

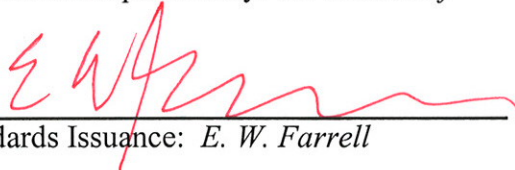
LLNL
FACILITIES
STANDARDS

PEL-E-16121

**MEDIUM-VOLTAGE
(5 kV and 15 kV)
POWER CABLES**



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CONTENTS

PART 1 GENERAL INFORMATION1

1.01 Purpose.....1

1.02 Reference Documents1

PART 2 DESIGN GUIDELINES3

2.01 General.....3

2.02 Conductor, Insulation, Shields, and Jacket3

2.03 Testing Requirements4

2.04 Identification4

2.05 Cable Reels4

END OF TABLE OF CONTENTS

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PART 1 GENERAL INFORMATION

1.01 PURPOSE

This standard provides guidelines for medium-voltage (5 kV and 15 kV) power cable for use in underground or exposed conduit applications.

1.02 REFERENCE DOCUMENTS

The manufacture, reeling, testing, certification, and shipping of the cable shall be in accordance with the following documents unless exceptions are listed. Where differences exist between codes, standards, and referenced specifications, the one affording the greatest protection shall govern.

Code of Federal Regulations (CFR)

29 CFR 1910.7 Definitions and Requirements for a Nationally Recognized Testing Laboratory (NRTL)

Association of Edison Illuminating Companies (AEIC)

AEIC CS-8 Specification for Extruded Dielectric, Shielded Power Cables Rated 5 through 46 kV

ASTM International (ASTM)

ASTM B 3 Standard Specification for Soft or Annealed Copper Wire

ASTM B 8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM B 496 Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors

Insulated Cable Engineers Association (ICEA)

ICEA S-93-639/
NEMA WC-74 5-46 kV Shielded Power Cable for Use in the Transmission & Distribution of Electric Energy

ICEA S-97-682 Utility Shielded Power Cables 5 – 46 kV

Institute of Electrical and Electronics Engineers, Inc. (IEEE)

IEEE 835 Standard Power Cable Ampacity Tables

National Electrical Manufacturer's Association (NEMA)

NEMA WC-26 Binational Wire and Cable Packaging Standard

Underwriters Laboratories, Inc. (UL)

UL 1072 Medium-Voltage Power Cables

PART 2 DESIGN GUIDELINES

2.01 GENERAL

- A. Cable shall be single-conductor copper, ethylene-propylene-rubber (EPR) insulated, shielded, jacketed power cable, approved for use in underground or exposed conduit applications.
- B. Only materials acceptable for the particular use, and compatible with all other cable materials shall be used in manufacturing the cable.
- C. Medium-voltage cable shall be designated as type MV, and shall comply in all respects with construction, test performance, and markings requirements.

2.02 CONDUCTOR, INSULATION, SHIELDS, AND JACKET

- A. The conductor shall be class B stranded in accordance with ASTM B 8, compact or concentric round in accordance with ASTM B 496, soft annealed uncoated copper in accordance with ASTM B 3.
- B. The conductor shield or screen shall be an extruded, thermosetting, semiconducting polymeric compound bonded to the EPR insulation.
- C. The insulation shall be 133% level. It shall be an ozone-resistant dielectric, ethylene-propylene-rubber, thermosetting, elastomeric compound, with a 105 degree temperature rating.
- D. The insulation shield shall have a metallic and nonmetallic component. The nonmetallic component shall be an extruded, black, thermoset, EPR-compatible compound material applied directly over the insulation. It shall be completely compatible with the EPR insulation and shall possess stripping and adhesion characteristics in accordance with AEIC CS-8. The metallic portion shall be a minimum of 5-mil thick uncoated copper tape shield, helically applied, with a 12.5% minimum overlap.
- E. The overall jacket shall be an extruded polyvinyl chloride (PVC) in accordance with ICEA S-93-639/NEMA WC-74, UL 1072, and ICEA-S-97-682. The jacket shall be rugged, resistant to fuel oils, mineral oils, fixed alkalis, acids, industrial chemicals, and shall be sunlight resistant.
- F. The cable shall be manufactured employing the triple tandem, dual tandem, or true triple extrusion process to maintain cleanliness and uniformity.

2.03 TESTING REQUIREMENTS

- A. Provide written verification of the testing procedures performed during production prior to acceptance of the cable purchased. Minimum acceptable list of procedures are listed in AEIC CS-8.
- B. Test the cable at the manufacturer's facility prior to shipping, in accordance with AEIC CS-8.
- C. Provide two copies of the certified test reports on a per-reel basis to the LLNS Representative within two weeks of test completion, or at the time of shipping, whichever comes first.

2.04 IDENTIFICATION

The cable protective outer jacket shall have an indelible roll-marked legend applied every two feet stating: Manufacturer, EPR insulation thickness, conductor size, conductor material (copper), rated voltage, insulation level (133%), MV-105, year of manufacture, and label from any NRTL as defined in 29 CFR 1910.7. Length marker shall be applied at 5-foot intervals. Cable and cable reel identification shall be in accordance with AEIC CS-8.

2.05 CABLE REELS

- A. Place the cable on nonreturnable reels, and secure a 12-inch minimum length of both cable ends of each reel on the same outside flange of the reel, to facilitate acceptance testing by LLNS. The cable ends shall be sealed and suitably protected during shipment. Provide suitable covers to protect the cable from crushing during shipment. The protective cover shall be multiple layers of class 2 materials for class 3 (heavy-duty physical protector), and class 4 (extra heavy-duty physical protector) where greater protection is necessary, in accordance with NEMA WC-26.
- B. Cable reels shall be in accordance with requirement of NEMA WC-26.
- C. Reel factory serial numbers and all other markings shall match identically with those shown on the factory test certificates. Markings shall include information requested in the purchase order.

END OF STANDARD