Cable solutions to meet the application needs of nuclear power plants
TODAY AND INTO THE FUTURE

MAY 2013
GENERAL CABLE DELIVERS
Advanced Reliability, Safety And Sustainability
To The Nuclear Power Industry

Safe, Reliable Cable Solutions for Safe, Reliable Operation

With nearly 40 years of nuclear experience and continuous service, General Cable is dedicated to advancing nuclear power and its commitment to providing safe and reliable electricity. We continue to invest in research and development to maintain and extend our leadership in technology, manufacturing and quality assurance—delivering nuclear-qualified cables with the design, performance and reliability to meet the needs of nuclear power plants both today and into the future.

At General Cable, continuous improvement as it relates to safety and best practices, both within our organization and in every nuclear cable we design and manufacture, is part of our corporate culture—it’s who we are. Our people are the powerful drivers behind our success as a nuclear wire and cable supplier and what differentiates us in the industry’s eyes in terms of quality, service and performance. These are the talented and dedicated individuals with expert knowledge of what it takes to deliver technology-driven high-performance products for nuclear power plants to ensure long-standing, sound and reliable operation under any condition.

Delivering value through leadership, innovation and technology, General Cable provides its nuclear customers with:
• A nearly 40-year track record of providing nuclear cable with proven quality and long-term reliability
• Performance that meets/exceeds stringent standards and evolving safety expectations
• Optimized cable designs to ensure more than 60 years of trustworthy power plant operation
• Ongoing investment and a commitment to continued improvement in all areas of our company
• A strong proponent for energy independence, alternative energy sources and sustainability
• Dedicated service and support with the flexibility and responsiveness to deliver valuable results

As one of the most established wire and cable companies in the world, General Cable has been leading the way in energy generation, transmission and distribution solutions for more than 165 years. We offer our valued nuclear customers the presence and strength of a large company, with the agility and responsiveness of a small one.

With more than 14,000 associates operating on six continents, General Cable serves its customers through a global network of 57 manufacturing facilities in 26 countries, with sales representatives and distribution centers worldwide. The combination of breadth of product line, strong brand recognition, and dedicated distribution and customer service makes General Cable your energy partner for the regeneration of nuclear power worldwide.
Zero and Beyond – Because NOTHING Else is Acceptable

At General Cable, our environmental, health and safety philosophy extends well beyond zero accidents in the workplace—it is in our DNA. Recognized as one of America’s safest companies* in 2012 with an industry-leading safety record, General Cable strongly encourages all of its associates to take responsibility for their decisions and actions, and to be role models of safety excellence to co-workers, families and communities.

While General Cable’s Zero and Beyond philosophy engages our associates at every level to think and act safely across all aspects of our business, we also embrace the unique safety requirements of the nuclear industry. With safety at the very core of our manufacturing excellence, all of our nuclear cables are designed to provide an infrastructure for safe and reliable nuclear operation.

General Cable’s corporate culture of safety provides:
- Absolute understanding that nuclear solutions must surpass the highest levels of safety and reliability
- OHSAS 18001 or equivalent health and safety management systems in all facilities
- Comprehensive testing, design control and quality assurance to ensure optimized cable safety
- Demonstrated safety leadership across all manufacturing facilities with dedicated EHS officers
- Significant investment in infrastructure with a focus on safety first through consequence thinking
- Ongoing commitment to continually measure and improve safety through responsible discovery
- Significantly lower reported accident and illness rates than the industry average

General Cable has one worldwide safety vision and goal – ZERO AND BEYOND. Through a corporate-wide practice of working safer by working together, General Cable extends that vision and goal into every nuclear cable we design and manufacture.

Responsible Operations Deliver Sustainable Solutions

General Cable recognizes our role and responsibility in promoting sustainability through continuous improvement in all areas of our company. As a result, our global facilities have fully implemented ISO 14001 or equivalent environmental management systems.

The quest to introduce new and better products through ongoing advancements in environmental designs reflects our commitment to achieving and exceeding industry standards and proactively responding to global environmental issues, while helping our nuclear customers deliver clean and reliable electricity. Just as important as internal sustainable practices is our inherent ability to design energy-efficient cables that are durable, reliable and optimized for long-standing, sustainable nuclear power plant operation.

General Cable was the first cable manufacturer to obtain certification for its environmental management system, in accordance with the ISO 14001 and EMAS Standards.

GENERAL CABLE DELIVERS
Innovation for Next Generation Nuclear Power

A History of Technological Advancements

For more than four decades, General Cable has consistently delivered technologically advanced cables that have enabled nuclear power to remain a safe, affordable and reliable source of clean energy. With a proven track record that stems from an intimate involvement and strong position in the electric utility market, General Cable is committed to partnering with our nuclear customers to share expert knowledge, identify evolving needs and solve today’s tough nuclear application challenges, both inside containment and out.

General Cable is strongly positioned to lead the nuclear industry well into the 21st century and beyond. Through ongoing investment in R&D, world-renowned testing, unsurpassed in-house compounding capabilities and a dedicated nuclear team, General Cable has developed the latest materials and advanced cable formulations with proven performance to help our nuclear customers differentiate themselves with safe, reliable and optimized nuclear power plant operations for the next 60 years and beyond.

ULTROL® 60+—safe, reliable, advanced cable solutions for the next 60 years and beyond.

ULTROL® from 40 to 60

1970: Brand-Rex Company of Willimantic, Conn. develops ULTROL® 14-year-life nuclear-qualified cable
1971: Brand-Rex pioneers fire testing program for cable standards in nuclear power plants
1975: ULTROL®(1) tested as one of the first radiation- and moisture-resistant cables with flame-retardant insulation
1982: Comprehensive product line of ULTROL® Class 1E cables
1999: General Cable acquires BICC Cables and Brand-Rex innovation and technology
2003: General Cable of Willimantic, Conn. commits R&D efforts for 60-year-life nuclear-qualified cable
2012: ULTROL® achieves nearly 46 years of uninterrupted service to the nuclear industry
2013: General Cable introduces ULTROL® 60+ Class 1E nuclear-qualified cable

 Ultrol60+©@generalcable.com

Telephone: (800) 237-6419 x8726
International: +1.860.465.8726
ultrol60+©@generalcable.com
ULTROL® – A Trusted Name in Nuclear Wire and Cable

As one of the first radiation- and moisture-resistant cable with flame-retardant insulation to guarantee a 40-year service life, the ULTROL® name has been synonymous with reliability and safety in nuclear cable for nearly 40 years. Backed by a continued commitment to provide the nuclear industry with cable solutions that deliver maximum service life, General Cable extends ULTROL®’s demonstrated quality and performance with its latest mastery of technology — ULTROL® 60+.

Based on a combination of ULTROL’s original renowned technology and General Cable’s industry-leading R&D, processing capabilities and decades of nuclear experience, ULTROL® 60+ features a unique balance of highly engineered insulation and jacket compounds coupled with high-grade copper conductors that ensure reliable electrical performance and superior durability under all operating conditions. Proven to meet the most rigorous Generation III reactor requirements for a 60-year operating life and beyond, ULTROL® 60+ is ready to support the modernization and construction of pressurized and boiling water nuclear power plants worldwide.

ULTROL 60+ is a step above the rest:
- Satisfies the most stringent nuclear safety standards for inside and outside containment
- Conforms to all U.S. Nuclear Regulatory Commission and global requirements
- Demonstrates thermal aging and radiation resistance up to 350 MRad exposure levels, proving 60+ year service life
- Meets/exceeds LOCA (loss-of-coolant accident) and HELB (high-energy line break) environmental qualification testing per IEEE 323 and IEEE 383
- Provides excellent wet electrical (submersion) performance upon aging at 90°C over two years
- Delivers reliability in extreme conditions (cold/hot temperatures, humidity, abrasion, fire performance in emergency, etc.)
- Offers new tougher, abrasion-resistant flame-retardant Cross-linked Polyolefin (XLPO) jacket compound

Based on comprehensive Arrhenius aging studies, ULTROL® 60+ has a predicted lifetime of more than 60 years.
GENERAL CABLE DELIVERS
Quality Assurance, Manufacturing Excellence and Unwavering Dedication

100% Quality Assurance Guaranteed

For more than a century, General Cable has been 100 percent committed to ongoing improvement and quality assurance across all aspects of our business. We continually strive to develop, produce and deliver products that meet our customers’ highest standards for performance, quality, value, service life and safety.

Under ASME NQA-1, 10CFR50 Appendix B and CSA Z299.1 quality assurance programs that include a highly experienced nuclear quality team, General Cable ensures every reel of ULTROL® 60+ leaving the plant meets stringent industry standards and the specified needs of our customers. Every ULTROL® 60+ cable is followed through the entire manufacturing process—from raw material inspection to rigorous performance testing. Every reel includes inspection results and certified documentation that is maintained and traceable.

General Cable’s quality assurance system for design, manufacturing and testing includes:
• ASME NQA-1:1994 and NQA-1:2008 with 2009 supplemental
• ISO 9001:2008 Certified (UL/DQS registered)
• ANSI N45.2
• NUREG 0800 Section 17.5
• Nuclear Regulatory Commission US NRC 10CFR50 Appendix B, 10CFR21 compliant
• CSA Z299.1:1985
• CSA Category Program for Testing (2nd party approval to ISO 17025)
• UL Data Acceptance Program (2nd party approval to ISO 17025)
• NUPIC and NIAC – Audited Quality System

Lifelong Manufacturing Excellence

Having produced ULTROL® since 1970, General Cable’s Willimantic, Connecticut facility is founded on a legacy of having the vision, innovation and cable expertise to lead markets that require specialized cable solutions. Today, Willimantic is an ISO 9001-certified manufacturing plant with dedicated associates who provide the technical expertise, and quality manufacturing and testing capabilities to maintain its nuclear status—all assured through regular NQA-1 and Appendix B audits by the Nuclear Procurement Issues Committee (NUPIC), Nuclear Industry Assessment Committee (NIAC) and other quality assurance organizations.

Dedicated to manufacturing excellence, the ASME NQA-1 Tier-1 Willimantic facility features some of the most advanced technology of its kind, offering unmatched reliability and production processes. The Willimantic facility is supported by Appendix B Tier-2 manufacturing capabilities, extensive testing and advanced material development at General Cable’s state-of-the-art technology centers.

Extensive third-party testing, performed by an Appendix B supplier, ensures the conformance of ULTROL® 60+ to all nuclear requirements.
A Dedicated Nuclear Team

To address the special needs of the nuclear market, match current and future nuclear application needs, and remain a valuable resource with an uninterrupted record of supply, General Cable backs ULTROL® 60+ with a cross-functional nuclear team built on long-standing industry experience, technical know-how and a mindset of continuous improvement.

General Cable’s nuclear team is committed to identifying objectives, establishing goals, defining action plans and drawing upon General Cable resources. Through active participation with standards bodies and long-term relationships with industry leaders, power plant operators, contractors and reactor manufacturers, our experienced team is empowered to satisfy and support a complex nuclear business—all with a commitment to safety and reliability.

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GENERAL CABLE DELIVERS
Cable Solutions to meet the Application Needs of the Nuclear Power Plant

The ULTROL® 60+ product line provides a full line of nuclear generating station cables for both inside and outside containment—all qualified for a 60-year service life. ULTROL® 60+ cables meet the application needs of the nuclear power industry, delivering reliable low- and medium-voltage power to ensure efficient power production as well as distribution and control, while transmitting the information needed for plant safety, critical monitoring and accurate measurement.

From the nuclear island, turbine island and balance of the plant to the grid infrastructure, ULTROL® 60+ delivers optimized reliable operation, maintenance and management in all known reactor environments.

• Exceeds 60-year service life requirements for insulations, shields and jackets
• Meets requirements of IEEE 323 and IEEE 383
• Meets the required flame testing of IEEE 1202 and IEEE 383
• Offers long-term thermal endurance at elevated and low temperatures
• Meets current pressurized and boiling water nuclear power plant requirements for service life beyond 60 years
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<td>Grid Infrastructure</td>
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**ULTROL® 60+ Class 1E** Comes with Certificate of Conformance; Certified Test Report (CTR): 10CFR50 Appendix B & 10CFR Part 21
* Post-LOCA long-term submergence test upon request

**ULTROL® 60+ Class 1E** (For Non-Class 1E applications)
** Commerical-Grade Products Comes with Certificate of Conformance
Utility-Grade Products Comes with Certificate of Conformance

Grid Infrastructure

Turbine Island

General Cable

Telephone: (800) 237-6419 x8726
International: +1.860.465.8726
ultrol60+@generalcable.com
# ULTROL® 60+ Cable Selection Guide

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<td>Single Conductor</td>
<td>600 V</td>
<td>FR-XLPE</td>
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<tr>
<th>SPEC</th>
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<td>FR-XLPE</td>
<td>14 AWG (2.08 mm²) - 1000 kcmil (507 mm²) Class B</td>
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<td>FR-XLPE / XLPO</td>
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<tr>
<th>SPEC</th>
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<tr>
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<td>600 V</td>
<td>FR-XLPE / XLPO</td>
<td>18 AWG (0.82 mm²) and 16 AWG (1.31 mm²) Class B</td>
<td><img src="image6.png" alt="Image" /></td>
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<td>225-60</td>
<td>2 - 37 Multi-conductor Overall Shield</td>
<td>600 V</td>
<td>FR-XLPE / XLPO</td>
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<td>600 V</td>
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<td>600 V</td>
<td>FR-XLPE / XLPO</td>
<td>14 AWG (2.08 mm²) - 10 AWG (5.26 mm²) Class B</td>
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<tr>
<td>300-60</td>
<td>2 - 37 Multi-conductor Overall Shield</td>
<td>600 V</td>
<td>FR-XLPE / XLPO</td>
<td>14 AWG (2.08 mm²) - 10 AWG (5.26 mm²) Class B</td>
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* -ER for > 2 conductors

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<td>EPR / XLPO</td>
<td>6 AWG (13.3 mm²) - 1000 kcmil (507 mm²) Class B</td>
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<td></td>
<td>15 kV (133%)</td>
<td>EPR / XLPO</td>
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</tbody>
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**ICON KEY**
- **class 1E**: RATED CLASS 1E
- **RADIATION-RESISTANT**: Radiation-Resistant
- **FLAME-RETARDANT**: Flame-Retardant
- **MOISTURE-RESISTANT**: Moisture-Resistant
- **UV/SUNLIGHT-RESISTANT**: UV/Sunlight-Resistant
- **CROSS-LINKED**: Cross-Linked
- **OIL-RESISTANT**: Oil-Resistant
- **INCREASED FLEXIBILITY**: Increased Flexibility
- **CUT-THROUGH**: Cut-Through
- **-40°C**: Cold Bend
- **-25°C**: Cold Bend
- **HEAVY WALL**: Heavy Wall

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General Cable
Telephone: (800) 237-6419 x8726
International: +1.860.465.8726
ultrol60+@generalcable.com
Meeting the needs of nuclear power plants TODAY AND INTO THE FUTURE

The nuclear power industry demands solutions that deliver high safety performance without fail and provide sustained reliability under rigorous conditions.

Building upon nearly 40 years of nuclear experience, General Cable has combined advanced materials with manufacturing expertise to produce ULTROL® 60+ Class 1E nuclear-qualified cables.

Third-party tested to meet Generation III reactor requirements, ULTROL® 60+ cables exceed stringent industry standards and specifications to provide a 60-year-plus service life to optimize nuclear power plant operations TODAY AND INTO THE FUTURE.

ultrol60+@generalcable.com
+1.860.465.8726