General Cable

EmPowr® Link CL™ ADVANTAGE

Built for Endurance, Economics, Efficiency, Environment

EmPowr® Link CL™ Advantage—the next evolutionary step in medium-voltage technology for renewable energy collection systems.

- **Enhanced Ruggedized Installation Protection**
- **Reduced Weight and Diameter**
- **Superior XLPE Jacket Technology**
- **Highly Efficient Fault Current Protection**

An Even Greater CL Advantage

General Cable has once again taken the next step in improving medium-voltage cable with superior physical characteristics for cost-effective renewable wind and solar energy collection systems. Building upon the widely accepted and innovative electrical advancements of Cross-linked Polyethylene (XLPE) jacketing coupled with reduced neutral redesigns, **EmPowr Link CL Advantage** provides superior protection in a compact, lightweight cable that delivers more ***Advantage*** than ever before.

The Endurance CL Advantage

EmPowr Link CL Advantage's XLPE jacketing outperforms typical LLDPE jackets in impact and scoring resistance, providing a cable that physically endures the rigors of today's direct buried installation techniques, subsoil conditions and the frequent handling of reels found in renewable collection system installations.

The Economics CL Advantage

Rather than typical round concentric neutral wires, industry-proven flat strap neutrals under the CL jacket provide better mechanical protection for the insulated core to withstand the pressures of automated cable handling equipment and an armor-like force to resist potential underground damages, minimizing risk of expensive repairs while optimizing profitability.

The Efficiency CL Advantage

The combination of a compact phase conductor and flat strap neutrals provides a lighter weight cable with an overall smaller diameter for longer cable lengths and highly efficient fault current protection. Together with the CL XLPE jacket's proven thermomechanical properties, EmPowr Link CL Advantage offers long-term efficiencies over the life of the cable.

The Environment CL Advantage

EmPowr Link CL Advantage's superior physical characteristics, smaller diameter and long-term performance make it the most environmentally friendly medium-voltage cable for today's solar and wind construction market. With built-in benefits, lead-free compounds and General Cable's recyclable reels and carbon credit value, CL Advantage is the total green solution.

Industry-Leading Reliability, Performance and Installation

EmPowr® Link CL™ Advantage is more durable and easier to install, making it the new standard for today's solar and wind farm collection systems while providing industry-leading reliability and performance. The test data on every purchase of EmPowr Link CL Advantage medium-voltage cable lets you know you're getting the performance you expect.

EmPowr Link CL Advantage UL Type MV-105* – The Better Choice

Utilities have historically used Linear Low Density Polyethylene (LLDPE) thermoplastic jackets and round concentric neutrals. The future of renewable medium-voltage cable is thermoset XLPE jackets with flat strap neutrals that provide a lower-total-cost solution.

Approximately 25% reduction in copper

LLDPE jackets are limited to a maximum transient temperature of 200°C versus XLPE's 350°C (per ICEA P-45-482 calculations). The higher temperature limit provides greater fault current capability for a given cross-sectional area, reducing required copper in the neutrals. It also reduces operating temperature, providing higher cable ampacities.

Reduced shield losses equate to lower line losses

Reduced copper flat strap neutrals also increase shield resistance for lower losses due to circulating currents—especially apparent in larger kcmil sizes.

Enhanced installation and reliability

EmPowr Link CL Advantage is proven to maintain the same jacket stripping and coefficient of friction of a traditional EmPowr Link LLDPE jacket construction. Compact phase conductor and flat strap neutrals further reduce overall diameter and significantly improve durability for even easier installation and long-term reliability.

Photograph courtesy of PLC Trenching Co., LLC.

Superior thermomechanical performance resists deformation

Through AEIC/ICEA thermomechanical testing simulating three-conductor installed performance, EmPowr Link CL Advantage XLPE-jacketed cables passed 3 x 1/C Cable/Conduit 140°C testing with no problem areas, while traditional LLDPE jacketed cables melted and fused together, causing exposed neutrals at some locations.

PHYSICAL JACKET PROPERTIES	Laboratory Data	
	LLDPE	CL XLPE
Sharp Impact Resistance Test (lbf-in)	9	13
Blunt Impact Resistance Test (lbf-in)	44	59
Abrasion Resistance Test (Test Cycles)	245	142
Scoring Resistance Test (Test Cycles)	25	49
Crush Resistance Test (lbs)	877	880
Puncture Resistance Test (lbs)	51	53

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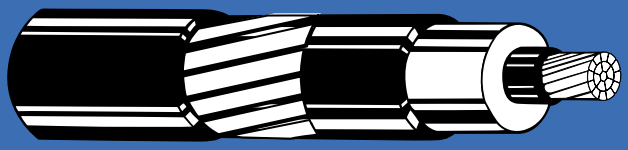
* UL Type MV-105 EmPowr Link CL Advantage is rated MV-105 in accordance with the UL 1072 standard. It should be noted that utilizing a 105°C normal operating conductor temperature will increase cable ampacity rating but will reduce the shield fault capability slightly. If the user plans on operating these cables at 105°C conductor temperature for normal operation and 140°C for emergency overload, please contact General Cable for the applicable cable ampacity and shield fault capability ratings. Another important consideration is that the migration of soil moisture away from the cable is more likely at the higher operating conductor temperature and can result in an increase in soil thermal resistivity, resulting in an increase in conductor and soil temperature.

U.S. Specification for TRXLPE Medium-Voltage Underground Distribution Cable with Flat Strap Neutrals and XLPE Jacket



1.0 SCOPE
This specification covers single conductor tree-retardant cross-linked polyethylene insulated, flat strap neutral cables rated from 5 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 105°C for normal operation, 140°C for emergency overload, and 250°C for short-circuit conditions in accordance with the latest revision of ANSI/ICEA S-94-649, AEIC CS8 and UL 1072 as applicable.

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) AEIC CS8, 3) ANSI/ICEA S-94-649, 4) UL 1072. 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. Compound pellets used for strand shield, insulation and insulation shield shall be received and unloaded using an ultra-clean bulk handling system and/or an ultra-clean box handling system. The bulk handling system shall be a closed system. The material transfer/ storage system shall use filtered air. The box handling system shall incorporate a dedicated material transfer system with filtered air involving at least the following: a Class 10,000 clean room per FED-STD-209E to hold the bag of compound as it is unloaded into the transfer system or a Class 10,000 clean compartment per FED-STD-209E surrounding the transfer point.

4.0 CONDUCTOR
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 ANSI/ICEA S-94-649 Part 2. Stranded aluminum conductor shall be compact per ANSI/ICEA S-94-649 Part 2. 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 AEIC CS8 and ANSI/ICEA S-94-649 Part 3. 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 AEIC CS8 and ANSI/ICEA S-94-649 Part 4. The thickness shall be as required by ANSI/ICEA S-94-649 Table 4-4. 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 ANSI/ICEA S-94-649 Part 5.

8.0 FLAT STRAP NEUTRAL
The flat strap neutral conductor shall consist of bare annealed copper wires per ANSI/ICEA S-94-649 Part 6, 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 flat strap neutral conductor. The neutral indents in the insulation shield shall be within the requirements of ANSI/ICEA S-94-649 Part 5.2. The cable shall contain water-blocking components for the flat strap neutral, and the completed cable longitudinal water penetration resistance shall comply with the requirements of ANSI/ICEA S-94-649 Part 6 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, meeting the physical requirements of Table 1 when tested by the methods specified in ANSI/ICEA S-94-649. 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, sequential length marking and three longitudinal extruded red stripes.

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.

10.0 TESTS
All production 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 ANSI/ICEA S-94-649 Part 10 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.

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