



**BRINGING ENERGY
ALL AROUND**





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EXTRA HIGH VOLTAGE

AC CABLES

Borouge and Borealis have been at the forefront of XLPE development in close co-operation with the global cable industry. First introduced in 1973 for 84kV submarine cables, Superclean cross linkable polyethylene (XLPE) is now used in Extra High Voltage (EHV) cables of up to 525kV.

Working in partnership with our customers and the value chain, Borouge and Borealis have developed the dedicated technology for the production and supply of compounds for EHV cables of higher operational stresses. In conjunction with the correct cable design and manufacturing standards, our patented Borlink™ technology platform ensures the production of high quality, clean XLPE compounds that ensure cable system reliability.

The presence of contaminants can reduce insulation performance and result in system failure. To address this, Borlink™ Superclean compounds are produced in a dedicated closed loop production environment to minimise the risk of contamination. Upon production, the cleanliness of the compound is further preserved with the Borealis EHV Octabin System. Produced to supplement Borlink™ Superclean compounds, our Supersmooth semicon compounds can be extruded with EHV XLPE insulation to produce Borlink EHV semicons for ultra smooth surfaces. These, when used together with our Borstar® and Casico™ protection solutions, enable us to deliver the best in reliable EHV cable systems.



Recommended Solutions

Characteristics	Borlink™ Insulation	Borlink™ Semicon	Jacket
Standard viscosity	LS4201EHV	LE0500	Borstar® HE6062/HE6063
High viscosity	LS4244EHV		Casico FR6082 (flame retardant) Borlink™ LE0563 (semicon)

Reference Projects for Borlink™ EHV Solutions

Project	Country	Voltage (kV)	Cable length (km)	In service
Chino Hills	USA	500	24	2017
Dardanelles I	Turkey	380	24	2015
Beijing	China	500	40	2014
Little Belt	Denmark	420	48	2013
BEC submarine connection, NJ - NY	USA	345	34.4	2012
Anhoit wind farm submarine	Denmark	245	75	2012
Beddington Tunnel	UK	400	30	2011
Changjiang Tunnel Bridge	China	220	132	2010
Chennai, Tamil Nadu	India	230	135	2010
Porce III	Columbia	500	5.4	2010
Istanbul	Turkey	380	27.9	2008
Milan	Italy	400	13	2006
Vienna	Austria	380	32	2006
Bureyskaya	Russia	500	2.5	2005
Zhengzhou City	China	220	8	2005
Rotterdam	Netherlands	400	12	2005
Madrid Airport	Spain	400	90	2004
London	UK	400	60	2004
Seoul	South Korea	345	66	2003
Taiwan R.O.C	Taiwan R.O.C	345	64	2003
Dachaosan	China	525	7	2001
Dublin	Ireland	220	40	2000
Berlin 1 & 2	Germany	400	63	1998 & 2000
Copenhagen 1 & 2	Denmark	400	108	1997 & 1999
Powergrid	Singapore	245	58	1997
PUB	Russia	220	168	1995

DC CABLES

Borouge and Borealis were one of the first producers of polymeric insulation and semicon materials used in early commercial polymeric DC cables. High voltage direct current (HVDC) power transmission technology supports the transportation of electricity over long distances without significant losses, making it efficient and environmentally friendly.

With industry trends indicating a growing demand for higher transmission capacities and voltage levels, Borouge and Borealis developed Borlink™ LS4258DCE, a new generation HVDC XLPE insulation compound produced on enhanced Supercure technology. Designed for minimum space charge accumulation, Borlink™ LE0550DC semicon is Supersmooth and provides both conductor and insulation shielding with even surfaces to alleviate electrical stresses. When used together with LE0550DC, LS4258DCE enables the extrusion of cables at extra high voltages and transmission levels – a safe and viable alternative to paper insulated cables.

Type and pre-qualification testing under the Cigré TB496 recommendation have seen a new world record of 640kV for a cable system produced with LS4258DCE insulation and LE0550DC semicon layers. This milestone was made possible by the unique characteristics of the insulation compound, which combines high levels of chemical and physical cleanliness to achieve the breakthrough step change in DC electrical performance. Furthermore, the compound is designed to enable a significant reduction in the degassing burden and improved scorch performance.

BORLINK™ LS4258DCE KEY PROPERTIES

- High levels of chemical and physical cleanliness
- Significantly reduced degassing burden
- Superior electrical conductivity performance; well suited for EHV DC applications
- Excellent scorch performance



Recommended Solutions

Application	Borlink™ Insulation	Borlink™ Semicon	Jacket
HVDC ≤320kV	LE4253DC	LE0550DC	Borstar® HE6062/HE6063 Casico FR6082 (flame retardant) Borlink™ LE0563 (semicon)
High productivity/Supercure based XLPE			
HVDC ≤320kV	LS4258DCS		
EHV DC	LS4258DCE		

Reference Projects – A proven 15-year track record in extruded HVDC systems

Project	Country	Power (MW)	Voltage (kV)	Cable length (km)	In service
Dalwin 2	Germany	916	320	160	2016
Nordbatt	Sweden - Lithuania	700	300	906	2016
ALink	Finland	100	80	316	2015
Troll A 3 & 4	Norway	100	60	280	2015
Dalwin 1	Germany	800	320	330	2015
Helwin 2	Germany	690	320	260	2015
Sylwin 1	Germany	864	320	410	2015
INELFE	France - Spain	1000	320	264	2015
Helwin 1	Germany	576	250	260	2015
Borwin 2	Germany	800	300	400	2015
Xiamen Flexible HVDC	China	1000	320	10.7	2015
East West IC	Ireland - UK	500	200	512	2014
Nan'Ao Island	China	100	160	38	2013
Zhoushan	China	1160	200	294	2013
Borwin 1	Germany	400	150	400	2010
Trans-Bay	USA	400	200	85	2010
Est-link	Finland - Estonia	350	150	105	2006
Troll A 1 & 2	Norway	80	60	68	2004
Murraylink	Australia	200	150	360	2002
Cross Sound	USA	330	150	84	2002
Direct Link	Australia	180	84	390	2000
Tjoerborg	Denmark	8	9	9	2000
Gotland	Sweden	60	80	140	1998



HIGH VOLTAGE

In high voltage (HV) cables, Borouge and Borealis can rely on a proven track record in the most demanding applications. Our Supercure based Borlink™ solutions are at the forefront of XLPE technology, providing significantly improved scorch safety which lowers the risk of insulation defects. This, in combination with an inherently reduced degassing burden, allows cable producers to benefit from a fully optimised production cycle.

Offered on two performance classes based on traditional voltage and new operational stress classifications, our HV XLPE solutions provide cable designers with maximum flexibility to develop compact cable solutions based on functional specifications. All Borlink™ solutions are produced and packed in a closed loop environment with advanced quality assurance systems to ensure consistent high levels of cleanliness, allowing them to deliver cable systems with long term reliability and overall system safety to utilities providers.



Recommended Solutions

Application	Voltage (kV)	Operating Stress (kV/mm)	Borlink™ Insulation	Borlink™ Semicon	Jacket
High productivity XLPE	≤161	≤7	LS4201H	LE0592S	Borstar® HE6062/ME6052
High productivity XLPE	≤230	≤10	LS4201S		Casico FR6082 (flame retardant)
High viscosity XLPE (low sag)	–	–	LE4244S		Borlink™ LE0563 (semicon)





MEDIUM VOLTAGE

Keeping up with the needs of power distribution companies is a major challenge for medium voltage (MV) cable producers, who have to ensure high productivity and cost effectiveness without compromising quality and long-term reliability.

High productivity XLPE solutions from Borouge and Borealis allow producers to generate increased output and longer campaign runs to achieve greater production flexibility and lower overall production costs while maintaining consistency and quality. They also have a wider processing temperature window and low scorch generation, allowing for extended production runs and higher outputs as compared to conventional, homogeneous XLPE solutions; producers can run extrusion lines with better efficiency, maximise output and produce longer lengths of cable per production run.

In additions to solutions which combine high productivity and enhanced electrical performance, Borouge and Borealis also offer water tree retardant (WTR) solutions derived from additive based solutions (up to 35kV) or copolymer based solutions (up to 72.5kV).

Recommended Solutions

Application	Borlink™ Insulation	Borlink™ Insulation Screen	Borlink™ Semicon	Borstar® Jacket
High productivity XLPE	LS4201R	LE0598/LE0592 LE0520	LE0598 LE0592	HE6062 ME6052 LE8707
Additive based WTR	LE4212	LE0520	LE0592	
Copolymer based WTR	LH4201R	LE0592	LE0592	



LOW VOLTAGE

Rapid urbanisation has led to a growing demand for higher quality power supply systems, with PE and XLPE increasingly becoming the materials of choice over PVC for the insulation of both overhead and underground cables as they are safer and more durable, environmentally friendly and cost efficient to produce.

Visico™/Ambicat™ XLPE solutions for low voltage (LV) applications allows producers to enjoy greater productivity, output and cost efficiency. With a reactor-made base material, Visico™ has an unparalleled scorch performance which enables non-stop production runs of up to one month. Used in combination with Visico™, our Ambicat™ catalyst is produced with sulphonic acid as a base – a greener alternative to harmful organic tin additives. Moreover, it generates a faster cross linking process, which in turn, facilitates the curing of the insulation layer at room temperature or ambient conditions, omitting the need for a water bath or sauna.

Recommended Solutions

Insulation		Jacket	
Visico™ (base material)	Colour	Borstar®	Colour
LE4423	Natural	HE6062	Black
LE4427	Black	HE6063	Natural
LE4421	Natural	LE8707	Black
ME4425	MD Natural	LE8706	Natural
Ambicat™ (catalyst)	Colour	Casico™ (flame retardant)	Colour
LE4476	Natural	FR6082	Black
LE4472	Black	FR6083	Natural
		FR4803	Natural





BUILDINGS

To address safety and environment related demands for building cables, our unique Low Smoke Zero Halogen (LSZH) flame retardant system comprises the following:

Visico™/Ambicat™ – XLPE compounds with a down-sizing potential of up to 40% and superior dielectric properties; a viable alternative to PVC based insulation solutions.

Casico™ – Enables the production of jacketing solutions that are 20% lighter than those produced with standard plastics. It also generates less heat and smoke, and does not emit corrosive gases, thus reducing the risk of secondary fire damage to equipment and installations.

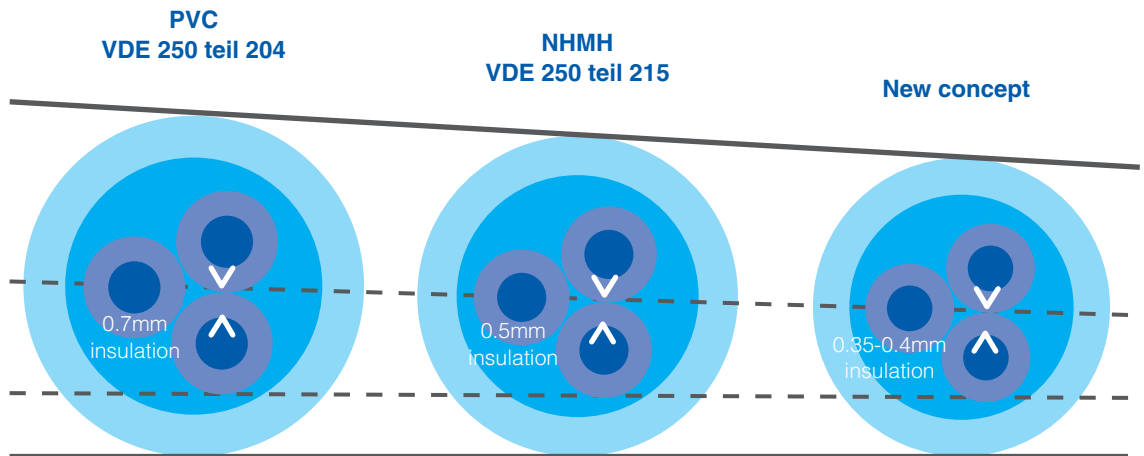


Diagram showing the downsizing of cables

Compatible with most PE and PVC extrusion equipment, our LSZH system is both environmentally safe and cost effective, facilitating the production of lighter weight end products that require less material to produce.

Recommended Solutions

Insulation	Jacket
Visico™ LE4423	Casico™ FR4803
Ambicat™ LE4476 (Natural)	



COMMUNICATIONS

Borouge and Borealis produce compounds for copper multipair, data, coaxial and fibre optic cables.

DATA

HE4883 is an ADCA-free compound for the physical foamed insulation of data cables. Offering the advantages of a full compound, it allows for stable processing at high line speeds and a fine and uniform cell structure with enhanced crushability. Longer production runs can also be achieved due to its anti plate-out nucleating agent system.

HE4883 can be used together with the following:

- **HE4872** – Solid insulation with improved copper and conductor adhesion to reduce cross talk. It can also be used as a conductor and outer skin.
- **ME6032** – Conductor skin.



FIBRE OPTIC

Borstar® technology enables the production of shrink and environmental stress cracking resistant compounds for a wide range of fibre optic jacketing applications, including linear low, medium and high density.

COPPER MULTIPAIR

We offer a broad range of products for PE jackets and both solid and chemical foamed insulation.

COAXIAL

Our complete range of gas injection insulation solutions for coaxial cables includes:

- **HE1106** – A fully formulated compound for gas injection insulation for 75ohm cables.
- **HE4883** – Easy to use, with consistent processability and excellent dielectric properties. Suitable for mini coaxial cables.
- **LE1120-HE1123** – Two-component solution for 50ohm cables.

Recommended Solutions

Application	Insulation	Jacket
Coaxial	LE6006 HE1106 (75ohm cables) LE1120-HE1123 (50ohm cables)	Borstar® HE6062, HE6063, ME6052, ME6053, LE8706, LE8707 LE6022
Data	HE1344 HE4872 HE4883 ME6032	
Copper Multipair	HE1344 HE1345 HE3366 ME1244 ME6032	
Fibre Optic	–	
		Borstar® HE6062, HE6067, HE6068, HE6069, 6081, ME6052, ME6053, LE8706, LE8707

About Borouge and Borealis 2018

Borealis is a leading provider of innovative solutions in the fields of polyolefins, base chemicals and fertilizers. With its head office in Vienna, Austria, the company currently has around 6,600 employees and operates in over 120 countries. Borealis generated EUR7.5 billion in sales revenue and a net profit of EUR1,095 million in 2017. Mubadala, through its holding company, owns 64% of the company, with the remaining 36% belonging to Austria-based OMV, an integrated, international oil and gas company. Borealis provides services and products to customers around the world in collaboration with Borouge, a joint venture with the Abu Dhabi National Oil Company (ADNOC).

Borealis and Borouge aim to proactively benefit society by taking on real societal challenges and offering real solutions. Both companies are committed to the principles of Responsible Care®, an initiative to improve safety performance within the chemical industry, and work to solve the world's water and sanitation challenges through product innovation and their Water for the World programme.

For more information, visit borouge.com

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