ANHUI FEICHUN SPECIAL CABLE CO., LTD.

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Technical Product Specification - Medium Voltage Power Cable

Type MV-105 Medium Voltage Power Cable

This technical specification defines the requirements, construction details, and performance characteristics for a three-conductor medium voltage power cable rated for 15 kilovolt service. The cable features tree retardant cross-linked polyethylene insulation with copper tape shielding, steel tape armor protection, and a polyvinyl chloride outer jacket suitable for industrial and commercial power distribution applications. This specification applies to cables manufactured in accordance with recognized industry standards and certified for safe operation in various installation environments.

◆ **PRIMARY PRODUCT SPECIFICATION**

3/C 4/0 AWG, 15kV, MV-105, 133% Insulation, XLPE-TR (Tree Retardant), Copper Tape Shield, Steel Tape Armor (STA), PVC Jacket

1. SCOPE AND APPLICATION

This specification establishes the requirements for Type MV-105 medium voltage power cable designed for primary distribution service in industrial facilities, commercial installations, and power generation plants. The cable construction provides reliable electrical performance in applications where line-to-ground fault currents remain within the design capabilities of the metallic shield system. The cable design permits installation in diverse environmental conditions and supports multiple installation methods as governed by applicable electrical codes and standards.

The cable may be installed in wet or dry locations and is suitable for deployment in raceway systems, underground duct banks, open-air industrial environments, aerial spans, and direct burial applications where permitted by the National Electrical Code and local authorities having jurisdiction. The tree retardant insulation system incorporates specialized additives that resist the formation of electrical trees, thereby extending the operational life of the cable in demanding service conditions. The steel tape armor provides enhanced mechanical protection against physical damage during installation and throughout the service life of the cable.

The cable is particularly well-suited for applications requiring robust mechanical protection combined with reliable electrical performance. The MV-105 temperature rating permits continuous operation at conductor temperatures up to one hundred five degrees Celsius under normal loading conditions, providing operational flexibility for varying load profiles. The sunlight-resistant jacket formulation permits outdoor installations without degradation of the outer jacket material, eliminating the need for additional protective conduit in many applications.

2. GOVERNING STANDARDS AND CERTIFICATIONS

The cable has been designed, manufactured, and tested in accordance with nationally recognized standards that establish minimum performance requirements for medium voltage power cables. Compliance with these standards ensures that the cable will perform safely and reliably when properly applied within its design parameters. The applicable standards represent industry consensus on appropriate materials, construction methods, and testing protocols for medium voltage cable products.

UL 1072

Medium Voltage Power Cables - Underwriters Laboratories Standard for medium voltage cables used in electrical distribution systems

ICEA S-93-639 / NEMA WC74

Standard for Shielded Power Cables Rated 5 through 46 kilovolts for distribution circuit applications

ICEA S-97-682

Standard for Utility Shielded Power Cables Rated 5 through 46 kilovolts for electric utility service

AEIC CS8

Specification for Extruded Dielectric Shielded Power Cables Rated 5 through 46 kilovolts

The cable carries Underwriters Laboratories listing under the MV-105 category, certifying that it has been evaluated against applicable safety standards and found to meet the requirements for medium voltage cable products. This listing provides assurance to specifying engineers, contractors, and facility owners that the cable has undergone rigorous third-party evaluation and testing. The listing covers both the electrical performance characteristics and the safety features incorporated into the cable design.

3. TECHNICAL SPECIFICATIONS AND PERFORMANCE DATA

The following technical data defines the electrical, mechanical, and dimensional characteristics of the cable. These specifications represent nominal values based on standard manufacturing practices and are subject to normal manufacturing tolerances. The data provided serves as the basis for engineering calculations, installation planning, and system design verification.

Characteristic	Specification Value	Unit of Measure
Conductor Size	4/0 AWG (253.3 mm^2)	AWG / square millimeters
Number of Phase Conductors	Three (3X6X1C Configuration)	—
Conductor Material	Soft Annealed Uncoated Copper	—
Conductor Classification	Compacted Class B per ASTM B496	—
Stranding Configuration	Nineteen (19) Individual Strands	strands
Conductor Diameter	0.48 inches (12.2 millimeters)	inches / millimeters
Voltage Rating (Medium Voltage)	15 kV Phase-to-Phase	kilovolts
Voltage Rating (Low Voltage Application)	0.6 kV	kilovolts
Insulation Material	Tree Retardant Cross-Linked Polyethylene (TR-XLPE)	—
Insulation Level Category	133 Percent (Medium Voltage Standard)	percent

Characteristic	Specification Value	Unit of Measure
Insulation Wall Thickness	220 mils (5.59 millimeters)	mils / millimeters
Maximum Conductor Temperature	MV-105 Rating (105°C Continuous)	degrees Celsius
Metallic Shield Construction	Copper Tape, 5 mil thickness, 25% minimum overlap	—
Grounding Conductor Quantity	Three Copper Conductors	—
Mechanical Armor	Steel Tape Armor (STA)	—
Outer Jacket Material	Polyvinyl Chloride (PVC), Black Color	—
Jacket Wall Thickness	110 mils (2.79 millimeters)	mils / millimeters
Overall Cable Diameter	2.53 inches (64.3 millimeters) Approximate	inches / millimeters
Cable Weight	4,206 pounds per thousand feet (6,260 kilograms per kilometer) Approximate	lb/kft / kg/km

4. CABLE CONSTRUCTION AND DESIGN DETAILS

The cable employs a sophisticated multi-layer construction methodology wherein each component serves a specific function in the overall electrical and mechanical performance of the assembly. The construction follows industry best practices for medium voltage cable design and incorporates materials selected for their proven performance characteristics in demanding service environments. The manufacturing process utilizes advanced extrusion technology and quality control procedures to ensure consistent product quality and reliable long-term performance.

Electrical Conductor System

The cable incorporates soft annealed uncoated copper conductors manufactured in accordance with ASTM B496 requirements for compacted Class B stranding. The conductor consists of nineteen individual copper strands arranged in a concentric pattern and subjected to a compaction process that reduces the overall diameter while maintaining the electrical cross-sectional area. This compaction process results in a more efficient cable design with reduced overall dimensions compared to non-compacted conductor constructions. The conductor achieves a diameter of 0.48 inches and provides the current-carrying capacity required for medium voltage distribution applications. The soft annealed copper offers excellent conductivity characteristics and facilitates installation by providing appropriate flexibility for bending and routing operations.

Conductor Shield Layer

A semiconducting cross-linked polyethylene shield is applied directly over the conductor surface through an extrusion process. This extruded semiconducting layer serves multiple critical functions in the cable design. It provides a smooth, cylindrical interface between the conductor and the primary insulation, eliminating air voids that could lead to partial discharge activity. The semiconducting shield ensures uniform distribution of the electric field across the insulation system and prevents stress concentrations at the conductor surface that could initiate insulation degradation. The cross-linked nature of the material ensures dimensional stability throughout the thermal cycles experienced during cable operation.

Primary Insulation System

The primary electrical insulation consists of thermoset tree retardant cross-linked polyethylene incorporating specialized chemical additives that inhibit the formation and propagation of electrical trees within the dielectric material. The insulation is applied to a nominal thickness of 220 mils, corresponding to the 133 percent insulation level specification for cables rated at 15 kilovolts. This enhanced insulation level provides additional dielectric strength beyond the minimum requirements, offering improved reliability and extended service life compared to 100 percent insulation level designs. The cross-linking process creates three-dimensional molecular bonds that provide superior thermal, electrical, and mechanical

properties compared to non-cross-linked thermoplastic insulation materials. The tree retardant formulation addresses the primary aging mechanism in medium voltage cables by preventing the formation of microscopic conductive pathways that can eventually lead to insulation failure.

Insulation Shield Layer

An extruded semiconducting cross-linked polyethylene layer is applied over the outer surface of the primary insulation. This insulation shield works in conjunction with the conductor shield to maintain a uniform electric field distribution throughout the insulation wall thickness. The semiconducting shield provides a smooth interface with the metallic shield system and ensures that the electric field terminates uniformly at the insulation outer diameter. This configuration prevents stress concentrations at the insulation-shield interface that could accelerate aging of the dielectric system. The cross-linked formulation ensures that the shield layer maintains its physical and electrical properties throughout the operational life of the cable.

Phase Identification System

Color-coded identification strings are incorporated into the construction of each phase conductor, utilizing black, red, and white colored yarns to enable rapid phase identification during installation and maintenance operations. This identification system eliminates the need to strip cable terminations to determine phase assignment and reduces the potential for phase reversal errors during installation. The color-coded strings remain visible throughout the service life of the cable and do not degrade or fade under normal operating conditions.

Metallic Shield System

The cable incorporates a longitudinally applied copper tape shield with a nominal thickness of 5 mils, applied with a minimum overlap of 25 percent to ensure continuous metallic coverage around the circumference of each insulated conductor. This metallic shield serves multiple essential functions in the cable system. It provides a low-impedance path for ground fault currents, enabling protective relay systems to detect and isolate faults rapidly. The shield confines the electric field within the cable structure, preventing external electrical interference and limiting electromagnetic emissions from the cable. The shield also provides mechanical protection for the underlying insulation system and facilitates the installation of cable terminations and splices by providing a convenient grounding connection point. The soft annealed copper construction provides appropriate flexibility while maintaining excellent electrical conductivity throughout the length of the cable.

Grounding Conductor System

Three soft annealed bare copper grounding conductors are cabled together with the insulated phase conductors, providing continuous grounding capability throughout the cable length. These grounding conductors are sized to safely carry anticipated ground fault currents and provide redundant grounding paths that enhance system reliability. The grounding conductors facilitate the effective operation of protective relay systems by ensuring low-impedance fault current return paths. The bare copper construction eliminates the need to strip insulation during termination operations and provides reliable electrical contact with shield systems throughout the cable length.

Cable Assembly Configuration

The three insulated and shielded phase conductors, together with the grounding conductors, are assembled in a cabled configuration utilizing non-hygroscopic filler materials as required to maintain cable roundness and provide mechanical support. The filler materials prevent moisture migration through the cable interstices and maintain the physical geometry of the conductor assembly during installation and operation. A binder tape is applied over the assembled core to maintain the integrity of the conductor grouping during subsequent manufacturing operations and throughout the service life of the cable. This assembly method provides appropriate flexibility for installation while maintaining the mechanical strength required for handling and pulling operations.

Steel Tape Armor Protection

A steel tape armor layer is applied over the cable core assembly, providing substantial mechanical protection against impact forces, crushing loads, and rodent damage. This armor layer is particularly important for direct burial installations where the cable may be subjected to mechanical stresses from soil movement, excavation activities, or surface loading. The steel tape construction provides a high degree of mechanical protection while maintaining sufficient flexibility to permit installation in typical cable routing configurations. The armor also provides an additional layer of protection against moisture ingress and serves as a secondary fault current path in the event of shield system damage.

Outer Jacket System

The final protective layer consists of a black polyvinyl chloride compound formulated specifically for medium voltage cable applications. The jacket material incorporates additives that provide resistance to sunlight degradation, permitting outdoor installations without the need for additional protective conduit or covering. The flame retardant formulation meets applicable flammability requirements and limits the potential for fire propagation in the event of exposure to external ignition sources. The jacket is applied to a nominal thickness of 110 mils, providing substantial protection against mechanical abrasion, chemical exposure, and environmental degradation. The compound meets Oil Resistance I requirements as defined in applicable standards, ensuring compatibility with transformer oils, industrial lubricants, and petroleum-based products commonly encountered in industrial facilities. The black pigmentation provides ultraviolet protection and presents a professional appearance suitable for visible installations in commercial and industrial settings.

5. PERFORMANCE FEATURES AND DESIGN ADVANTAGES

The cable incorporates several advanced design features that distinguish it from conventional medium voltage cable products and provide enhanced performance characteristics for demanding applications. These features represent the incorporation of proven technologies and materials that have demonstrated superior performance in field service.

UL Listed MV-105	**Sunlight Resistant Jacket**	**Oil Resistance I Rating**	**Tree Retardant Insulation**
133% Insulation Level	**Steel Tape Armored**	**Flame Retardant Jacket**	**Triple Extrusion Process**

Underwriters Laboratories Listing

The cable carries Underwriters Laboratories listing under the MV-105 category, certifying that it meets applicable safety standards for medium voltage cable products. This listing provides third-party verification of the cable's electrical and fire safety characteristics and is widely recognized by authorities having jurisdiction throughout North America. The MV-105 designation confirms that the cable is rated for continuous operation at conductor temperatures up to 105 degrees Celsius under normal loading conditions, providing operational flexibility for varying load profiles and ambient temperature conditions.

Sunlight Resistance Characteristics

The outer jacket compound incorporates specialized additives that provide resistance to degradation from ultraviolet radiation exposure. This feature permits outdoor installations without the need for additional protective conduit or covering, simplifying installation requirements and reducing overall system costs. The sunlight resistance rating is particularly valuable for aerial installations, rooftop cable runs, and outdoor industrial facilities where cable routing flexibility is important. The rating applies to conductor sizes of 1/0 AWG and larger, encompassing the 4/0 AWG conductor size specified in this product.

Chemical Resistance Properties

The jacket formulation meets Oil Resistance I requirements as defined in applicable standards, ensuring compatibility with transformer oils, hydraulic fluids, industrial lubricants, and petroleum-based products commonly encountered in power generation facilities and industrial plants. This chemical resistance prevents jacket degradation in applications where incidental contact with oils or solvents may occur during normal operation or maintenance activities. The chemical resistance also extends to various industrial chemicals, enhancing the suitability of the cable for chemical processing facilities and similar demanding environments.

Advanced Manufacturing Process

The cable is manufactured using a true triple extrusion system for the conductor shield, primary insulation, and insulation shield layers. This advanced manufacturing process applies all three layers in a single operation without intermediate cooling, resulting in superior interlayer adhesion and enhanced dielectric properties. The process eliminates interfaces between layers that could trap contaminants or moisture, contributing to improved long-term reliability. The manufacturing facility employs closed handling systems for raw materials that eliminate exposure to ambient air during the extrusion process, preventing moisture absorption and contamination that could compromise the electrical properties of the insulation system.

6. QUALITY ASSURANCE AND TESTING PROTOCOLS

Each production run of this cable undergoes comprehensive quality assurance testing to verify compliance with applicable standards and specifications. The testing protocol encompasses electrical, mechanical, and dimensional verification procedures designed to confirm that the finished cable meets all specified requirements. These quality control measures ensure consistent product quality and provide documentation of compliance for regulatory and customer requirements.

The testing program includes conductor resistance measurements performed in accordance with standard test methods to verify proper conductor sizing and stranding configuration. Insulation resistance testing confirms the integrity of the dielectric system and detects any manufacturing defects that could compromise electrical performance. Dielectric strength testing validates the voltage withstand capability of the insulation system under both normal and fault conditions. Partial discharge testing is performed using sensitive detection equipment to identify and eliminate any insulation voids or contaminants that could serve as initiation sites for electrical treeing or other degradation mechanisms.

Shield continuity verification ensures that the metallic shield system provides an uninterrupted current path throughout the cable length and that the specified overlap percentage has been achieved during manufacturing. Dimensional verification confirms that all cable components conform to specified tolerances and that the overall cable diameter falls within acceptable limits for installation in standard raceways and ducts. Jacket integrity testing validates the effectiveness of the environmental protection system and confirms that the jacket material meets specified thickness and physical property requirements. All test results are documented and retained in accordance with quality management system requirements, providing traceability for each production lot.

Important Product Information and Disclaimer

The technical data presented in this specification represents typical values for this cable design based on standard manufacturing practices and testing procedures. Actual measurements and performance characteristics may vary within normal manufacturing tolerances and should be confirmed for critical applications requiring guaranteed performance parameters. The information provided is intended for reference and preliminary design purposes and does not constitute a warranty of specific performance characteristics for any particular installation or application.

For project-specific applications requiring guaranteed performance parameters, detailed product testing, certification documentation, or custom cable designs, customers should contact the technical services department to arrange appropriate verification testing and documentation. Installation of this cable must be performed in strict accordance with applicable national and local electrical codes, including the National Electrical Code where applicable. Specifying engineers and installation contractors should consult with qualified electrical engineers and local authorities having jurisdiction to ensure proper application of the cable and compliance with all applicable safety standards and installation requirements.

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FEICHUN SPECIAL CABLES

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