

**UniShield®**

EPR 5-35 kV Power Cable  
UL Type MV-105

# Performance Beyond Just Power



# UniShield®

## Designed to be the best

In the 1960s, a design team was given the task to develop an industrial MV cable that addressed the deficiencies of existing cable designs in use at that time. Called the Wabash Project, these engineers took a “blank sheet of paper” approach, without traditional thought processes or production constraints, and asked themselves the following questions:

### What were the inherent shortcomings of existing designs? What features would carry the most customer benefit?

The discussions led them to these conclusions:

**The fragile nature of copper tape shields contributed to both unpredictable performance in short circuit conditions and declining performance as cables age in service.**

**The weakest link in copper tape designs was the copper tape itself, making installation more difficult and decreasing long-term reliability.**

**Creating a smaller diameter cable that was more forgiving during installation and easier to terminate would offer the greatest benefit to the customer.**

The result was the creation of the innovative UniShield design, which incorporated the placement of six longitudinally applied and corrugated copper drain wires encompassed in a semi-conducting CPE jacket.

While there have been minor design changes over the years to keep up with compounding technology improvements, the original UniShield design concept has withstood the test of time and is still utilized today.

UniShield's benefits include everything from increased cable reliability, lower installed costs, lower conduit and tray fill, and quicker dissipation of heat to the ability to use smaller reels and handling equipment.

### UniShield® Delivers

**Long-Term Shield Reliability and Performance:** Unique shield design provides consistent and reliable impedance protection and fault current-carrying performance that remains constant and will not degrade over the life of the cable.

**Smaller Size:** Smaller and lighter in weight than tape shield designs, UniShield is easier to handle, saving valuable time and space.

**Ease of Installation:** Drain wire shielding system simplifies splicing and termination, reducing UniShield's installation costs by up to 30%.

**Unsurpassed Performance:** UniShield is virtually impervious to temperature extremes, passing a -55°C cold bend test, and provides excellent moisture resistance and mechanical protection under the most severe environmental conditions.

### Wherever the need for a reliable MV-105 power cable solution, you can count on UniShield.

#### 1 Compact Conductor: Smaller, Smoother, Smarter

UniShield's stress control layers and insulation are extruded over a smooth, compact conductor to form a superior electrode. The dimensional precision and near-perfect roundness of the conductor allows for better control of electrical stress and corona.

#### 2 EPR Insulation: Because it's simply the best

General Cable's proprietary Ethylene Propylene Rubber (EPR) insulation is rated for MV-105 applications and exhibits high dielectric strength, low dielectric loss and excellent electrical stability under even the harshest environmental conditions. Our ultra-clean, state-of-the-art compound center ensures the quality, reliability and consistency required to produce the highest quality EPR compound.

#### 3 Drain Wire Construction: The most important advantage, and the least understood

Metallic shielding is provided by six corrugated drain wires, laid longitudinally and embedded in an extruded semi-conducting composite jacket system. This unique arrangement offers excellent and consistent fault current-carrying capability and unmatched impedance protection over the life of the cable.

#### 4 Chlorinated Polyethylene (CPE) Composite Insulation Shield/Jacket System: Provides outstanding mechanical protection

UniShield's composite insulation shield/jacket system exceeds the performance characteristics of PVC-jacketed tape-shielded cables in the UL Cold Bend Test and UL 1072 Vertical Tray Flame Test. Additionally, the jacket compound exhibits excellent resistance to cut, abrasion, crush and impact, as well as providing outstanding flexing properties.

#### 5 40-Year Design Life Warranty

UniShield has been engineered and built for a 40-year designed service life, backed by a written warranty upon request.

**From the north slope of Alaska  
to the heat of the Saudi desert,  
UniShield performs.**

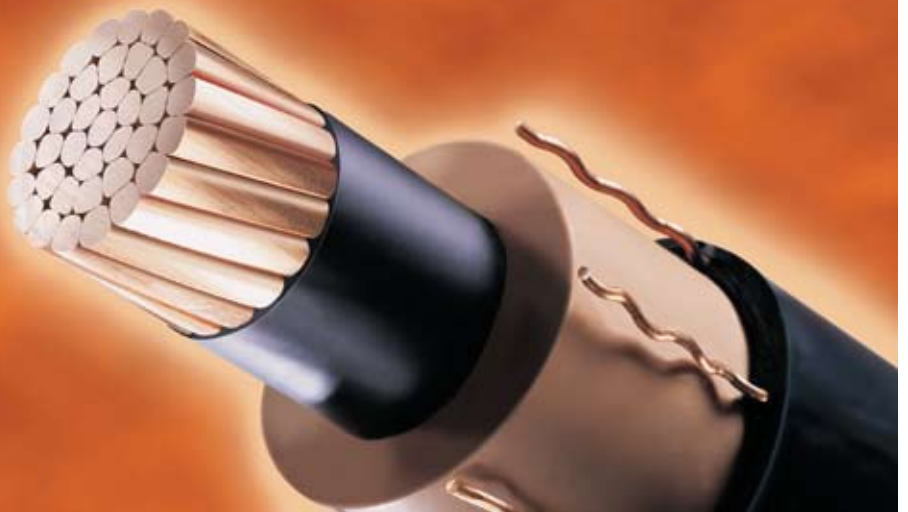
# Why UniShield® is the best engineered MV cable

Product Features	Application Benefits
<b>Compact Conductor</b>	<ul style="list-style-type: none"> <li>• 5% smaller than compressed Class B conductors</li> <li>• Allows UniShield to consistently be the smallest diameter MV-105 design</li> </ul>
<b>Internal Development and Compounding Capability</b>	<ul style="list-style-type: none"> <li>• In-house development and manufacture of all EPR insulation and shield compounds ensures the highest quality, reliability and consistency</li> <li>• Clean-room technology ensures quality at every step of the compounding process</li> </ul>
<b>Unique Shield System</b> Six corrugated drain wires embedded in a composite CPE shield and jacket system	<ul style="list-style-type: none"> <li>• Uniform and stable impedance and fault current-carrying capability performance over the life of the cable, particularly where heavy load-cycling conditions exist</li> <li>• Encapsulated drain wires provide corrosion protection of shield</li> <li>• Longitudinal drain wires do not restrict the expansion or contraction of the cable during temperature cycling</li> <li>• More forgiving and less prone to damage during difficult installations</li> </ul>
<b>Drain Wires</b> Act as “rip cord”, easing splicing and termination	<ul style="list-style-type: none"> <li>• Labor savings of up to 30% when compared to copper tape shield</li> <li>• Allow for simple removal of jacket and insulation shield in one step</li> <li>• No longitudinal scoring required, meaning less chance of insulation damage</li> <li>• Reduced installation costs, particularly important on jobs with high number of terminations</li> </ul>
<b>The Most “Installation-Friendly” MV Cable</b>	<ul style="list-style-type: none"> <li>• 8 times O.D. minimum bending radius versus 12 times O.D. for copper tape shield per ICEA/NEMA guidelines, allowing for tighter bends during installation</li> <li>• Lower coefficient of friction as compared to thermosetting jackets</li> <li>• Lighter weight eases installation for long cable pulls</li> <li>• Compatible with all standard splice and termination kits</li> </ul>
<b>Exceptional Physical Properties</b>	<ul style="list-style-type: none"> <li>• Excellent resistance to crush, impact, cut, abrasion, and chemicals</li> <li>• CPE jacket burns to a char under fire conditions and exhibits no thermoplastic drip like PVC jackets, reducing fire spread</li> <li>• Enhanced flexing properties versus copper tape shield designs</li> <li>• More forgiving and less prone to damage during installation</li> <li>• Excellent performance in wet applications</li> </ul>
<b>Excellent Thermal Stability</b>	<ul style="list-style-type: none"> <li>• Passes UL Cold Bend Test at -55°C, allowing for -40°C installation temperature</li> <li>• Superior heat deformation characteristics as compared to thermoplastic PVC and LSZH jackets</li> <li>• Delivers superior performance at widest temperature range</li> </ul>
<b>40-Year Design Service Life Warranty</b>	<ul style="list-style-type: none"> <li>• UniShield® design guarantees long-term performance</li> </ul>
<b>Available from Stock</b>	<ul style="list-style-type: none"> <li>• Full range of both 5 kV and 15 kV 133% insulation level</li> <li>• Can be manufactured from 5 kV (100%) through 35 kV (133%) insulation level</li> </ul>

No matter the application – UniShield® delivers

**UniShield’s Unique Metallic Shield...**

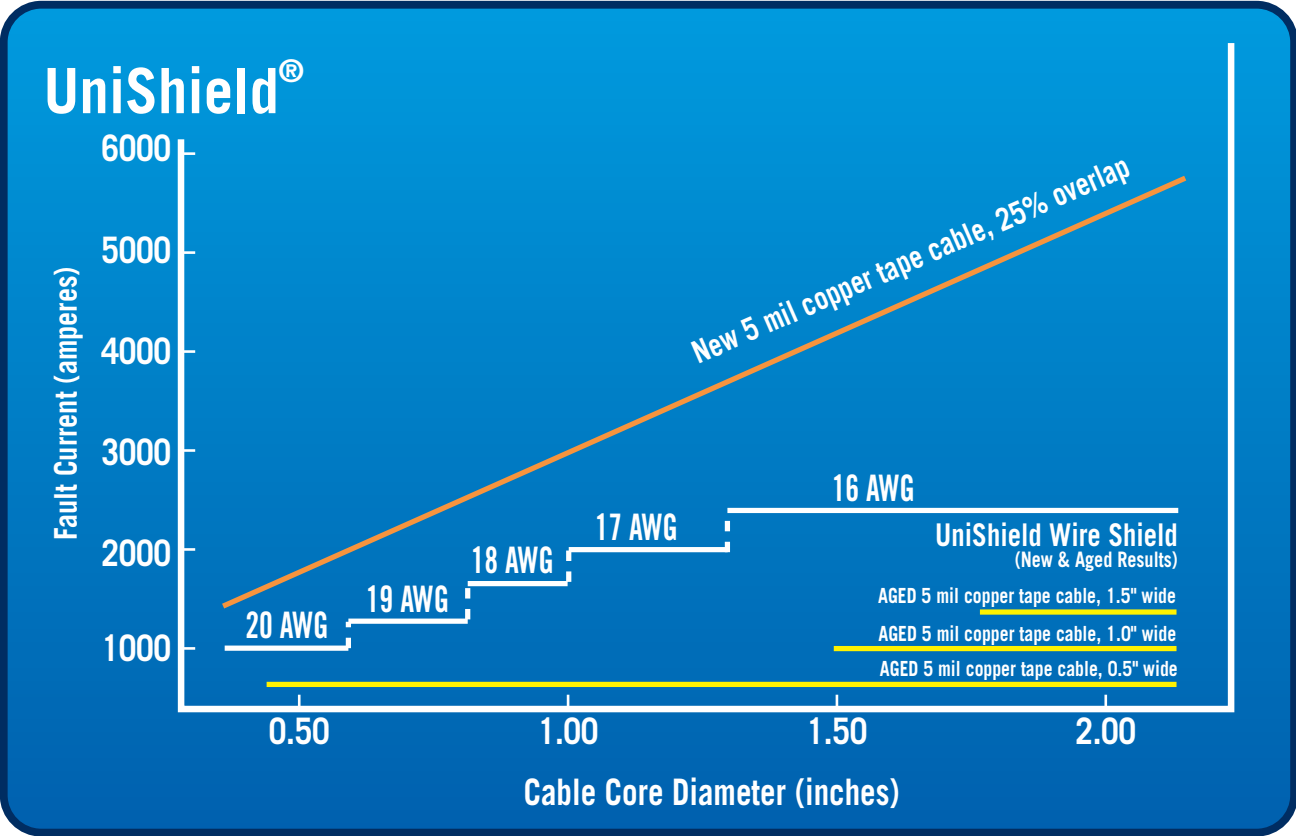
**The most important advantage, and the least understood.**



# UniShield® Performance Beyond Just Power

## The UniShield Unique Shielding System: The most important advantage, and the least understood.

### Shield Short Circuit Performance (per ICEA P-45-482 Formula 2)



UniShield's embedded drain wire in a composite semi-conducting shield/CPE jacket system, designed to be equivalent to a 4 mil tape shield, exhibits stable and constant shield performance both under load and over time as compared to helically applied 5 mil copper tape shield. While tape shield may initially carry more fault current than the corrugated wire shield, as time passes, the contact resistance between the tape overlap in the shield increases due to heat and moisture.

This causes the tape shield to perform as if there were no overlap, causing the current travel path to follow the helical path of the tape, resulting in a deteriorating shield performance over the life of the cable.

This serves to effectively make the tape width for any given tape thickness the determining factor of the fault current limit.

Formula 2 (per ICEA P-45-482 standard) has been used to calculate the cross-sectional area of the tape shield, which reduces the fault current-carrying ability of the aged tape shield, as shown in the chart.

The most important factor is that the deterioration in short circuit performance of a copper tape shield from the new to aged results is not a linear function of time and varies greatly depending on operating conditions. UniShield eliminates this issue, providing stable and constant performance that will not change over the life of the cable.

# UniShield® is the easiest MV cable to prep for termination and to install

- UniShield provides labor-saving costs of up to 30% when compared to tape shield designs.
- Unique metallic shield helps to more effectively separate the semi-conducting jacket/insulation shield from the EPR insulation for easier stripability and quicker cable preparation time.
- No longitudinal scoring is needed, minimizing potential damage to the underlying conductor insulation, eliminating costly repair time.
- UniShield's light weight and flexibility allow for ease of handling, splicing and termination and permit longer pulls from terminal to terminal.

## How to Prepare UniShield for Termination and Installation



**1** Affix tape collar guide for drain wire removal in accordance with the information provided by the accessory manufacturer.



**2** Pull drain wire back to tape.



**3** Affix metal collar in accordance with specified manufacturer's instructions.



**4** Cut through shield to insulation layer, no more than 1" from the end of the cable.



**5** Grasp shield layer only and pull back to loosen.



**6** Loosen shield around entire circumference of cable.



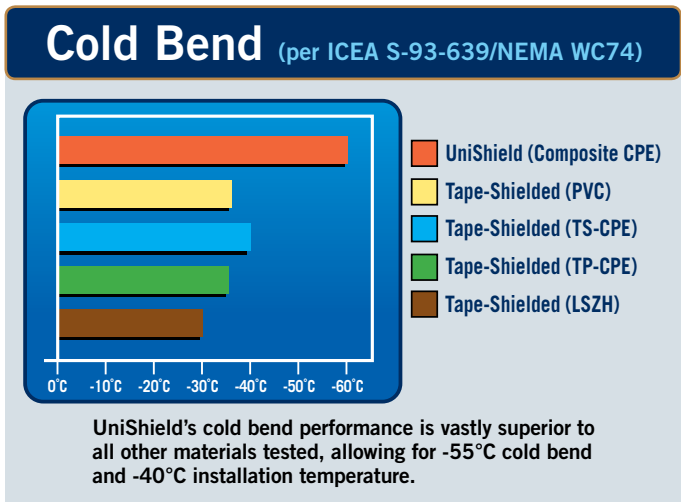
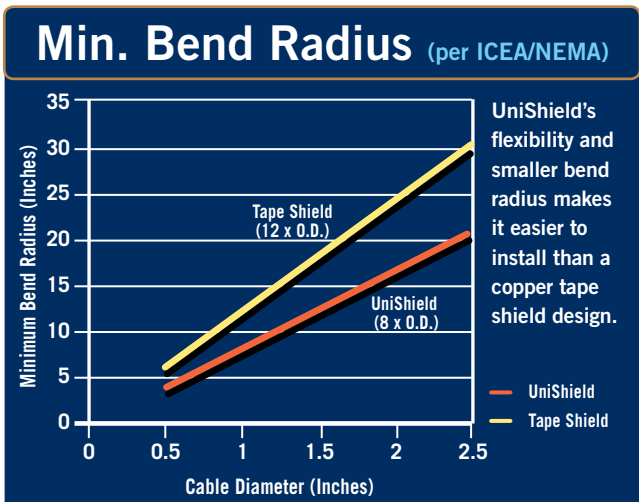
**7** Wind shield on tip of needle-nose pliers to collar.



**8** Cut shield material circumferentially.



**9** Clean insulation surface with solvent, working from free end to shield cutoff.



# UniShield® Performance Beyond Just Power

## Why the UniShield® CPE Jacket is the Best

While the corrugated drain wire shielding system provides unparalleled fault current performance and impedance protection, the semi-conducting UniShield CPE jacket also provides the ultimate in physical performance. In accordance with internal testing of commonly specified MV jacket materials, the UniShield® semi-conductive CPE jacket provides the following advantages:

### UniShield CPE Jacket Features and Benefits

Product Features	Application Benefits
<b>Outstanding Tensile &amp; Elongation Properties</b>	Superior results to all thermoplastic materials tested, and equivalent to thermoset CPE, the UniShield CPE jacket is the most durable jacket for even the most difficult installations.
<b>Excellent Aging Characteristics</b>	Exceeding all materials tested, UniShield's CPE jacket retains exceptional physical properties as it ages in service, important in applications with high degrees of heat cycling.
<b>Excellent Flame &amp; Fire Resistance Properties</b>	Meets requirements and passes the IEEE 1202 flame test, assuring industry-standard flame and fire performance. UniShield's CPE burns to an ash and, unlike PVC, will not exhibit thermoplastic drip properties, critical to reducing flame spread to other components during fire conditions.
<b>Superior Oil &amp; Chemical Resistance</b>	Higher degree of oil and chemical resistance compared to thermoplastic PVC and LSZH. Results were achieved at higher temperature (100°C vs. 70°C) and for longer test duration (18 hrs. vs. 4 hrs. per ICEA requirements). With results comparable to thermoset CPE, typically specified for its outstanding oil resistance properties, UniShield provides a logical substitution for thermoset-jacketed MV cables.
<b>Industry-Standard Low Temperature Performance</b>	Passes UL Cold Bend Test at -55°C, allowing for industry-standard -40°C installation temperature. <ul style="list-style-type: none"> <li>• Thermoset CPE (-40°C cold bend and -25°C installation)</li> <li>• PVC (-35°C cold bend and -20°C installation)</li> <li>• Thermoplastic CPE (-35°C cold bend and -20°C installation)</li> <li>• LSZH (-30°C cold bend and -15°C installation)</li> </ul>
<b>Excellent Ozone Resistance</b>	Ensures performance when cables are installed in close proximity to electrical equipment discharging corona.
<b>Superior Heat Distortion</b>	Industry-standard heat distortion performance, providing superior performance in applications with high degrees of heat, such as heavy load cycling or where high ambient operating temperatures may occur.

**NOTE:** Due to the specific formulation of the UniShield jacket and the design of the shielding system, the following guidelines should be followed:

- Due to the nature of single-point grounded systems, where voltage can build up at the end away from the grounded point and arc at the tray ladders, multi-point grounding should be utilized.
- UniShield jacket is not compatible with wax-based lubricants and can be installed using any standard non-wax-based lubricant.

# Most Commonly Asked Questions About UniShield®

## **Q Is the UniShield semi-conducting CPE jacket an effective substitute for thermosetting Hypalon®\* or CPE?**

The UniShield semi-conducting CPE jacket is thermoplastic; however, it performs similarly to a thermosetting material, particularly in low temperature environments. Combined with the corrugated drain wire system, its semi-conducting properties also provide unparalleled shield reliability and performance properties.

## **Q Why are UniShield drain wires corrugated, and why do we refer to them as drain wires?**

Corrugated drain wires allow UniShield to be bent with less risk of damaging the shield, and the wires serve to “drain” the charging current from the surface of the insulation, performing the identical function of copper tape.

## **Q What are the performance advantages of UniShield’s shielding system?**

The shielding system provides a fixed and known path to ground, and unlike copper tape shields, its performance remains stable and consistent as the cable ages in service.

## **Q What are the benefits and concerns of a semi-conducting jacket?**

Benefits: Unlike non-conductive jackets, semi-conducting jackets facilitate the flow of fault current not only from one jacket to another but also down other sets of drain wires, or to a metal conduit or ground wire in contact with any cable in the installation.

Concerns: A condition where arcing may be induced between a semi-conducting jacket and grounded components may be of concern, particularly as you go away from the grounded end point. However, this may be alleviated through the use of multi-point grounding.

## **Q What is single-point grounding, and why is it not recommended with UniShield?**

The metallic shield is grounded on only one end of a circuit and is typically utilized for shorter runs or installations with small electrical loads. It is not recommended for UniShield due to increased potential for arcing of fault current to grounded components.

## **Q What is multi-point grounding, and why is it recommended with UniShield?**

The metallic shield is grounded at more than one point along the length of the circuit and is recommended for longer cable runs or installations with higher electrical loads. It is recommended for installations utilizing semi-conducting jacketed cables or where the induced voltage of single-point grounding can produce unsafe conditions.

## **Q Does UniShield require a special pulling lubricant?**

Due to its semi-conductive properties, wax-based lubricants must not be used with UniShield; however, there is no unique pulling lubricant for UniShield.

## **Q What is the recommended bending radius for tape-shielded MV cables as compared to UniShield?**

ICEA/NEMA guidelines specify that tape-shielded cables be bent to no less than 12X O.D., whereas the guidelines for UniShield allow it to be bent to as little as 8X O.D.

\*Hypalon is a trademark of the DuPont Company.

# UniShield® Product Data Type MV-105, 5–35 kV shielded power cable.

## SPEC 6100 5,000 Volts 133% Insulation Level Ungrounded, 8,000 Volts 100% Insulation Level Grounded

CATALOG NUMBER	COND. SIZE (AWG/kcmil)	NOMINAL CONDUCTOR DIAMETER		INSULATION DIAMETER INCHES		DRAIN WIRE SIZE (AWG)	NOMINAL CABLE				COPPER WEIGHT		AMPACITY			CONDUIT SIZING (4) (INCHES)	
		INCHES	MIN.	MAX.	DIAMETER		WEIGHT		LBS/1000 FT	kg/km	LBS/1000 FT	kg/km	CONDUIT IN AIR (1)	UNDERGROUND DUCT (2)	TRAY (3)		
					INCHES		mm	LBS/1000 FT									kg/km
19101.650200	2	0.27	0.510	0.590	20	0.71	18.03	404	601	225	335	165	165	—	2.5		
19101.655100	1/0	0.34	0.580	0.655	20	0.78	19.81	555	825	346	515	215	215	220	2.5		
19101.665200	2/0	0.38	0.620	0.695	19	0.83	21.08	666	990	436	649	255	245	250	3		
19101.665300*	3/0	0.43	0.665	0.745	19	0.88	22.35	791	1177	562	808	290	275	290	3		
19101.665400	4/0	0.48	0.720	0.795	19	0.93	23.62	951	1415	678	1010	330	315	335	3		
19101.676000	250	0.53	0.770	0.850	18	1.01	25.65	1112	1655	804	1196	365	345	370	3.5		
19101.676200	350	0.62	0.870	0.945	18	1.11	28.19	1463	2176	1113	1656	440	415	460	3.5		
19101.686500	500	0.74	0.990	1.065	17	1.24	31.50	2003	2980	1585	2358	535	500	575	4		
19101.687000	750	0.91	1.170	1.250	17	1.44	36.57	2875	4278	2357	3507	655	610	745	5		
19101.667500*	1000	1.06	1.320	1.400	16	1.61	40.89	3746	5574	3138	4669	755	690	890	5		

## SPEC 6300 15,000 Volts 133% Insulation Level Ungrounded

CATALOG NUMBER	COND. SIZE (AWG/kcmil)	NOMINAL CONDUCTOR DIAMETER		INSULATION DIAMETER INCHES		DRAIN WIRE SIZE (AWG)	NOMINAL CABLE				COPPER WEIGHT		AMPACITY			CONDUIT SIZING (4) (INCHES)	
		INCHES	MIN.	MAX.	DIAMETER		WEIGHT		LBS/1000 FT	kg/km	LBS/1000 FT	kg/km	CONDUIT IN AIR (1)	UNDERGROUND DUCT (2)	TRAY (3)		
					INCHES		mm	LBS/1000 FT									kg/km
19161.660200	2	0.27	0.710	0.800	19	0.93	23.88	555	835	230	342	165	165	—	3		
19161.675100	1/0	0.34	0.780	0.865	18	1.01	25.91	734	1102	358	533	215	215	220	3.5		
19161.675200	2/0	0.38	0.820	0.905	18	1.05	27.18	844	1259	443	659	255	245	250	3.5		
19161.665300*	3/0	0.43	0.865	0.955	18	1.10	28.45	978	1458	550	818	290	275	290	3.5		
19161.675400	4/0	0.48	0.920	1.005	18	1.16	29.72	1151	1716	685	1019	330	315	335	4		
19161.686000	250	0.53	0.970	1.060	17	1.23	31.50	1325	1984	813	1210	365	345	370	4		
19161.686200	350	0.62	1.070	1.155	17	1.33	33.78	1691	2530	1122	1669	440	415	460	5		
19161.686500	500	0.74	1.190	1.275	17	1.46	37.08	2238	3344	1585	2358	535	500	575	5		
19161.697000	750	0.91	1.370	1.460	16	1.67	42.42	3174	4739	2368	3523	655	610	745	6		
19161.307500*	1000	1.06	1.520	1.610	16	1.86	47.24	4122	6133	3138	4669	755	690	890	6		

## SPEC 6500 25,000 Volts 133% Insulation Level Ungrounded, 35,000 Volts 100% Insulation Level Grounded

CATALOG NUMBER	COND. SIZE (AWG/kcmil)	NOMINAL CONDUCTOR DIAMETER		INSULATION DIAMETER INCHES		DRAIN WIRE SIZE (AWG)	NOMINAL CABLE				COPPER WEIGHT		AMPACITY			CONDUIT SIZING (4) (INCHES)	
		INCHES	MIN.	MAX.	DIAMETER		WEIGHT		LBS/1000 FT	kg/km	LBS/1000 FT	kg/km	CONDUIT IN AIR (1)	UNDERGROUND DUCT (2)	TRAY (3)		
					INCHES		mm	LBS/1000 FT									kg/km
19261.685100*	1/0	0.34	1.020	1.120	17	1.29	32.77	1014	1509	367	546	215	215	220	4		
19261.685200*	2/0	0.38	1.060	1.160	17	1.36	34.54	1163	1731	452	672	255	245	250	5		
19261.685300*	3/0	0.43	1.105	1.205	17	1.41	35.81	1310	1949	559	832	290	275	285	5		
19261.685400*	4/0	0.48	1.160	1.260	17	1.43	36.32	1442	2146	694	1033	330	315	335	5		
19261.686000*	250	0.53	1.210	1.315	16	1.51	38.35	1645	2448	824	1226	365	345	370	5		
19261.686200*	350	0.62	1.310	1.410	16	1.60	40.64	2024	3012	1133	1685	440	415	455	5		
19261.686500*	500	0.74	1.430	1.530	16	1.74	44.20	2608	3881	1596	2374	535	500	565	6		
19261.687000*	750	0.91	1.610	1.710	16	1.95	49.78	3596	5351	2368	3523	655	610	730	6		
19261.687500*	1000	1.06	1.760	1.865	16	2.11	53.59	4513	6715	3138	4669	755	690	870	8		

Dimensions and weights are nominal; subject to industry tolerances.

\* Non-stock item; minimum runs apply. Please consult Customer Service for price and delivery.

Other insulation levels available upon request.

(1) Ampacities are in accordance with Table 310-73 of the NEC for triplexed or three single conductor copper cable in isolated conduit in air, based on a conductor temperature of 105°C (221°F) and an ambient air temperature of 40°C (104°F).

(2) Ampacities are in accordance with Table 310-77 of the NEC for triplexed or three single conductor copper cable in underground ducts (three conductors per duct), based on a conductor temperature of 105°C (221°F) and an ambient earth temperature of 20°C (68°F), electrical duct arrangement per Figure 310.60 Detail 1, 100% load factor, and earth thermal resistance (rho) of 90.

(3) Ampacities are based on single conductor Type MV-105 sizes #1/0 AWG and larger in an uncovered tray in accordance with Section 392-13(B) of the NEC at an ambient air temperature of 40°C (104°F); the ampacities are based on 75% of the values per Table 310-69. For cable trays with unventilated covers for more than 6 feet, the ampacities shall not exceed 95% of the values shown above.

(4) Based on nominal cable diameters, three single cables in the duct (PVC Schedule 40) with no ground wire and a maximum of 40% fill. Jam ratio has been considered, but it should be checked for individual installations.

Note: a) Sizes smaller than 1/0 AWG do not include "FOR CT USE".

b) The NESC lightning bolt symbol is on all UniShield® constructions.

c) Values for each table calculated for 133% insulation voltage rating.



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