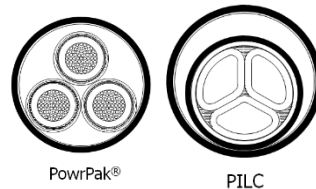


**Electric Utility - PowrPak®
Frequently Asked Questions**

Q: What is PowrPak®?

A: It is a medium-voltage power cable intended for use in today's aging and expanding urban underground distribution systems of electric utilities where Paper (In)sulated (oil impregnated), Lead Covered (PILC) cable has been used previously. General Cable's unique PowrPak® design and special manufacturing techniques enables a reduction in the overall cable diameter relative to industry standard solid dielectric cables. This smaller cable diameter permits PowrPak® to be installed into the existing PILC ductwork.



Q: How long has PowrPak® been around?

A: General Cable has proven itself as a pioneer and innovator in the cable industry for more than 100 years. PowrPak® is one example of how the company has thought ahead and anticipated the changing needs of the electric utility industry. Since 1989, electric utilities have installed millions of feet of General Cable's PowrPak® cable in Canada and in the U.S.

Q: How can PowrPak® have a higher ampacity rating than PILC cable?

A: In terms of ampacity rating, PILC cable has an upper conductor temperature limit of 70°C. PowrPak® is designed with polymeric materials that allows the conductor to have a normal operating temperature of 105°C. The PowrPak® cable can run hotter and allow a higher ampacity rating for the same size copper conductor.

Q: What type of insulation does PowrPak® use?

A: PowrPak®'s insulation system has traditionally been EPR (Ethylene Propylene Rubber) which is often classified as a "solid dielectric" material. Today's PowrPak® cable offers a lead-free filled Ethylene Alkene Copolymer rubber insulation with the designation of EAM. PILC cable, on the other hand, consists of helically wound paper tapes that are impregnated with oil.

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Q: Can PowrPak® designs be customized for specific applications?

A: Yes. The PowrPak® cable design can be customized to meet particular application needs. However, what we have found is that a design that works for one electric utility may work for another electric utility. Key features will depend on the voltage and current rating of the previous PILC system, the required fault current cable carrying requirements, and the size of the duct that the cable must pull through.

Q: When you make a cable smaller, do you always reduce the nominal thickness of the insulation?

A: No. Reducing the thickness of the insulation is the last factor considers when designing a PowrPak® cable for a PILC cable replacement. When designing a smaller cable, you minimize the overall diameter by using a compact copper conductor and a flat strap concentric neutral, along with utilizing reduced thickness values for the conductor shield and cable jacket. The nominal thickness of the insulation is only reduced as the last resort to achieve a required overall cable diameter.

Q: Is a PowrPak® cable more flexible than a PILC cable?

A: Yes. PowrPak® is an assembly of individually jacketed power cables which enable a more flexible and lighter weight product that is easy to work with. A PILC cable construction is typically three conductors within a common lead sheath that is stiff, heavy and difficult to handle.

Q: What do you use for transition splices between PILC cable and PowrPak® cable?

A: Special transition splices are required in order to seal the oil inside the PILC insulation preventing it from coming in contact with the PowrPak® cable or leaking out of the PILC cable. Transition splices are commercially available for this application.


Q: Does General Cable have an approved list of cable transition splices, taps and terminations for PowrPak® cable?

A: The list of manufacturers that provide transition splices, cable splices, cable taps, and terminations for use with PowrPak® cable includes, but is not limited to, Patton & Cooke Co., Richards, Tyco Electronics, and 3M. These can be hot shrink or cold shrink splice kits.

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Q: How do you calculate the duct clearance for PowrPak® cable?


A1: When the cable construction is triplexed on a reel from the factory the following formula is to be used when calculating the duct clearance.



$$\text{Clearance} = \frac{D}{2} - (1.366 \times d) + \left[\left(\frac{D-d}{2} \right) \times \sqrt{1 - \left(\frac{d}{D-d} \right)^2} \right]$$

Where : D = Inside diameter of duct (inches)
 d = Max. diameter of one of the insulated cables (inches)

A2: When the cable construction is paralleled on a reel from the factory, or when three single cable constructions are field installed paralleled (cradled), the following formula is to be used when calculating the duct clearance. Please note that when pulling in cable you must also consider cable jamming. To avoid this, it is best to utilize a factory triplexed assembly of the insulated cables.



$$\text{Clearance} = \frac{D}{2} - \frac{d}{2} + \frac{D-d}{2} * \sqrt{1 - \left[\frac{d}{2 \times (D-d)} \right]^2}$$

Where: D = Inside diameter of duct (inches)
 d = Max. diameter of one of the insulated cables (inches)

When pulling three individual cables into the duct, the following conditions can exist:

- *If 1.05D/d is larger than 3.2, jamming of the cables is impossible.*
- *If 1.05D/d is between 2.8 and 3.2, jamming of the cables is probable.*
- *If 1.05D/d is between 2.5 and 2.8, jamming of the cables is possible.*
- *If 1.05D/d is less than 2.5, jamming is impossible but the clearance should be checked.*

Q: Why should I consider a Polypropylene cable jacket?

A: One of the ways to reduce the overall diameter of the cable is to utilize a smaller nominal jacket thickness. Polypropylene is a tough jacket material that allows for a smaller jacket thickness while not compromising the mechanical “ruggedness” of the cable during installation. Polypropylene also has a much higher softening point than a conventional Polyethylene jacket and this enhanced thermomechanical performance provides excellent resistance to deformation inside the duct bank when exposed to higher operating temperatures.

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Q: Is PowrPak® easy to install?

A: Yes. As mentioned previously, PowrPak® is an assembly of individually jacketed power cables which enable a more flexible and lighter weight product that is easy to work with especially when racking the cable in vaults. PowrPak® requires less onerous work skills for splicing and terminating as there is no hand taping or lead wiping to complete. A PILC cable construction is typically three conductors within a common lead sheath that is stiff, heavy and difficult to handle. The special skills required for terminating and splicing are limited and labor-intensive.

Q: Why choose General Cable's PowrPak® over other similar constructions on the market today?

A: Simply put... Long-Term Reliability

PowrPak® is manufactured using state-of-the-art super clean ingredient components, mixed with techniques that produce homogeneous compounds believed to be the cleanest in the power cable industry. General Cable's cable manufacturing process technology allows for tight control of all the cable dimensions. Our triple extrusion techniques control dimensional tolerances. Material handling systems for all PowrPak® cable core are modern and up to date, including the use of Class 1000 and 10000 Clean Rooms at compounding and the cable manufacturing facilities. This assures a high degree of purity, consistency and long-term cable reliability that is RoHS compliant.

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