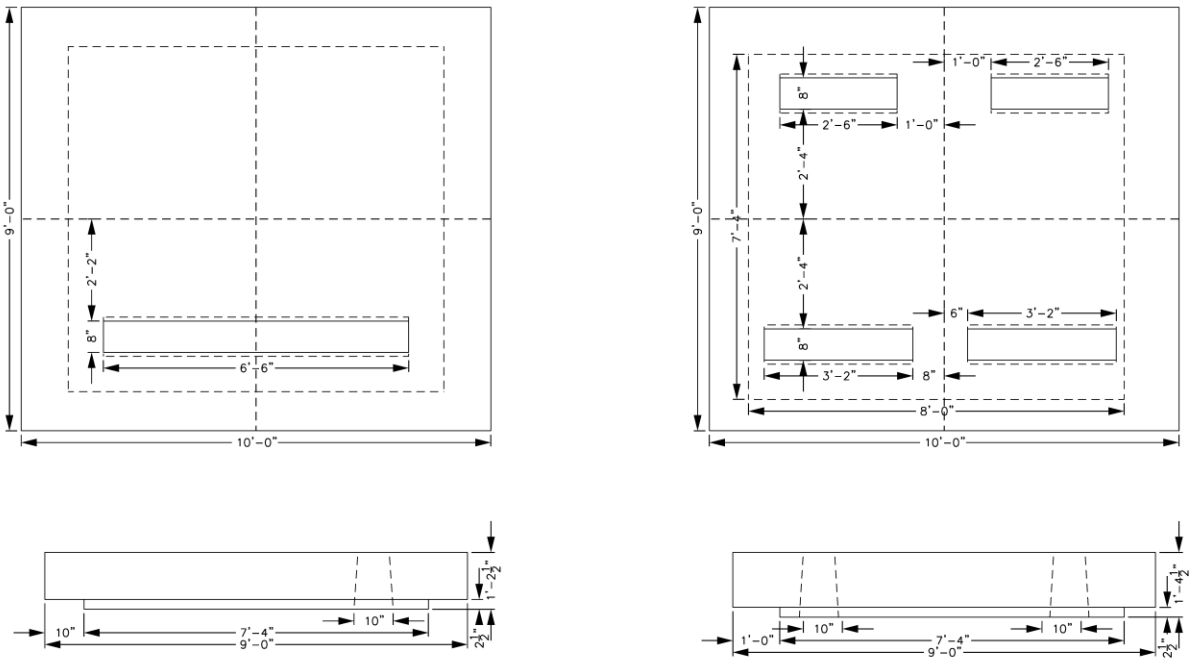


STD ITEM	SAP ITEM ID	PS ITEM ID
UM40	1003938	NA





Designer	Drawing	Date
MPR	MS3479-1	11/16/21
	33-141	
	UM41	



COLLAR "K"
HI DUTY RECLOSER US54P27

COLLAR "K1"
25kV CLASS HI DUTY LIVEFRONT SWITCHGEAR

Designer	Drawing	Date
MPR	MS3479-2	11/10/21
	33-142	
	UM41	

MATERIAL DESCRIPTION			
ISSUE	**PAGE NUMBER**	**UNDERGROUND CONSTRUCTION STANDARD**	ppl
7/22	**50 – UM41**		

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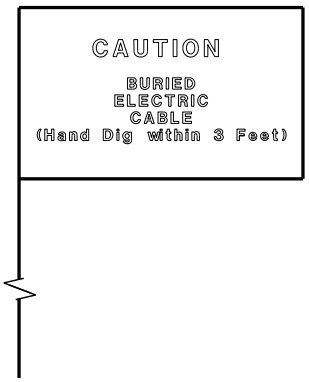
MARKER FLAG

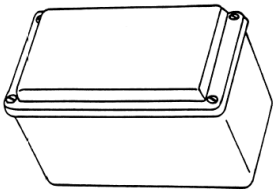
Temporary location marker, 6 in. x 5 in. PVC flag fastened to a 30 in. long steel rod. Background color shall be red and printed legend shall be white. Legend shall read “CAUTION BURIED ELECTRIC CABLE (Hand Dig within 3 Feet)”.



STD ITEM	SAP ITEM ID	PS ITEM ID
UM50	9315365	0805832

ENCLOSURE BOX

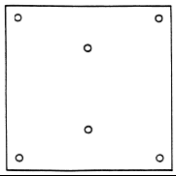
Fiberglass-reinforced plastic enclosure, grey in color, and UL listed. Enclosure shall have an internal hinged and gasketed cover and shall be watertight, raintight, dustight, oil-tight and corrosion-resistant. Furnished with four subpanel mounting screws for use with Control Unit, item UN5C, or fuse holder mounting plate, item UN1P.



SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
7½" x 6" x 5–3/16"	UN1B	9311818	2030353
11½"X8"X 6-7/8"	UN1C	9393271	

MOUNTING PLATE

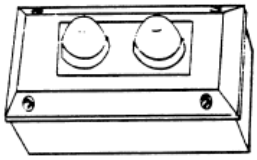
Zinc-plated steel or aluminum mounting plate, 4⅞ x 4⅞ x 5/64". Plate shall have a minimum pre-punched holes to mount a fuse holder, item UN4F, and to secure mounting plate enclosure box, item UN1B.



STD ITEM	SAP ITEM ID	PS ITEM ID
UN1P	9311817	2030354

INDICATING LIGHT

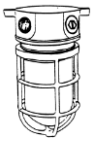
Fiberglass reinforced polyester enclosure with removable cover and associated mounting screws and gasket. Unit shall be pre-assembled with two 120V indicating lights with green polycarbonate lenses. Lights shall be suitable for 120V miniature bayonet type bulbs, #120MB. Complete unit shall be watertight, raintight, dustight, oil-tight and corrosion-resistant with approximate overall dimensions of 3¾" x 7"x 5". For use with network protectors to indicate open position.



STD ITEM	SAP ITEM ID	PS ITEM ID
UN3G	9313648[Y]	2031150[Y]

LIGHT FIXTURE

Glass-filled thermoplastic polyester, ceiling-mounted 150W maximum incandescent light fixture, grey in color, with glass globe and polyester guard. Base shall be furnished with four ¾ -inch drilled and dapped conduit holes with three of the holes supplied with removable non-metallic threaded plugs.



STD ITEM	SAP ITEM ID	PS ITEM ID
UN3L	9311424	2503470

LAMP

Lamp, Incandescent, 120VAC, 150 watt, medium base, clear bulb. For use with UN3L light fixture.

STD ITEM	SAP ITEM ID	PS ITEM ID
UN3LL	9321891	9001400

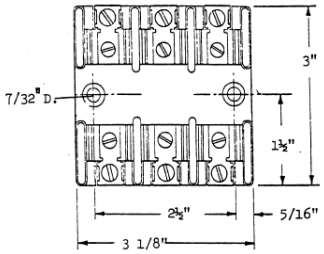
STACKLIGHT

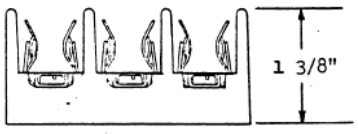
Indicator light to be used for status of the position of the network protecote

STD ITEM	SAP ITEM ID	PS ITEM ID
UN3SL	9388705	NA

FUSE HOLDER

Three-pole, 250V, 30A, Class R, UL listed fuse holder with phenolic base and tinned plated copper clips with reject feature. Furnished with screw-type connector terminals suitable for #10 AWG and smaller copper or aluminum wire. For use with fuses, item F8A, 30A and smaller.

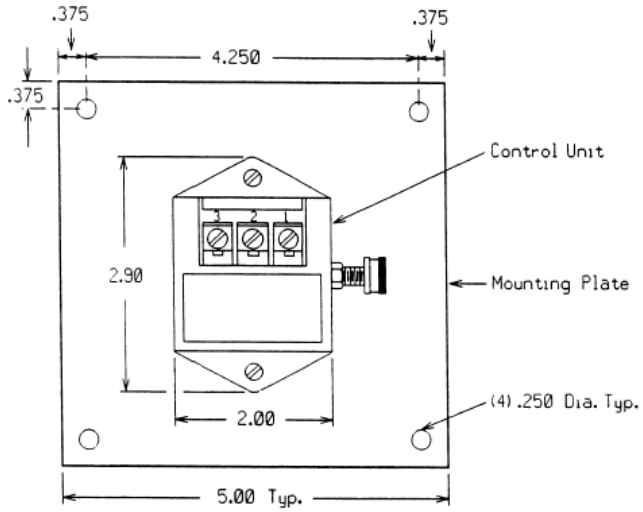




STD ITEM	SAP ITEM ID	PS ITEM ID
UN4F	9321404[Y]	8026184[Y]

CONTROL UNIT

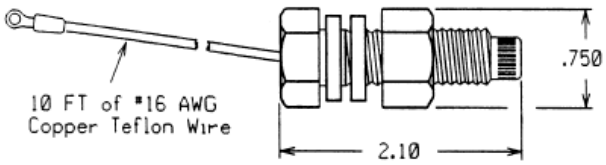
Control unit consisting of electronic components that are epoxy-sealed within a plastic housing designed to seal out contaminates and provide an exceptional resistance to corrosion which is mounted and sealed into a specially designed anodized aluminum heat sink and mounting plate. For use with Probe, item UN5P, to monitor liquid level in network manholes.



STD ITEM	SAP ITEM ID	PS ITEM ID
UN5C	9311985	2030365

SENSING PROBE

Sensing Probe consisting of an epoxy-filled nylon 101 body, a stainless steel sensing tip and 10 feet of #16 AWG copper Teflon insulated wire which connects to the probe terminal on the Control Unit. For use with Control Unit, item UN5C, to monitor liquid levels in network manholes,



STD ITEM	SAP ITEM ID	PS ITEM ID
UN5P	9311984	2030366

PUMP, SUMP

Sump pump for use in manholes and network vaults. Sump is rated at ½ HP.

STD ITEM	SAP ITEM ID	PS ITEM ID
UN6	9316413	2012125

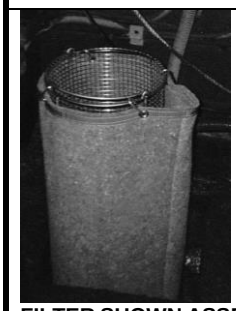
BASKET, STAINLESS STEEL

12” diameter, 24” high stainless steel basket to be used with filter (Std Item UN6G).

STD ITEM	SAP ITEM ID	PS ITEM ID
UN6B	9306235	9202067

FILTER, FELT -- MAINTENANCE USE

Single ply Absorb-It Felt filter, 36”X 3/8” thick with upper fasteners, chain-weighted base. To be used with obsolete 36” high stainless steel basket.

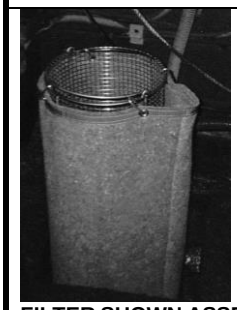


FILTER SHOWN ASSEMBLED ON WIRE BASKET

STD ITEM	SAP ITEM ID	PS ITEM ID
UN6F	9306234	9202068

FILTER, FELT

Single ply Absorb-It Felt filter, 24”X 3/8” thick with upper fasteners, chain-weighted base. To be used with stainless steel basket (Std Item UN6B).



FILTER SHOWN ASSEMBLED ON WIRE BASKET

STD ITEM	SAP ITEM ID	PS ITEM ID
UN6G	9307955	9202346

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

HOSE, BLACK, FLEXIBLE

Hose, 1-1/4", Black, flexible, 24' long, with end fitting, for use with sump pump for vaults.

STD ITEM	SAP ITEM ID	PS ITEM ID
UN6H	9307870	9202266

CLAMP, HOSE

Clamp Adjustable 1 1/16" to 2" stainless steel. For sump pump discharge hose attachments in network vaults.

STD ITEM	SAP ITEM ID	PS ITEM ID
UN6HC	9307881	9202365

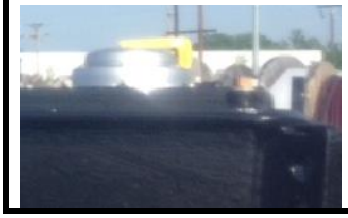
ADAPTER, REDUCING, PVC 1-1/4" to 1-1/2"

Adapter, reducing male adapter, schedule 40 PVC, white, MPT x S, 1-1/4" male thread to 1-1/2" female smooth.

STD ITEM	SAP ITEM ID	PS ITEM ID
UN6P	9307630	9202942

PRESSURE RELIEF VALVE

Valve for network transformers, cast in brass with stainless steel components.



STD ITEM	SAP ITEM ID	PS ITEM ID
UN6PRD	9388716	NA

VALVE, CHECK

Valve, check, 1-1/4” opening for flexible hose attachment on output end. 1-1/4” or 1-1/2” threaded opening for input end to attach to pump, plastic, black, 4-1/4” long. For use in sump pump in network vaults.

STD ITEM	SAP ITEM ID	PS ITEM ID
UN6V	9315637	6004206

BOOT, SECONDARY TEMPORARY END CAP

Rubber boot for temporary insulation of live secondary cables, especially in network secondary systems.

STD ITEM	SAP ITEM ID	PS ITEM ID
UN7	9304272	5646330

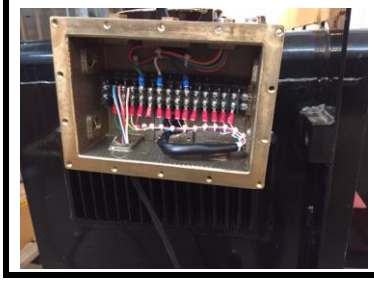
DGA, SENSOR

Dissolved Gas Analyzing sensor monitors the amount of hydrogen. The sensors can be installed in either the head space or off the drain valve. It requires 24volt DC for power and sends its information via RS485. Note: Optimal installation is straight off a connecting pipe.

STD ITEM	For use in	SAP ITEM ID
UN8SA	Head space (air/nitrogen)	9390576
UN8SS	Fluid (Silicone/FR3/Mineral)	9390605

KIT, COMMUNICATIONS NETWORK DGA

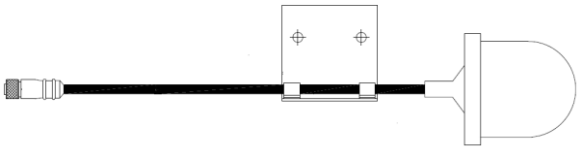
The kit includes Junction box and wiring accessories. Box mounted to protector door, interfaces wiring from transformer gauges and network protector relay.



STD ITEM	SAP ITEM ID	
UN9K	9390915	

SENSOR, WATER LEVEL, NETWORK VAULT /DGA

This water level sensor mounts onto the vault wall. Sensor is wired into the junction box for communications in the network. Sensor comes with a 30 foot cable.



STD ITEM	SAP ITEM ID	
UN9W	9392470	

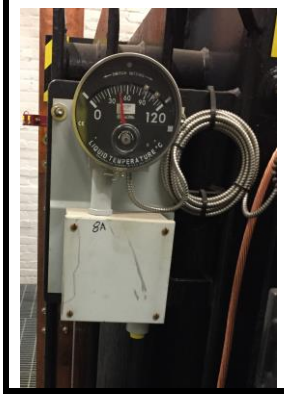
FLUID LEVEL GUAGES

Fluid level gauges for network transformers. Passive magnetic style. For use for retrofitting gauges on network transformers manufactured prior to 2018 with output accessory for communications. Gauge to provide 1.5k to15k ohm potentiometer output to convert to fluid level. If replacement model is not listed, contact engineering standards.

STD ITEM	SAP ITEM ID	REPLACES MODEL
UN10L1	9390934	036-89
UN10L2	9390998	036-95
UN10L3	9390931	036-35
UN10L4*	9393245	035-080-01
UN10L5	9392241	042-13
*NOTE item casing is non-metallic resin		

TEMPURATURE GUAGES

Temperature gauges for network transformers. Drywell probe style. For use for retrofitting gauges on network transformers manufactured prior to 2018 with output accessory for communications. Gauge requires mounting structure and 120-volt ac. Gauge to provide 4 to 20 ma output to convert to temperature. If replacement model is not listed, contact engineering standards.



STD ITEM	SAP ITEM ID	REPLACES MODEL
UN10T1	9390996	056-1
UN10T2	9390932	082-8
UN10T3	9392240	165-310-10
UN10T4	9390999	101-1, 104-1.104-4, 104-413-01

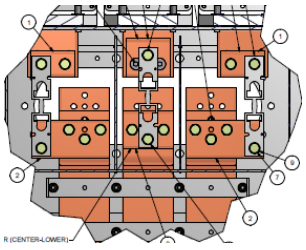
TEMPURATURE GUAGE RESIN STYLE UNIVERSAL

Temperature gauges for network transformers. Drywell probe style. For use for retrofitting gauges on network transformers manufactured prior to 2018 with output accessory for communications. Gauge comes threaded 7/8" NPT with adaptors to fit all smaller threaded drywell sizes ¾-14NPT, ½-14NPT and 3/8-18NPT Pre-terminated 10 foot cable for communications interface. Gauge is a resistance temperature detector style. The gauge requires 5-volt DC which is powered from the network protector relay. A voltage signal is transmitted back to the relay to convert to temperature.

STD ITEM	Item ID
UN10TR	9393270

BUS BAR , KIT

Bus bar replacement kit for retrofitting CM52 style network protectors with Y or Z style fuses.



PROTECTOR SIZE	STD ITEM	SAP ITEM ID
3500	UN14L	9391320
2875	UN14M	9391325
1875	UN14S	9391321

PROTECTOR, NETWORK

Three pole, low-voltage transformer-mounted network protector with submersible enclosure for secondary network transformers. For use on three phase, four wire, wye connected secondary networks. For complete specifications, refer to PPL Specification MS 2595.

RATED VOLTAGE (VOLTS)	RATED CON' T CURRENT (AMPERES) (GE)	RATED CON' T CURRENT (AMPERES) (WEST)	CURRENT TRANSFORMER RATIO (AMPERES)	INTERRUPTING RATING (AMPERES)	NETWORK TRANSFORMER SIZE (KVA)	PROTECTOR FUSE SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
216Y/125	1950	1875	1600/5	30,000	500	Y and Z style fuses are to be used as shown in the table on the next page. Older style fuses are available for maintenance use as needed on legacy GE and Westinghouse Protectors.	UP2B	9300345	6285041
	2950	2825	2500/5	45,000	750		UP2C	9300343	6287041
	3500	—	3000/5	60,000	1000		UP2D	9300341	6290041
480Y/277	1875	1875	1600/5	30,000	1000		UP3C	9300342	6290035
	2825	2825	2500/5	45,000	1500		UP3D	9300340	6291035
	3500	—	3000/5	45,000	2000		UP3E	9300339	6292035
	4500	—	3500/5	60,000	2500		UP3F	9300338	6293035
	1875	1875	1600/5	30,000	1000	Silver sand style fuses to be used with the external fuse style.	UP3G***	9388629[Y]	NA
	2825	2825	2500/5	45,000	1500		UP3H***	9388630[Y]	NA

*** External Fuse Style Protector for limited use in Syracuse area.

MECHANISM, NETWORK PROTECTOR – MAINANENCE USE ITEM

Three pole, low-voltage mechanism for replacement in network protector housings. For use on three phase, four wire, wye connected secondary networks. For complete specifications, refer to PPL Specification MS 4320.

RATED VOLTAGE (VOLTS)	RATED CON' T CURRENT (AMPERES) (GE)	RATED CON' T CURRENT (AMPERES) (WEST)	CURRENT TRANSFORMER RATIO (AMPERES)	INTERRUPTING RATING (AMPERES)	NETWORK TRANSFORMER SIZE (KVA)	PROTECTOR FUSE SIZE	STD ITEM	MANUFACTURER	
								EATON	ETI
								ITEM ID	ITEM ID
216Y/125	1950	1875	1600/5	30,000	500	Y and Z style fuses are to be used as shown in the table on the next page. Older style fuses are available for maintenance use as needed on legacy GE and Westinghouse Protectors.	UP2B!1	TBD	9394305
	2950	2825	2500/5	45,000	750		UP2C1	TBD	TBD
	3500	——	3000/5	60,000	1000		UP2D1	TBD	TBD
480Y/277	1875	1875	1600/5	30,000	1000		UP3C1	TBD	9394309
	2825	2825	2500/5	45,000	1500		UP3D1	TBD	TBD
	3500	——	3000/5	45,000	2000		UP3E1	TBD	TBD
	4500	——	3500/5	60,000	2500		UP3F1	NA	TBD

Note: mechanisms are manufacture specific housing and cannot be interchanged.

FUSE, G E NETWORK PROTECTOR (FOR MAINTENCE USE)

Low voltage network protector fuse element for use in G.E. network protectors, items UP2A, B, C & D and UP3A, B, C, D, E & F.

TYPE AND SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
S2	UP4A	9316121	2003001
S3	UP4B	9316103	2003002
S4	UP4C	9316120	2003003
Y11*	UP4D	9316225	2003020
Y15*	UP4E	9316226	2003021
Y22.5*	UP4F	9316227	2003022
Z37.5	UP4G	9316114	2003023
Z44	UP4H	9316113	2003024
Z50	UP4I	9316112	2003025

*Without asbestite enclosure

NETWORK PROTECTOR Y AND Z FUSES

Low voltage network protector fuse element for use in all network protectors starting in January 2018. Cover assembly for use only for 216 volt applications.

TYPE AND SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
Y15	UP4E	9316226	2003021
Y22.5	UP4F	9316227	2003022
Y25	UP4FF	9391027	NA
Y37.5	UP4GG	9391034	NA
Y50	UP4I I	9391032	NA
Z11	UP4DD	9391045	NA
Z15	UP4EE	9391048	NA
Z22.5	UP4FA	9391029	NA
Z25	UP4FFF	9391046	NA
Z37.5	UP4G	9316114	2003023
Z50	UP4I	9316112	2003025
asbestite cover assembly		UP4	9391033	NA
Indicator wire		UP4W	9391318	NA

FUSE, WESTINGHOUSE CMD NETWORK PROTECTOR (FOR MAINTENANCE USE)

Low-voltage network protector non-expulsion, silver-sand type fuse for use in Westinghouse Type CMD network protectors (only), items UP2A, B, & C and UP3A, B, C, & D

PROTECTOR CURRENT RATING	TYPE AND SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
800	NPL140D318G04	UP5A1	9316119[Y]	2003011[Y]
1200	NPL140D318G05	UP5A2	9316118[Y]	2003012[Y]
1875	NPL140D318G01	UP5A3	9316117[Y]	2003013[Y]
2825	NPL140D318G02	UP5A4	9316116[Y]	2003014[Y]

FUSE, WESTINGHOUSE. NETWORK PROTECTOR (FOR MAINTANENCE USE)

Low-voltage network protector non-expulsion, silver-sand type fuse for use in 125/216 volt Westinghouse network protectors.

PROTECTOR CURRENT RATING	TYPE	CURVE	STD ITEM	SAP ITEM ID	PS ITEM ID
2000	Alloy (lagged)	220760	UP5B1	9317805[E]	5906575[E]
2825	Alloy Std Speed	250300	UP5B2	9317797[E]	5906580[E]
1200	Alloy Std Speed	250300	UP5B3	9317795[E]	5906585[E]
1600	Alloy Std Speed	250300	UP5B4	9317794[E]	5906590[E]
2000	Alloy Std Speed	250300	UP5B5	9317793[E]	5906595[E]

FUSE, GE. NETWORK PROTECTOR (FOR MAINTENANCE USE)

Low-voltage network protector non-expulsion, silver-sand type fuse for use in 125/216 volt GE network protectors.

PROTECTOR CURRENT RATING	TYPE	CURVE	STD ITEM	SAP ITEM ID	PS ITEM ID
1600	Open CU Link	6043616	UP5C1	9317790[E]	5906630[E]
2000	Alloy - NF6		UP5C2	9317792[E]	5906610[E]
2500	Alloy – NF7		UP5C3	9317791[E]	5906620[E]

RELAY, NETWORK PROTECTOR, MICROPROCESSOR

For use in G.E. network protectors. Replaces electromechanical and SSNPR OEM relays. These relays require grounded “Y” CT wiring.

G.E. NETWORK PROTECTOR STD ITEM	RELAY				
	Use	Communicating	STD ITEM	SAP ITEM ID	PS ITEM ID
UP2 (All) and UP3 (All)	maintenance	no	UP6A	9315105	0809195
	Any	yes	UP6AC	9392291	na

RELAY, NETWORK PROTECTOR, MICROPROCESSOR

For use in Richards 313NP network protectors. Replaces NMPR PN521038 OEM relay with “Y” CT’s. Also for use in Westinghouse/Cutler Hammer/Eaton CM-22 and CMR-8 network protectors. Replaces CN-33 and MPCR-22 OEM. These relays require grounded “Y” CT wiring.

NETWORK PROTECTOR STD ITEM	RELAY				
	Use	Communicating	STD ITEM	SAP ITEM ID	PS ITEM ID
UP2A, B, & C and UP3A, B, C, & D	maintenance	no	UP6B	9314266	0809197
	Any	yes	UP6BC	9392246	na

RELAY, NETWORK PROTECTOR, MICROPROCESSOR

For use in Westinghouse/Cutler Hammer/Eaton Type CMD network protectors. Replaces CN-33 and MPCR-D OEM relays These relays require grounded “Y” CT wiring.

WESTINGHOUSE NETWORK PROTECTOR STD ITEM	RELAY				
	Use	Communicating	STD ITEM	SAP ITEM ID	PS ITEM ID
UP2D and UP3E	maintenance	no	UP6C	9315083	0809196
	Any	yes	UP6CC	9392248	na

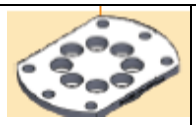
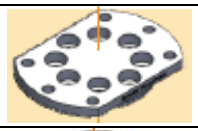
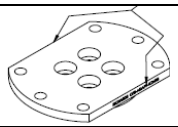
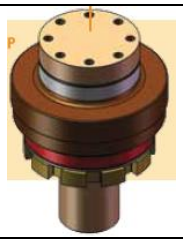
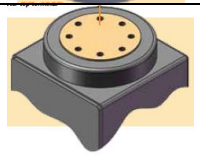
RELAY, NETWORK PROTECTOR, MICROPROCESSOR (for maintenance use)

For use in 313NP and CM22 network protectors. This relay requires ungrounded “Y” CT wiring, for use only on the 216 volt system. Relay is communications ready.

NETWORK PROTECTOR STD ITEM	RELAY	
	STD ITEM	SAP ITEM ID
UP2B	UP6D	9390866
UP2C		
UP2D		

ADAPTOR PLATES FOR LARGE LINK BOX, NETWORK PROTECTOR, FOR 2000 TO 4500 AMP ASSEMBLY'S

For use on 277/480 Network Protectors to mount the link boxes to the network protector terminal. Each adaptor has specific bolt hole pattern for mounting to specific terminal.

Adaptor				
Terminal Type				
Protector to use on.	313NP	137NP,MG8, MG14	CM22,CM52, CMD	CMR8
STD ITEM	UP7LA3	UP7LA2	UP7LA1	UP7LA4
SAP ITEM ID	9386611	9386610	9386609	9387796
PS ITEM ID	9203052	9203051	9203050	

LINK BOX, LARGE, NETWORK PROTECTOR, FOR 2000 TO 4500 AMP ASSEMBLY'S

For use on 277/480 Network Protectors to isolate the incoming secondary. Link box shall need adaptor an plate to match up to mounting hole pattern for installation.

FOR 2000 TO 3500 AMP ASSEMBLY'S

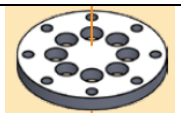
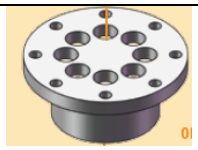
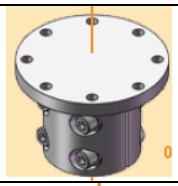
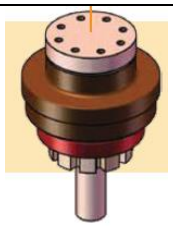
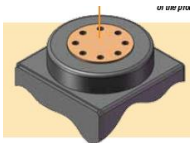
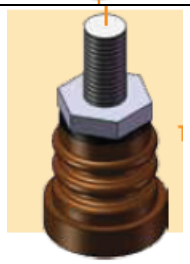
STD ITEM	SAP ITEM ID	PS ITEM ID
UP7LBL	9386606	9203047

FOR 4500 AMP ASSEMBLY'S

STD ITEM	SAP ITEM ID	PS ITEM ID
UP7LB4	9387185	N/A
Clear cover		
UP7LBLCC	9390015	NA
Clear cover for testing only		
UP7LBLTC	9388498	NA

ADAPTOR PLATES FOR SMALL LINK BOX, NETWORK PROTECTOR, ASSEMBLYS LESS THAN 2000 AMPS

For use on 277/480 Network Protectors to mount the link boxes to the network protector terminal. Each adaptor has specific bolt hole pattern for mounting to specific terminal.

Adaptor			
Terminal Type			
Protector to use on.	313NP, 137NP , MG8	CM22,CM52, CMD	THREADED STUD
STD ITEM	UP7SA1	UP7SA2	UP7SA3
SAP ITEM ID	9387052	9387054	9387095

LINK BOX, SMALL, NETWORK PROTECTOR, FOR ASSEMBLY'S LESS THAN 2000 AMPS

For use on 277/480 Network Protectors to isolate the incoming secondary. Link box shall need adaptor an plate to match up to mounting hole pattern for installation.

STD ITEM	**SAP ITEM ID**
UP7LBS	9387050
Clear cover	
UP7LBSCC	9390026
Clear cover for testing only	
UP7LBSTC	9388495

TERMINAL SPADES FOR NETWORK PROTECTORS

STYLE	AMP RATING	FIG	313NP	137NP	147NP	CM22/CM52	GE	WESTING HOUSE
OFFSET HORIZONTAL SPADE	2500	9	UP7ST8 9388842*					
SHORT HORIZONTAL SPADE	2000	1	UP7SP8 9387365*	UP7SP8 9387365*		UP7SP1 9307934		
		8	UP7ST6 9387620*	UP7ST6 9387620*				
SHORT HORIZONTAL SPADE	4500	1	UP7SP9 9387235**	UP7SP3 9307577	UP7SP3 9307577	UP7SP3 9307577		
LONG HORIZONTAL SPADE	4500	2	UP7SQ** 9387535	UP7SP2 9307933	UP7SP2 9307933	UP7SP2 9307933		
X LONG HORTIZONTAL SPADE	4500	10	UP7ST9** 9389625					
1.5INCH STUD	2000	3	UP7ST3 9387190	UP7ST3 9387190	NA	UP7ST4 9387189	UP7ST1* 9307932	
3 INCH STUD	4500	4	UP7ST5** 9387188	UP7ST2 9307931	UP7ST2 9307931	UP7ST2 9307931	UP7ST2 9307931	
SHORT VERTICAL SPADE	2000	5	UP7SP6 9387187	UP7SP6 9387187		UP7SP4 9307578	UP7SP6 9387187	
LONG VERTICAL SPADE	4500	6	UP7SP7 9387186	UP7SP5 9307579	UP7SP5 9307579	UP7SP5 9307579		UP7SP7 9387186
U SHAPE	4500	7	UP7ST7** 9387711					

- * Terminal bolt hole mounting pattern also aligns up for use on small link box
- ** Terminal bolt hole mounting pattern also aligns up for use on the large link box

FIGURES FOR NETWORK TERMINALS

Full detailed drawings are in MS4315

Figure1

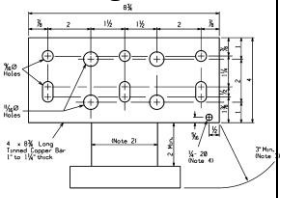


Figure 2

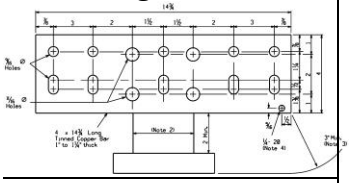


Figure 3

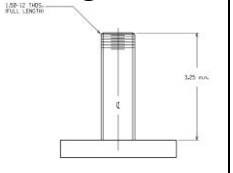


Figure 4

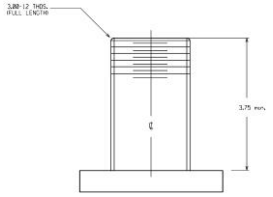


Figure 5

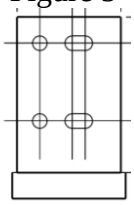


Figure 6

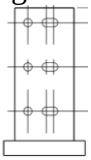


Figure 7

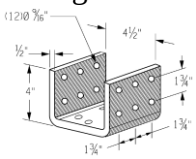


Figure 8

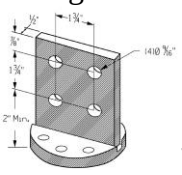


Figure 9

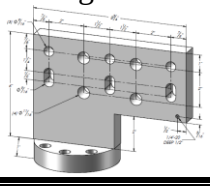
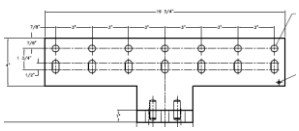
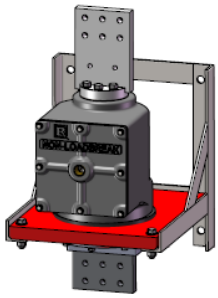


Figure 10



WALL MOUNT LINK BOX, LARGE, NETWORK PROTECTOR,

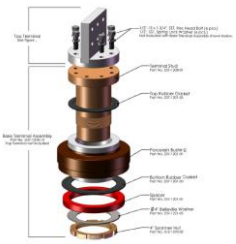
For use on 277/480 Network Protectors to isolate the incoming secondary.



FOR UP TO 3500 AMP ASSEMBLY'S		
STD ITEM	**SAP ITEM ID**	
UP7LBW	9387709	
FOR 4500 AMP ASSEMBLY'S		
STD ITEM	**SAP ITEM ID**	
UP7LBX	9387795	

TERMINAL REPLACEMENT KIT

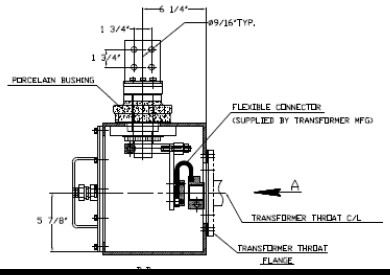
Kits are available for replacing terminals on the network protectors.



AMP	STYLE	STD ITEM	SAP ITEM ID	PS ITEM ID
1875	137NP	UP8A	9388373	NA
3500	137NP	UP8A1	9388476	NA
1875	313NP	UP8L2	9388435	NA
3500	313NP	UP8L3	9388436	NA

CHAMBER, TERMINAl,

For use to convert network transformer to radial style.



FOR 1875 AMP ASSEMBLY'S		
STD ITEM	**SAP ITEM ID**	**Maximo ID**
UP8RS	9332559	160143
FOR 3500 AMP ASSEMBLY'S		
STD ITEM	**SAP ITEM ID**	
UP8RL	9392206	NA

Grease, gasket

Gasket grease to keep network protector door gaskets from drying out. It is available in a 16oz tub container

STD ITEM	SAP ITEM ID	PS ITEM ID
UP9G	9389518	

PAINT, INSULATING

Red enamel general purpose insulating, oil and water resistant paint. To be furnished in quart cans for brush on applications

STD ITEM	SAP ITEM ID	PS ITEM ID
UP10	9321489[Y]	8010133[Y]

PAINT, PAD MOUNT GREEN

Green enamel paint, for touch up of pad mounted equipment. 12-ounce spray can. Spraying paint inside the secondary compartment of pad mount transformers shall be done de energized.

STD ITEM	SAP ITEM ID	PS ITEM ID
UP11G	9306536	9201693

PAINT, NETWORK

Black, epoxy mix resin base paint. Comes boxed in a kit 4 to 1 mixture.

STD ITEM	SAP ITEM ID	PS ITEM ID
UP12B	9389546	

PAINT, NETWORK PRIMER

Zink primer, epoxy mix resin base paint. Comes boxed in a kit 4 to 1 mixture.

STD ITEM	SAP ITEM ID	PS ITEM ID
UP12P	9389566	

T WRENCH

Fully insulated up to 1000 volts, for use on network protector doors. 33 inch long handle.

Socket size in inches	STD ITEM	SAP ITEM ID	PS ITEM ID
9/16	UP13A	9390326	
3/4	UP13B	9390310	
7/8	UP13C	9390300	

CHUTE, ARC

Replacement arc chute assembly for maintenance use.

	STD ITEM	SAP ITEM ID
CM22 /313NP	UP14A	9328253
MG-8/137NP	UP14B	9394055
Support for MG-8/137NP	UP14BS	9394065

TAG, CABLE PHASE IDENTIFICATION

A, B and C phase identification tags 2.6" x 1.6" with slotted holes for mounting directly onto cable with cable ties.⅞ inch wide. hot stamped polypropylene, black characters embossed on yellow.

LETTER	STD ITEM	SAP ITEM ID	PS ITEM ID
"A"	UP21A	9388976	NA
"B"	UP21B	9388988	NA
"C"	UP21C	9388975	NA

TAG, LETTER

⅞ inch wide x 1⅝ inch high, hot stamped polyethelene, black characters embossed on yellow background. All inks shall be treated for U.V. exposure. Use with slide in tag holder, UP21W.

LETTER	STD ITEM	SAP ITEM ID	PS ITEM ID
"A"	UP21L	9314869	0800029
"B"	UP21L	9314868	0800030
"C"	UP21L	9314867	0800031
"D"	UP21L	9314866	0800032
"E"	UP21L	9314865	0800033
"F"	UP21L	9314957	0800034
"G"	UP21L	9314864	0800035
"H"	UP21L	9314863	0800036
"I"	UP21L	9314862	0800037
"J"	UP21L	9314861	0800038
"K"	UP21L	9314860	0800039
"L"	UP21L	9314859	0800040
"M"	UP21L	9314858	0800041
"N"	UP21L	9314757	0800042
"O"	UP21L	9314756	0800043
"P"	UP21L	9314755	0800044
"Q"	UP21L	9314857	0800045
"R"	UP21L	9314856	0800046
"S"	UP21L	9314855	0800047
"T"	UP21L	9314833	0800048
"U"	UP21L	9314832	0800049
"V"	UP21L	9314831	0800050
"W"	UP21L	9314830	0800051
"X"	UP21L	9314808	0800052
"Y"	UP21L	9314807	0800053
"Z"	UP21L	9314806	0800054
"–" (dash)	UP21L	9314805	0800055

TAG, NUMBER

⅞ inch wide x 1⅝ inch high, hot stamped polyethelene, black characters embossed on yellow background. All inks shall be treated for U.V. exposure. Use with slide in tag holder, UP21W.

NUMBER	STD ITEM	SAP ITEM ID	PS ITEM ID
“0”	UP21N	9314804	0800056
“1”	UP21N	9314803	0800057
“2”	UP21N	9314802	0800058
“3”	UP21N	9314809	0800059
“4”	UP21N	9314958	0800060
“5”	UP21N	9314801	0800061
“6”	UP21N	9314799	0800062
“7”	UP21N	9314798	0800063
“8”	UP21N	9314797	0800064
“9”	UP21N	9314796	0800065
“1/2”	UP21N	9306442	9201816

TAG, PHRASE

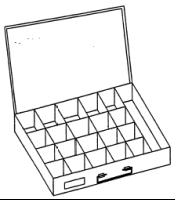
⅞ inch wide x 1⅝ inch high, hot stamped polyethelene, black characters embossed on yellow background. All inks shall be treated for U.V. exposure. Use with slide in tag holder, UP21W.

PHRASE	STD ITEM	SAP ITEM ID	PS ITEM ID
“A PHASE”	UP21P	9309207	5105866
“B PHASE”	UP21P	9309206	5105867
“C PHASE”	UP21P	9309205	5105868
“COMPANY OWNED”	UP21P	9389932	NA
“CUSTOMER OWNED”	UP21P	9389869	NA
“CUSTOMER OWNED” LG	UP21P	9309215	NA
“FROM”	UP21P	9388856	NA
“H1A”	UP21P	9309195	5100007
“H1B”	UP21P	9309192	5100010
“H2A”	UP21P	9309194	5100008
“H2B”	UP21P	9309199	5100011
“H3A”	UP21P	9309193	5100009
“H3B”	UP21P	9309191	5100012
“LINE”	UP21P	9315506	9202609
“LIVE CAP”	UP21P	9393204	
“LOAD”	UP21P	9322024	9202608
“MAIN”	UP21P	9309208	5105865
“NEUTRAL”	UP21P	9390498	
“NETWORK”	UP21P	9388911	NA
“N – ASB”	UP21P	9391770	
“PARALLEL SERVICE”	UP21P	9314497	0811211
“SOURCE”	UP21P	9388257	NA
“SWITCH”	UP21P	9303978	5647932
“TO”	UP21P	9303979	5647930
“TO BLDG”	UP21P	9388865	NA
“TO CABINET”	UP21P	9390908	
“TO ENCLOSURE”	UP21P	9314310[Y]	0810504[Y]
“TO HANDHOLE”	UP21P	9315176	0807649
“TO HOUSE”	UP21P	9390535	
“TO MH”	UP21P	9309209	5105864
“TO PULL BOX”	UP21P	9390035	NA
“TO RISER”	UP21P	9315177	0807648
“TO SWITCH”	UP21P	9315178	0807647
“TO SWITCHGEAR”	UP21P	9307557	9202966
“ TO ST LT “	UP21P	9389717	NA
“TO XFMR PAD”	UP21P	9315175	0807650
“XFMR”	UP21P	9310736	5105863
“TO XFMR “	UP21P	9388855	NA
“TO VAULT”	UP21P	9388866	NA
“VIA”	UP21P	9389478	NA
“600V”	UP21P	9308357	9201750
“120/240V”	UP21P	9308346	9201740
“120/208V”	UP21P	9308345	9201739
“277/480V”	UP21P	9308335	9201738
“#”	UP21P	9307480	9202415
“HOUSE LEFT”	UP21P	9307633	9202442

"HOUSE RIGHT"	UP21P	9307555	9202443
BLANK	UP21P	9387622	none
"RADIAL"	UP21P	9387625	none

CASE, STEEL STORAGE

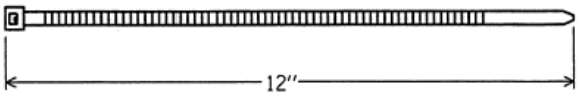
18 in. x 12 in. x 3 in. with 20 deep scoop compartments and one large 4in. x 12in. bin. Baked enamel, grey hammerstone. For use storing items UP21L, UP21P, UP21N, UP21T and UP21W



STD ITEM	SAP ITEM ID	PS ITEM ID
UP21S	9314854	0800026

CABLE TIES

12 inch long, black, high quality nylon, self locking with minimum loop tensile strength of 50 lbs. U.V. resistant. For use with tag holder, item UP21W



STD ITEM	SAP ITEM ID	PS ITEM ID
UP21T	9314871	0800027

TAG HOLDER

Tag Holder, black polyethylene, easy slide-in design. For use with items UP21L, UP21N, and UP21T

STD ITEM	DIGIT LENGTH	SAP ITEM ID	PS ITEM ID
UP21W	6	9314870	0800028
UP21W1	10	9314330	0810508
UP21W2	2	9310998	5103066

TAG HOLDER,MAGNETIC

Tag Holder, black polyethylene, magnetic backing, easy slide-in design. For use with items UP21L, UP21N, and UP21T

STD ITEM	DIGIT LENGTH	SAP ITEM ID	PS ITEM ID
UP21X	6	9393175	
UP21X1	10	9393044	

SIGN, "DEAD OPERATION ONLY"

4" square laminated vinyl, white letters on red background.

STD ITEM	SAP ITEM ID	PS ITEM ID
UP22DO	9304293[E]	5647914[E]

SIGN, SUBMARINE CABLE CROSSING, LARGE

Permanent location sign for submarine cable water crossing, 12 feet wide by 8 feet high, anodized aluminum, baked enamel paint, with a clear polyurethane coating. Printing shall be black characters on a white background with an international orange border. All colors (international orange, black and white) as per ANSI Standard Z53.1. Sign to be in accordance with NMPC Dwg. C-34371-S, Sheets 1 of 3 & 3 of 3

STD ITEM	SAP ITEM ID	PS ITEM ID
UP22W1	9320017[Y]	8002350[Y]

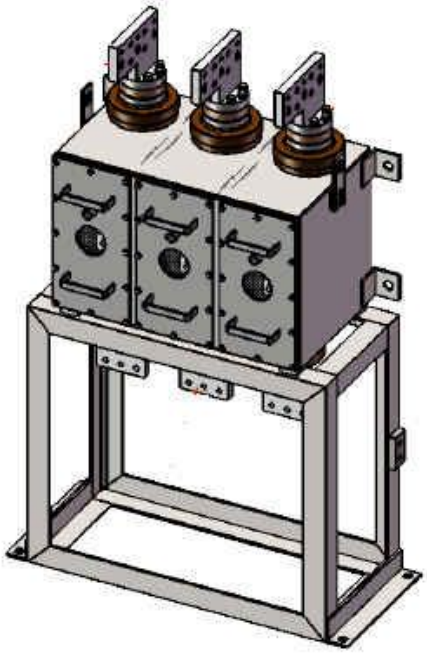
SIGN, SUBMARINE CABLE CROSSING, SMALL

Permanent location sign for submarine cable water crossing, 24 inches wide by 15 inches high, anodized aluminum, baked enamel paint, with a clear polyurethane coating. Printing shall be black characters on a white background with an international orange border. All colors (international orange, black and white) as per ANSI Standard Z53.1. Sign to be in accordance with NMPC Dwg.
C-34733-S

STD ITEM	SAP ITEM ID	PS ITEM ID
UP22W2	9320016[Y]	8002352[Y]

FUSE ENCLOSURE, AMP TRAC, 600V

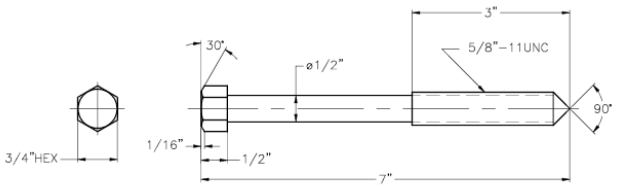
Fuse enclosure for Amp Trac Fuses (STD ITEM F11B_) used on 208V network services. Enclosure provided with bushings for mounting cables. Enclosure can be mounted on vault wall. Stand is 36 inches tall. Units manufactured after June 2016 have a clear viewing port. Replacement cover UP70FBC with viewing port is available to retrofit older units.



STD ITEM	SAP ITEM ID	PS ITEM ID
UP70FB	9387255	
Clear cover		
UP70FBC	9389996	

BOLT, NETWORK PROTECTOR DOOR

Bolt, locking, network protector door, grade 316 stainless steel, 0.625” diameter, 3” of bolt to be threaded, 11 UNC, bolt to have a 45 deg tip.



STD ITEM	BOLT LENGTH	SAP ITEM ID	PS ITEM ID
UPB1	5.125	9387751	none
UPB2	6.25	9387754	none
UPB3	6.375	9387752	none
UPB4	6.5	9387722	none
UPB5	7.0	9387774	none

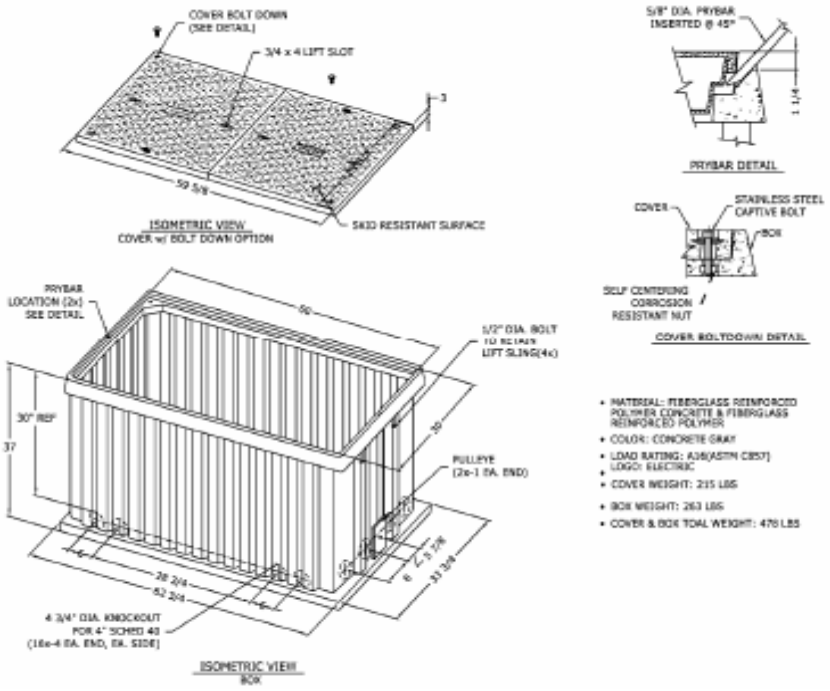
ENCAPSULANT, RE-GEL

Encapsulant, Re-Gel, Parts A & B, 6-gallon pail of each part, for use in network termination chambers. Requires pumping system and static mixer, STD Item UR2SM. One year shelf life. Order only when needed.

	STD ITEM	SAP ITEM ID	PS ITEM ID
Encapsulant, Re-Gel	UR2AB	9307628	9202944
Mixer, static for Re-Gel	UR2SM	9307627	9202945

BOX, PRIMARY PULL & SPLICE, RECTANGULAR

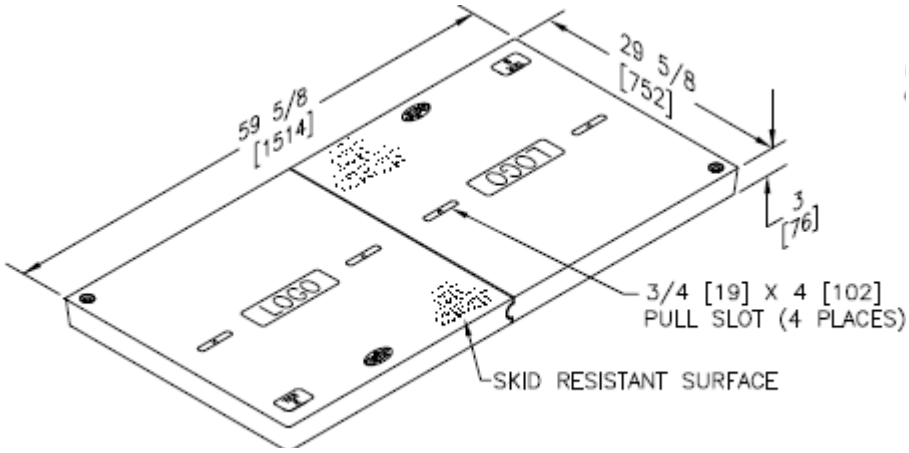
Primary cable pull / splice box, Fiberglass, with polymer concrete cover, cable pulling eyes, and conduit knockouts. For use in conduit URD systems. In accordance with PPL Material Specification MS 5057.



	STD ITEM	SAP ITEM ID	PS ITEM ID
	UR6	9309511	5640808

COVER, TWO PIECE, FOR PRIMARY PULL & SPLICE BOX, RECTANGULAR

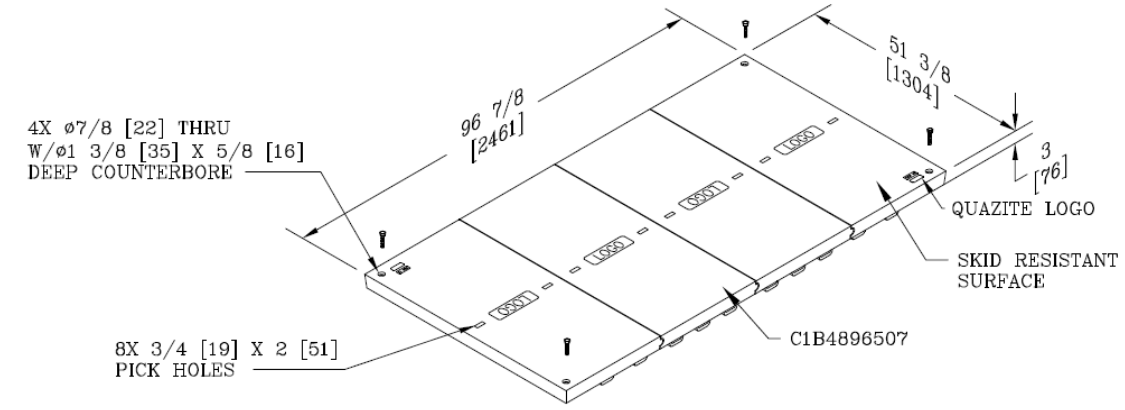
Two piece polymer concrete cover, for primary pull / splice box. For use in conduit URD systems. In accordance with PPL Material Specification MS 5057. Cover can be used as a replacement for the one piece cover.

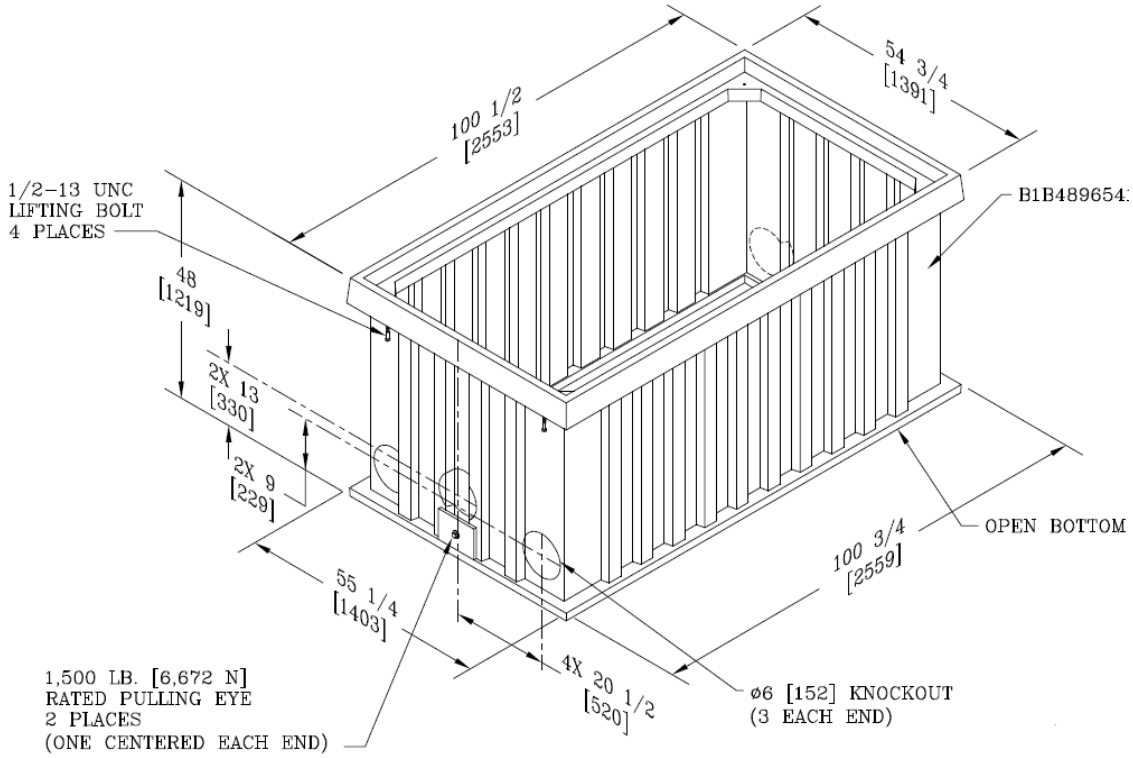


STD ITEM	SAP ITEM ID	PS ITEM ID
UR6C	9308054	9202714

BOX, PRIMARY PULL & SPLICE, LARGE, RECTANGULAR

Primary cable pull / splice box, Fiberglass, with polymer concrete cover, cable pulling eyes, and conduit knockouts. For use in conduit URD systems. In accordance with PPL Material Specification MS 5057.

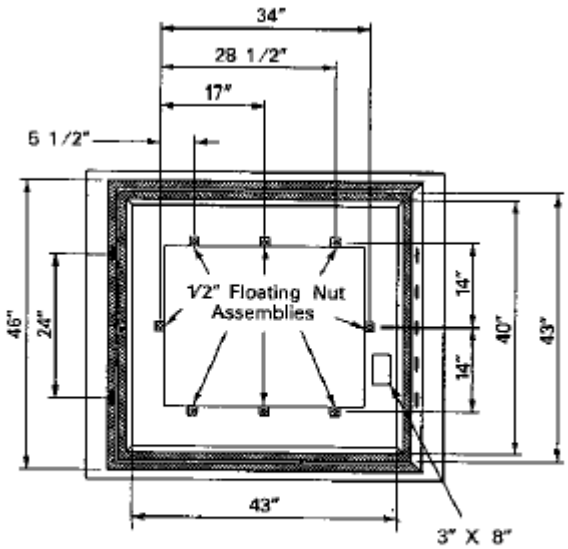




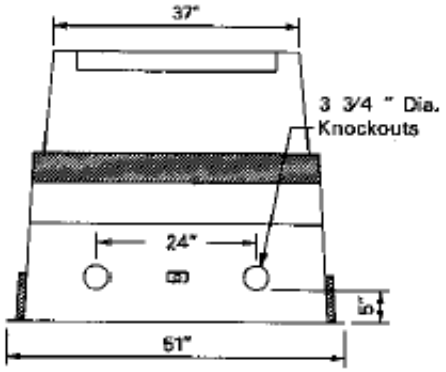
STD ITEM	SAP ITEM ID	PS ITEM ID
UR7	9392019	N/A

BOX PAD, FIBERGLASS, MINI PAD, CONDUIT

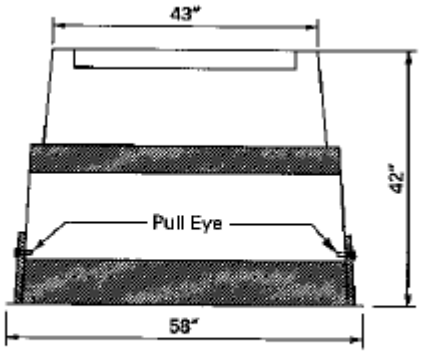
Fiberglass reinforced box pad (51 in. x 58 in. x 42 in. deep) with nine 3-3/4" conduit knockouts, for use with single phase pad mounted transformers, Item UT30 or UT31. Approximate weight 265 lbs. In accordance with PPL Material Specification Standard MS-5059. Use boxpad cover item UR9G prior to transformer installation to avoid injury to the public from falling inside vault opening.



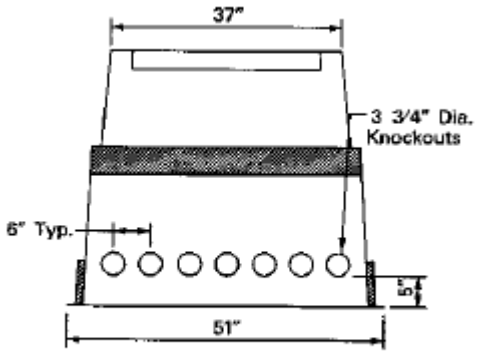
Top View-Foundation



House End View



Side View

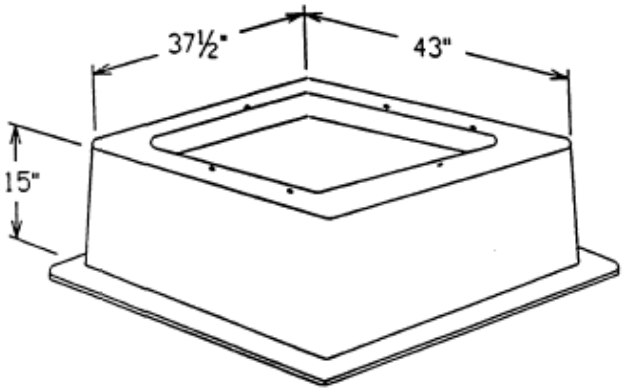


Street End View

STD ITEM	SAP ITEM ID	PS ITEM ID
UR8B	9309542	5642500

VAULT PAD, FIBERGLASS, MINI PAD, DIRECT BURIED, SHALLOW

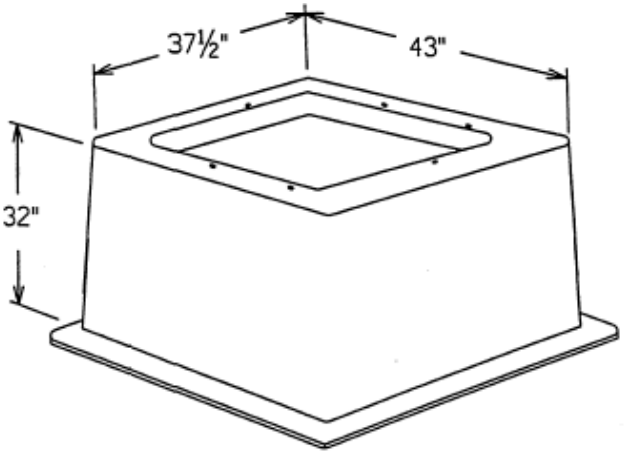
Fiberglass reinforced plastic vault pad (43 in. x 37½ in. x 15 in. deep) for use with single phase pad mounted transformers, item UT30 or UT31, three phase pad mounted junction enclosures, item US33, and three phase distribution switchgear, item US32D. This vault pad was designed for rocky terrain applications. Approximate weight 75 lbs.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR8F	9315166	0808110

VAULT PAD, FIBERGLASS, MINI PAD, DIRECT BURIED, DEEP

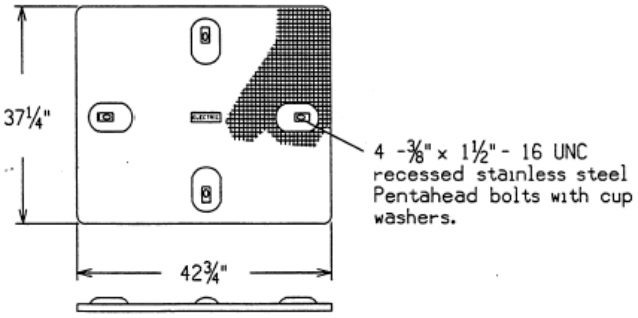
Fiberglass reinforced plastic vault pad (43 in. x 37½ in. x 32 in. deep) for use with single phase pad mounted transformers, item UT30 or UT31, single and three phase pad mounted junction enclosures, item US33. Approximate weight 100 lbs.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR9F	9316170	2012204

COVER, VAULT PAD, FIBERGLASS

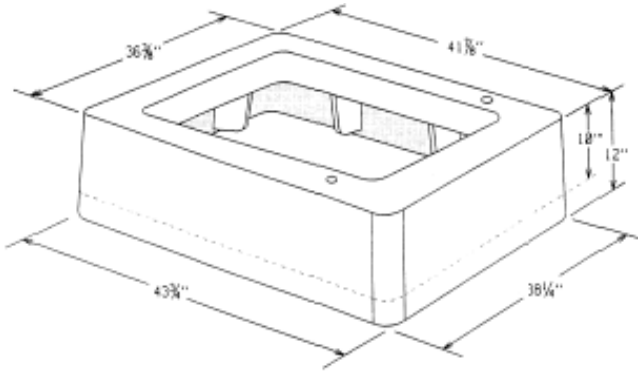
Fiberglass reinforced plastic, skid-resistant cover (42¾ in. x 37¼ in. ⅜ in.). Furnished with four recessed Pentahead bolts. For use with fiberglass vault pad, items UR8B, UR8F and UR9F. Approximate weight 37 lbs.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR9G	9314947	2012205

SPACER, VAULT PAD, FIBERGLASS

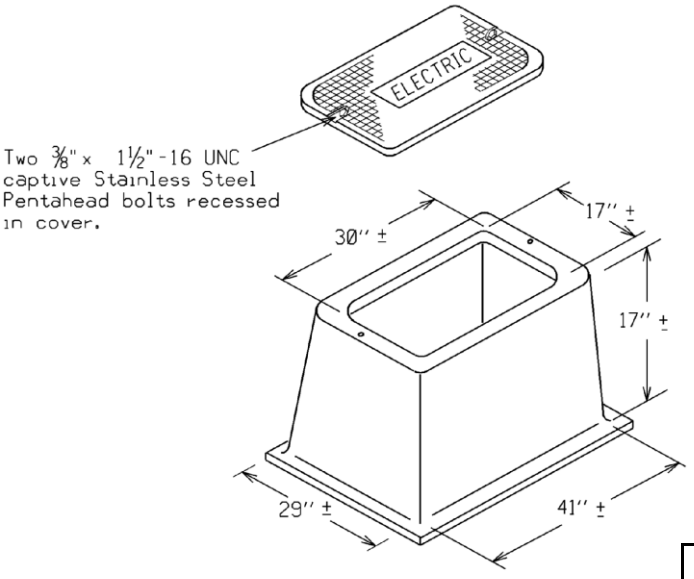
Fiberglass reinforced plastic 10 inch high spacer, 43¾ in. x 38¼ in. x 12 in. high, with a 2 inch overlapping lip to prevent slippage and assure a tight fit, no fasteners are required. For use with fiberglass vault pad, items UR9F and UR8B



STD ITEM	SAP ITEM ID	PS ITEM ID
UR9S	9316169	2012207

HANDHOLE, SECONDARY SERVICE, RECTANGULAR

Fiberglass reinforced plastic secondary service handhole and cover for housing secondary, service lateral and street lighting terminations. Approximate weight 30 lbs.

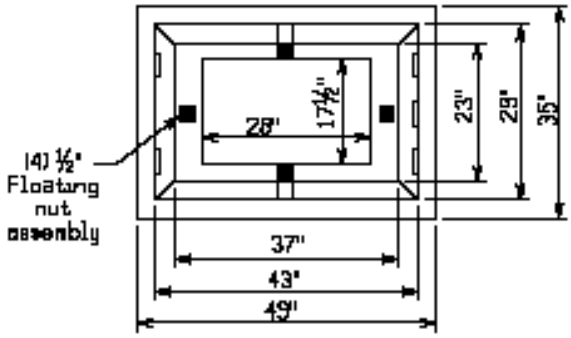


Rhode Island USE LIMITED TO MAINTENANCE ONLY.

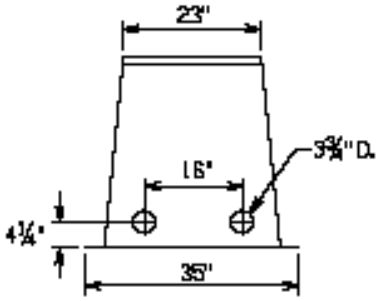
	STD ITEM	SAP ITEM ID	PS ITEM ID
Handhole With Cover	UR10F	9309540	5643077
Replacement Cover	UR10FC	9307864	9202272
Pedestal Cover (Dome)	UR10FD	9387806	n/a

HANDHOLE, SECONDARY SERVICE, RECTANGULAR, CONDUIT SYSTEMS

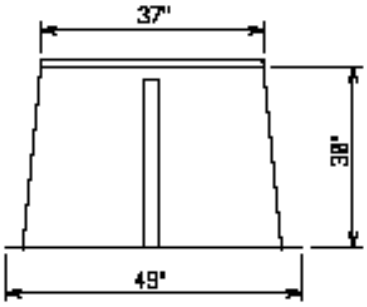
Fiberglass reinforced plastic secondary service handhole and gray cover for housing secondary, service lateral and street lighting terminations. For use in conduit URD installations. Approximate weight 100 lbs. In accordance with PPL Material Specification Standard MS-5051.



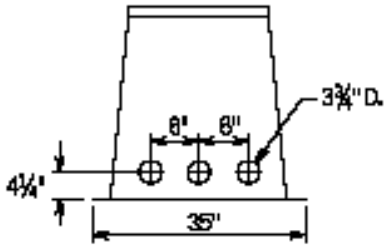
HANDHOLE - TOP VIEW



HOUSE END VIEW



SIDE VIEW

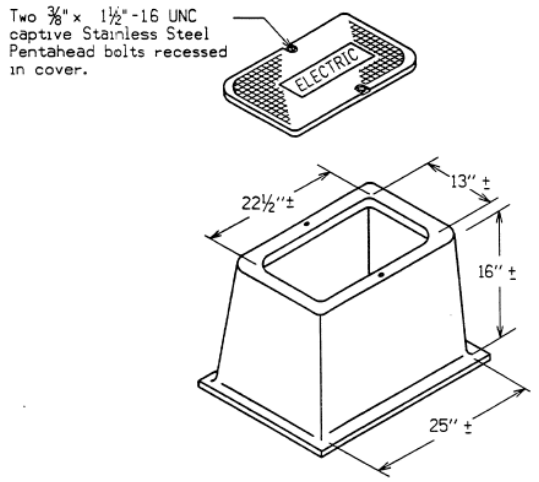


STREET END VIEW

STD ITEM	SAP ITEM ID	PS ITEM ID
UR10G	9309539	5643082

HANDHOLE, SECONDARY SERVICE, RECTANGULAR, DIRECT BURIED CABLES

High density Polyethylene (HDPE). Approximate weight 25 lbs including cover.

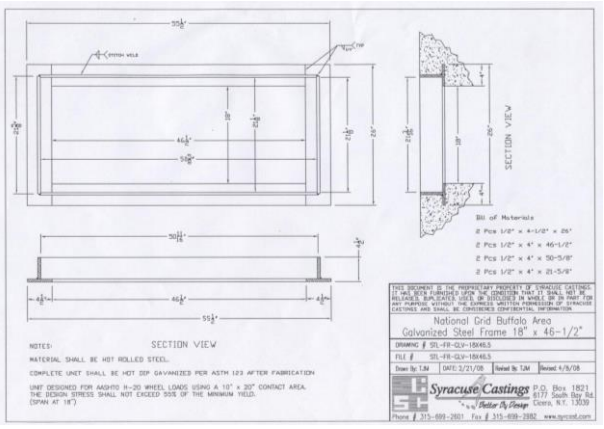


UR10PED

	STD ITEM	SAP ITEM ID	PS ITEM ID
	UR10PE	9314166	0810695
2" Extension Ring for item UP10PE	UR10ER	9314165[Y]	0810696[Y]
Replacement cover	UR10PEC	9307525	9202392
Pedestal Style Cover (2 piece)	UR10PED	9387598[Y]	n/a

FRAME – HANDHOLE – (FOR BUFFALO, NY ONLY)

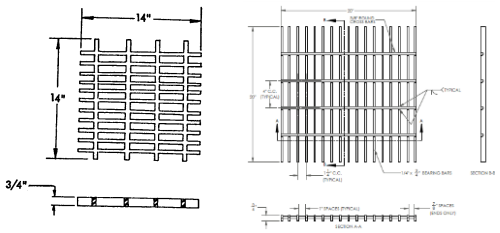
18" x 46 ½", HD20 rated (10" x 20" contact area), hot rolled galvanized steel.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR10R	9306706[Y]	9201891[Y]

GRATING, SUMP

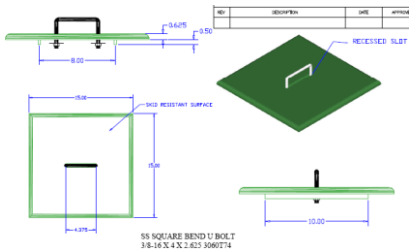
Sump grating, Borden-Galvanized Steel, Type W/B (Standard), 14” x 14”, with 3/4"x 1/8" bearing bars. For underground vaults. Per PPL Material Specification Standard MS 3540.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR11A	9307159	9200903
UR11A1	9392617	NA

COVER SUMP HOLE

Fiberglass cover 15” x15” for manhole sump cover for use while in manhole to minimize tripping hazard.

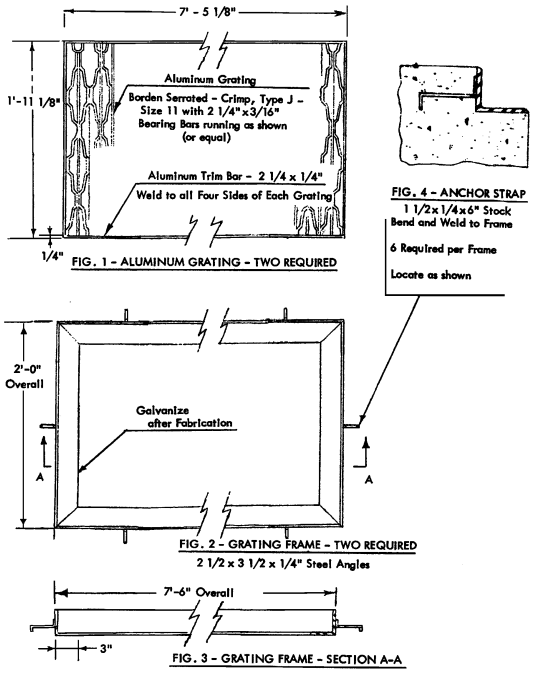


STD ITEM	SAP ITEM ID	PS ITEM ID
UR11AC	9307524	9202393

GRATING, SURFACE, SIDEWALK VAULT

Surface grating and frame for sidewalk vault, Borden Serrated Aluminum Grating and Galvanized Steel Frame. For underground sidewalk vaults. Per PPL Material Specification Standard MS 3541.

NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.

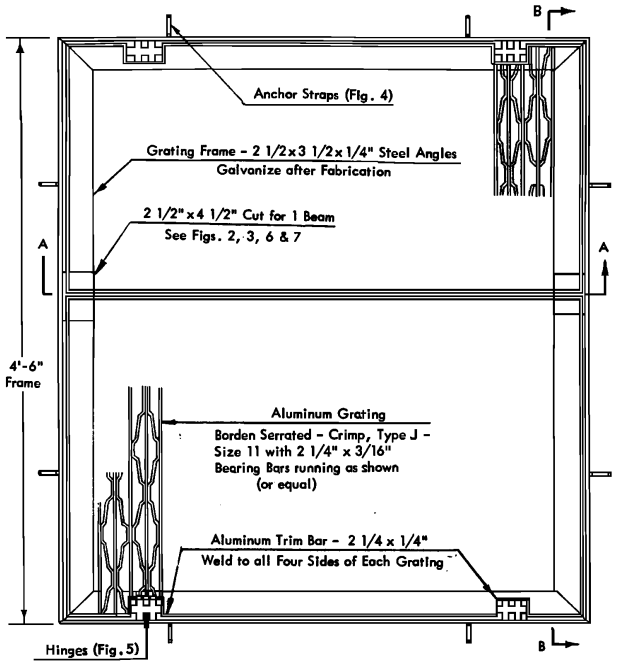


	STD ITEM	SAP ITEM ID	PS ITEM ID
Grating	UR11B	1000206	9200907
Frame	UR11C	1000207	9200908

GRATING, SURFACE, SIDEWALK VAULT ENTRANCE

Surface grating and frame, Borden Serrated Aluminum Grating and Galvanized Steel Frame. For access to underground sidewalk vaults. Per PPL Material Specification Standard MS 3543.

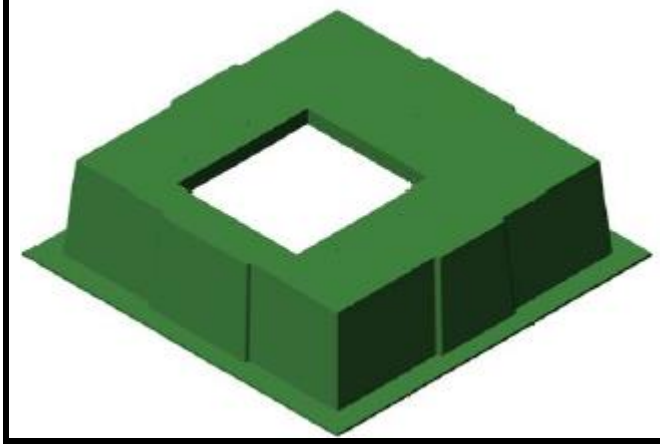
NOTE: This is a 'Profiled Item'. It is not stocked and a material request must be completed when needed.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR11D	1000205	9200906

VAULT PAD, FIBERGLASS

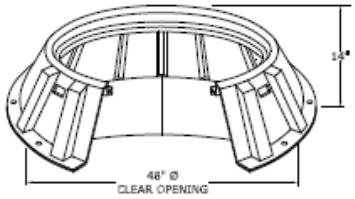
Fiberglass reinforced plastic, universal pad for converting a submersible transformer to minipad transformer for where there is no other available standard designs, 48” x 48” x 15” high with a 22” x 24” opening.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR11U	9308053	9202715

FRAME, POLYMER - URD VAULT to PADMOUNT CONVERSION DISCONTINUED

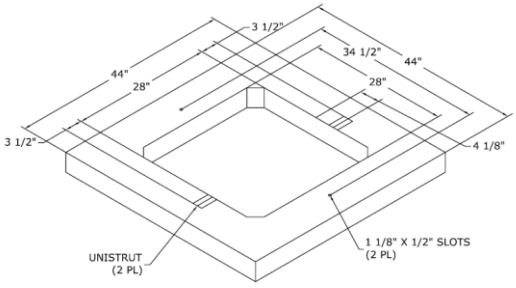
Frame, polymer concrete, tapered 48” base diameter to 40” top diameter x 14” high, weight = 60 pounds, for use in EUA area to convert submersible transformer to mini-pad, Item 5106640 to be set on top of this frame for mini-pad. For replacements use STD Item UR11U.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR12EC	9311921[E]	9202576[E]

BOX, PADMOUNT, REINFORCED PLASTIC MORTAR DISCONTINUED

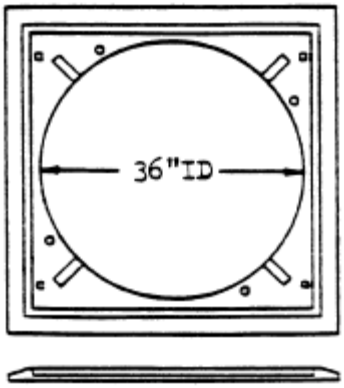
Box, padmount, reinforced plastic mortar pad & structural plastic, base size 44” x 44” x 4” thick above ground pad, with 28” square opening. Attached to circular, tapered, 14” deep base with 48” clear bottom opening. For replacements use STD Item UR11U.



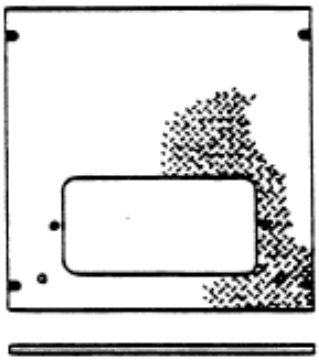
STD ITEM	SAP ITEM ID	PS ITEM ID
UR12EP	9305545[E]	5106641[E]

PAD, URD VAULT to PADMOUNT CONVERSION

Reinforced plastic mortar submersible to padmount conversion adapter assembly consisting of top cap, cover and associated mounting hardware, For conversion of 36 inch submersible enclosures to padmount installations.



Top Cap

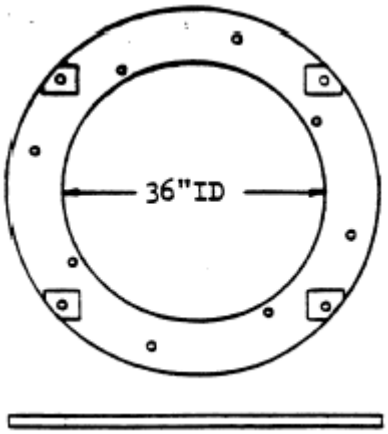


Cover

	WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
Top Cap	87#	UR12F	9316412[Y]	2012150[Y]
Cover	87#	UR12G	9316390[Y]	2012151[Y]

RING, URD VAULT to PADMOUNT CONVERSION ADAPTER

Reinforced plastic mortar submersible to padmount conversion adapter ring and associated mounting hardware, for use with items UR12F, Top Cap and UR12G, Cover. For conversion of 48 inch submersible enclosures to padmount installations.



WEIGHT	STD ITEM	SAP ITEM ID	PS ITEM ID
120#	UR12H	9316389[Y]	2012152[Y]

PAD, URD VAULT to PADMOUNT CONVERSION

Precast Concrete – 46-1/2” wide x 48” Long x 3” Thick. In accordance with PPL Material Specification Standard MS-5066.

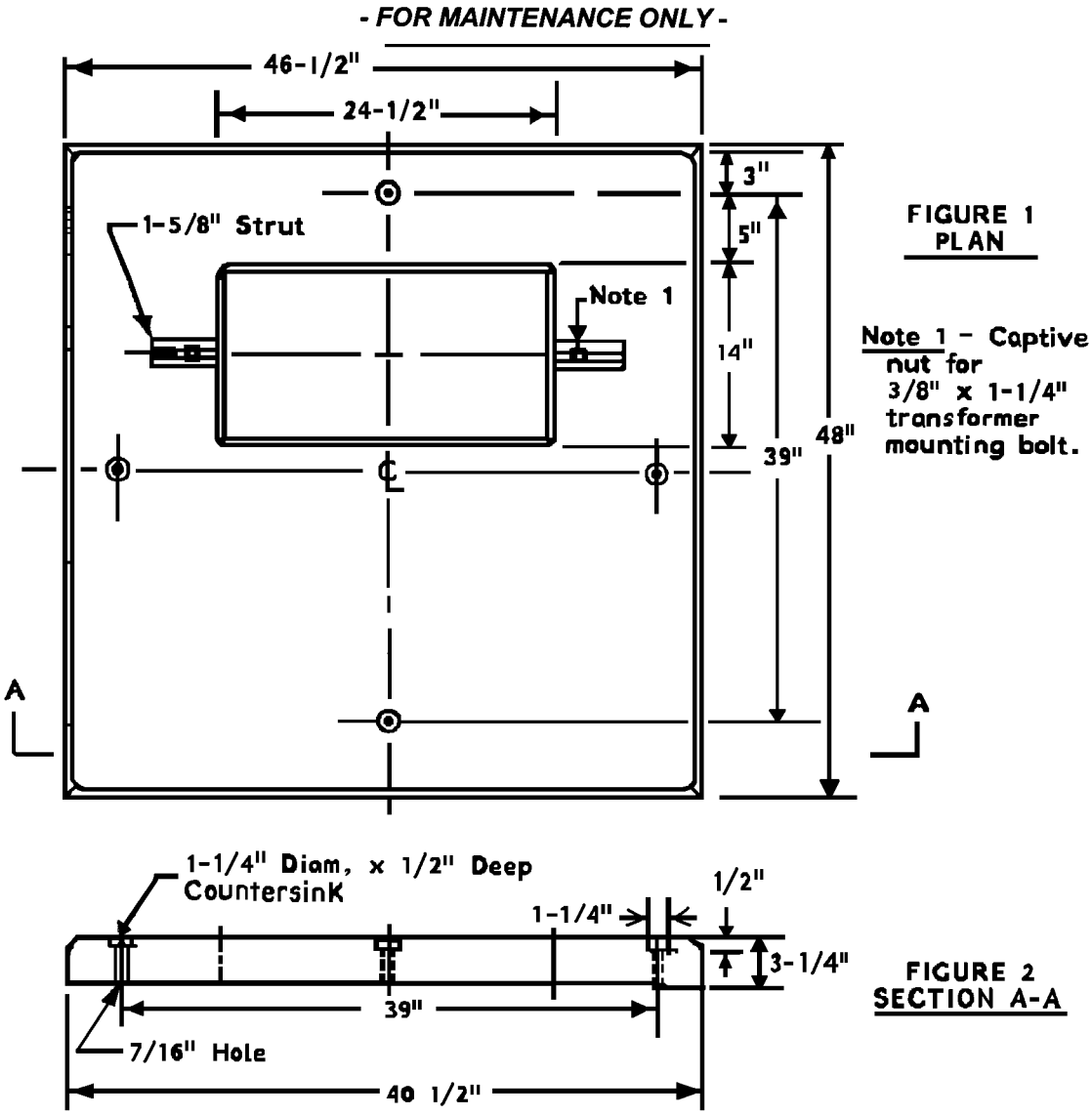


FIGURE 1
PLAN

Note 1 – Captive nut for 3/8" x 1-1/4" transformer mounting bolt.

FIGURE 2
SECTION A-A

STD ITEM	SAP ITEM ID	PS ITEM ID
UR12P	9303512[E]	5645275[E]

GRATING, TRANSFORMER VAULT

Aluminum, – 40-1/2" wide x 34-3/4" Long, In accordance with PPL Material Specification Standard MS-5054.

FOR MAINTENANCE ONLY

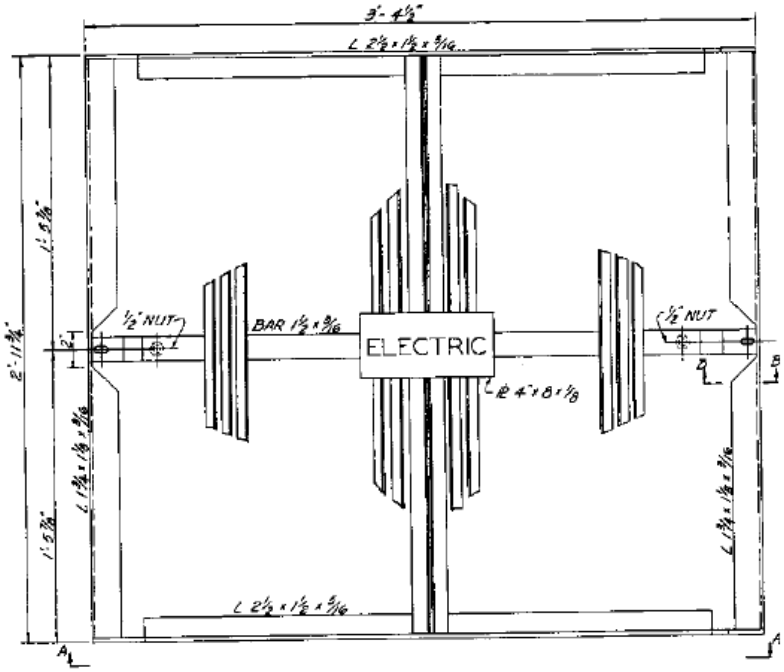


Figure 1 - Plan

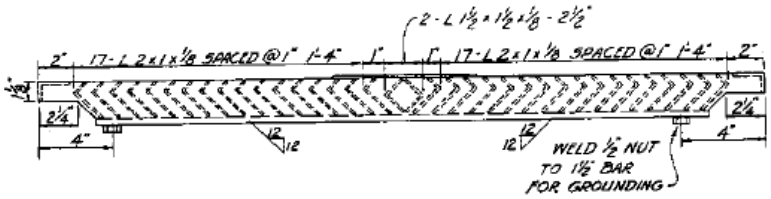


Figure 2 - A-A

STD ITEM	SAP ITEM ID	PS ITEM ID
UR12T	9304526[E]	5642943[E]

SHIELD, URD SUBMERSIBLE VAULT

Shield for URD submersible vault with open grating. For Maintenance of Existing vaults only.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR13B	9309172[Y]	2012116[Y]

CONNECTOR, URD SECONDARY, INSULATED, 350 MAX

Single 5/16-inch Allen head set screw type, 600V, insulated secondary connector designed for connecting insulated copper or aluminum secondary cables with a cable range of #10 AWG stranded through 350 kcmil. Suitable for handhole, submersible transformer direct burial and vault applications.

	STD ITEM	SAP ITEM ID	PS ITEM ID
4 Position	UR15A4	9304599	5641672
6 Position	UR15A6	9304598	5641674
8 Position	UR15A8	9311912	2014938

CONNECTOR, URD SECONDARY, INSULATED

Connector, submersible, 8" long EPDM rubber, for 350 kcmil URD secondary.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR15B2	9311729	2014959

CONNECTOR, URD SECONDARY, INSULATED, 500 MAX

Single 5/16-inch Allen head set screw type, 600V, insulated secondary connector designed for connecting insulated copper or aluminum secondary cables with a cable range of #10 AWG stranded through 500 kcmil. Suitable for handhole, submersible transformer direct burial and vault applications.

	STD ITEM	SAP ITEM ID	PS ITEM ID
4 Position	UR15E4	9302482	5109705
6 Position	UR15E6	9308332	9201459
8 Position	UR15E8	9308333	9201458[E]

CONNECTOR, FLOOD SEAL, INSULATED, #2 - 1000

Twin 5/16-inch Allen head set screw type, 600V, insulated secondary connector designed for connecting insulated CU or AL secondary cables with a range of #2-1000. Fully submersible.

	STD ITEM	SAP ITEM ID	PS ITEM ID
4 Position	UR15F4	9387616	none
6 Position	UR15F6	9387615	none
8 Position	UR15F8	9387617	none
12 Position	UR15F12	9387845	none
16 Position	UR15F16	9387840	none

CONNECTOR, UNITAP, INSULATED 600V

Insulated connector, 600V, Unitap for connecting cables in junction boxes, connector has conductor range

RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
#10 awg – 250 kcmil #6 awg – 500 kcmil	UR15G UR15G2	9388965 9391747	n/a n/a

CONNECTOR, UNITAP, INSULATED 600V

Insulated connector, 600V, Unitap for connecting cables in junction boxes, range #10 – 250 kcmil

STD ITEM	SAP ITEM ID	PS ITEM ID
UR15G1	9390806	n/a

CONNECTOR, UG SECONDARY, COPPER, INSULATED, 750 MAX

Two 5/16-inch Allen head set screw type, 600V, insulated secondary connector designed for connecting insulated copper secondary cables with a cable range of #2 AWG stranded through 750 kcmil. Suitable for use in conventional underground applications.

	STD ITEM	SAP ITEM ID	PS ITEM ID
4 Position	UR15H4	9389627	N/A
6 Position	UR15H6	9389655	N/A

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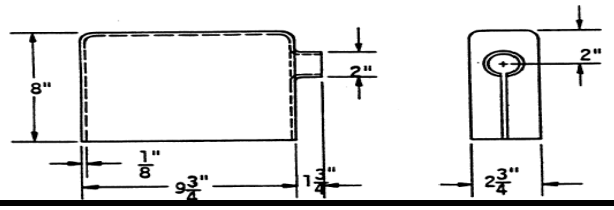
BOOT, INSULATING

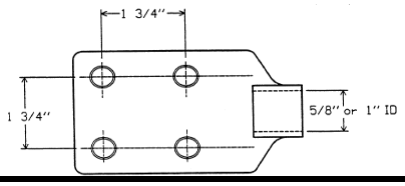
Rubber boot for covering the secondary bushing and cable terminals on single phase pad transformers, items UT30A and UT30B.
MAINTENANCE ONLY



STD ITEM	SAP ITEM ID	PS ITEM ID
UR16G	9311897[Y]	2014933[Y]

CONNECTOR, TRANSFORMER SECONDARY SPADE

4 hole, NEMA “H” spade, tin plated copper alloy, screw-on type connector in accordance with ANSI C57.12.25. For use with single-phase, pad-mounted transformers, items UT30A and UT30B.



TRANSFORMER STUD SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
⅝” – 11 UNC	UR20A	9316688[Y]	2014864[Y]
1” – 14 UNC	UR20B	9311888[Y]	2014865[Y]

CONNECTOR, PADMOUNT SECONDARY, STRAIGHT

For use with single-phase, padmount transformer secondary. Quick disconnect dual sized 5/8 and 1”. Six (6) or Three (3) position connector, aluminum construction for #2 AWG through 500kcmil conductors. One position for St Light # 14 to #2. Packed as three (3) connectors, two (2) insulated connectors for live legs. Bare connector for neutral

	STD ITEM	SAP ITEM ID	PS ITEM ID
6 position	UR21	9307942	9202832
3 position	UR21A	9386997	NONE

CONNECTOR, PADMOUNT SECONDARY, STRAIGHT **MAINTENANCE ONLY**

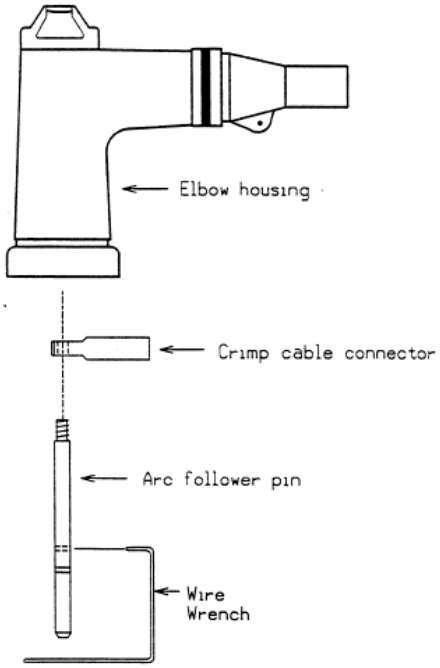
Items discontinued, okay to use up existing inventory, items replaced by UR21

For use with single-phase, padmount transformer secondary. Six (6) position connector, aluminum construction for #2 AWG through 500kcmil conductors. Packed as three (3) connectors and two (2) insulated boots for live legs. Boot not needed for neutral

STUD SIZE	STD ITEM	SAP ITEM ID	PS ITEM ID
5/8" stud – (25-75 KVA)	UR21	9309528	5641661
1" stud – (100-167 KVA)	UR21E	9304621	5641662

ELBOW, 15kV LOADBREAK, 200 AMP

Loadbreak elbow kit, for use on aluminum and copper 15kV primary cables with concentric neutral. The kit shall include all material necessary for installation, including a shielded elbow housing, arc follower pin, crimp cable connector, wrench and silicone grease.



CABLE SIZE (AWG)	INSULATION O.D.	STD ITEM	SAP ITEM ID	PS ITEM ID
#2	0.575" – 0.74"	UR23A	9311911	2014943
1/0	0.665" – 0.905"	UR23A1	9305495[E]	5106725[E]
2/0	0.665" – 0.905"	UR23A2	9309883[E]	5106726[E]
4/0	0.83" – 1.060"	UR23A4	9304530	5642458

JACKET SEAL, CABLEACCESORY

Jacket seal for use with premolded terminations.

	STD ITEM	SAP ITEM ID	PS ITEM ID
200A 600A	UR23B UR23B1	9303969 9388870	5643868 n/a

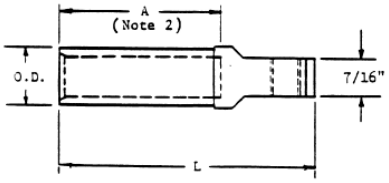
PIN, CONTACT, 200 AMP, 15kV LOADBREAK ELBOW

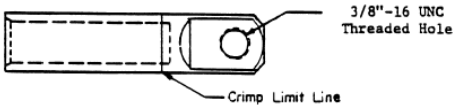
Replacement contact pin for 200 amp loadbreak elbow.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR23P	9314914	0810979

CONNECTOR, 15kV LOADBREAK ELBOW TERMINAL

Tinned aluminum/copper compression connector with one ⅜"–16 UNC threaded hole. For use with 200A loadbreak elbows, item UR23A. Furnished compound filled and capped. For use on voltages of 15 kV and below.





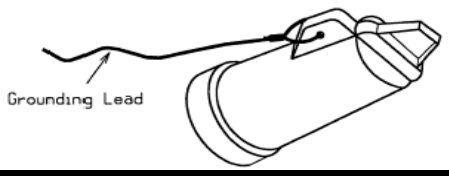
AL OR CU CABLE SIZE (AWG)	A	L	OD	MD6	CRIMPS	Y35 OR Y39	CRIMPS	STD ITEM	SAP ITEM ID	PS ITEM ID
#2	1.88	2.88 – 2.92	0.625	W-BG	3	UBG	3	UR23T	9311881	2014915
				BG	6					

NOTES: 1. All dimensions are in inches and approximate

2. "A" dimension is inserted depth of square cut cable before crimping.

INSULATED CAP, 15kV LOADBREAK BUSHING, 200 AMP

Insulating cap used for insulating, shielding and water sealing an energized loadbreak bushing, item UR36B.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR24	9311910	2014944

INSULATED CAP, 15kV LOADBREAK BUSHING, 200 AMP, BOND-LESS

Insulating cap used for insulating, shielding and water sealing an energized loadbreak bushing, item UR36B. Bond tail not needed. **NOTE: Discontinued. Not to be used in dead front compartments**

STD ITEM	SAP ITEM ID	PS ITEM ID
~~UR24A~~	~~9390631~~	~~N/A~~

INSULATED CAP, 25/35KV LOADBREAK BUSHING, 200 AMP, BOND-LESS

Insulating cap used for insulating, shielding and water sealing an energized loadbreak bushing, item UR36B. Bond tail not needed. **NOTE: Discontinued. Not to be used in dead front compartments**

STD ITEM	SAP ITEM ID	PS ITEM ID
~~UR24B~~	~~9390689~~	~~N/A~~

INSULATED CAP, 25kV LOADBREAK BUSHING, 200 AMP

Insulating cap used for insulating, shielding and water sealing an energized 25kV loadbreak bushing.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR24C	9307585	9202978

DEADEND PLUG - STORAGE

Deadend plug – 15kV, for bushing well. For covering bushing well on deadfront pole type and subway transformers while in storage.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR24S	9305450	5106772

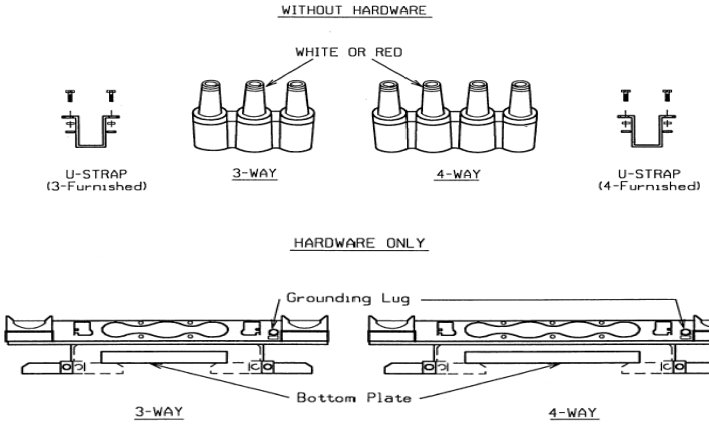
ELBOW, 25kV LOADBREAK, 200 AMP

Elbow, loadbreak, 200A, 25kV, 125kV BIL,.1/0 AL/CU compression lug, long barrel friction welded bimetallic, with copper top section, probe tin plated.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR26	9387635	none

JUNCTION, 15kV LOADBREAK, 200 AMP

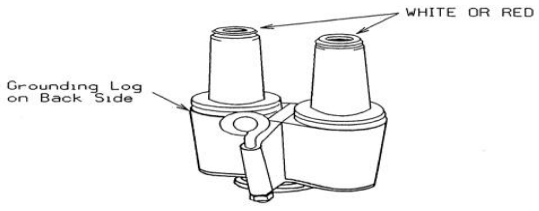
Loadbreak junction for connecting loadbreak elbows, item UR23, in vaults and enclosures.



		STD ITEM	SAP ITEM ID	PS ITEM ID
Without Hardware	3-Way	UR28C	9311721	2014960
	4-Way	UR28D	9311719	2014961
Hardware Only	3-Way	UR28CH	9311715	2014968
	4-Way	UR28DH	9311714	2014969

FEED THRU, 15kV LOADBREAK, 200 AMP

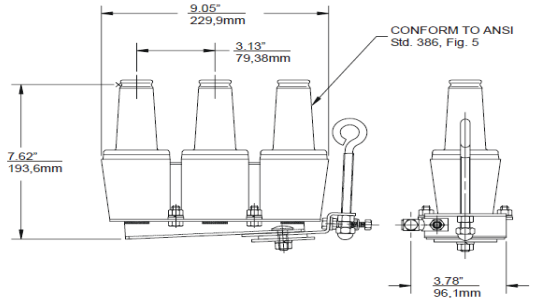
Feed thru device for electrically connecting and water sealing two loadbreak elbows or connecting one loadbreak elbow to other loadbreak accessories. For installing on a 15kV style parking stand.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR29B	9311718	2014962

FEED THRU, 15kV LOADBREAK, 200 AMP – 3-POSITION

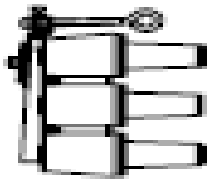
Feed thru loadbreak device 3-way, 200 amp., 15kV, for electrically connecting and water sealing three loadbreak elbows or loadbreak accessories. Adjustable mounting bracket to provide flexability for mounting on a parking stand.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR29B3	9307869	9202267

FEED THRU, 25kV LOADBREAK, 200 AMP – 3-WAY

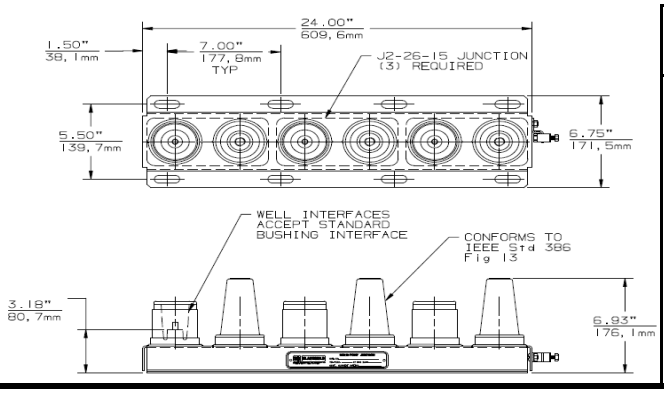
Feed thru device for electrically connecting and water sealing three loadbreak elbows or loadbreak accessories. Adjustable mounting bracket for mounting on a parking stand.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR29C3	9387606	none

FEED THRU, 15kV DEADDBREAK, MULTIPOINT 200 - 600 AMP

Feed-thru, deadbreak device, 600A-200A, 15KV, multipoint 6-position, for electrically connecting and water sealing three 600A deadbreak elbows to three 200A deadbreak accesories. Install in manhole or vault wall.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR29DB6	9387664	none

BUSHING, 15kV, DEAD FRONT TO LIVE FRONT CONVERSION

Air bushing to screw into dead front bushing well, for conversion of dead front transformer to live front connections. For **TEMPORARY** use when a live front has failed and the cables are too short for elbow installation. Not for use in single phase minipads. Must be removed as soon as possible.

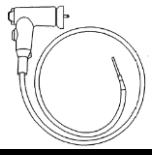
Connector

STD ITEM	SAP ITEM ID	PS ITEM ID
UR30	9303971	5648165
UR30A	9388399	n/a

GROUNDING ELBOW, 15kV

An unshielded, insulating and water sealing elbow, orange and yellow in color, for grounding applications. Furnished completely assembled in individual cartons with a six-foot long yellow-jacketed #1/0 AWG copper flexible welding type cable with a crimped on tinned plated copper terminal plug connector. For use on 3-phase step-down or step-up padmount underground transformers.

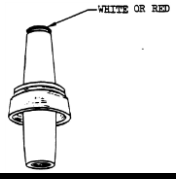
NOTE: THIS ITEM IS NOT TO BE USED FOR PERSONAL PROTECTIVE GROUNDING. REFER TO THE TOOL CATALOG FOR THE PROPER ELBOW GROUNDS FOR PERSONAL PROTECTIVE GROUNDING.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR32	9316662	2014954

BUSHING WELL INSERT, 15kV LOADBREAK, 200 AMP

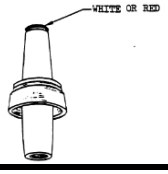
Loadbreak bushing well insert for use as an interface between an apparatus bushing well and a loadbreak elbow, item UR23, or other loadbreak accessories.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR36B	9311717	2014963

BUSHING WELL INSERT, 25kV LOADBREAK, 200 AMP

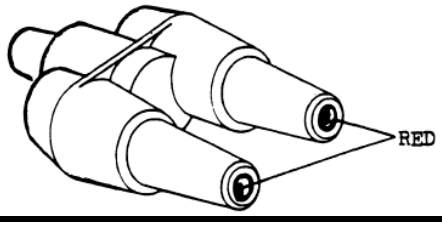
Loadbreak bushing well insert for use as an interface between an apparatus bushing well and a loadbreak elbow, item UR26, or other loadbreak accessories.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR36C	9390577	

FEED THRU INSERT, ROTATABLE, 15kV LOADBREAK, 200 AMP

Loadbreak feed-thru insert for use as an interface between an apparatus bushing well and a loadbreak elbow(s), item UR23, or other loadbreak accessories, including associated mounting hardware.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR37	9311915	2014935

PARKING STAND, 15kV LOADBREAK

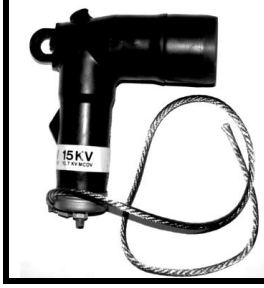
STD ITEM	SAP ITEM ID	PS ITEM ID
UR38	9304245	5645700

PARKING STAND, 25kV LOADBREAK

STD ITEM	SAP ITEM ID	PS ITEM ID
UR38A	9393328	na

SURGE ARRESTER, ELBOW

Distribution class, metal oxide type surge arrester, shielded elbow housed, in accordance with ANSI/IEEE 386 and with a bare 37” long, #6 AWG stranded copper grounding cable. In accordance with PPL Material Specification Standard MS-2608.



	MCOV kV (RMS)	STD ITEM	SAP ITEM ID	PS ITEM ID
12 kV	10.20	UR40A3	9308875	5100691
15 kV	12.70	UR40A4	9308873	5100692
27 kV	22.00	UR40A6	9313870	5980731

SURGE ARRESTER, PARKING STAND

Distribution class, metal oxide type surge arrester, shielded elbow receptacle, in accordance with ANSI/IEEE 386 and with a bare 37” long, #6 AWG stranded copper grounding cable. In accordance with PPL Material Specification Standard MS-2608.

	STD ITEM	SAP ITEM ID	PS ITEM ID
12 kV	UR40B3	9320477	5101476

SURGE ARRESTER, BUSHING WELL

Distribution class, metal oxide type surge arrester, bushing style, in accordance with ANSI/IEEE 386 and with a bare 37” long, #6 AWG stranded copper grounding cable. In accordance with PPL Material Specification Standard MS-2608.

	STD ITEM	SAP ITEM ID	PS ITEM ID
12 kV	UR40C3	9308892	5103703

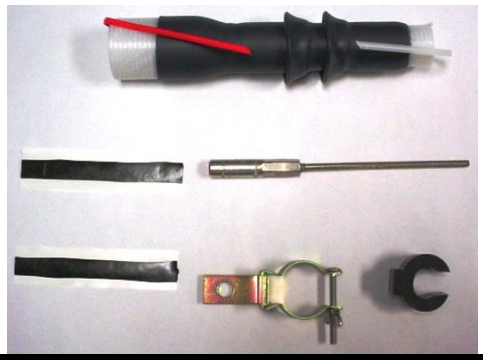
SURGE ARRESTER, ELBOW 600 AMP BUSHING STYLE

Distribution class, metal oxide type surge arrester, shielded elbow housed, in accordance with ANSI/IEEE 386 and with a bare 37” long, #6 AWG stranded copper grounding cable minimum. In accordance with PPL Material Specification Standard MS-2608.

	MCOV kV (RMS)	STD ITEM	SAP ITEM ID	PS ITEM ID
12 kV	10.20	UR40D3	9393765	
15 kV	12.70	UR40D4	9393768	
27 kV	22.00	UR40D6	9393769	

TERMINATION, COLD SHRINK, 15 kV, #2 ONLY

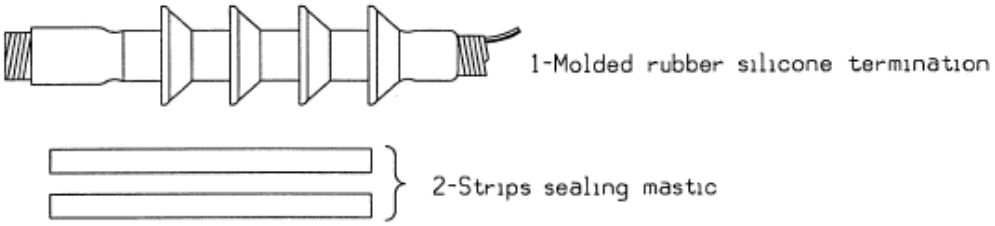
Cold shrink termination designed for terminating #2 conductor, 15kV cable only. This terminator to be used on poles only. For switchgear, use item UR44B. This kit contains the pin connector and single clamp bracket for mounting the terminator to the pole bracket, item C35 or E12M.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR42	9307129	9201104
UR42A Clamp Bracket Single	9387015	n/a

TERMINATION, COLD SHRINK, 5-25 kV

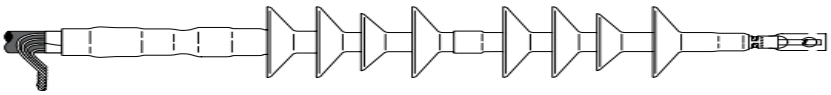
Cold shrink termination designed for terminating cables up to 25kV. Kits do not include connectors. Choose kit based on cable insulation O.D.



ORIENTATION	INSUL. O.D. RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
Upright	0.64” – 1.08”	UR44B	9314648	0810937
Upright	0.83” – 1.53”	UR44C	9303963	5643876
Upright	1.05” – 1.80”	UR44D	9314293	0810501
Upright	1.53” – 2.32”	UR44E	9303964	5643878
Inverted	0.72” – 1.29”	UR44L	9310182[Y]	9201305[Y]
Inverted	1.05” – 1.80”	UR44M	9310183[Y]	9201304[Y]

TERMINATION, COLD SHRINK, 35 kV

Cold shrink termination designed for terminating 35kV cables. Kit does not include connector. Choose kit based on cable insulation O.D.

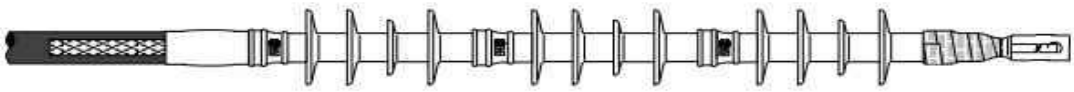


Molded Rubber Silicone 8-skirt Termination

INSUL. O.D. RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
0.72" – 1.29"	UR45B1	9314555	0810901
1.05" – 1.80"	UR45C3	9314447	0810976
1.53" – 2.32"	UR45H	9314501	0811180

TERMINATION, COLD SHRINK, 46 kV

Cold shrink termination designed for terminating 46kV cables. Kit does not include connector.

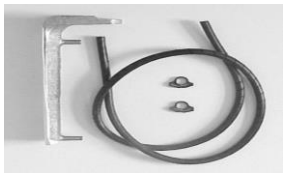


Molded Rubber Silicone 12-skirt Termination

Insulation OD	STD ITEM	SAP ITEM ID	PS ITEM ID
1.31 – 2.1"	UR46	9390156	N/A

CABLE POSITIONER

Aluminum bracket to attach terminator to pole bracket. Required for terminations on all cable with conductor larger that #2.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR47CP	9309543	5642411

GROUNDING KIT, TERMINATION

Accessory kit for neutral connection / grounding of cables with copper tape insulation shield. This kit is needed in addition to the cold shrink terminator, item UR43 – UR45. Kit includes ground braid and spring clamps.

Insulation OD	STD ITEM	SAP ITEM ID	PS ITEM ID
0.82 – 1.63”	UR47T4	9310177	9201267
1.15 – 2.42”	UR47T5	9310175	9201268

SPLICE, COLD SHRINK, 5 – 35 KV (DISCONTINUED)
NOTE: FOR MAINTENANCE ONLY – USE UP REMAINING STOCK

Cold Shrink splice kit for concentric neutral XLP and EPR cables, copper or aluminum conductor. Each kit contains parts for 1 single phase splice. Select proper connector from UC60 - UC63. Connector must meet dimensional requirements of splice kit. See instructions.

For aerial cable applications, replace outer jacket in splice kit with silicone jacket, Standard Item UR49D.

VOLTAGE (kV)	INSULATION O. D.	STD ITEM	SAP ITEM ID	PS ITEM ID
5-15	0.64-1.01”	UR49A1	9314436	0811158
5-15	0.84-1.38”	UR49A2	9314458	0811159
5-15	1.04-1.70”	UR49A3	9314519	0811160
5-15	1.08-1.70”	UR49A4	9314459	0811161
25	0.84-1.36”	UR49B1	9314697	0811077
25	1.07-1.70”	UR49B2	9314517	0811162
25	1.24-2.07”	UR49B3	9314516	0811163
35	1.07-1.70”	UR49C1	9314471	0811215
35	1.24-2.07"	UR49C2	9314515	0811164
Silicone Outer Jacket for Aerial Applications		UR49D1 UR49D3	9314470 9306802	0811216 9201658

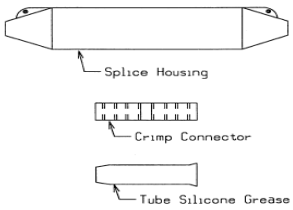
SPLICE, PREMOLDED, 15 kV, #2 ALUMINUM

Premolded straight cable splice for two #2 AWG concentric neutral primary cables in URD applications. Use for aluminum and / or copper conductors. The kit includes a shielded splice housing, one crimp connector and silicone grease. If both cables are jacketed, cover the splice with rejacketing kit, item UR75A.

CABLE SIZE	INSULATION O.D.	STD ITEM	SAP ITEM ID	PS ITEM ID
#2	0.64" – 0.82"	UR50	9315156	0809726

SPLICE, REPAIR, PREMOLDED, 15 kV, ALUMINUM

Premolded straight cable splice for two concentric neutral primary cables in URD applications. Use for aluminum and / or copper conductors. This kit allows the removal of up to 6" of damaged cable without having to install a new piece of cable. The kit includes a shielded splice housing, one crimp connector and silicone grease. If both cables are jacketed, cover the splice with rejacketing kit, item UR75A.



CABLE SIZE (AWG)	INSULATION O.D.	STD ITEM	SAP ITEM ID	PS ITEM ID
# 2	0.64" – 0.82"	UR50R	9303849	5647012
# 1/0	0.637" – 0.90"	UR50R1	9303848[E]	5647013[E]

SPLICE, COLD SHRINK, 5 – 35 KV, "ALL IN ONE"

Cold Shrink splice kit for jacketed concentric neutral, flat strap and tape shield XLP and EPR cables, copper or aluminum conductor. Each kit contains parts for 1 single phase splice. The "All In One" design incorporates a silicone rubber splice body, integrated neutral sock and EPDM re-jacketing sleeve in one tube. For aerial applications the re-jacketing sleeve is UV resistant. Select proper connector from UC59_. Connector must meet dimensional requirements of splice kit. See instructions.

VOLTAGE (kV)	NOMINAL CABLE RANGE	INSULATION O. D.	STD ITEM	SAP ITEM ID
5	4/0 - 500	0.64"–1.20"	UR51A	9388525
15	#2 – 4/0	0.64"-1.20"	UR51A	9388525
15	350 – 500	0.87"-1.40"	UR51B	9388526
15	500 – 1000 *	1.03"–1.58"	UR51F	9389651
15	750 - 1000	1.28"-2.05"	UR51C	9388535
25	1/0 – 350	0.87"-1.40"	UR51B	9388526
25	350 - 750	1.03"–1.58"	UR51F	9389651
25	500 - 1000	1.28"-2.05"	UR51C	9388535
35	1/0 – 2/0	1.03"-1.49"	UR51D	9388506
35	500 - 1000	1.36"-2.05"	UR51E	9388499
	*Do not use on 1000-1000 splice			

ELBOW, DEADBREAK, 600 AMP, (T-BODY)

Deadbreak elbow kit for use on 5-35 kV concentric neutral primary cable. The kit includes shielded elbow housing, threaded stud and silicone grease. Select connector (UR63) and cable adapter (UR64) to fit cable size. Install cable jacket seal (UR23B1). **NOTE: Std. Item UR60A has been discontinued and replaced by Std. Item UR60CS_. Use up remaining stock.**

VOLTAGE kV	STD ITEM	SAP ITEM ID	PS ITEM ID
5, 15 & 25	UR60A	9304528	5642460
35	UR60B	9304529	5642459

ELBOW, DEADBREAK, 600A, 5-25 KV, COLD SHRINK (T-BODY)

Elbow, 600 amp, 5-25 kV, cold shrink, test point and jacket seal included in housing, packaged with 600 amp rated threaded stud and silicone grease. Range-Taking option eliminates cable adapters.

COND. SIZE	INS. O.D. RANGE	STD ITEM	SAP ITEM ID
1/0-350	0.725”-1.360”	UR60CS1	9391410
350-750	0.990”-1.650”	UR60CS2	9391385
750-1500	1.268”-2.095”	UR60CS3	9391408

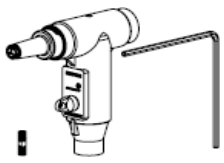
ELBOW, DEADBREAK, EXTENDED, 600 AMP, (T-BODY)

Deadbreak guillotine elbow kit for use on 5-25 kV concentric neutral primary cable. The kit includes shielded elbow housing, threaded stud and silicone grease. Select connector (UR63) and cable adapter (UR64) to fit cable size. Install cable jacket seal (UR23B1)

VOLTAGE kV	STD ITEM	SAP ITEM ID	PS ITEM ID
5, 15 & 25	UR60E	9307837	9202747

ELBOW, WITH REDUCING TAP WELL, 600 AMP, 15kV

Elbow, 600 amp with 200 amp reducing tap well bushing, 15kV, test point included in housing, packaged with 600 amp rated threaded stud and hex tool torque wrench. Install cable jacket seal (UR23B1). **NOTE: This item has been discontinued and replaced by Std. Item UR60R_. Use up remaining stock**



STD ITEM	SAP ITEM ID	PS ITEM ID
UR60R	9307623	9202955

ELBOW, DEADBREAK, 600A, 15KV, COLD SHRINK, WITH 200A REDUCING TAP WELL

Elbow, 600 amp, 15 kV, cold shrink, with 200 amp reducing tap well bushing, test point and jacket seal included in housing, packaged with 600 amp rated threaded stud and silicone grease. Range-Taking option eliminates cable adapters.

COND. SIZE	INS. O.D. RANGE	STD ITEM	SAP ITEM ID
1/0-350	0.725”-1.360”	UR60R1	9391407
350-750	0.990”-1.650”	UR60R2	9391395
750-1500	1.268”-2.095”	UR60R3	9391388

THREADED STUD, DEADBREAK ELBOW

Threaded stud for connection at 600 Amp deadbreak elbows (T-Body) Item UR60 and related components.

VOLTAGE kV	STD ITEM	SAP ITEM ID	PS ITEM ID
5, 15 & 25	UR61A	9303842	5647300
35	UR61B	9303841	5647305

900 AMP ELBOW KITS, FOR USE ON NETWORK TRANSFORMERS BUILD AFTER MAY 2015

900 amp elbow kits come complete with copper lug, adaptor, end cap and reducing tap well where applicable. Some kits might contain 2 cable adaptors, use the appropriate one based on the cable insulation O D Elbows to have 900A label secured to the housing for identification.

				OPERATING AREA			
STANDARD ITEM	Item ID	CABLE SIZE	VOLTAGE CLASS	RHODE ISLAND			
UR62C	9388922	4/0	15				
UR62C2	9388844	4/0	15	x			
UR62E2*	9388925	1/0	25				
UR62G**	9388935	2/0	35				
UR62G2**	9388840	2/0	35				
	* Buffalo system uses 23kV 1/0 cable, however the transformer bushings and elbows are 35kV class 150BIL. ** The 35kV class elbows are rated for 200kV BIL. Note: # 2 cable has been removed due to ampacity limitation on the shield under fault conditions.						

CONNECTOR, DEADBREAK ELBOW LUG

Aluminum compression connector for copper or aluminum conductors. Used with 600 amp deadbreak elbows and splices, standard items UR60A, UR60B and UR72.

CONDUCTOR SIZE AWG / kcmil	STD ITEM	SAP ITEM ID	PS ITEM ID
#2	UR63A	9304629	5641648
1/0	UR63B	9304636	5641651
2/0	UR63C	9310431	9201046
4/0	UR63D	9304626	5641656
350, 400 compact	UR63E	9304625	5641657
500 compact	UR63F	9304622	5641660
500	UR63G	9304624	5641658
750	UR63H	9304623	5641659
1000	UR63J	9304628	5641653

CONNECTOR, DEADBREAK ELBOW SHEAR BOLT LUG

Aluminum shear bolt connector lug for copper and aluminum conductors. Use with 600 Amp deadbreak elbows (T-Body) Item UR60CS_ and UR60R_. Lugs are range taking and can be used with diffent size conductors.

RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
#5-300	UR63SB1	9392869	N/A
3/0-600	UR63SB2	9392862	N/A
600-1250	UR63SB3	9392935	N/A

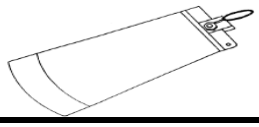
CABLE ADAPTER, DEADBREAK ELBOW

Molded rubber cable adapter for use with 600 amp deadbreak elbows and joints, items UR60A, UR60B and UR71. Select proper adapter based upon cable insulation O. D.

VOLTAGE kV	INSULATION O.D. (in.)	STD ITEM	SAP ITEM ID	PS ITEM ID
5, 15 & 25	0.64 - 0.82	UR64A1	9304685	5640013
	0.85 - 1.05	UR64A2	9304680	5640025
	0.98 - 1.18	UR64A3	9304681	5640024
	1.09 - 1.31	UR64A4	9304411	5640028
	1.18 - 1.465	UR64A5	9304679	5640026
	1.37 - 1.63	UR64A6	9304410	5640031
	1.515 - 1.78	UR64A7	9304682	5640022
	1.725 -1935	UR64A8	9389608	NA
35	0.85 - 1.05	UR64B5	9306563[Y]	9201415[Y]
	0.98 - 1.18	UR64B1	9304684	5640015
	1.09 - 1.31	UR64B2	9310404	9201042
	1.18 - 1.46	UR64B3	9310405	9201041
	1.72 - 1.93	UR64B4	9304683	5640021
	1.515 – 1.780	UR64B6	9314981	9202653

INSULATED CAP, DEADBREAK ELBOW, 5 - 25kV

Cap for insulating a 600A apparatus bushing or the male stud end of a deadbreak connecting plug, item UR66.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR65	9311727	2014945[Y]

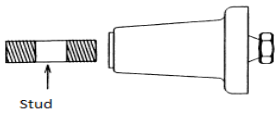
CONNECTING PLUG, DEADBREAK ELBOW

For connection between two 600A deadbreak elbows, item UR60, or between one 600A deadbreak elbow and one 600A deadbreak bushing extension, item UR69.

VOLTAGE kV	STD ITEM	SAP ITEM ID	PS ITEM ID
5, 15 & 25	UR66A	9304193	5645732
35	UR66B	9304196	5645729

INSULATING PLUG, DEADBREAK ELBOW

An insulating plug for 600A deadbreak elbow, item UR60, or a 600A deadbreak bushing extension, item UR69. Furnished with end cap.



VOLTAGE kV	STD ITEM	SAP ITEM ID	PS ITEM ID
5, 15 & 25	UR67A	9319818	5645730
35	UR67B	9304216	5645727

REDUCING TAP WELL, DEADBREAK ELBOW, 15kV, 35kV

A reducing bushing well interface between a 600A deadbreak elbow, item UR60, or 600A deadbreak bushing extension, item UR69, and a 200A loadbreak bushing plug insert, item UR36. Requires bail assembly, item UR68B.

STD ITEM	kV	SAP ITEM ID	PS ITEM ID
UR68A	15	9303977	5648003
UR68C	25	9307590	9202973
UR68D	35	9310209	9201290

BAIL ASSEMBLY

Bail deadend assembly to prevent 200 amp loadbreak elbow from separating from 600 amp deadbreak elbow during a fault. Use with Standard Item UR68A.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR68B	9304425	5640220

BUSHING EXTENSION DEADBREAK ELBOW

For extending apparatus bushings and connection, item UR60 to deadend connecting plug, item UR66. Furnished with a loose packaged stud.

STD ITEM	kV	SAP ITEM ID	PS ITEM ID
UR69	5 - 25	9311720	2014981
UR69A	35	9308076	9202244

SPANNER WRENCH, DEADBREAK ELBOW

Wrench to install deadbreak elbow components.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR70	9311730	2014982

JOINT, SEPARABLE DEADBREAK, 5-35 kV

Pre-molded, separable cable joint, three (3) or four (4) position, for solid dielectric cables. Kit includes boots, bolts & washers. Use with connectors UR63, Cable Adapter UR64A_ (NOTE; use 25kV cable adaptors for 35kV joint) and retaining rings UR72. Unused positions must be covered with Insulating Cap UR73. 35kV kit also includes restraint clamps.

NOTE: Items UR71AH and UR71AY have been discontinued, replaced by Std. Items UR74_. Use up remaining stock

JOINT TYPE	kV	STD ITEM	SAP ITEM ID	PS ITEM ID
H	5 – 25	~~UR71AH~~	~~9310324~~	~~9201166~~
Y	5 – 25	~~UR71AY~~	~~9304246~~	~~5646994~~
H	35	UR71BH	9389326	
Y	35	UR71BY	9310323	9201167

JOINT, SEPARABLE DEADBREAK COLD SHRINK 35 kV

Cold shrink separable H joint 35kV, range taking. Kit includes H bus, insulated cold shrink sleeves, lug connectors, ground braid, cable spiking stem with cover and sleeve restraining clamp

RANGE	STD ITEM	SAP ITEM ID
600-1250 1/0-450	UR71BH1 UR71BH2	9392046 9394236

REPLACEMENT BOLT AND WASHER, FOR H-BODY SEPARABLE JOINT

Top head breaks away when proper torque is applied.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR71BW	9387375	none

CONNECTOR, BUS H JOINT, INSULATED 5 – 25 kV

Connector H joint, rubber insulated aluminum bus, rated 25kV, capacitive test point, to be used with separable joint UR74 and spiking stem UR71G_

STD ITEM	SAP ITEM ID	PS ITEM ID
UR71H	9392589	none

CLAMP, STAINLESS STEEL, FOR H-BODY SEPARABLE JOINT

Clamp shall be used on all 35kV class Y joints over boot assembly. The clamp is required to maintain required BIL. Clamp should be used on all 15/25kV H and Y joints when assembling to boot becomes easy. The clamp will ensure a watertight seal.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR71HC	9387549	none

CABLE SPIKING STEM, 15 -35Kv

Spiking stem, for use on a spare position of an H or Y body deadbreak separable joint. Stem comes in a kit with the stem, bolt, washer, grease and boot.

Voltage Class	STD ITEM	SAP ITEM ID	PS ITEM ID
15/25kV	UR71G15	9389327	NA
35kV	UR71G35	9389345	NA

JOINT, SEPARABLE DEADBREAK, SACRIFICIAL 5-25 kV

Pre-molded, separable cable joint, four (4) position, for solid dielectric cables. Sacrificial connector is a guillotine-able replaceable connector. Kit includes boots, sacrificial connector, bolts & washers STD Item UR71S. Use with connectors UR63, Cable Adapter UR64A_ and retaining rings UR72. Unused positions must be covered with Insulating Cap UR73. Replacement Kit Std Item 71SR includes bus and sacrificial connector. Replacement Sacrificial connector only is STD Item UR71SL.Seal cable jacket with Std Item UR23B1.

NOTE: Std. Item UR71S has been discontinued, replaced by Std. Item UR74_. Use up remaining stock. Order Std. Item UR71SR to get bus and sacrificial connector.

STD ITEM	SAP ITEM ID	PS ITEM ID
~~UR71S~~	~~9307917~~	~~9202843~~
UR71SR	9307916	9202844
UR71SL	9307915	9202845

RETAINING RINGS, CABLE

Cable Retaining Rings for use with premolded joint UR71. One ring required per cable position.

CONDUCTOR SIZE AWG / kcmil	STD ITEM	SAP ITEM ID	PS ITEM ID
#2	UR72	9304269	5646105
1/0 – 2/0	UR72A	9306505	9201705
4/0	UR72B	9306504	9201706
350	UR72C	9306503	9201707
500	UR72D	9306502	9201708
750	UR72E	9306501	9201709
1000	UR72F	9306500	9201710

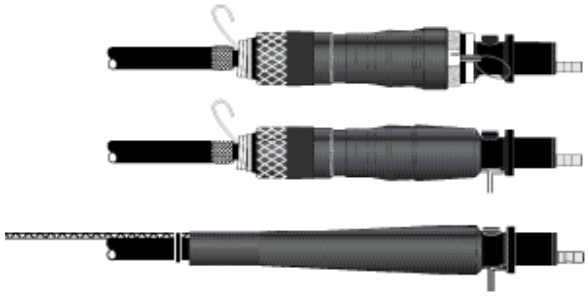
CAP, INSULATING, 5-35 kV

Insulating cap for unused positions of separable deadbreak Y or H joint, item UR71.

kV	STD ITEM	SAP ITEM ID	PS ITEM ID
5 - 25	UR73A	9304101	5646002
35	UR73B	9310322	9201168

JOINT, SEPARABLE DEADBREAK, COLD SHRINK 5-25 kV

Pre-molded, separable cable joint, cold shrink, for solid dielectric cables. Range taking. Cable adapters and retaining rings are not required for this installation. Kit includes splice body (boot), shear bolt lug connector, shear bolt bus connector & washer, 24" solder blocked ground braid, strips of sealing mastic, roll of copper mesh and roll of semi-con tape. To be used with H bus Item UR71SR



5-15KV RANGE	25KV RANGE	STD ITEM	SAP ITEM ID
2-350	2-4/0	UR74A	9389921
350-750	4/0-350	UR74B	9389936
350-750	350-750	UR74C	9389920
750-1000	750-1000	UR74E	9389937

CABLE JACKET, COLD SHRINK

EPDM rubber tube, open ended in an expanded state, mounted on two inner supporting plastic cores. Designed for use on 15kV, 25kV & 35kV cable as an outer covering jacket for in line splices installed on jacketed power cables. The kit shall contain (1) cold shrink jacketing tube and (1) three-foot roll of rubber mastic tape.

MIN CABLE JACKET OD (INCHES)	MAX SPLICE OD (INCHES)	MAX CABLE JACKET OPENING (INCHES)	CORE ID (INCHES)	MIN INSTALLED LENGTH (INCHES)	MAX INSTALLED LENGTH (INCHES)	STD ITEM	SAP ITEM ID	PS ITEM ID
0.95	2.4	20.0	2.85	23.0	27.0	UR75A	9315052	0809453
1.15	3.3	28.0	3.87	32.0	35.0	UR75B	9315051	0809455
1.55	4.0	30.0	4.50	33.0	37.0	UR75C	9315059	0809454

CABLE JACKET, COLD SHRINK

EPDM cold shrink insulating tubing. 2/0 - 250 kcmil, 600V max. Used for insulating splices. These sleeves are not to be used with network cables

STD ITEM	SAP ITEM ID	PS ITEM ID
UR76A	9388875	N/A

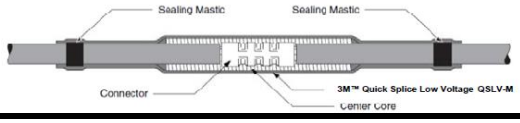
CABLE JACKET, COLD SHRINK

EPDM cold shrink insulating tubing. 250 - 400 kcmil, 600V max. Used for insulating splices. These sleeves are not to be used with network cables

STD ITEM	SAP ITEM ID	PS ITEM ID
UR76B	9388854	N/A

CABLE JACKET, COLD SHRINK

Cold shrink insulating tubing. #2 - 500 kcmil, 600V max. Used for insulating splices, includes mastic. Preferred for URD secondary cables splices.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR76CS	9306239	9202063

SEAL, CABLE, LIVE END

Designed to insulate and seal the end of an energized 5kV – 25kV cable. Single conductor kits are for solid dielectric or paper / oil insulation. Three conductor kits are for paper / oil insulation only.

MAX kV	CABLE	PILC INS. Min – Max	SOLID INS Min – Max	STD ITEM	SAP ITEM ID	PS ITEM ID
15	1/C	0.60”-0.90”	0.65”-1.05”	UR77A1	9314660	0811116
15	1/C	0.85”-1.10”	0.90”-1.30”	UR77B1	9304440	5640901
15	1/C	1.05”-1.30”	1.10”-1.60”	UR77C1	9314140	0810707
15	1/C	1.20”-1.50”	1.25”-1.80”	UR77D1	9393985	n/a
25	1/C	0.85”-1.25”	0.85”-1.25”	UR77E1	9304438	5640903
25	1/C	1.15”-1.50”	1.15”-1.50”	UR77F1	9314941	0810709
25	1/C	1.50”-1.90”	1.50”-1.90”	UR77G1	9304822	5640905
15	3/C	0.60”-1.00”	N/A	UR77A3	9314661	0811115
15	3/C	0.85”-1.10”	N/A	UR77B3	9314888	0811114
15	3/C	1.05”-1.50”	N/A	UR77C3	9304821[Y]	5640907[Y]
25	3/C	0.85”-1.20”	N/A	UR77E3	9304820[E]	5640908[E]
25	3/C	1.15”-1.40”	N/A	UR77F3	9304819[E]	5640909[E]
25	3/C	1.50”-1.70”	N/A	UR77G3	9304818[E]	5640910[E]

SPLICE, HEAT SHRINK, TRANSITION, STRAIGHT

Straight transition splice for 1/C PILC to 1/C solid dielectric cable. 15, 25, and 35kV items are also suitable for 1/C PILC to 1/C PILC applications.

kV	PILC		POLY / EPR		STD ITEM	SAP ITEM ID	PS ITEM ID
	COND	INS. OD	COND	INS. OD			
5	#2-4/0	0.50-1.00	#2-4/0	0.50-1.00	UR79A1	9305287[E]	5643717[E]
5	4/0-500	0.80-1.10	4/0-500	0.80-1.10	UR79A2	9305387[E]	5643712[E]
15	#4-4/0	0.60-0.90”	#4-4/0	0.65-1.05”	UR79B1	9305253	5643720
15	250-350	0.85-1.10”	250-350	0.90-1.30”	UR79B2	9305311	5643725
15	500-750	1.05-1.30”	500-750	1.10-1.60”	UR79B3	9305286	5643715
15	750-1000	1.15-1.50	750-1000	1.25-1.80”	UR79B4	9309354[E]	5106008[E]
25	#1-250	0.85-1.20”	#1-250	0.90-1.25”	UR79C1	9315044	0809538
25	350-500	1.15-1.45”	350-500	1.15-1.50”	UR79C2	9315060	0809541
25	750-1000	1.50-1.70”	750-1000	1.60-1.90”	UR79C3	9306811[E]	9201666[E]
35	1/0-250	1.05-1.40”	1/0-250	1.05-1.40”	UR79D1	9306322[Y]	9201365[Y]
35	300-750	1.20-1.70”	300-750	1.30-1.75”	UR79D2	9306323[Y]	9201364[Y]

SPLICE, HEAT SHRINK, TRANSITION REDUCING, STRAIGHT

Straight transition reducing splice for 1/C PILC to 1/C solid dielectric cable. These splices are not suitable for PILC to PILC.

kV	PILC		POLY / EPR		STD ITEM	SAP ITEM ID	PS ITEM ID
	COND	INS. OD	COND	INS. OD			
15	#4-4/0	0.60-0.90”	#4-350	0.90-1.30”	UR80B1	9305271	5643716
15	#4/0-350	0.80-1.10”	500-750	1.10-1.60”	UR80B2	9306413	9200966
25	#1-350	0.80-1.20”	350-500	1.15-1.50”	UR80C1	9305386[E]	5643708 [E]

SPLICE, HEAT SHRINK, TRANSITION, TRIFURCATING

Trifurcating transition splice for 3/C PILC to 1/C solid dielectric cable.

kV	PILC		POLY / EPR		STD ITEM	SAP ITEM ID	PS ITEM ID
	COND	INS. OD	COND	INS. OD			
15	#4-4/0	0.60-1.00”	#4-4/0	0.65-1.05”	UR81B1	9315046	0809536
15	250-350	0.85-1.10”	4/0-350	0.90-1.30”	UR81B2	9309359	5105994
15	500-750	1.05-1.50”	500-750	1.10-1.60”	UR81B3	9314141	0810706
25	#1-250	0.85-1.20”	#1-250	0.90-1.25”	UR81C1	9319596	5106011
25	350-500	1.15-1.40	350-500	1.15-1.50”	UR81C2	9315043	0809539
25	750-1000	1.50-1.70”	750-1000	1.60-1.90”	UR81C3	9309351	5106013
35	250-750	1.20-1.70”	250-750	1.30-1.75”	UR81D3	9314613[Y]	0810883[Y]

SPLICE, HEAT SHRINK, TRANSITION REDUCING, TRIFURCATING

Trifurcating transition reducing splice for 3/C PILC to 1/C solid dielectric cable.

kV	PILC		POLY / EPR		STD ITEM	SAP ITEM ID	PS ITEM ID
	COND AWG/ kcmil	INS. OD	COND AWG/ kcmil	INS. OD			
15	#4-3/0	0.60-1.00”	4/0-350	0.90-1.30”	UR82B1	9309352	5106009
15	4/0-350	0.80-1.20”	500-750	1.10-1.60”	UR82B2	9305254	5643722
25	1/0-400	0.80-1.20”	350-500	1.15-1.50”	UR82C1	9305310	5643723

SPLICE, HEAT SHRINK, 3/C PILC, STRAIGHT - DISCONTINUED

Straight splice for 3/c PILC to 3/C PILC.

kV	PILC		STD ITEM	SAP ITEM ID	PS ITEM ID
	COND AWG/kcmil	INS. OD			
15	4/0-600	0.85-1.25”	UR83B1	9305314	5643730
25	#1-350	0.85-1.15”	UR83C1	9305316[E]	5643732 [E]
25	350-750	1.10-1.50”	UR83C2	9305485[E]	5643734[E]

SPLICE, HEAT SHRINK, Y

Y splice for solid dielectric cable. These splices can be used as transition splices by adding Oil Barrier Tube, item UR89T

kV	MAIN RUN		TAP		STD ITEM	SAP ITEM ID	PS ITEM ID
	COND AWG/ kcmil	INS. OD	COND AWG/ kcmil	INS. OD			
15	#2-4/0	0.65-1.05”	#2-4/0	0.65-1.05”	UR84B1	9315045	0809537
15	250-750	0.95-1.45”	#2-750	0.65-1.45”	UR84B2	9309358	5105996

SPLICE, HEAT SHRINK, STRAIGHT

Straight splice for solid dielectric cables. To be used only where Cold Shrink Splices, item UR 51, do not fit due to manhole room. These splices are not suitable for adaptation to transition splices for PILC. 15kV items UR79__ include wrap around zipper outer jacket. Some kits include external ground kits. Other ground kits are available under item UR89G_.

kV	COND AWG/ kcmil	INS. OD	STD ITEM	SAP ITEM ID	PS ITEM ID
15	#2-4/0	0.65-1.05”	UR85B1	9305183	5106797
15	250-350	0.90-1.30”	UR85B2	9305182	5106798
15	250-350	0.90-1.30”	UR85B3	9305388[E]	5643713[E]
15	500-750	1.10-1.60”	UR85B4	9305389	5643714
15	750-1000	1.25-1.80”	UR85B5	9310769	5101760
25	#1-250	0.90-1.20”	UR85C1	9303739[E]	5643865[E]
25	350-500	1.20-1.50”	UR85C2	9309299[E]	5104312[E]
25	750-1000	1.50-1.80”	UR85C3	9305524[E]	5110908[E]
35	4/0-600	1.20-1.70”	UR85D1	9305185[E]	5106794[E]
35	1/0 - 3/0	0.95-1.35”	UR87RC	9316703	2014070
35	600 - 1000	1.55-2.15”	UR87RH	9316696[Y]	2014077[Y]

JACKET, HEAT SHRINK, 1000V

Heat shrink wraparound sleeve (1000V) used to cover network cable splices. Sleeve is made of crosslinked polyolefin consisting of a raised rail profile and a stainless steel channel. Raychem part # CRSM 107/29-1200

STD ITEM	SAP ITEM ID	PS ITEM ID
UR87	9310699	5646315

SPLICE, HEAT SHRINK STRAIGHT, SHIELD INTERRUPT, 35KV

Heat shrink, 35kV, straight splice with shield interrupt. For use in the Block Island land portion cable. Model HVS-3513S-J-SI

STD ITEM	SAP ITEM ID	PS ITEM ID
UR87SI	9390805	N/A

BOOT, BREAKOUT

Breakout boot, heat shrink, for sealing solid dielectric cables with overall PE jacket, items UC18, UC25FJ, UC25GJ, UC34EF, UC34FG. Use with rejacketing, item UR89R2

CONFIGURATION	STD ITEM	SAP ITEM ID	PS ITEM ID
3 Legs	UR89B1	9304427	5640790
6 Legs	UR89B	9314612	0810884

SPLICE, HEAT SHRINK, TRANSITION, OIL STOP, 600V, 500 MCM

Heat shrink straight cable splice for 600V transition splice with an oil stop for splicing together one copper PILC cable to one copper EPR cable. The kit includes 1clear oil barrier tube, 1 red insulating tube, 1 black outer jacket tube, 2 red sealant strips and 3 yellow stress relief material strips.

Kit does not include connector, use connector item UC60M.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR89LV	9316648	2014820

KIT, CABLE GROUNDING

Kit for grounding cable splices for JCN, flat strap, tape shield and PILC cables. Kit contains 60” tinned copper braid with a solder block, two constant force springs, a roll of copper mesh and two strips of mastic.

INSULATION DIAMETER	STD ITEM	SAP ITEM ID	PS ITEM ID
0.30-1.25”	UR89G1	9391017	n/a
1.00-2.15”	UR89G2	9391038	n/a
1.55-3.40”	UR89G3	9391037	n/a

REJACKETING, HEAT SHRINK

Rejacketing sleeve, heat shrink, consisting of 3-30” MWTM-140/42 sleeves, 3-4” WCSM – 19/6 sleeves, 9-1/2” strips sealant S1251-25-300-4. For rejacketing of splices in jacketed #2 URD cable.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR89R1	9303835[E]	5643864[E]

REJACKETING, HEAT SHRINK

Rejacketing sleeve, heat shrink,5' length, without adhesive, for rejacketing of phase conductors over copper tape shield on items UC18, UC25FJ, UC25GJ, UC34EF, UC34FG.

Use with breakout boot item UR89B

STD ITEM	SAP ITEM ID	PS ITEM ID
UR89R2	9314611	0810885

REJACKETING, HEAT SHRINK

Re-jacketing sleeve, heat shrink, heavy wall, adhesive sealant coated (1000V) for use on XLP and PE coated secondary cable to seal in line splices. 9" tube cable range #2-500. WCSM-34/8-225-S

STD ITEM	SAP ITEM ID	PS ITEM ID
UR89R3	9334158	none

REJACKETING, HEAT SHRINK

Re-jacketing sleeve, heat shrink, cross-linked poly size 2" ID recovered x 0.63" ID x 12" length shrinkable adhesive sealant coated, 1000 volt. Used to seal in-line splices. Cable range 250 – 1000. WCSM-56/16.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR89R4	9302714	5648800[E]

REJACKETING, HEAT SHRINK LSZH

Re-jacketing sleeve, heat shrink, Low Smoke Zero Halogen,1000V for use on LSZH jacketed network cables to seal in line splices. 9.75" tubes. ZCSM-24/8 and ZCSM-32/12. Kits contain 3 heat shrink tubes and 3 pieces of LSZH mastic.

CABLE RANGE	STD ITEM	SAP ITEM ID	PS ITEM ID
#2-4/0	UR89R5	9390838	None
250-500	UR89R6	9390839	None

SEALANT STRIP, RED MASTIC

1” wide x 12” long, x 0.15” thick. Red mastic.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR89S	9310893	5100590

SHIM KIT, HEAT SHRINK SPLICE, 5 – 35 kV

Designed for heat shrink joints on cables different conductor sizes, to increase the diameter of the insulation and jacket on the smaller cable. Shim kit can only be used on solid dielectric insulation (EPR or XLPE), not on PILC (even over OBT – Oil Barrier Tube).

	STD ITEM	SAP ITEM ID	PS ITEM ID
Starting insulation diameter of 0.60 – 1.05”	UR89SK	9306473	9200983
Starting insulation diameter of 0.90 – 1.50”	UR89SL	9387034	none

TUBE, OIL BARRIER

Heat shrink oil barrier tube for isolating oil insulated insulation in splices. Used as a replacement for damaged tubes or as an accessory for splice items UR84B__. Tube supplied in 4’ lengths.

TUBE RANGE AWG/kcmil	STD ITEM	SAP ITEM ID	PS ITEM ID
#2 – 4/0	UR89T1	9314503	0811178
250 - 750	UR89T2	9314502	0811179

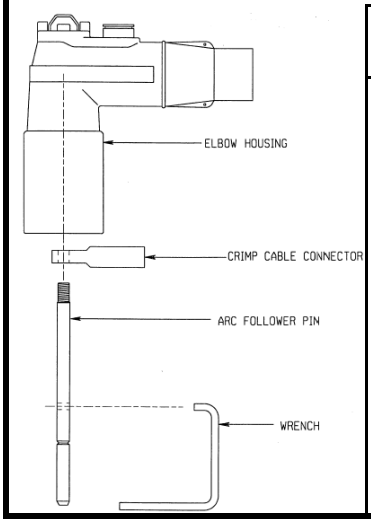
MODIFICATION KIT, HEAT SHRINK JOINT

Modification kit for making adding a fourth cable to a heat shrink Y joint.

MAIN COND	TAP COND	INS. OD	STD ITEM	SAP ITEM ID	PS ITEM ID
#2 – 4/0	#2 – 4/0	0.65-1.05”	UR89Y1	9310211	9201287
250-750	#2 - 750	0.65-1.45”	UR89Y2	9310210	9201288

ELBOW, 35kV LOADBREAK, 200 AMP

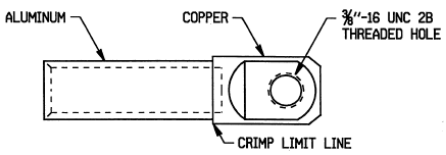
Loadbreak elbow kit, for use on aluminum and copper 35kV primary cables with concentric neutral. The kit shall include all material necessary for installation, including a shielded elbow housing, arc follower pin, crimp cable connector, wrench and silicone grease. To be in accordance with ANSI/IEEE 386.

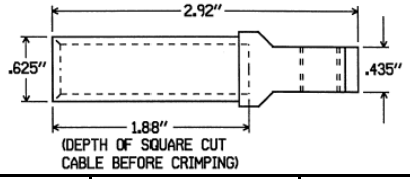


CABLE SIZE (AWG)	INSULATION O.D.	STD ITEM	SAP ITEM ID	PS ITEM ID
#1/0 AL	0.98" – 1.18"	UR90C	9316701	2014072
#2/0 CU	1.09" – 1.31"	UR90D	9314440[Y]	0810985[Y]

CONNECTOR, 35kV LOADBREAK ELBOW TERMINAL

Bi-metallic copper/aluminum compression connector for use with 200A loadbreak elbow, item UR90. Furnished compound filled and capped. To be in accordance with ANSI/IEEE 386

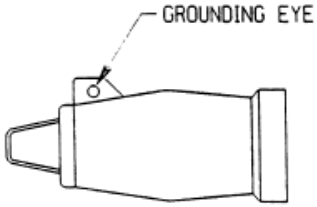




CONDUCTOR SIZE (AWG)	MD6	CRIMPS	Y35 OR Y39	CRIMPS	STD ITEM	SAP ITEM ID	PS ITEM ID
1/0 Al.	W–BG	6	UBG	3	UR90T	9311880	2014919
	BG	3					

INSULATED CAP, 35kV LOADBREAK BUSHING, 200 AMP

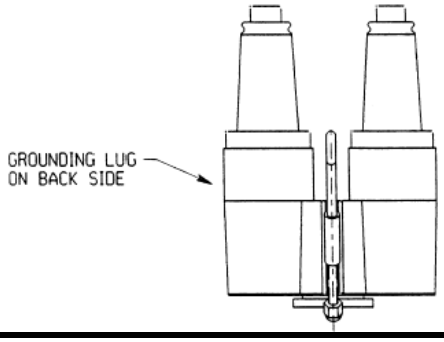
Insulating cap used for insulating, shielding and water sealing an energized loadbreak bushing plug insert, item UR94. To be in accordance with ANSI/IEEE 386.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR91	9316700	2014073

FEED THRU, 35kV LOADBREAK, 200 AMP

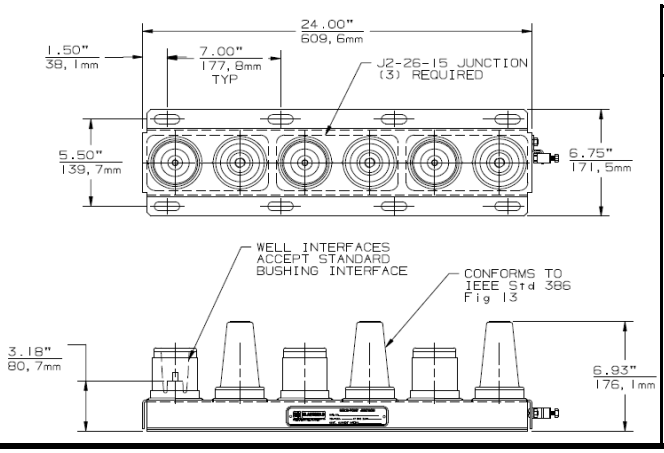
Feed-thru device for electrically connecting and water sealing two loadbreak elbows or connecting one loadbreak elbow to other loadbreak accessories. To be installed on a 35kV style parking stand. To be in accordance with ANSI/IEEE 386.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR92	9316699	2014074

FEED THRU, 35kV DEADDBREAK, MULTIPOINT 200 - 600 AMP

Feed-thru, deadbreak device, 600A-200A, 35KV, multipoint 6-position, for electrically connecting and water sealing three 600A deadbreak elbows to three 200A deadbreak accesories. Install in manhole or vault wall.

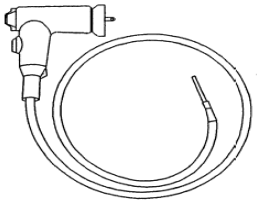


STD ITEM	SAP ITEM ID	PS ITEM ID
UR92DB6	9387685	none

GROUNDING ELBOW, 35kV

An unshielded, insulating and water sealing elbow, orange and yellow in color, for grounding applications. Furnished completely assembled in individual cartons with a six-foot long yellow-jacketed #1/0 AWG copper flexible welding type cable with a crimped on tinned plated copper terminal plug connector. For use on 3-phase step-down or step-up padmount underground transformers.

NOTE: THIS ITEM IS NOT TO BE USED FOR PERSONAL PROTECTIVE GROUNDING. REFER TO THE TOOL CATALOG FOR THE PROPER ELBOW GROUNDS FOR PERSONAL PROTECTIVE GROUNDING.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR93	9316698	2014075

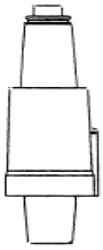
PARKING STAND, 35kV LOADBREAK

Stand-off plug used to isolate a 35 kV loadbreak elbow.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR93P	9304241	5645703

BUSHING WELL INSERT, 35kV LOADBREAK, 200 AMP

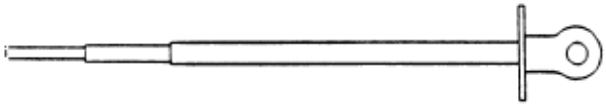
Loadbreak bushing well insert for use as an interface between an apparatus bushing well and a loadbreak elbow, item UR90, or other loadbreak accessories. To be in accordance with ANSI/IEEE 386.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR94	9316697	2014076

ROD, TEST, 5 - 35 KV

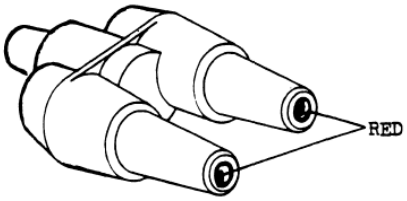
Test rod for use in instrument testing of equipment with 200A loadbreak devices. DO NOT USE for live voltage testing. In accordance with ANSI/IEEE 386.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR95	9311913	2014937

FEED THRU INSERT, ROTATABLE, 35 kV LOADBREAK, 200 AMP

Loadbreak feed-thru insert for use as an interface between an apparatus bushing well and a loadbreak elbow(s), item UR90, or other loadbreak accessories, including associated mounting hardware.



STD ITEM	SAP ITEM ID	PS ITEM ID
UR95F	9304009[E]	5643475[E]

ELBOW, VOLTAGE SENSOR 15KV CLASS

Elbow style voltage sensor for use on the 15kV class 200 amp wye systems. 14,000 to 1 voltage divider with a 10 foot waterproof socket. UR96C connector for terminating into control.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR96	9390896	NA
UR96C	9391319	NA

BUSHING, APPARATUS, NETWORK TRANSFORMER 15/25KV 900AMP

Bolt in style bushing for network transformer transformers.

STD ITEM	SAP ITEM ID	PS ITEM ID
UR97	9393628	NA

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material

CLAMP, SPRING

Constant force spring clamp for connecting tinned copper braid to cables with copper tape shield or lead sheath.

DIAMETER OVER SHIELD	STD ITEM	SAP ITEM ID	PS ITEM ID
0.67” – 1.14”	US1A	9311246	5105523
0.99” – 1.54”	US1B	9311244	5105524
1.57” – 2.36”	US1C	9306810	9201667
1.97” – 2.95”	US1D	9306749	9201668
2.24” – 3.35”	US1E	9306759	9201669

LEAD RIBBON (STRAP)

Flat lead ribbon used for bonding associated with the lead sheath of cable. Flat lead ribbon shall be 0.125 inches thick and furnished in 25 lb. coils.

WIDTH	APPROX. LENGTH	STD ITEM	SAP ITEM ID	PS ITEM ID
1”	40’	US3A	9316561[Y]	2014251[Y]
2”	20’	US3B	9316600[Y]	2014252[Y]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

SOLDER, WIPING

Tin/lead (40/60) solder bar used for wiping PILC splices. Wiping solder shall be furnished in nominal 3 lb. ingots and shall be in accordance with the current ASTM Standard B32. Alloy to be SN40B. Long dimension of ingot not to exceed 6" per PPL Standard MS 4216, latest edition.

STD ITEM	SAP ITEM ID	PS ITEM ID
US4	9309554	5599540

SOLDER, STICK

Tin/lead (50/50) stick solder in accordance with current ASTM Standard B32, Alloy Grade SN50. 5/16" X 16", each stick weight ½ pounds, per PPL Standard MS 4216, latest edition.

STD ITEM	SAP ITEM ID	PS ITEM ID
US5	9309553	5599580

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

FLUX PASTE

Non-corrosive soldering flux paste for use with stick solder, item US5. Furnished in a 2 oz. container.

STD ITEM	SAP ITEM ID	PS ITEM ID
US7	9304732	5592560

KIT, EPOXY RESIN

For lead cable sheath repair.

STD ITEM	SAP ITEM ID	PS ITEM ID
US9	9305408	5643845

KIT, FIBERGLASS PATCH

Fiberglass patch kit for repairing small holes in fiberglass and metal equipment. Kit is a 3” x 6” patch.

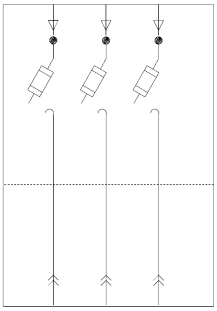
STD ITEM	SAP ITEM ID	PS ITEM ID
US10	9308066	9202255

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

SWITCHGEAR, PMH-4, 3 PHASE, 15kV – MAINTENANCE ONLY

Three phase pad-mounted switchgear, PMH-4 style. One 3 phase fuse compartment, one 3 phase 200 amp loadbreak elbow compartment. Use SML-20 fuses, item F6_.

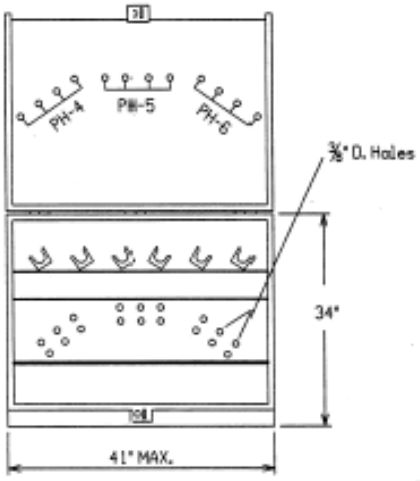
To Be Used for MAINTENANCE ONLY – NOT FOR NEW INSTALLATIONS

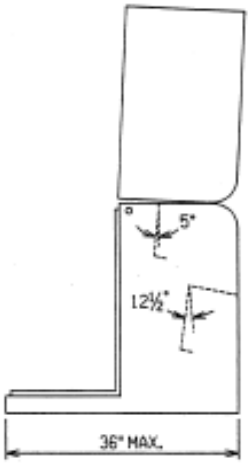


STD ITEM	SAP ITEM ID	PS ITEM ID
US32	9316110[Y]	2004304[Y]

ENCLOSURE, JUNCTION, 1 PHASE AND 3 PHASE

1 phase and 3 phase pad-mounted enclosure for three-way and four-way loadbreak junctions, item UR28.



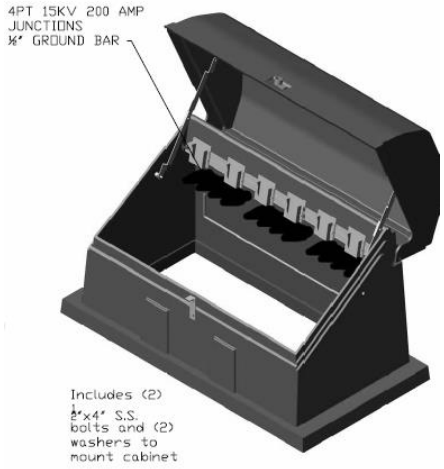


STD ITEM	SAP ITEM ID	PS ITEM ID
US33	9316111	2004033

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

ENCLOSURE – JUNCTION – FIBERGLASS – 3-PHASE

Enclosure, junction, fiberglass reinforced, 3-phase, mounts on 30” x 60” splice box, (3)-four position 200-amp 15kV bushing inserts, stainless steel parking stands mounted above bushings. 3/8” diameter ground bus bar installed below bushings, (4) – ½” x 4-inch stainless steel mounting bolts. Color: GREEN.



STD ITEM	SAP ITEM ID	PS ITEM ID
US33F	9306249	9201828

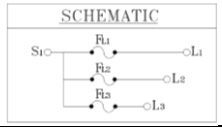
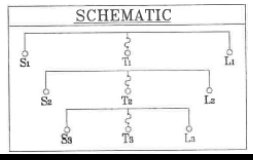
ENCLOSURE – JUNCTION – FIBERGLASS – 1-PHASE

Enclosure, junction, fiberglass reinforced, 1-phase, mounts on 37” x 43” transformer box pad, (1)-four position 200-amp 15kV bushing insert, stainless steel parking stand mounted above bushings. 3/8” diameter ground bus bar installed below bushing, (4) – ½” x 4-inch stainless steel mounting bolts. Color: GREEN.

STD ITEM	SAP ITEM ID	PS ITEM ID
US33F1	9306195	9201859

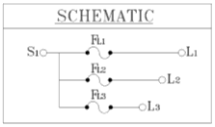
SWITCH, FUSE PAD, 15kV, STEEL

Switch, fuse pad, 15kV, 200 amp, see style for configuration, mild steel enclosure, Munsell green, STD. Item US34 shown

STYLE	STD ITEM	SAP ITEM ID	PS ITEM ID
	US34	9307974	9202671
	US34A	9392377	NA

SWITCH, FUSE PAD, 15kV, STAINLESS STEEL

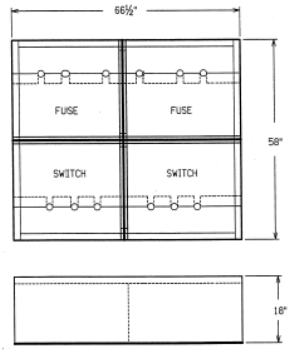
Switch, fuse pad, 15kV, 4-200 amp. Bushings, 1 source and 3 bayonet style fuse positions, Grade 304 stainless steel enclosure, Munsell green, 38” x 28.5 “.



STD ITEM	SAP ITEM ID	PS ITEM ID
US34SS	9307973	9202672

BASE SPACER, 15 kV SWITCHGEAR, FEDERAL PACIFIC OR EEI ONLY

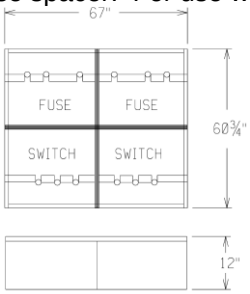
58" x 66 ½" x 18" high, steel base weldment including RED GPO-3 switch and fuse barriers. For use with Federal Pacific or EEI 15 kV switchgear item US36.



STD ITEM	SAP ITEM ID	PS ITEM ID
US36B	9314210[Y]	0809932[Y]

BASE SPACER, STEEL, 15 kV SWITCHGEAR, S&C ONLY

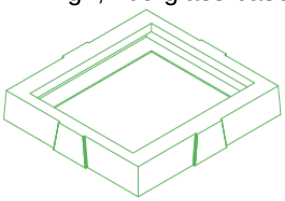
12" high, steel base spacer. For use with S&C 15 kV switchgear item US36.



STD ITEM	SAP ITEM ID	PS ITEM ID
US36B1	9311089	9201340

BASE SPACER, FIBERGLASS, 15 kV SWITCHGEAR, S&C ONLY

12" high, fiberglass base spacer. For use with S&C 15 kV switchgear item US36.



STD ITEM	SAP ITEM ID	PS ITEM ID
US36B2	9307520	9202409

BASE SPACER, STEEL, 15 kV SWITCHGEAR, S&C ONLY

12" high X 75" x 66-3/4" steel base spacer. For use with S&C 15 kV switchgear item US45, US45C and us45CL.

STD ITEM	SAP ITEM ID	PS ITEM ID
US36B3	9389728	NA

BARRIER – FUSE

Barrier, fuse dual position, clear lexan, used to guard against inadvertent contact with live parts.

STD ITEM	SAP ITEM ID	PS ITEM ID
US36BF	9306440	9201819

BARRIER – SWITCH

Barrier, switch dual position,clear lexan, used to guard against inadvertent contact with live parts.

STD ITEM	SAP ITEM ID	PS ITEM ID
US36BS	9306441	9201818

CLIP – FOR BARRIERS

Clip – plastic loop, replacement clip for fuse barrier and switch barrier. Includes 2-plastic strips and mounting hardware in each package.

STD ITEM	SAP ITEM ID	PS ITEM ID
US36C	9306439	9201820

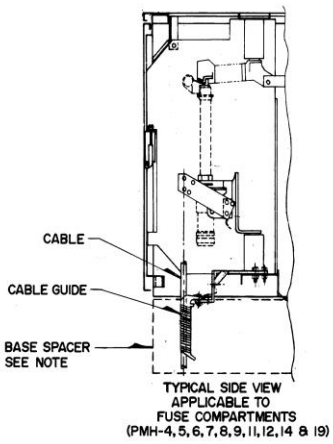
BLADE, SWITCH

Blade used for grounding the load side of a switchgear.

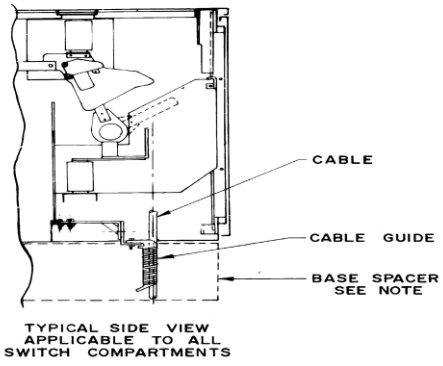
DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
SMU-20 Style	US36D	9306755	9202162
SML-4Z Style	US36D1	9306788	9202161

BRACKET, CABLE SUPPORT, SWITCHGEAR

Bracket, cable support, cable guide, used on PMH-9 livefront switchgear. For fuse side, cable sizes #2 through 4/0. For switch side, cable sizes #2 through 1,000. Support guide can only be installed in switchgear installed on a base spacer or in base with a cable pit. For installing cable support brackets on other style pad mounted switchgear call distribution standards for further assistance.



Fuse Side

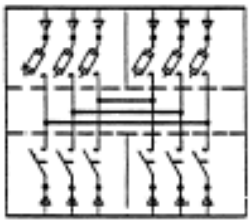
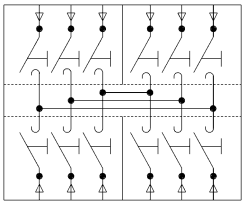
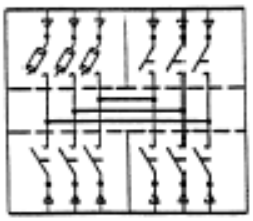
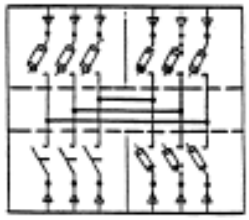


Switch Side

	STD ITEM	SAP ITEM ID	PS ITEM ID
Fuse Side	US36E	9314764	9202650
Switch Side	US36E1	9314984	9202651

SWITCHGEAR, 3 PHASE, 15kV, PAD-MOUNTED **FOR MAINTENANCE USE ONLY**

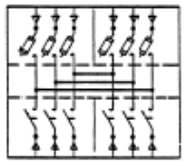
Three phase 14.4 kV, 600A., low-profile, pad-mounted, outdoor, metal-enclosed switchgear containing gang operated loadbreak switches and S&C type SML-20 loadbreak power fuses and the necessary accessory components. For complete specifications, refer to PPL Specification MS 2791. If installed on vault pad UF3, adaptor UF3CA is needed for installation.

	CONFIGURATION	STD ITEM	SAP ITEM ID	PS ITEM ID
	PMH-9 Two Switch Compartments Two Fuse Compartment			
		US36H	9316109	2004309
	HS IS STAINLESS STEEL	US36HS	9306782	9201931
	PMH-10 Four Switch Compartments			
		US36J	9320739	5671906
	PMH-11 Three Switch Compartments One Fuse Compartment			
		US36K	9316108	2004311
	PMH-12 One Switch Compartment Three Fuse Compartments			
		US36L	9316107	2004312

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

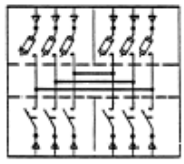
SWITCHGEAR, 3 PHASE, 23kV 12.5ka (25kV CLASS), PAD-MOUNTED

Live Front, 3 phase 23 kV, 12.5ka 600A., low-profile, pad-mounted, outdoor, metal-enclosed switchgear containing gang operated load break switches and S&C type SM-4Z loadbreak power fuses.

	CONFIGURATION	STD ITEM	SAP ITEM ID	PS ITEM ID
	PMH-9 Two Switch Compartments Two Fuse Compartment	US37H	9320737[E]	5671912[E]
	Fiberglass reinforced box pad for use with US37H switchgear	US37HA	9306553[E]	9201950[E]

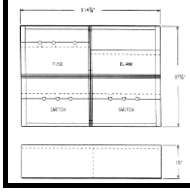
SWITCHGEAR, 3 PHASE, 23kV 20ka (25kV CLASS), PAD-MOUNTED

Live Front, 3 phase 23 kV, 600A.,20ka low-profile, pad-mounted, outdoor, metal-enclosed switchgear containing gang operated load break switches, S&C type SM-5 power fuses and 120 volt auxiliary heaters. Fuse holder Std Item C50I. Install on collar "K1"

	CONFIGURATION	STD ITEM	SAP ITEM ID	PS ITEM ID
	PMH-9 Two Switch Compartments Two Fuse Compartment	US37I	9393037[E]	NA

BASE SPACER, SWITCHGEAR

87 1/4" x 114 3/4" x 18" high, steel base weldment including GPO-3 glastic switch, fuse and blank barriers. For use with item US38F, when installed in excessive moisture areas.



STD ITEM	SAP ITEM ID	PS ITEM ID
US38B	9315012[Y]	0809931[Y]

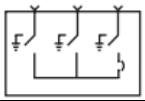
SWITCHGEAR, CONTROL CABLE

Control programming interface cable for vista style switchgear. USB to USB connector ends, cable is 6 feet long for VFI programming of the switchgear.

STD ITEM	SAP ITEM ID	PS ITEM ID
US38CC	9393766	

SWITCHGEAR, 3 PHASE, 35kV (38kV CLASS), PAD-MOUNTED

Three phase 38 kV, 600A., 25KA, model 321, Vista Green style CO2 and novec blend insulating medium, Low profile pad mounted, stainless steel tank and enclosure, olive green finish, potential indicator for voltage and phasing, 600-amp. Bushing complete with studs. Note: suitable for new use and in-kind replacement for original model 321 style SF6 insulated switchgear.

	CONFIGURATION	STD ITEM	SAP ITEM ID	TYPE
	3 – way	US38D1	9393767	Manual
	2-way load interrupting 1-way VFI	US38D1A	939XXXX	Auto source transfer

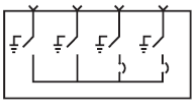
BOXPAD, FIBERGLASS BASE

Fiberglass reinforced box pad for use with US38D1 & US38E.

STD ITEM	SAP ITEM ID	PS ITEM ID
US38DA	9306554	

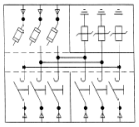
SWITCHGEAR, 3 PHASE, 35kV (38kV CLASS), PAD-MOUNTED FOR MAINTANENCE USE ONLY ITEMS DISCONTINUED

Three phase 38 kV, 600A., SF6 gas insulating medium, Low profile pad mounted, stainless steel tank, mild steel enclosure, olive green finish, potential indicator for voltage and phasing, 600-amp. Bushing complete with studs. NOTE: For new or replacement applications contact Distribution Engineering Services for further assistance

	CONFIGURATION	STD ITEM	SAP ITEM ID	PS ITEM ID
	4 – way 2-way load interrupting 2-way VFI	US38E	9306658	9201947

SWITCHGEAR, 3 PHASE, 35kV (38kV CLASS), PAD-MOUNTED FOR MAINTANENCE USE ONLY

3 phase, 600A., low-profile, pad-mounted, compartmental-type, free-standing, outdoor, metal-enclosed switchgear containing gang operated interrupter switches and single-pole S&C type SM-5 power fuse disconnects and with the necessary accessory components. Fuse holder Std. Item F7H

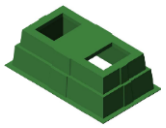


Two Switch Compartments
One Fuse Compartment
One Surge Arrester Compartment

STD ITEM	SAP ITEM ID	PS ITEM ID
US38F	9316106[Y]	2004315[Y]

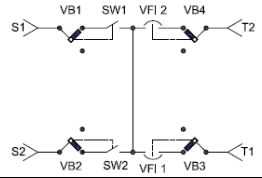
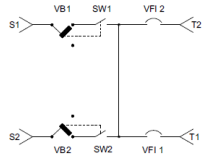
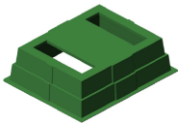
SWITCHGEAR, 3 PHASE, 35kV (38kV CLASS), PAD-MOUNTED

3 phase, 600A., low-profile, pad-mounted, compartmental-type, free-standing, outdoor, metal-enclosed, oil insulated switchgear containing gang operated vacuum switch

		STD ITEM	SAP ITEM ID	PS ITEM ID
	Vacuum switch with visible open window. 600 Amp bushings.	US38G	9386519	9203001
	Fiberglass reinforced box pad for use with switchgear US38G. Dimensions are 86”x43.5”, Ht=32”. Internal openings are 29.75”x20.5” Color: Green	US38GA	9388045	None

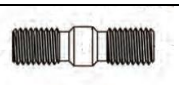
SWITCHGEAR, 3 PHASE, 35kV (38kV CLASS), PAD-MOUNTED

3 phase, 600A., low-profile, pad-mounted, compartmental-type, free-standing, outdoor, metal-enclosed, oil insulated switchgear containing gang operated vacuum switches on the source sides and VFI switches on the load sides.

<table>
<tr><td rowspan="2"> 
</td><td rowspan="2">Source side has two vacuum switches with visible open windows and the load side has two VFI switches with visible open windows.</td><td>STD ITEM</td><td>DESC.</td><td>SAP ITEM ID</td><td>PS ITEM ID</td></tr>
<tr><td>US38H</td><td>600A Source /200A Load</td><td>9391026</td><td>9203002</td></tr>
<tr><td colspan="6">NOTE: below is the original design of US38H (Item ID 9386518) with visible windows on the source side only.</td></tr>
<tr><td> 
</td><td>Source side has two vacuum switches with visible open windows and the load side has two VFI switches.</td><td colspan="4">  </td></tr>
<tr><td rowspan="2">  </td><td rowspan="2">Switch can be installed onto fiberglass base or 7x14 switchgear manhole with collar J, contact electric material standards for further details.</td><td>US38HA</td><td>36” HIGH</td><td>9387087</td><td>NONE</td></tr>
<tr><td>US38HT</td><td>52” HIGH</td><td>9388858</td><td>NA</td></tr>
</table>

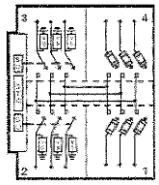
RECLOSER / SWITCHGEAR, THREADED STUD

Replacement threaded stud for use on Cooper 38kV class elbow style padmounted reclosers and padmounted switchgear. 5/8"-11 threaded x 2.42 inches long. Aluminum. Comes in a package of 3.

	STD ITEM	SAP ITEM ID
	US38S	9391278

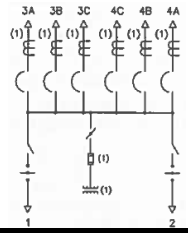
SWITCHGEAR, 3 PHASE, 15kV, PAD-MOUNTED, AUTOMATIC

Three phase 14.4 kV, 600A., low-profile, pad-mounted, livefront stype, outdoor, air insulated, metal-enclosed switchgear containing gang operated loadbreak switches and S&C type SML-20 loadbreak power fuses and the necessary accessory components. Equipped with automatic motor operated loadbreak disconnects. For use on 4 wire system.

	CONFIGURATION	STD ITEM	SAP ITEM ID	PS ITEM ID
	PMH-9 Two Switch Compartments Two Fuse Compartment	US39H	9320722[E]	5671905[E]

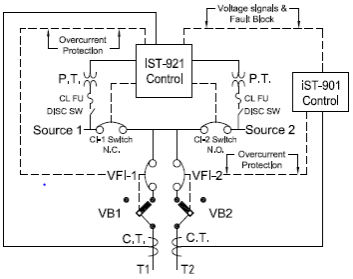
SWITCHGEAR, 15kV CLASS, 3 PHASE, ADVANCED PAD-MOUNTED SWITCHGEAR 15kV CLASS

Three phase, 600A., low-profile, pad-mounted, oil insulated, outdoor, metal-enclosed switchgear containing vacuum interrupters and electronic fusing. SCADA style switch uses communications using cellular with antenna for remote operation. Internal PTs are wired for a wye system and the source side has viewing windows. Load side can be programmed for single or gang tripping.

	Voltage Class	STD ITEM	SAP ITEM ID	PS ITEM ID
	15	US39I	9388862	NA

SWITCHGEAR, 3 PHASE, AUTO TRANSFER ADVANCED PAD-MOUNTED SWITCHGEAR

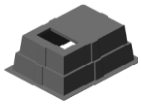
Three phase, 600A., low-profile, pad-mounted, oil insulated, outdoor, metal-enclosed switchgear containing vacuum interrupters and electronic fusing. Switch is automatic transfer and communicates using cellular with an antenna for remote operation. For 15, 25 and 35kV class systems as indicated in the chart below. The internal PT's are specific for the voltage/system. Viewing windows are on the load side. Load side can be programmed for single or gang tripping.



Voltage	System	STD ITEM	SAP ITEM ID
12.47/13.2/13.8 kV	Wye	US39L	9390295
13.8 kV	Delta	US39LD	9394012
22.9 kV	Delta	US39J	9388766
34.5 kV	Wye	US39K	9388747

SWITCHGEAR, PRIMARY METERING, 3 PHASE, PAD-MOUNTED

Three phase, 15 kV 95kV BIL, or 35kV 150kV BIL, dead front, mild steel enclosure, olive green finish. CTs and PTs not included - contact meter engineering.

	DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
	15kV 200A bushings unit	US39M	1003839	N/A
	15kV 600A bushings unit	US39N	1003841	N/A
	35kV 600A bushings unit	US39O	1003840	N/A
	Fiberglass reinforced box pad for use with US39M and US39N primary metering devices. Color: Green	US39P	9308022[E]	9202179 [E]

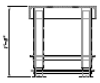
CORD, INTERFACE, ELASTIMOLD

Programming interface cord for legacy Elastimold switches. Cord is 30 feet long.

STD ITEM	SAP ITEM ID
US40EE	9393666

SWITCH, VACUUM, SUBMERSIBLE, 15 kV

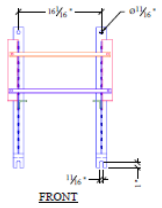
Submersible 15kV vacuum switch, single and three phase, with or without overcurrent protection, with 200 or 600 amp dead break elbows. For installation in a manhole.
Note: Std Item US40L3 manufactured after September 2015 have an interrupting rating of 16kA.

	DESCRIPTION	STD ITEM	SAP ITEM ID
	Single Phase With overcurrent protection		
	200 Amp	US40L1	9388249
	600 Amp	US40L2	9388242
	Three Phase With overcurrent protection		
	600 Amp	US40L3	9388345
	Control for single phase switch	US40L1C	9388930
	Control for three phase switch	US40L3C	9388960
	Switch handle for applications where a straight handle is required	US40LH	9390091
	Motor for 3 phase switch	US40LM	9388931
	Motor control cable (required to connect and operate motor remotely)	US40LMCC	9389745
	Remote control for motor	US40MC	9388956
	Control Cable for Programming	US40CC	9389086
	20' Extension Cord for Control	US40CE	9389115
	Stand for 1 or 3 phase switch	US40LS	9388867

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

BRACKET – FOR THREE PHASE SWITCH MAINTENANCE ITEM

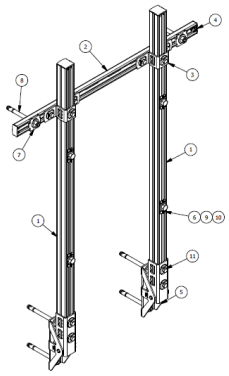
Bracket, wall mount, galv. Steel, for 3-phase switch manufactured before 2015, adjustable angle. Connection bolts, washers, & nuts to be ½" SS.. Switch stand allow switch to be wall mounted at angles from 30 to 60 degrees from side of wall.



STD ITEM	SAP ITEM ID	PS ITEM ID
US40GA	9307625	9202953

Bracket, wall mount for switch

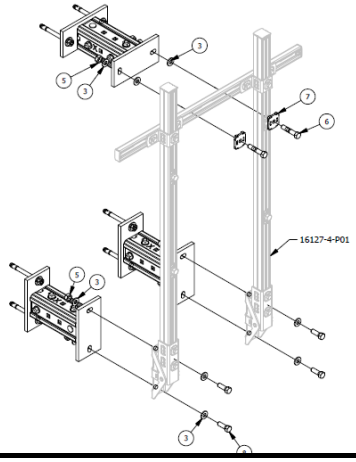
Bracket, wall mount, stainless steel, for 3-phase switch standard item US40L3, bracket has pivot feet for aid in mounting to wall. Comes complete with stainless steel mounting hardware.



STD ITEM	SAP ITEM ID	PS ITEM ID
US40GB	9390209	NA

Wall bracket for switch

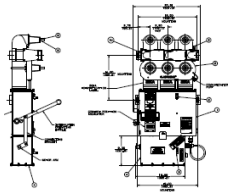
Bracket, extension for wall mount, stainless steel, for 3-phase switch standard item US40L3, extensions will offset the bracket 8 inches off the wall. Comes complete with stainless steel mounting hardware. Extensions come packaged in a set of three.



STD ITEM	SAP ITEM ID	PS ITEM ID
US40GBB	9390210	NA

SWITCH, NON-SUBMERSIBLE, VACUUM, NETWORK 15kV - DISCONTINUED

Switch, non-submersible, vacuum interrupter, network controller, 15.5 kV, 600 amp, 3 phase, 20kA int cap, with type 20 control and motor controller (motor controller needs 120 v ac supply)



STD ITEM	SAP ITEM ID	PS ITEM ID
US40H	9386608	9203049

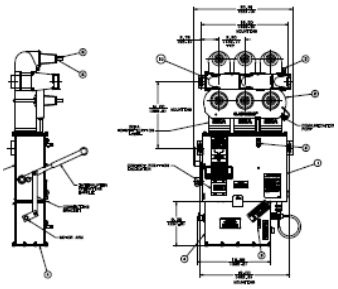
SWITCH, SUBMERSIBLE, VACUUM, NETWORK 15kV

Switch, submersible, vacuum interrupter, network controller, 15 kV, 600 amp, 3 phase, 16kA int cap, external control with pendent to operate, requires external 120 v ac supply/

STD ITEM	SAP ITEM ID	PS ITEM ID
US40H1	9390168	NA

SWITCH, NON-SUBMERSIBLE, VACUUM, NETWORK 23kV (27kV CLASS) - DISCONTINUED

Switch, non-submersible, vacuum interrupter, network controller, 27 kV, 600 amp, 3 phase, 12.5kA int cap, with type 20 control and motor controller (motor controller needs 120 v ac supply)

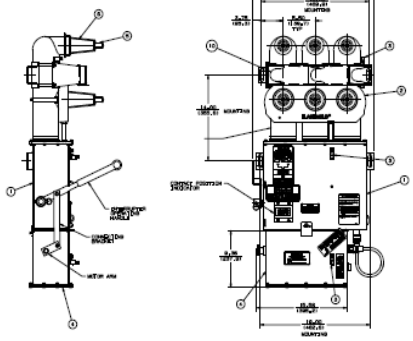


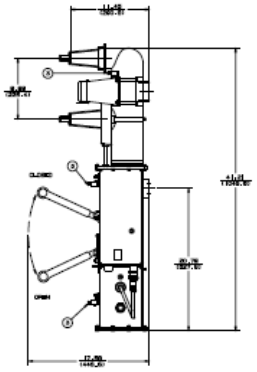
NOTE: Item is being replaced with a 38kV NMVI (Item US40J). Existing units in inventory will be used up in the field

STD ITEM	SAP ITEM ID	PS ITEM ID
US40I	9386605	9203046

SWITCH, NON-SUBMERSIBLE, VACUUM, NETWORK 35kV (38kV CLASS) - DISCONTINUED

Switch, non-submersible, vacuum interrupter, network controlled, 38 kV, 600 amp, 3 phase, 12.5kA int cap, two way, six 600A apparatus bushings, network molded vacuum fault interrupter, type 20 control and motor controller with remote pendant (motor controller needs 120 v ac supply)





STD ITEM	SAP ITEM ID	PS ITEM ID
US40J	9386972	None

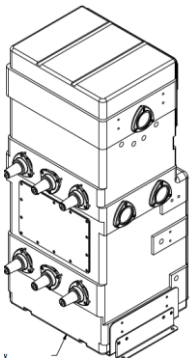
SWITCH, SUBMERSIBLE, VACUUM, NETWORK 35kV (38kV Class)

Switch, submersible, vacuum interrupter, network controller, 35 kV, 600 amp, 3 phase, 12.5kA int cap, external control with pendent to operate, requires external 120 v ac supply/

STD ITEM	SAP ITEM ID	PS ITEM ID
US40J1	9390130	NA

SWITCH, SUBMERSIBLE, VACUUM, NETWORK 15kV CLASS HI DUTY 40KA (AKA VISOVAC)

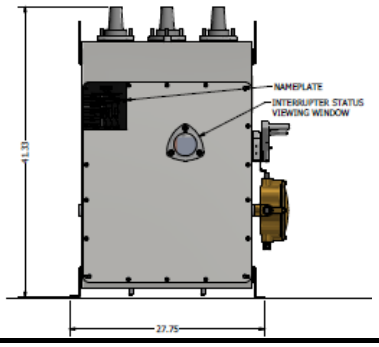
Switch, submersible, vacuum interrupter, scada controlled, 15 kV class, 600 amp bushings on side, 3 phase, 40kA int cap, one way, six 600A apparatus bushings. Switch has visible open and grounding position. Comes with an adjustable 12 to 18 inch stand. Switch is 59 inches high, 33 inches wide and 30 inches deep.



STD ITEM	SAP ITEM ID	PS ITEM ID
US40K	9389948	None

SWITCH, SUBMERSIBLE, VACUUM, NETWORK 15kV CLASS HI DUTY 40KA (AKA LOWBOY)

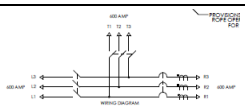
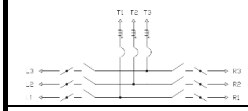
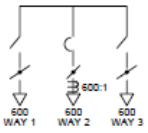
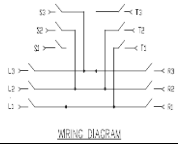
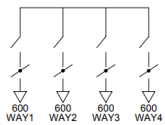
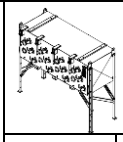
Switch, submersible, vacuum interrupter, scada controlled, 15 kV class, 600 amp, 3 phase, 40kA int cap, one way, 600A apparatus bushings on top. An adjustable 12 to 18 inch stand is available. Switch is 42 inches high, 33 inches wide and 30 inches deep.



STD ITEM	SAP ITEM ID	PS ITEM ID
US40L	9392056	None
US40LBS	9392242	None

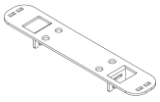
SWITCH, VACUUM, SUBMERSIBLE, 15 kV

Three phase, 15 kV, submersible vacuum switch, with bushings for deadbreak elbows.

	CONFIGURATION	STD ITEM	SAP ITEM ID	PS ITEM ID
	3 WAY Two Switches, 600 Amp One vacuum fault interrupter. Switch includes relay control.			
		US41A	9320808	5670347[E]
	3 way switch, 2 way scada ready with visible open. Communications is cellular.	US41A1	9388616	NA
	Galvanized steel stand for use with US41A	US41AA	9306577	9201948
**Replacement item, switch comes with relay.	Relay, overcurrent, for use with US41A	US41AR	9306517	9201964[E]
	3 way switch, 2 way auto transfer with visible open. Communications is cellular. Switch includes stand. Bushings are on side.	US41A2	9391602	
	Replacement motor for US41A2.	US41AM	9392165	
	Replacement external potential transformer for US41A2, included cradle for wall mounting.	US41APT	9392118	
	4 WAY Four Switches, 600 Amp			
		US41B	9302582	5670348
	Stand for STD Item US41B	US41BA	9306779	9201934
	4 WAY Four Switches, 600 Amp, air insulted, vault style with stand, 86” long, 68” high, 36” deep			
		US41BV	9393497	

HOLDER, TAG HOLDER FOR SWITCH HANDLE

Stainless steel tag holder for 6 position tag Std Item UP21W. Holder slides onto handle of all models of older style Trayer submersible switch handle. Once in place secure it with cable ties and then secure UP21W onto holder with cable ties through mounting holes.



STD ITEM	SAP ITEM ID	PS ITEM ID
US41BB	9307853	9202731

SWITCH, VACUUM, SUBMERSIBLE, 15KV (FOR MAINTANENCE USE)

Switch, replacement for the legacy installations at the Providence mall. 4 way, 4 switches, 15kv class, 600 amp, oil insulated, vault style mounted. 51"Lx27"Hx23"D. Stand for switch is US41BVMA.

	STD ITEM	SAP ITEM ID
Switch	US41BVM	9393567
Stand	US41BVMA	9395565

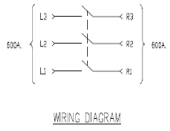
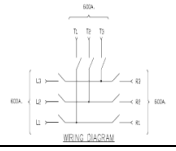
SWITCH, VACUUM, SUBMERSIBLE, 15 kV

Three phase, 15 kV, submersible switch, 600-Amp.

	CONFIGURATION	STD ITEM	SAP ITEM ID	PS ITEM ID
	4 WAY Two Ways Switched Two Ways VFI. Switch includes 2 relay controls.	US41C	9306820	9201932
	4 way switch, 2 way scada ready. Communications is cellular.	US41C1	9388745	NA
	Stand for US41C	US41CA	9306781	9201933
Converter, Power, Cable, Adapter, 120 AC volt plug in to 12 volt DC Powercord for Maysteel relay. – Used with US41AR and US41CR		US41CC	9314790	9202659
** Replacement item, switch comes with relay.	Relay, overcurrent, for use With US41C	US41CR	9306506	9201963[E]
Motor left hand	Use on US41A1 and US41C1	US41ML	9391108	
Motor right hand	Use on US41A1 and US41C1	US41MR	9391135	

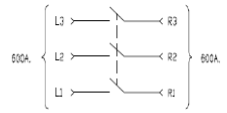
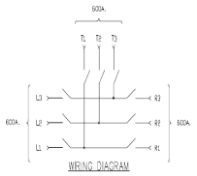
SWITCH, VACUUM, SUBMERSIBLE, 23 kV (25kV CLASS) **FOR MAINTANENCE USE ONLY**

Three phase, 23 kV, submersible vacuum switch, with bushings for deadbreak elbows for replacements in kind for existing installations. For new installations use Std Items US43.

	CONFIGURATION	STD ITEM	SAP ITEM ID	PS ITEM ID
 WIRING DIAGRAM	2 WAY One Switch, 600 Amp	US42A	9302590[E]	5670417[E]
	Stand for STD Item US42A	US42AA	9306757	9201935
 WIRING DIAGRAM	3 WAY Three Switches, 600 Amp	US42B	9302597	5670422
	Stand for STD Item US42B	US42BA	9306756	9201936

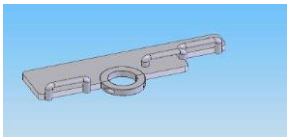
SWITCH, VACUUM, SUBMERSIBLE, 35 kV (38kV CLASS)

Three phase, 35 kV, submersible vacuum switch, with bushings for deadbreak elbows.

	CONFIGURATION	STD ITEM	SAP ITEM ID	PS ITEM ID
 WIRING DIAGRAM	2 WAY One Switch, 600 Amp			
		US43A	9307957	9202344
	Stand for STD Item US43A	US42AA	9306757	9201935
 WIRING DIAGRAM	3 WAY Three Switches, 600 Amp			
		US43B	9307956	9202345
	Stand for STD Item US43B	US42BA	9306756	9201936

BRACKET, STAINLESS STEEL, VACUUM SWITCH

Bracket, stainless steel, retrofit mount for Trayer 3-way, 3-position submersible switch, remote rope operator



.

STD ITEM	SAP ITEM ID	PS ITEM ID
US44	9306194	

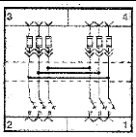
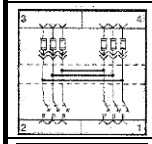
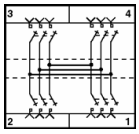
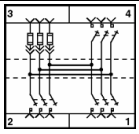
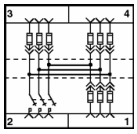
[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

SWITCHGEAR, 3 PHASE, 15kV, PAD-MOUNTED, DEADFRONT 4 WAY

Three phase 14.4 kV, 600Amp. low-profile, pad-mounted, outdoor, metal-enclosed switchgear containing gang operated loadbreak switches and S&C type SMU-20 loadbreak power fuses and the necessary accessory components. Switch compartments with bushings for 600 amp deadbreak elbows, fuse compartments with bushings for 200 amp loadbreak elbows.

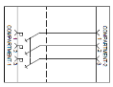
Switchgear comes complete with base adaptor to fit on fiberglass base boxpad Std.ItemUF3 or switchgear manhole collar Std. Item UM20A

End fittings for fuses are a separate item and do not come with the switchgear, Std Item C51E or C51CL.

	CONFIGURATION		STD ITEM	SAP ITEM ID	PS ITEM ID
	PME-9 Two Switch Compartments Two Fuse Compartments SMU-20 mounting		US45	9307834	9202301
		Stainless Steel	US45SS	9387577	NONE
	PME-9 Two Switch Compartments Two Fuse Compartments Current limiting fuse mounting.		US45CL	9387248	NONE
	PME-10 Four Switch Compartments		US45A	9387100	NONE
		Stainless Steel	US45ASS	9392288	NONE
	PME-11 Three Switch Compartments One Fuse Compartment SMU-20 mounting		US45B	9386919	NONE
	PME-12 One Switch Compartment Three Fuse Compartments SMU-20 mounting		US45C	9386918	NONE

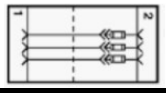
SWITCHGEAR, 3 PHASE, 15kV, PAD-MOUNTED, DEADFRONT 1 WAY

Three phase 14.4 kV. low-profile, pad-mounted, outdoor, metal-enclosed switchgear containing gang operated loadbreak switches is available in 600 or 200 amp configuration. Switch compartments with bushings for 600 amp deadbreak elbows or 200 amp loadbreak elbows. Switchgear installs on switchgear manhole collar Std. Item UM20

	CONFIGURATION	RATING AMPS	STD ITEM	SAP ITEM ID
	PME-3 One Switch Compartment	200 600	US45D2 US45D6	9390957 9390980

SWITCHGEAR, 3 PHASE, 15kV, PAD-MOUNTED, DEADFRONT 1 WAY

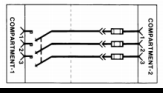
Three phase 14.4 kV. low-profile, pad-mounted, outdoor, metal-enclosed switchgear containing SMU-20 fuses is available in 200 amp configuration. Compartments with 200 amp load break elbows.
Switchgear installs on a fiberglass box pad STD. Item UF4.

	CONFIGURATION	RATING AMPS	STD ITEM	SAP ITEM ID
	PME-4 One fuse Compartment	200	US45E	9392156

Commented [VJF1]:

SWITCHGEAR, 3 PHASE, 15kV, PAD-MOUNTED, DEADFRONT 1 WAY

Three phase 14.4 kV. low-profile, 200 amp configuration, pad-mounted, outdoor, metal-enclosed switchgear containing SMU-20 fuses. Compartments with 200 amp load break elbows. Switchgear mounts on a fiberglass boxpad Std. Item US50R.

	CONFIGURATION	RATING AMPS	STD ITEM	SAP ITEM ID
	PME-5 One switch, one fuse Compartment	200	US45F	9393345

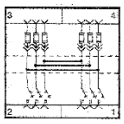
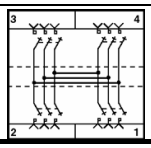
SWITCHGEAR, THREADED STUD

Replacement threaded stud for use on S&C elbow style pad mounted switchgear. 5/8”-11 threaded x 2.5 inches long. Aluminum tinned.

	STD ITEM	SAP ITEM ID
	US45TS	9391255

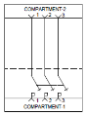
SWITCHGEAR, 3 PHASE, 23kV (25kV CLASS), PAD-MOUNTED, DEADFRONT

Three phase 25 kV, 600Amp. low-profile, pad-mounted, outdoor, metal-enclosed switchgear containing gang operated loadbreak switches and S&C type SM-4Z power fuses or beginning in 2021 a newer version of this switchgear with SM-20 style power fuses has been made available along with the necessary accessory components. Switch compartments with bushings for 600 amp deadbreak elbows, fuse compartments with bushings for 200 amp loadbreak elbows.
Switchgear to be installed on a switchgear manhole collar Std. Item UM21
End fittings for fuses are a separate item and do not come with the switchgear, Std Item C51E25 for SM-4Z style and Std. Item C51E for SM-20 style.

	CONFIGURATION	FUSE TYPE	STD ITEM	SAP ITEM ID
	PME-9 Two Switch Compartments Two Fuse Compartments	SM-4Z SM-20	US46 US46B	9387578 9393579
	PME-10 Four Switch Compartments	US46A	US46A	9388536

SWITCHGEAR, 3 PHASE, 23kV (25kV CLASS) , PAD-MOUNTED, DEADFRONT 1 WAY

Three phase 25 kV, 600A, low-profile, pad-mounted, outdoor, metal-enclosed switchgear containing gang operated loadbreak switch. Switch compartments have bushings for 600 amp deadbreak elbows.
Switchgear installs on switchgear manhole collar Std. Item UM20F.

	CONFIGURATION	RATING AMPS	STD ITEM	SAP ITEM ID
	PME-3 Two Switch Compartments	600	US46D6	9391745

RECLOSER – PADMOUNT – 27kV CLASS, 560 AMP., WITH FORM 6 CONTROL

Recloser, padmount, 27kV, 560 amp, 12kA interrupting capacity, control – Form 6, power from external 120 volt source, cable connections to be 600 amp. Deadbreak, Munsell green color. Installed on a switchgear manhole with collar "C".

STD ITEM	SAP ITEM ID	PS ITEM ID
US50	9308003	9202172

BASE-FIBERGLASS FOR PADMOUNT RECLOSERS

Base, for padmount reclosers US50 and US51_.

STD ITEM	SAP ITEM ID	PS ITEM ID
US50R	9389905	

RECLOSER – PADMOUNT – COMMUNICATIONS, 560 AMP., WITH FORM 6 CONTROL (Discontinued for maintenance use)

Recloser, padmount, communications ready, 560 amp, 12kA interrupting capacity, control – Form 6, self-powered, cable connections to be 600 amp. Deadbreak, Munsell green color. Installed on a switchgear manhole with collar "C". 15kV class to include voltage sensors.

	STD ITEM	Voltage Class (kV)	System Voltage (kV)	SAP ITEM ID
	US51A	15	12.47,13.2,13.8 wye	9391825
	US51B	27	22.9 delta	9389588
Control	US51AC			9391107

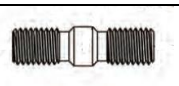
RECLOSER – PADMOUNT – COMMUNICATIONS, 600 AMP.12.5KA, WITH SEL CONTROL, DER

Recloser, pad mount, communications ready, 600 amp, 12kA interrupting capacity, control – SEL651R, self-powered, cable connections to be 600 amp. Dead break, Munsell green color. Installed on a switchgear manhole with collar "J2".
***Note:** For 23 kv delta applications use US54P25. US52B is a maintenance use item.

STD ITEM	Voltage Class (kV)	System Voltage (kV)	SAP ITEM ID
US52A	15	12.47,13.2,13.8 wye	9389615
US52B Maintenance use only	27	22.9 delta*	9391066
US52C	38	34.5 wye	9393043

RECLOSER / SWITCHGEAR, THREADED STUD

Replacement threaded stud for use on Cooper 15 and 25kV class elbow style padmounted reclosers and padmounted switchgear. 5/8"-11 threaded x 2.18 inches long. Aluminum. Comes in a package of 3.

	STD ITEM	SAP ITEM ID
	US52S	9391306

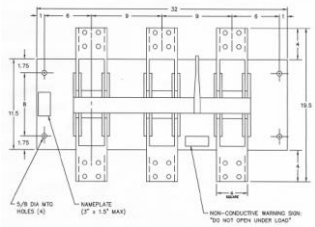
RECLOSER - PADMOUNTED – COMMUNICATIONSS, 600 AMP, 40KA, WITH SEL CONTROL DER

Recloser, pad mount, communications ready, 600 amp, 40kA interrupting capacity, control – SEL651R, self-powered, cable connections to be 600 amp. Dead break, Munsell green color. Installed on a switchgear manhole with collar "M" for 15kv class and collar "K" for 25kv class.
The recloser can be used at 12.47, 13.2, 13.8, 22.9 and 34.5 kV system voltages (wye, delta and ungrounded).

Voltage Class kV	STD ITEM	SAP ITEM ID
15	US54P15	9391887
25	US54P25	9393191
38	US54P38	9393190

SWITCH, DISCONNECT, NETWORK

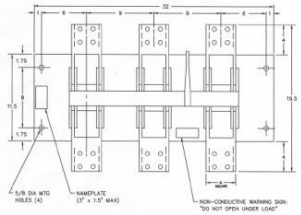
Switch, disconnect, 600 volt, 2000 amp rated, 3 phase, 3 individual hook eye stick operating disconnects with grounding knubs on the hinge side. with individual barrier boards between phases, non load break.



STD ITEM	SAP ITEM ID	PS ITEM ID
US60A	9386603	9203044

SWITCH, DISCONNECT, NETWORK

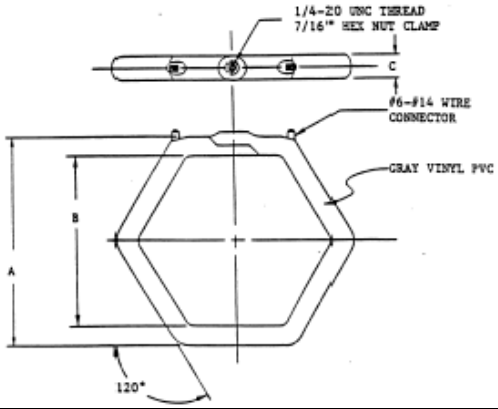
Switch, disconnect, 600 volt, 4000 amp rated, 3 phase, 3 individual hook eye stick operating disconnects with grounding knubs on the hinge side. with individual barrier boards between phases, non load break.



STD ITEM	SAP ITEM ID	PS ITEM ID
US60C	9386604	9203045

TRANSFORMER, CURRENT

Split-core, window type current transformer for use with ampere demand meter, item UM2B. Transformer is designed to be installed around conductors or the bushing of a low-voltage network protector without disconnecting the cables or terminals. The ends of the winding are provided with solderless tinned copper connectors which serve as secondary terminals.



CT RATIO	A	B	C	STD ITEM	SAP ITEM ID	PS ITEM ID
1200/5	10.75	8.75	1.25	UT2D5	9313428[Y]	3010156[Y]
2000/5	11.25	8.75	1.6	UT2F5	9313427	3010157
3000/5	11.25	8.75	1.6	UT2H5	9313947[Y]	3010158[Y]
4000/5	11.25	8.75	1.6	UT2K5	9313946[Y]	3010159[Y]

Note: All dimensions are in inches and are approximate.
CT shown is hex shaped, a round version could be supplied at well.

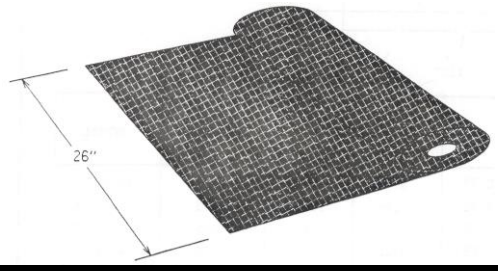
TAPE, INSULATING, HEAT SHRINK

High-voltage insulating, heat shrink tape. Adhesive coated, heat activated amalgamation, supplied in 25 ft. rolls. For 5 kV thru 35 kV applications.

	STD ITEM	SAP ITEM ID	PS ITEM ID
2 inch wide	UT6A	9314747	0801736
4 inch wide	UT6B	9314725[Y]	0801737[Y]

SHEET, INSULATING, HEAT SHRINK

High-voltage insulating, heat shrink sheet. Adhesive coated, heat activated amalgamation in 26 inch x 33 ft. rolled sheets. For 5 kV thru 35 kV applications.



STD ITEM	SAP ITEM ID	PS ITEM ID
UT6S	9314724[Y]	0801738[Y]

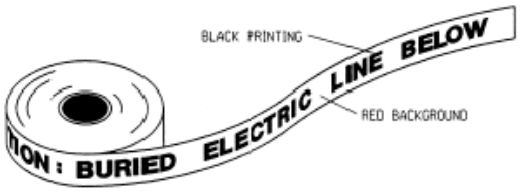
TUBING, INSULATING, HEAT SHRINK

High voltage insulating, heat shrink, heavy wall tubing. For use on 5 kV thru 35 kV applications.

BUS WIDTH (INCHES)	LENGTH (FEET)	DIAMETER (INCHES) MIN.	DIAMETER (INCHES) MAX.	STD ITEM	SAP ITEM ID	PS ITEM ID
1	60	0.70	1.10	UT7A	9314723[Y]	0801739[Y]
2	50	1.10	1.55	UT7B	9314722[Y]	0801740[Y]
3	50	1.75	2.45	UT7C	9314721[Y]	0801741[Y]
4	50	2.60	3.60	UT7D	9314720[Y]	0801742[Y]

TAPE, MARKING, UNDERGROUND CABLE

6 inch wide x 1,000 ft. roll, 4 mil thick. Tape shall be red in color with black printed message "CAUTION: BURIED ELECTRIC LINE BELOW". For use marking underground electric installations.



STD ITEM	SAP ITEM ID	PS ITEM ID
UT8	9314748	0801735

STUD, BUSHING WELL REPLACEMENT

Replacement stud for 200 amp bushing wells in dead front pad mounted equipment

STD ITEM	SAP ITEM ID	PS ITEM ID
UT10S	9303844	5647280[E]

TRANSFORMER, 1 PHASE, SUBMERSIBLE

Single-phase, subsurface distribution transformer for use on a loop feed, grounded neutral, underground distribution system. Transformers have no primary taps, have two 200A, high-voltage bushing wells, three low-voltage insulated cable leads extending above the top of the cover and a high-voltage bayonet fuse. Per PPL specification MS 2590, latest edition.

NOTE: These units are for **MAINTENANCE ONLY** where a standard minipad transformer, item UT31xx, absolutely **CANNOT** be installed. These units are **NOT** to be installed in a manhole or vault.

HIGH VOLTAGE kV	LOW VOLT	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
4.16 GrdY/2.4	240/120	50	UT20A		5425015[E]
3.74 GrdY / 2.16 X 13.2 GrdY / 7.62	240/120	25	UT20B	9301079[E]	5425545[E]
4.16 GrdY / 2.4 X 13.2 GrdY / 7.62	240/120	25 50	UT20D	9300453 9300350	5425620 5425670
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97	240/120	25 50	UT20E	9300454[E]	5425738[E] 5425739[E]
12.47 GrdY / 7.2	240/120	25 50	UT20G	9301207[E]	5425190[E] 5425210[E]
13.2 GrdY / 7.62	240/120	75 100 167	UT20H	9300348[E] 9300349 9300452[E]	5425287[E] 5425288 5425285[E]
13.8 GrdY / 7.97	240/120	25 75 100	UT20J	9301124[E] 9301125[E] 9301078[E]	5425440[E] 5425455[E] 5425456[E]

TRANSFORMER, 1 PHASE, SUBMERSIBLE

Single-phase, subsurface distribution transformer for use on a radial feed, grounded neutral, underground distribution system. Transformers have no primary taps, have one 200A, high-voltage bushing well, three low-voltage insulated cable leads extending above the top of the cover and a high-voltage bayonet fuse. Per PPL specification MS 2590, latest edition.

NOTE: These units are for **MAINTENANCE ONLY** where a standard minipad transformer, item UT31xx, absolutely **CANNOT** be installed. These units are **NOT** to be installed in a manhole or vault.

HIGH VOLTAGE kV	LOW VOLT	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97	120/240	100	UT21ER	9301067[E]	5424937[E]
13.8 GrdY / 7.97	120/240	25 50 100 167	UT21JR	9301019[E] 9301022[E] 9301066[E] 9301024[E]	5424813[E] 5424814[E] 5424820[E] 5424817[E]

TRANSFORMER, 1 PHASE, SUBWAY, LOW PROFILE

Single-phase, low profile, subway type distribution transformer for use on a radial feed, underground distribution system. Transformers have no primary taps, are equipped with two 200 Amp high-voltage bushing wells and four low-voltage bushings with threaded studs. Per PPL Specification MS 2552, latest edition.

NOTE: These units do not have any internal fusing. Fuse protection must be provided either by the riser pole fuse or an MVI vacuum interrupter.

HIGH VOLTAGE kV	LOW VOLTAGE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
2.4/4.16Y	120/240	25 50	UT25A	9300406[E] 9300405[E]	9200884[E] 9200883[E]

TRANSFORMER, 1 PHASE, LOOP FEED, SUBWAY

Single-phase, subway type distribution transformer for use on a loop feed, underground distribution system. Primary taps are indicated in the table. All transformers are equipped with two 200 Amp high-voltage bushing wells, two or four low-voltage bushings with threaded studs, bayonet fuse holder and current limiting fuse under oil. Per PPL Specification MS 2551, latest edition.

HIGH VOLTAGE kV	LOW VOLT	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
4.16Grdy/2.4	120/240	00	50 100 167	UT26A	9301176[E] 9301089 9300970	5422864[E] 5422865 5422867
4.16Grdy/2.4	120/240	14	50 100 167	UT26B	9300969[E] 9390788[E]	5422902[E] 5422903[E] n/a
4.16Grdy/2.4	277/480	14	167	UT26D	9301047[E]	5422956[E]
4.16Grdy/2.4	292x584	22	100	UT26F	9300967[E]	5422910[E]
4.16Grdy/2.4 X 12.47GrdY/7.2	120/240	00	50 100 167	UT26H	9300064[E] 9300065[E] 9300380[E]	9200996[E] 9200997[E] 9201592[E]
12.47GrdY/7.2	277/480	00	167	UT26K	9301048[E]	5422971[E]
3.47Grdy/2.1 X 13.2GrdY/7.6	120/240	00	100 167	UT26L	9300247[E] 9300246[E]	9201954[E] 9201953[E]
4.16Grdy/2.4 X 13.2GrdY/7.6	120/240	00	50 100 167	UT26M	9300239[Y] 9300248 9300245	9202159[Y] 9201955 9201952
4.16Grdy/2.4 X 13.2GrdY/7.6	277/480	00	167	UT26N	9387009	*n/a*
4.16Grdy/2.4 X 13.8GrdY/7.9	120/240	00	50 100 167	UT26P	9300283[E] 9300287[E] 9300210[E]	9201783[E] 9201735[E] 9201718[E]
4.16Grdy/2.4 X 13.8GrdY/7.9	277/480	00	100 167	UT26Q	9301088[E] 9390349	9202654[E] n/a

TRANSFORMER, 1 PHASE, RADIAL FEED, SUBWAY

Single-phase, subway type distribution transformer for use on a radial feed, underground distribution system. Transformers have no primary taps, are equipped with two 200 Amp high-voltage bushing wells, four low-voltage bushings with threaded studs, bayonet fuse holder and current limiting fuse under oil. Per PPL Specification MS 2553, latest edition.

HIGH VOLTAGE kV	LOW VOLTAGE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
2.4/4.16Y	120/240	25 50 100 167	UT27A	9301076[E] 9301137[E] 9300074[E] 9300063[E]	5422861[E] 5422862[E] 9200991[E] 9200990[E]
2.4/4.16Y X 7.2/12.47Y		100	UT27C	9301032[E]	5422974[E]
13800D		167	UT27D	9390199[E]	N/A
11500D	292/584	500	UT27E	9393336[E]	N/A

TRANSFORMER, 3 PHASE, LOOP FEED, SUBWAY, 208Y/120 VOLT SECONDARY

Three-phase, subway type distribution transformer for use on a loop feed, underground distribution system. Transformers are equipped with six 200 Amp high-voltage bushing wells, four low-voltage bushings with threaded studs for moles, bayonet fuse holders and current limiting fuses under oil. Per PPL Specification MS 2554, latest edition.

HIGH VOLTAGE kV	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
4.16Y / 2.4	00	300	UT28A	9301081[E]	5425756[E]
4.16 GrdY / 2.4	00	150	UT28AG	9301033[E]	5423077[E]
4.16Y / 2.4	14	500	UT28AT	9300391[E]	5425762[E] Discontinued (Sutton 1 in stock, use up)
4800D	00	500	UT28D	9387916[Y]	n/a
4.16 GrdY / 2.4 X 13.8GrdY / 7.97	90	500	UT28MG	9300807	2285519
13800D	90	500	UT28N	9388837	n/a

TRANSFORMER, 3 PHASE, RADIAL FEED, SUBWAY (Walk-In Vault)

Three-phase, subway walk-in vault type distribution transformer for use on a radial feed, underground distribution system. Transformers are equipped with side-mounted 600 Amp high-voltage bushing wells, four low-voltage bushings with threaded studs, bayonet fuse holder and current limiting fuse under ester fluid (FR3). Per PPL Specification MS 2556, latest edition.

HIGH VOLTAGE kV	LOW VOLTAGE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
11.5	120/208	500	UT29A	9393505[E]	n/a

TRANSFORMER, 1 PHASE, PAD-MOUNTED, (MINIPAD)

Single-phase, low profile, pad-mounted type distribution transformer for use on a loop feed, grounded neutral, underground distribution system. Transformers have no primary taps, are equipped with two 200 Amp high-voltage bushing wells, three low-voltage bushings with threaded studs, bayonet fuse holder and current limiting fuse under oil. Per PPL Specification MS 2561, latest edition.

HIGH VOLTAGE kV	LOW VOLT	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
3.74 GrdY / 2.16 X 13.2 GrdY / 7.62	240/120	25 50 100	UT31A	9301097[E] 9301077[E] 9300374[E]	5422083[E] 5422084[E] 9201360[E]
2.4 / 4.16Y **Note 1**	240/120	25 50 100	UT31B	9301071[E] 9300582[E] 9301070[E]	5422006[E] 5422003[E] 5422004[E]
4.16 GrdY / 2.4 X 12.47 GrdY / 7.2	240/120	25 50 75 100	UT31C	9301051[E] 9301013[E] 9301250[E] 9300588[E]	5422087[E] 5422088[E] 5421947[E] 5422089[E]
4.16 GrdY / 2.4 X 12.47 GrdY / 7.2	480/240	50	UT31C1	9300352	9201067
4.16 GrdY / 2.4 X 13.2 GrdY / 7.62	240/120	25 50 75 100 167	UT31D	9300927 9300930 9301042 9300933 9300838	0625561 0650561 0675561 0676561 0678561
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97	240/120	25 50 75 100 167	UT31E	9300586[E] 9301115[E] 9300956[E] 9301099[E] 9300986[E]	5422076[E] 5422078[E] 5422108[E] 5422079[E] 5421987[E]
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97	480/240	50	UT31E1	9393745[E]	n/a
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97 Stainless Steel	240/120	25 50	UT31ES	9300382 9300383	9201598 9201599
8.32 GrdY / 4.8 X 13.2 GrdY / 7.62	240/120	25	UT31F	9300925	0625549
8.32 GrdY / 4.8	240/120	100	UT31F1	9300302[Y]	9202020[Y]
12.47 GrdY / 7.2	240/120	25 50 75 100 167	UT31G	9300583 9301044 9300279[E] 9301072[E] 9300334[E]	5422008 5422010 5422231[E] 5422009[E] 5422233[E]
12.47 GrdY / 7.2 Stainless Steel	240/120	25 50 100	UT31GS	9300309[E] 9300308[E] 9300977[E]	9201600[E] 9201601[E] 9202525[E]
13.2 GrdY / 7.62	240/120	25 50 75 100 167	UT31H	9300926 9300929 9301092 9300932 9300839	0625560 0650560 0675560 0676560 0678560

Note 1: These transformers to be used ONLY in Manchester-By-The-Sea, MA.

TRANSFORMER, 1 PHASE, PAD-MOUNTED, (MINIPAD) (Continued)

Single-phase, low profile, pad-mounted type distribution transformer for use on a loop feed, grounded neutral, underground distribution system. Transformers have no primary taps, are equipped with two 200 Amp high-voltage bushing wells, three low-voltage bushings with threaded studs, bayonet fuse holder and current limiting fuse under oil. Per PPL Specification MS 2561, latest edition.

HIGH VOLTAGE kV	LOW VOLTAGE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
13.2 GrdY / 7.62 Stainless Steel	240/120	25 50 75 100 167	UT31HS	9300842[E] 9300841[E] 9300890[E] 9300828[E] 9300356[E]	5421951[E] 5421952[E] 5421950[E] 5421953[E] 5421954[E]
13.8 GrdY / 7.97	240/120	25 50 75 100 167	UT31J	9300584[E] 9300872[E] 9300871[E] 9301098[E] 9300587[E]	5422022[E] 5422024[E] 5422016[E] 5422081[E] 5422082[E]
13.8 GrdY / 7.97 Stainless Steel	240/120	25 50	UT31JS	9300307[E] 9300381[E]	9201602[E] 9201597[E]
34.5 GrdY / 19.9	240/120	25 50 75	UT31K	9300886[E] 9300857[E] 9300825[E]	5422046[E] 5422047[E] 5422059[E]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, 600Y/346 VOLT SECONDARY

Three-phase, pad-mounted transformer for use on an underground distribution system. Transformers have primary taps, no fuse, four low-voltage bushings equipped with NEMA Standard ten (10) hole spade terminals. Dead front units are equipped with 200 Amp high-voltage bushing wells. Live front unit equipped with three high-voltage clamp type bushings. Per PPL Specification MS 2573, latest edition.

NOTE: 5423182 & 9202347 are type 50 radial, 9201527 is type 30 loop.

HIGH VOLTAGE kV	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
13.8 Delta, Dead Front	87 21 90	1500 2000 2500	UT39KT	9300442 9301149[E] 9300304[E]	5423291 5423182[E] 9201527[E]
23 Delta, Live Front	92	2000	UT39MT	9300082[E]	9201286[E]
11.5 Delta, Dead Front	80	1000	UT39NT	9301239[E]	9202347[E]
4160 Delta x 13800 Delta, Dead Front	90	150 500	UT39XT	9300270[E] 9300271[E]	5422187[E] 5422188[E]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, LIVE FRONT (Discontinued)

Three-phase, pad-mounted transformer with high-voltage bushings (live front) for use on a radial feed, grounded neutral, underground distribution system. With three high-voltage clamp type bushings, four low-voltage bushings with NEMA Standard spade terminals, four (4) hole for 75-300 kVA transformers, six (6) hole for 500 kVA and ten (10) hole for 750-1000 kVA transformers.

DISCONTINUED, use up existing stock. Replaced by UT42x.

HIGH VOLTAGE	LOW VOLTAGE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
4160 Grd.Y/2400 x 13200 Grd Y/7620 (No Taps)	208Y/120	1000	UT40B	9300242[Y]	1190519[Y]
4800 x 13200 Grd, Y/7620 (No Taps)		1000	UT40C	9300255[Y]	1190517[Y]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, DEAD FRONT, RADIAL (Discontinued)

Three-phase, pad-mounted transformers with high-voltage bushing wells for use on a radial feed, grounded neutral, underground distribution system. With four low-voltage bushings equipped with NEMA Standard spade terminals, four (4) hole for 75-300 kVA transformers, six (6) hole for 500 kVA and ten (10) hole for 750-1000 kVA transformers. Per PPL specification MS 2572 latest edition.

DISCONTINUED, use up existing stock. Replaced by UT42x.

HIGH VOLTAGE	LOW VOLTAGE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
13200 Grd Y/7620 (No Taps)	208Y/120	300	UT41A		1483531[Y]
		750		9300218[Y]	1487531[Y]
4160 Grd.Y/2400 x 13200 Grd Y/7620 (No Taps)		75	UT41B		1475519[Y]
		500		9300220[Y]	1485519[Y]
		1000		9300216[Y]	1490519[Y]
4800 x 13200 Grd.Y/7620 (No Taps)		75	UT41C	9300225[Y]	1475517[Y]
		150		9300224[Y]	1477517[Y]
		500			1485517[Y]
		750		9300256[Y]	1487517[Y]
		1000		9300217[Y]	1490517[Y]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, DEAD FRONT, RADIAL, 208Y/120 SECONDARY

Three-phase, pad-mounted transformers with high-voltage bushing wells for use on a radial feed, underground distribution system. With four low-voltage bushings equipped with NEMA Standard ten (10) hole spade terminals. Per PPL specification MS 2572 or MS2573 latest edition.

HIGH VOLTAGE	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
4160 Grd.Y/2400	None	1000	UT41E	9300249	9201956
4800D	None	1000	UT41F	9300209[Y]	9201961[Y]
11500D	22	300	UT41NT	9300948	5423135
	22	500		9301178[E]	5423149[E]
	80	750		9300514[E]	5423124[E]
	80	1000		9300303[E]	9201505[E]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, DEAD FRONT, LOOP, 208Y/120 SECONDARY

Three-phase, pad-mounted transformers with high-voltage bushing wells for use on loop feed, underground distribution system. Includes bayonet loadbreak fuse holder with expulsion link and current limiting fuse under oil. Equipped with four NEMA Standard low-voltage spade terminals. Per PPL specification MS 2572 or MS 2573, latest edition.

HIGH VOLTAGE kV	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
2.4/4.16Y/2.4	00	75 150 300	UT42A	9301132[E] 9301155[E] 9301133[E]	5422577[E] 5422576[E] 5422578[E]
3.74 GrdY / 2.16 X 13.2 GrdY / 7.62	00	75 150 300 500 750	UT42B	9300879[E] 9300320[E] 9301157[E] 9300593[E] 9300398[E]	5422539[E] 5422549[E] 5422567[E] 5422571[E] 9200971[E]
4.16 GrdY / 2.4 X 12.47 GrdY / 7.2	00	75 150 300 500	UT42C	9300880[E] 9300881[E] 9300882[E] 9300883[E]	5422541[E] 5422542[E] 5422543[E] 5422544[E]
4.16 GrdY / 2.4 X 13.2 GrdY / 7.62	00	75 150 300	UT42D	9301035 9301036 9301158	5422563 5422564 5422566
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97	00	75 150 300	UT42E	9301253[E] 9301251[E] 9301213[E]	5422591[E] 5422592[E] 5422594[E]
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97 stainless	00	150 500	UT42E	9300992[E] 9387092	9202902[E] N/A
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97	90	500 750 1000	UT42ET	9301212 9301242 9388686	5422596 5422589 n/a
4.8D X 13.2 GrdY / 7.62	00	75 150 300 500 750 1000	UT42F	9300295[Y] 9300306 9300296[Y] 9300297[Y] 9300298[Y] 9300299[Y]	9201467[Y] 9201468 9201469[Y] 9201470[Y] 9201471[Y] 9201472[Y]
4160 Delta x 13800 Delta, Dead Front	90	300	UT42XT	9300346[E]	5422192[E]
12.47 GrdY / 7.2	00	75 150 300 500	UT42G	9300863[E] 9300610[E] 9301023[E] 9301021	5422316[E] 5422317[E] 5422318[E] 5422319
12.47 GrdY / 7.2 stainless	00	150	UT42GS	9300978[E]	9202526[E]
12.47 GrdY / 7.2	82	750 1000	UT42GT	9300268[E] 9300282[E]	5422343[E] 5422342[E]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, DEAD FRONT, LOOP, 208Y/120 SECONDARY (Continued)

Three-phase, pad-mounted transformers with high-voltage bushing wells for use on loop feed, underground distribution system. Includes bayonet loadbreak fuse holder with expulsion link and current limiting fuse under oil. Equipped with four NEMA Standard low-voltage spade terminals. Per PPL specification MS 2572 or MS 2573, latest edition.

HIGH VOLTAGE kV	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
13.2 GrdY / 7.62	00	75 150 300	UT42H	9300259 9300613 9300260	5422352 5422353 5422354
13.2 GrdY / 7.62 stainless	00	75 150 300 500	UT42HS	9300862[E] 9301025[E] 9301026[E] 9300262[E]	5421969[E] 5421977[E] 5421978[E] 5422361[E]
13.8 GrdY / 7.97	00	75 150 300	UT42J	9301196[E] 9301203[E] 9301195[E]	5422427[E] 5422440[E] 5422446[E]
13.8 GrdY / 7.97	90	500 750 1000 1500	UT42JT	9301191 9301193 9300615 9300829	5422479 5422474 5422475 5423481
13.8D	00	75 500	UT42K	9300993[E] 9300988[E]	5422126[E] 5422138[E]
13.8D	87	300 750 1000	UT42KT	9300267 9300944 9300357[E]	5422170 5423274 5422182[E]
13.8D	90	150	UT42KT	9300987[E]	5422149[E]
34.5 GrdY / 19.9	00	75 150 300 500	UT42L	9300870 9300869 9300867 9300868	5422492 5422501 5422503 5422502
34.5 GrdY / 19.9	96	750	UT42LT	9301245	5422601

TRANSFORMER, 3 PHASE, PAD-MOUNTED, LIVE FRONT (Discontinued)

Three-phase, pad-mounted transformer with high-voltage bushings (live front) for use on a radial feed, grounded neutral, underground distribution system. With three high-voltage clamp type bushings, four low-voltage bushings with NEMA Standard spade terminals, four (4) hole for 75-300 kVA transformers, six (6) hole for 500 kVA and ten (10) hole for 750-1000 kVA transformers.

DISCONTINUED, use up existing stock. Replaced by UT46__.

HIGH VOLTAGE	LOW VOLTAGE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
4800 x 13200 GrdY/7620	480Y/277	150	UT45C	9300284[Y]	1177545[Y]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, LIVE FRONT

Three-phase, pad-mounted transformer with high-voltage bushings (live front) for use on a radial feed, ungrounded, delta, underground distribution system. Equipped with three high-voltage clamp type bushings, four NEMA Standard low-voltage spade terminals. Per PPL specification MS 2573, latest edition.

HIGH VOLT kV	TAP CODE	LOW VOLT	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
22.9 D	92	208Y / 120	75	UT45GT	9300238[E]	9202126[E]
			300		9300448[E]	5424173[E]
			750		9300954[E]	5424175[E]
			1000		9300061[E]	9200989[E]
		480Y / 277	300	UT45MH	9301085	5424187
			500		9301122[E]	5424188[E]
			750		9300957[E]	5424181[E]
			1000		9300461[E]	5424189[E]
			1500		9300451[E]	5424196[E]
			2000		9300450[E]	5424180[E]
			2500		9300067	5424191
34.5D	22	480Y / 277	1000	UT45NT	9386630[Y]	9203063[Y]
			2500		9300286[Y]	1193936[Y]
		208Y / 120	300	UT45PT	9300997[E]	9202888[E]
		480Y / 277	300		9301563[E]	9202911[E]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, DEAD FRONT, RADIAL, 480Y/277 SECONDARY

Three-phase, pad-mounted transformers with high-voltage bushing wells for use on a radial feed, grounded neutral, underground distribution system. With four low-voltage bushings equipped with NEMA Standard spade terminals, four (4) hole for 150-500 kVA transformers and ten (10) hole for 750-2500 kVA transformers. Per PPL specification MS 2572 or MS 2573 latest edition.

Units with 13kV Grounded Y primary, 1500 kVA and below are DISCONTINUED. Existing stock may be used up. Replacement units are loop feed and found in Item UT47__. Units of 2000 and 2500 kVA will remain as radial.

HIGH VOLTAGE	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
13200 GrdY/7620 **Discontinued**	None	500 1000	UT46A	9300257 9300215[Y]	1485587 1490587[Y]
13200 GrdY/7620		2000 2500		9300213[Y] 9300226[Y]	1492587[Y] 1493587[Y]
13200 GrdY/7620 **Discontinued**	22	500 1500	UT46AT	9300219[Y] 9300214[Y]	1485528[Y] 1491528[Y]
4160 GrdY/2400 x 13200 Grd Y/7620 **Discontinued**	None	150 300 1000	UT46B	9300222 9300221	1477548 1483548 1490548[Y]
4800D x 13200 GrdY/7620 **Discontinued**	None	150 1500	UT46C	9300223[Y]	1477545[Y] 1491545[Y]
4160 GrdY/2400	None	1000 1500	UT46E	9300250 9300251	9201957 9201958
4800 D	None	1000 1500	UT46F	9300253[Y] 9300252[Y]	9201960[Y] 9201959[Y]
11500 D	80 22 80 80 80 80	300 500 750 1000 1500 2000	UT46GT	9301177[E] 9301135[E] 9300919[E] 9301230[E] 9300917[E] 9301136[E]	5423146[E] 5423158[E] 5423138[E] 5423144[E] 5423139[E] 5423159[E]
12470 GrdY/7200	82	2000 2500	UT46HT	9300317[E] 9300975[E]	5423371[E] 5423372[E]
13800 D	87 21 87	2000 2500 3750	UT46JT	9300946[E] 9301150[E] 9301140[E]	5423096[E] 5423203[E] 5423168[E]
13800 GrdY	90	2000 2500	UT46KT	9300447[E] 9300832[E]	5423563[E] 5423564[E]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, DEAD FRONT, LOOP, 480Y/277 SECONDARY

Three-phase, pad-mounted transformers with high-voltage bushing wells for use on loop feed, underground distribution system. Includes bayonet loadbreak fuse holder with expulsion link and current limiting fuse under oil. Equipped with four NEMA Standard low-voltage spade terminals. Per PPL specification MS 2572 or MS 2573, latest edition.

HIGH VOLTAGE kV	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
2.4/4.16Y/2.4	00	150	UT47A	9301156[E]	5422574[E]
3.74 GrdY / 2.16 X 13.2 GrdY / 7.62	00	150 300 500 750	UT47B	9300876[E] 9300877[E] 9300605[E] 9300389[E]	5422536[E] 5422537[E] 5422538[E] 5422448[E]
4.16 GrdY / 2.4 X 12.47 GrdY / 7.2	00	75 150 300 500	UT47C	9300884[E] 9300885[E] 9301075[E] 9300858[E]	5422545[E] 5422546[E] 5422547[E] 5422548[E]
4.16 GrdY / 2.4 X 13.2 GrdY / 7.62	00	75 150 300	UT47D	9301224 9301199 9301198	5422553 5422554 5422556
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97	00	75 150 300	UT47E	9301153[E] 9300570[E] 9301167[E]	5422603[E] 5422604[E] 5422605[E]
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97 Stainless	00 90	75 300 500	UT47ES	9300960[E] 9300959[E] 9300914[E]	9202989[E] 9202988[E] 9202336[E]
4.16 GrdY / 2.4 X 13.8 GrdY / 7.97	90	500 750 1000	UT47ET	9301090 9300571 9388425	5422606 5422610 n/a
4.8D X 13.2 GrdY / 7.62	00	75 150 300 500 750 1000	UT47F	9300300[Y] 9300301[Y] 9300291[Y] 9300292[Y] 9300293[Y] 9388426[Y]	9201475[Y] 9201476[Y] 9201462[Y] 9201463[Y] 9201464[Y] n/a
12.47 GrdY / 7.2	00	75 150 300 500	UT47G	9301020[E] 9301017[E] 9301016[E] 9301015[E]	5422322[E] 5422323[E] 5422324[E] 5422325[E]
12.47 GrdY / 7.2	82	750 1000 1500	UT47GT	9300611 9300612 9300258[E]	5422321 5422326 5422345[E]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, DEAD FRONT, LOOP, 480Y/277 SECONDARY (Continued)

Three-phase, pad-mounted transformers with high-voltage bushing wells for use on loop feed, underground distribution system. Includes bayonet loadbreak fuse holder with expulsion link and current limiting fuse under oil. Equipped with four NEMA Standard low-voltage spade terminals. Per PPL specification MS 2572 or MS 2573, latest edition.

HIGH VOLTAGE kV	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
13.2 GrdY / 7.62	00	75 150 300	UT47H	9300264 9300265 9301197	5422371 5422372 5422374
13.2 GrdY / 7.62 stainless	00	75 150 300 500 750	UT47HS	9301027[E] 9387097[E] 9301028[E] 9300263[E] 9300363[E]	5421980[E] None 5421981[E] 5422365[E] 9200980[E]
13.2 GrdY / 7.62	85	750	UT47HT		9200968[E]
13.8 GrdY / 7.97	00	75 150 300	UT47J	9301188[E] 9301210[E] 9301209[E]	5422487[E] 5422488[E] 5422489[E]
13.8 GrdY / 7.97	90	500 750 1000 1500	UT47JT	9300874 9301190 9301192 9300616	5422516 5422482 5422478 5422483
13.8D	00	300	UT47K	9300266[E]	5422164[E]
13.8D	90	150 500 750 1000 1500	UT47KT	9300269[E] 9300280[E] 9300402[E] 9300608[E] 9300607[E]	5422171[E] 5422172[E] 9200419[E] 5422177[E] 5422173[E]
34.5 GrdY / 19.9	00	75 150 300 500 2000 2500	UT47L	9300594 9300866 9300892 9300865 9300609 9301154	5422486 5422504 5422491 5422506 5422301 5422602
34.5 GrdY / 19.9	96	750 1000 1500	UT47LT	9300579 9301134 9300569	5422585 5422584 5422586

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

TRANSFORMER, 3 PHASE, PAD-MOUNTED, DEAD FRONT (Discontinued)

Three-phase, pad-mounted transformer with high-voltage bushing wells for use on a radial feed, grounded neutral, underground distribution system. Four low-voltage terminals equipped with NEMA Standard ten (10) hole spade terminals are provided.

DISCONTINUED, use up existing stock. Replaced by UT47L.

HIGH VOLTAGE	LOW VOLTAGE	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
34500 GrdY/19920	480Y/277	96	1500	UT48A	9300923[Y]	1191933[Y]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, DEAD FRONT (Discontinued)

Three-phase, pad-mounted transformer with high-voltage bushing wells for use on a radial feed, grounded neutral, underground distribution system. Four low-voltage terminals equipped with NEMA Standard ten (10) hole spade terminals are provided. Per PPL specification MS 2572 latest edition.

DISCONTINUED, use up existing stock. Replaced by UT47L.

HIGH VOLTAGE	LOW VOLTAGE	TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
34500 GrdY/19920	480Y/277	96	2000	UT49A	9300212[Y]	1492933[Y]

TRANSFORMER, 3 PHASE, NETWORK, 11kV

Three-phase, secondary network transformer equipped with primary switch, low voltage bushings and provisions for mounting a low-voltage network protector. Transformer to be in accordance with the current ANSI Standard C57.12.40, unless otherwise specified. Per PPL specification MS 2595 latest edition. Refer to the Material Specification for more information.

HIGH VOLT	LOW VOLT	TAPS	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
11000	208Y/120	11275/10725/ 10450/10175	500	UT50A1	9300994[E]	5424778[E]
			750		9301000[E]	5424786[E]
			1000		9301010[E]	5424787[E]
11000	480Y/277	11275/10725/ 10450/10175	750	UT50A2	9300069[E]	5424773[E]
			1000		9300996[E]	5424785[E]
			1500		9300995[E]	5424781[E]
			2000		9300991[E]	5424777[E]

TRANSFORMER, 3 PHASE, NETWORK, 15kV

Three-phase, secondary network transformer equipped primary dead break switch(externally mounted), low-voltage bushings and provisions for mounting a low-voltage network protector. Transformer to be in accordance with the current ANSI Standard C57.12.40, unless otherwise specified. Per PPL specification MS 2595 latest edition. Refer to the Material Specification for more information.

VOLTAGE			PRI		STD		
HIGH	LOW	TAPS	SW	KVA	ITEM	SAP ITEM ID	PS ITEM ID
14400	216Y/125	14040/13680 13320/12960/ 11500	DB	500	UT52A2	9301050	2385880[Y]
			DB	750		9300053	2387880[Y]
			DB	1000		9300798	2390880[Y]
14400	480Y/277	14040/13680/ 13320/12960	DB	500	UT52B1	9300058	2385887
			DB	750		9300052	2387887[Y]
			DB	1000		9300787	2390887[Y]
			DB	1500		9300097	2391887[Y]
			DB	2000		9300234	9202099[E]
14400	480Y/277	14040/13680/ 13320/11860/ 11500	DB	500	UT52B2	9300060[Y]	2385876[Y]
			DB	750		9300054[Y]	2387876[Y]
			DB	1000		9300788[Y]	2390876[Y]
			DB	1500		9300098[Y]	2391876[Y]

TRANSFORMER, 3 PHASE, NETWORK, 15kV - SMALL FOOTPRINT

Three-phase, secondary network transformer equipped primary dead break switch(internally mounted), low-voltage bushings and provisions for mounting a low-voltage network protector. Transformer to be in accordance with the current ANSI Standard C57.12.40, unless otherwise specified. Per PPL specification MS 2595 latest edition. Refer to the Material Specification for more information.

VOLTAGE			PRI		STD		
HIGH	LOW	TAPS	SW	KVA	ITEM	SAP ITEM ID	
14400	216Y/125	14040/13680 13320/12960/ 11500	DB	750	UT52S1	9390417[Y]	
				1000	UT52S1	9392577[Y]	

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

TRANSFORMER, 3 PHASE, NETWORK, 5kV

Three-phase, secondary network transformer equipped primary switch (dead break), low-voltage bushings and provisions for mounting a low-voltage network protector. Transformer to be in accordance with the current ANSI Standard C57.12.40, unless otherwise specified. Per PPL specification MS 2595 latest edition. Refer to the Material Specification for more information.

VOLTAGE		TAPS	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
HIGH	LOW					
4330Y/ 2550	216Y/ 125	None	500 750	UT53A	9300804[Y] 9300055[Y]	2385204[Y] 2387204[Y]
4800D	216Y/ 125	5040/4920/ 4680/4560	500 750	UT53C	9391165[Y] 9390925[Y]	9202860[Y] 9202861[Y]
4800D	480Y/ 277		1500	UT53D	9390926[Y]	9202862[Y]

TRANSFORMER, 3 PHASE, NETWORK, 23Kv (discontinued)

Three-phase, secondary network transformer equipped with dead break primary switch, low voltage bushings and provisions for mounting a low-voltage network protector, item UP2 or UP3. Transformer to be in accordance with the current ANSI Standard C57.12.40, unless otherwise specified. Per PPL specification MS 2595 latest edition. Refer to the Material Specification for more information.

DISCONTINUED, use up existing stock. Replaced by UT54S1 and UT54S2. Strike thru indicates none left in stock.

HIGH VOLTAGE	LOW VOLTAGE	TAPS	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
22900	216Y/125	No Taps	500 750 1000	UT54A	9300057[Y] 9300076[Y] 9300099[Y]	2385988[Y] 2387988[Y] 2390988[Y]
22900	480Y/277	24100/23500/ 22300/21700	750 1000 1500 2500	UT54B	9300062[Y] 9300785[Y] ~~9300096[Y]~~ 9301052[Y]	2387951[Y] 2390951[Y] ~~2391951[Y]~~ 2393951[Y]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

TRANSFORMER, 3 PHASE, NETWORK, 23Kv

Three-phase, secondary network transformer equipped with dead break primary switch (switch in main tank), low voltage bushings and provisions for mounting a low-voltage network protector, item UP2 or UP3. Transformer to be in accordance with the current ANSI Standard C57.12.40, unless otherwise specified. Per PPL specification MS 2595 latest edition. Refer to the Material Specification for more information.

HIGH VOLTAGE	LOW VOLTAGE	TAPS	KVA	STD ITEM	SAP ITEM ID	
22900	216Y/125	No Taps	500 750 1000	UT54S1	9390756[Y] 9390769[Y] 9390770[Y]	
22900	480Y/277	24100/23500/ 22300/21700	750 1000 1500 2500	UT54S2	9390768[Y] 9390757[Y] 9390766[Y] 9390708[Y]	

TRANSFORMER, 3 PHASE, NETWORK, 23kV, BUFFALO STYLE

Three-phase, secondary network transformer equipped with dead break primary switch, low voltage bushings and provisions for mounting a low-voltage network protector, item UP2 or UP3. Transformer to be in accordance with the current ANSI Standard C57.12.40, unless otherwise specified. Special configuration for non standard Buffalo area vaults. Per PPL specification MS 2597 latest edition. Refer to the Material Specification for more information.

HIGH VOLTAGE	LOW VOLTAGE	TAPS	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
22900	216Y/125	No Taps	500 750	UT55A	9300056[Y] 9300789[Y]	2385990[Y] 2387990[Y]
22900	480Y/277	24100/23500/ 22300/21700	750 1000	UT55B	9388751[Y] 9300088[Y]	2387953[Y] 2390953[Y]

TRANSFORMER, 3PHASE, NETWORK, 35kV

Three-phase, secondary network transformer equipped with dead break primary switch, low voltage bushings and provisions for mounting a low-voltage network protector, item UP3. Transformer to be in accordance with the current ANSI Standard C57.12.40, unless otherwise specified. Per PPL specification MS 2595 latest edition. Refer to the Material Specification for more information

HIGH VOLTAGE	LOW VOLTAGE	TAPS	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
34400	480Y/277	36200/35300 33500/32600	1000 1500 2000 2500	UT56B	9300077[Y] 9300086[Y] 9300384[Y] 9300084[Y]	2390987[Y] 2391987[Y] 2392987[Y] 2393987[Y]

[1]This Item appears in other CUs
[2]This CU contains additional items needed for installation per standards
[3]This item has a CU with labor/material and a CU with material only

TRANSFORMER, DRY TYPE, 3PHASE, NETWORK, 15kV

Three-phase, secondary network transformer equipped with primary and low voltage bushings with provisions for mounting a low-voltage network protector. Transformer to be in accordance with the current ANSI Standard C57.12.01, 51, 52 and 91, unless otherwise specified.
NOTE: Transformer does not have a primary switch.

HIGH VOLTAGE	LOW VOLTAGE	TAPS	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
14400	480Y/277	140*40/13680/ 13320/12960*	1000	UT58	9394216[Y]	

TRANSFORMER, 3 PHASE, PAD-MOUNTED, STEP DOWN (Ratio)

Three-phase, pad-mounted, dead front, step down distribution transformer for use on a radial feed, underground distribution system. Transformers equipped with 200 amp primary and secondary bushing wells, except 2500 KVA units which have secondary 600 amp bushings for deadbreak elbows, item UR60. Neutral bushings are 4 hole spades, except item UT60B where the primary neutral is a bushing well. Per PPL specification MS2544 latest edition.

VOLTAGE (kV)		TAP	kVA	STD	SAP ITEM ID	PS ITEM ID
HIGH	LOW	CODE		ITEM		
13.2 GrdY/ 7.62	4.16GrdY/ 2.4	None	500 1000 2500	UT60A	9300290 9300288[Y] 9300228[Y]	1685555[Y] 1690555[Y] 1693555[Y]
13.2 GrdY/ 7.62	4.16GrdY/ 2.4	85	1500	UT60AT	9300976[E]	5423428[E]
13.2 GrdY/ 7.62	4.8D	None	500 1000 2500	UT60B	9300389[Y] 9300207[Y] 9300229[Y]	1685556[Y] 1690556[Y] 1693556[Y]
12.47 GrdY/7.2	4.16Y/2.4 / 2.4D	82	1500	UT60DT	9394276	----------
12.47 GrdY/7.2	4.16GrdY/ 2.4	82	750 1000 2500	UT60ET	9300335[E] 9301041[E] 9300974[E]	9201086[E] 5422341[E] 5423368[E]
12.47 GrdY/7.2	11.5D	82	3750	UT60FT	9393309	----------
13.2D	4.16Y/2.4 / 2.4D	85	1500	UT60GT	9300440[E]	5423185[E]
13.8D	4.16Y/ 2.4	87 87 21	2000 2500 2500	UT60HT	9300515[E] 9300947[E] 9300833[E]	5423105[E] 5423106[E] 5423217[E]
	4.16Y/2400/ 2400D	21	1000	UT60JT	9301152[E]	5423212[E]
22.9GrdY/13.2	13.8D	22	7500	UT60K	9393806	n/a
24.9GrdY/14.4	13.8GrdY/7.9	14	2500	UT60MT	9300830[E]	5423492[E]
34.5GrdY/19.9	13.2GrdY/7.6	22	5000	UT60NT	9301064	5422509
34.5GrdY/19.9	4.16GrdY/2.4	96	750 2500	UT60PT	9300831[E] 9300068	5423494[E] 5424471
34.5GrdY/19.9	4.8D	22	2500	UT60QT	9300230[Y]	1693919[Y]
34.5GrdY/19.9	4.16Y/2.4 / 2.4D	96	1000	UT60R	9300285[E]	9202644[E]

TRANSFORMER, 3 PHASE, PAD-MOUNTED, STEP DOWN (Ratio)

Three-phase, pad-mounted transformer with high-voltage bushings (live front) for use on a radial feed, ungrounded, delta, underground distribution system. Equipped with three high-voltage clamp type primary bushings. Transformers equipped with 200 amp primary and secondary bushing wells, except 2500 KVA units which have secondary 600 amp bushings for deadbreak elbows, item UR60. Neutral bushings are 4 hole spades. Per PPL specification MS2547 latest edition.

VOLTAGE (kV)		TAP CODE	kVA	STD ITEM	SAP ITEM ID	PS ITEM ID
HIGH	LOW					
22.9D	4.16GrdY/ 2.4	22	2000	UT61AT	9301231	5424192
		92	2500 3750		9300984[E] 9301084[E]	5424198[E] 5424186[E]
22.9D	4.16Y/2400/ 2400D	92	2500	UT61BT	9300244[E]	9201381[E]
22.9D	13.8GrdY/7.9	92	5000 7500	UT61DT	9300983 9389568	5424193 N/A

TRANSFORMER, 3 PHASE, PAD-MOUNTED, STEP DOWN (Ratio)

Three-phase, pad-mounted transformer with high-voltage bushings (live front) for use on a radial feed, to step down sub-transmission voltages to distribution system voltages. Equipped with three high-voltage clamp type primary bushings. Transformers equipped with 200 amp primary and secondary bushing wells, except 2500 KVA units which have secondary 600 amp bushings for deadbreak elbows, item UR60. Per PPL specification MS2548 latest edition.

VOLTAGE (kV)		TAP CODE	kVA	STD ITEM	SAP ITEM ID	PS ITEM ID
HIGH	LOW					
34.5D	4.8D	22	2500	UT61GT	9392215[Y]	----------

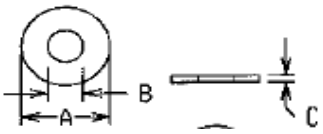
TRANSFORMER, SINGLE PHASE, INDUSTRIAL

Transformer, industrial, no fuses, with (1) 15kV primary bushing well on cover, Tank to be 14 gauge minimum steel, painted Munsel GRAY. Per PPL Material Specification MS2524.

VOLTAGE		TAP CODE	KVA	STD ITEM	SAP ITEM ID	PS ITEM ID
HIGH (kV)	LOW (V)					
13.8 GrdY/ 7.97	120/240	00	250	UT70C	9300277[E]	5422226[E]
13.8 GrdY/ 7.97	120/240	00	333	UT70D	9300208[E]	9201711[E]
13.8 GrdY/ 7.97	277/480Y	00	333	UT70H	9300275[E]	5422222[E]
13.8 GrdY/ 7.97	277/480Y	00	500	UT70J	9300276[E]	5422223[E]
13.8 GrdY/ 7.97	277/480Y	00	833	UT70K	9300278[E]	5422228[E]
13.8 GrdY/ 7.97	2400/4160Y	00	500	UT70N	9300274[E]	5422219[E]
7.97/13.8Y	292/594	22	333	UT70T	9300273[E]	5422217[E]

WASHER, FLAT

Galvanized steel EEI Standard TD – 10.



DESCRIPTION	DIMENSION A	DIMENSION B	DIMENSION C	STD ITEM	SAP ITEM ID	PS ITEM ID
For ⅜" bolt	1"	7/16"	.083"	W5	9321579	7006001
For ½" bolt	1⅜"	9/16"	.109"	W7	9309339	7006003
For ¾" bolt	2"	13/16"	.148"	W8	9321675	7006006

WIRE, COVERED, #4 COPPER

Wire, #4 AWG, covered, solid, tinned, soft drawn.350' reel.

STD ITEM	SAP ITEM ID	PS ITEM ID
W11F	9316528	4005640

WIRE, BARE, #4 COPPER

Wire, bare, #4 AWG, solid, tinned, soft drawn, for splice bonding and grounding. 200' spool.

STD ITEM	SAP ITEM ID	PS ITEM ID
W11F1	9313371	5943075

WIRE, COVERED, #2 COPPER

Wire, 45 mils PE covering, #2 AWG, 7 strand, soft drawn, for arrester line leads. 244' coil (approx 50 lbs.).

STD ITEM	SAP ITEM ID	PS ITEM ID
W13E	9312556	4001042

WIRE, BARE, #2 COPPER

Wire, bare, #2 AWG, 7 strand, tinned, soft drawn, for neutrals and grounding. 500' reel.

STD ITEM	SAP ITEM ID	PS ITEM ID
W13F	9302800	5943865

WIRE, BARE, #2 COPPER

Wire, bare, #2 AWG, 7 strand, soft drawn, for neutrals and grounding. 244' coil (approx 50 lbs.).

STD ITEM	SAP ITEM ID	PS ITEM ID
W13G	9315672	4015032

WIRE, BARE, 2/0 COPPER

Wire, bare, 2/0 AWG, 19 strand, soft drawn, for neutrals and grounding. 120' coil (approx 50lbs).

STD ITEM	SAP ITEM ID	PS ITEM ID
W17G	9310172	9201272

WIRE, BARE, 4/0 AWG COPPER

Wire, bare, 4/0 AWG, 7-strand, hard drawn.

PACKAGE	STD ITEM	SAP ITEM ID	PS ITEM ID
153' coil	W19B	9315783	4035283

WIRE, BARE, 4/0 AWG COPPER

Wire, bare, 4/0 AWG, 19-strand, soft drawn for switchgear and manhole grounding.
NOTE: Coil recently changed to 77' (50lbs) – existing stock is 153' (100 lbs).

PACKAGE	STD ITEM	SAP ITEM ID	PS ITEM ID
77' coil (50 lbs)	W19G	9316038	4035019
3000' reel	W19G	9315355	0806400

WIRE, 600 VOLT, GENERAL PURPOSE COPPER

Wire, single conductor, #12 AWG soft drawn stranded copper, type THHN/THWN insulation, 90°C temperature rating. 500' spools. For network vault wiring.

COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
Black	W52B	9312640	Use W54B
Green	W52G	9312633[Y]	4005064[Y]
Blue	W52L	9312637[Y]	4005055[Y]
Orange	W52O	9312632[Y]	4005066[Y]
Red	W52R	9312638[Y]	4005054[Y]
White	W52W	9312639	4005053[Y]

WIRE , FERREL SLEEVE

Wire and Ferrel for use to make up lock for securing hatch covers. Clear plastic coated 3/16 in galvanized steel wire

	STD ITEM	SAP ITEM ID	PS ITEM ID
Wire	W60	9388881	NA
Ferrell Sleeve	W60S	9388896	NA

WIRE, 600 VOLT, GENERAL PURPOSE COPPER

Wire, single conductor, #10 AWG soft drawn stranded copper, type THHN/THWN insulation, 90°C temperature rating. 500' spools. For network vault wiring.

COLOR	STD ITEM	SAP ITEM ID	PS ITEM ID
Black	W54B	9312640	4005050
White	W54W	9312641[Y]	4005049[Y]

EXTENSION CORD, PORTABLE

Three conductor, #14 AWG copper, 600V, type SO hard service portable cord with yellow jacket. Packaged in 250 ft. spools.

STD ITEM	SAP ITEM ID	PS ITEM ID
X10A50	9316532[Y]	4005314[Y]

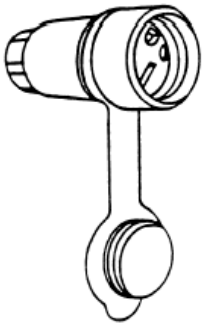
CORD CAP, MALE, GENERAL PURPOSE

Water resistant, NEMA #5-15P, male cord connector, rated 15 Amps, 125V. with oil resistant rubber cover, yellow in color.

STD ITEM	SAP ITEM ID	PS ITEM ID
X10D51	9321383[Y]	8025077[Y]

CORD CAP, FEMALE, GENERAL PURPOSE

Water resistant, NEMA #5-15R, female cord connector, rated 15 Amps, 125V. with oil resistant rubber cover, yellow in color.



STD ITEM	SAP ITEM ID	PS ITEM ID
X10D52	9309413[Y]	8025079[Y]

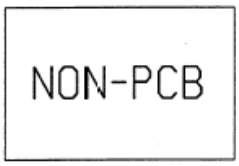
LABEL, PCB

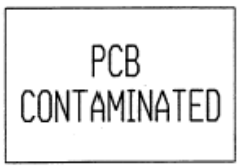
Black on Yellow background.

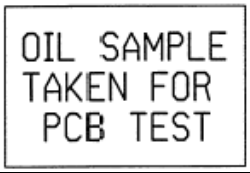
DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
CLASS II 6" X 6" Flexible Sign for field attachment to wood pose wit a PCB filled capacitor.	Z5	9319940[Y]	8002300[Y]
CLASS III 6" X 6" Self Sticking for shop attachment to PCB filled capacitors.	Z6	9319939	8002301
CLASS III 2" X 2" Self Sticking for shop attachments to PCB filled capacitors.	Z7	9319938[Y]	8002302[Y]

LABEL, PCB INFORMATION

Self Sticking Vinyl 3" Wide X 2" High.



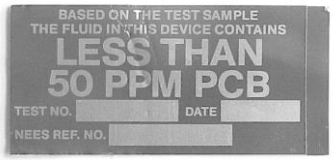




DESCRIPTION	STD ITEM	SAP ITEM ID	PS ITEM ID
"NON-PCB" White on Blue	Z8	9319944[Y]	8002296[Y]
"PCB CONTAMINATED" White on Green	Z9	9319943[Y]	8002297[Y]
"OIL SAMPLE TAKEN FOR PCB TEST" Black on White	Z10	9319942[Y]	8002298[Y]

LABEL, PCB INFORMATION

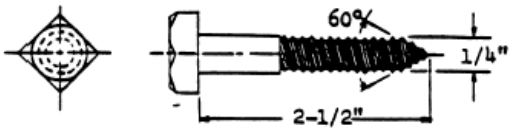
Blue marker w/ grey lettering, 4-1/2" x 2", aluminum foil label. Used to identify PCB content of transformer / equipment oil.



LEGEND	STD ITEM	SAP ITEM ID	PS ITEM ID
"Less Than 50 PPM-PCB"	Z11A	9318679[E]	5467249[E]
"Non-PCB Dielectric Fluid"	Z11B	9318678[E]	5467250[E]

LAG SCREW, GIMLET POINT

¼" x 2½" square head, hot dipped galvanized steel, gimlet point, lag screw in accordance with EEI TDJ-3 (NEMA PH 3). For use with round washer, item 5WAA, for installing PVC riser guard, item UK10.



STD ITEM	SAP ITEM ID	PS ITEM ID
1BLS	9322028[Y]	7011860[Y]

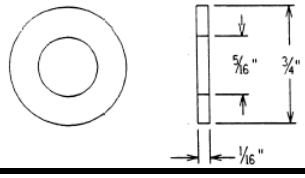
TAPE, COLD APPLIED

35 Mil Vinyl Mastic. 2"x 50' long.

STD ITEM	SAP ITEM ID	PS ITEM ID
1WBP	9315630[Y]	6010732[Y]

WASHER, ROUND

5/16" I.D. x ¾" O.D. hot dipped galvanized steel plain round washer in accordance with ANSI B27.2, type A wide. For use with lag screw, item 3BA, for installing PVC riser guard, item UK10.



STD ITEM	SAP ITEM ID	PS ITEM ID
5WAA	9321577[Y]	7006005[Y]

Footnotes Used in the Distribution Standards Material Catalogs

A “E” at the end of an Item ID indicates that the item is exclusively available in Rhode Island. Likewise, a “Y” at the end of an Item ID indicates that the item is not currently available.

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