EmPowr® Link CL™

General Cable

CSA C68.5 Specification for TRXLPE Medium-Voltage Underground Distribution Cable with XLPE Jacket

1.0 SCOPE
This specification covers single conductor tree-retardant cross-linked polyethylene insulated, concentric neutral cables rated from 15 kV to 46 kV. The cable shall be suitable for both single- and three-phase primary underground distribution (UD) for installation in underground ducts, conduit and direct burial in wet or dry locations. It shall also be suitable for on-grade and aerial installations. The cable shall be rated 90°C for normal operation, 130°C for emergency overload, and 250°C for short-circuit conditions in accordance with the latest revision of CSA C68.5.

2.0 GENERAL
Cable shall meet or exceed the latest requirements of the following industry specifications and standards. The order of precedent is as follows: 1) Customer Specification, 2) CSA C68.5. Where a particular product requirement or characteristic is specified in more than one document, the most stringent requirement will apply. Wherever reference is made to an industry specification or standard, it shall be understood to be the latest edition of that document.

3.0 QUALITY ASSURANCE
The cable shall be produced with the conductor shield, insulation and insulation shield applied in the same extrusion operation. All three extruded layers shall be applied in a common extruder head. A dry-cure process shall be used.

4.0 CONDUCTORS
The central conductor shall be either solid or stranded. If stranded, it shall be filled with a material compatible with the conductor and the conductor shield to prevent the longitudinal penetration of water into the conductor. Solid aluminum shall meet the requirements of CSA C68.5 Clause 4. Stranded aluminum conductor shall be Class B, compressed per CSA C68.5 Clause 4. Conductor temper shall be H-16 to H-19 (3/4 to hard drawn) for stranded conductors and H-14 to H-16 (1/2 to 3/4 hard) for solid conductors.

5.0 CONDUCTOR SHIELD
The conductor shield shall be an extruded thermosetting semi-conductive material complying with the applicable requirements of CSA C68.5 Clause 5. The extruded shield shall be easily removable from the conductor and shall be firmly bonded to the overlying insulation.

6.0 INSULATION
The insulation shall be a tree-retardant cross-linked polyethylene and shall comply with CSA C68.5 Clause 6. The thickness shall be as required by CSA C68.5 Table 11. An insulation pellet inspection system capable of examining 100% of the insulation pellets and rejecting contaminants shall be used. The manufacturer shall state the method used to examine and reject contaminated pellets.

7.0 INSULATION SHIELDING
The insulation shield shall be a thermosetting semi-conductive material complying with the applicable requirements of CSA C68.5 Clause 7.

8.0 CONCENTRIC NEUTRAL
The concentric neutral conductor shall consist of bare annealed copper wires per CSA C68.5 Clause 8, applied helically and essentially equally spaced over the outer semi-conducting shield, with a lay length of not less than six nor more than ten times the diameter over the concentric neutral conductor. The neutral indents in the insulation shield shall be within the requirements of CSA C68.5 Clause 7.2. The cable shall contain water-blocking components for the concentric neutral, and the completed cable longitudinal water penetration resistance shall comply with the requirements of CSA C68.5 Clause 8 and ANSI/ICEA T-34-664.

9.0 OVERALL OUTER JACKET*
The outer jacket is an extruded-to-fill black non-conducting cross-linked polyethylene jacket with higher temperature resistance performance than standard LLDPE as specified in CSA C68.5. The jacket meets the physical requirements of Table 1 when tested by the methods specified in CSA C68.5 Clause 11. The jacket shall be free-stripping and not interfere with an intimate contact between the neutral wires and the underlying extruded insulation shield. The jacket shall contain a print legend marking and sequential length marking.

10.0 TESTS
All tests required by the referenced specifications shall be performed and passed prior to shipment, and a certified copy of the results of the tests shall be sent to the customer, if so requested. The manufacturer shall either submit with the quotation, or have on file with the customer, certified support data for the qualification tests required by CSA C68.5 Clause 12 as applicable.

11.0 EXCEPTIONS
All exceptions to these specifications are to be clearly stated in the bid proposal and will require the review and approval of the customer.

Table 1: Physical Properties of Extruded-to-Fill XLPE Jacket

PHYSICAL REQUIREMENTS	VALUES
Unaged Tensile Strength, Min. (psi)	1500
Aged* Tensile Strength, Min. Ret. (%)	70
Unaged Elongated, Min. (%)	150
Aged* Elongated, Min. Ret. (%)	70
Heat Distortion 1 hr at 131°C, Max. (%)	30

*Aged for 168 hrs at 121°C.

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EmPowr® Link versus EmPowr® Link CL™

COMPRESSED CONDUCTOR CLASS B STRAND			INS. DIAMETER (1)		NOM. JACKET THKN.(1)	LLDPE JACKET							APPROX. SHIELD FAULT CAPACITY (4)	EMPOWR® LINK CL™							TYPICAL LENGTH (5)	COND. SIZE
			IN (mm)		IN (mm)	NEUTRAL CONFIGURATION				NOM. JACKET O.D.	AMPACITY (2)			NEUTRAL CONFIGURATION			NOM. JACKET O.D.	AMPACITY (2)		APPROX. TOTAL WT.		
AL (AWG or kcmil)	NOM. COND. DIA. IN (mm)	APPROX. AL WT. LBS/KFT (kg/km)	MIN. INS. O.D.	MAX. INS. O.D.	LLDPE JACKET	NEUT. SIZE	NO. OF WIRES	WIRE SIZE (AWG)	APPROX. CU WT. (1) LBS/KFT (kg/km)	INCHES (mm)	DIRECT BURIED FLAT (3)	DIRECT BURIED TRE-FOIL	CURRENT @ 6 CYCLES (AMPS)	NO. OF WIRES	WIRE SIZE (AWG)	APPROX. CU WT. (1) LBS/KFT (kg/km)	INCHES (mm)	DIRECT BURIED FLAT (3)	DIRECT BURIED TRE-FOIL	LBS/KFT (kg/km)	FT (m)	AL (AWG or kcmil)
1/0	0.362 (9.19)	99 (147)	1.045 (26.54)	1.145 (29.08)	0.055 (1.40)	Full	16	14	214 (318)	1.404 (35.66)	245	230	13500	19	16	159 (237)	1.377 (34.99)	245	230	831 (1236)	8000 (2450)	1/0
						2/3	17	16	143 (213)	1.378 (35.00)	245	230	9000	13	16	109 (162)	1.377 (34.99)	245	230	786 (1169)		
						1/2	13	16	109 (162)	1.378 (35.00)	250	230	6900	10	16	84 (125)	1.377 (34.99)	250	230	778 (1158)		
						1/3	9	16	76 (113)	1.378 (35.00)	250	230	4800	7	16	59 (88)	1.377 (34.99)	250	230	778 (1158)		
3/0	0.456 (11.58)	158 (235)	1.140 (28.96)	1.240 (31.50)	0.055 (1.40)	Full	16	12	339 (504)	1.532 (38.91)	310	300	21400	18	14	240 (357)	1.498 (38.05)	315	300	1053 (1567)	7000 (2150)	3/0
						2/3	17	14	227 (338)	1.498 (38.05)	315	300	14300	20	16	168 (250)	1.471 (37.37)	315	300	964 (1434)		
						1/2	20	16	168 (250)	1.472 (37.39)	315	300	10600	15	16	126 (187)	1.471 (37.37)	320	300	927 (1379)		
						1/3	14	16	118 (176)	1.472 (37.39)	320	300	7400	10	16	84 (125)	1.471 (37.37)	320	300	912 (1357)		
4/0	0.512 (13.00)	199 (296)	1.195 (30.35)	1.295 (32.89)	0.055 (1.40)	Full	20	12	423 (630)	1.588 (40.34)	350	340	26800	23	14	307 (457)	1.554 (39.47)	350	340	1196 (1780)	7000 (2150)	4/0
						2/3	21	14	280 (417)	1.554 (39.47)	355	340	17700	16	14	214 (318)	1.554 (39.47)	355	340	1112 (1655)		
						1/2	16	14	214 (318)	1.554 (39.47)	355	340	13500	19	16	159 (237)	1.528 (38.81)	360	340	1038 (1544)		
						1/3	17	16	143 (213)	1.528 (38.81)	360	340	9000	13	16	109 (162)	1.528 (38.81)	365	340	993 (1477)		
350	0.661 (16.79)	329 (490)	1.355 (34.42)	1.455 (36.96)	0.080 (2.03)	2/3	22	12	466 (693)	1.797 (45.64)	440	445	29500	26	14	347 (516)	1.763 (44.78)	445	445	1542 (2294)	5000 (1500)	350
						1/2	26	14	347 (516)	1.763 (44.78)	445	445	21900	30	16	252 (375)	1.737 (44.12)	455	445	1428 (2125)		
						1/3	28	16	235 (350)	1.737 (44.12)	455	450	14800	20	16	168 (250)	1.737 (44.12)	465	450	1353 (2013)		
						1/6	14	16	118 (176)	1.737 (44.12)	475	450	7400	10	16	84 (125)	1.737 (44.12)	475	450	1278 (1902)		
500	0.789 (20.04)	468 (697)	1.480 (37.59)	1.580 (40.13)	0.080 (2.03)	2/3	20	10	673 (1002)	1.967 (49.96)	505	535	42600	23	12	487 (725)	1.925 (48.90)	510	540	1952 (2904)	5000 (1500)	500
						1/2	24	12	508 (757)	1.925 (48.90)	510	540	32200	27	14	361 (537)	1.891 (48.03)	520	540	1798 (2675)		
						1/3	25	14	334 (497)	1.891 (48.03)	525	545	21100	29	16	243 (362)	1.865 (47.37)	540	545	1662 (2473)		
						1/6	20	16	168 (250)	1.865 (47.37)	555	545	10600	15	16	126 (188)	1.865 (47.37)	570	550	1565 (2328)		
750	0.968 (24.59)	703 (1047)	1.670 (42.42)	1.770 (44.96)	0.080 (2.03)	1/2	22	10	741 (1102)	2.184 (55.47)	585	655	49600	26	12	551 (820)	2.142 (54.41)	590	660	2461 (3662)	5000 (1500)	750
						1/3	24	12	508 (757)	2.142 (54.41)	595	665	32200	27	14	361 (537)	2.108 (53.54)	615	670	2245 (3340)		
						1/6	30	16	252 (375)	2.082 (52.88)	645	675	15900	22	16	185 (275)	2.082 (52.88)	670	680	2053 (3055)		
1000	1.117 (28.37)	937 (1394)	1.815 (46.10)	1.920 (48.77)	0.080 (2.03)	1/2	30	10	1010 (1503)	2.333 (59.26)	650	740	64000	22	10	741 (1102)	2.333 (59.26)	650	760	3690 (5490)	4000 (1200)	1000
						1/3	20	10	673 (1002)	2.333 (59.26)	645	755	42600	23	12	487 (725)	2.291 (58.19)	660	765	2774 (4127)		
						1/6	25	14	334 (497)	2.257 (57.32)	695	775	21100	29	16	243 (362)	2.231 (56.67)	725	785	2470 (3676)		
1250	1.251 (31.78)	1172 (1744)	1.960 (49.78)	2.065 (52.45)	0.080 (2.03)	1/3	25	10	842 (1253)	2.481 (63.02)	690	825	53300	29	12	615 (915)	2.439 (61.95)	700	845	3271 (4867)	3500 (1050)	1250
						1/6	20	12	424 (631)	2.439 (61.95)	730	855	26800	23	14	307 (457)	2.405 (61.09)	765	870	2943 (4379)		
						1/12	25	16	210 (313)	2.405 (61.09)	815	880	13200	18	16	151 (225)	2.379 (60.43)	850	885	2779 (4136)		

(1) Extruded layer thicknesses and insulation and insulation shield diameters are in accordance with CSA C68.5. Dimensions and weights not designated as minimum or maximum are nominal values and are subject to manufacturing tolerances.

(2) Ampacity based on earth thermal resistivity of 90°C-cm/watt, 90°C conductor temperature, 20°C earth ambient temperature, 75% load factor and 36" depth of burial. Values are based on one three-phase circuit, one conductor per phase, with neutral wires bonded at each end.

(3) Cables buried in flat configuration with 7.5" spacing between conductors.

(4) EmPowr® Link CL™ neutral configurations are designed to provide equivalent shield fault capacity of the corresponding neutrals, based on LLDPE jackets with 90˚C normal operation.

(5) Based on capacity of 96" non-returnable wood reels.