

# Submarine Power Cables

State-of-the-art production facility, more than 100 years of experience and reference installations around the world.



# Reliable submarine power cables

ABB is one of the world's most experienced submarine cable manufacturers, with well over a century's experience of cable manufacturing and installation. We offer complete cable systems for all types of applications, from medium voltage distribution to high voltage AC and DC transmission.

Our product range covers paper-lapped cables for HVDC and extruded polymeric insulation cables for either AC or DC applications. The reference list is long and includes numerous world record-breaking events. For example, we introduced the HVDC technology in the 1950's and installed the world's first submarine HVAC cable with XLPE insulation in the late 1960's. In 1997 we launched the HVDC Light concept with extruded DC cables, and in 1999 we qualified a 1 GW cable for 500 kV DC operation. The major part of the world's longest submarine power cable is also produced by ABB. It is the 580 km long NorNed cable between Norway and the Netherlands.

Our vast experience from submarine cable projects has made us an ideal supplier of cables for off-shore oil- and gas platforms as well as cables for off-shore wind farms.



# s from ABB

The global focus on environmental issues has led to an increasing demand for submarine cables. For example, governments and power suppliers are supporting renewable energy sources such as off-shore wind power. Also oil and gas companies are replacing local generation on platforms with power feeding from the mainland. The knowledge we have acquired from all of our submarine cable installations worldwide, makes ABB uniquely qualified to design and install the optimal cable

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ABB's factory for submarine power cables, has its own deep sea harbour for efficient loading of submarine cables.

system subject to transmission capacity needs, environmental issues and cost for installation and operation.

ABB is one of the world's leading electro-technical groups with 104,000 employees in more than 100 countries. ABB develops, produces, sells and services systems and products in a wide range of areas related to the production, transmission, distribution and application of electricity. The focus is on power and automation technologies that enable utility

and industry customers to improve performance while lowering environmental impact. We spend much time and effort on research and development to maintain our position as market leader and trend setter on cable transmission systems.



# From planning to installation

The earlier a customer involves ABB in the planning phase of a project, the more the customer can benefit from our extensive cable project experience. We know the permit processes and are able to assist our customers by supplying necessary documents for keeping the permit process as short as possible.

All submarine cable projects have their own special challenges. Whether it is the voltage, power rating, water depth, route length, installation or protection method that requires special attention, the know-how of ABB assures that the most efficient and optimized system is chosen. Being a project supplier, we also take complete responsibility

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Loading of a 115 kV cable destined for the oilfields in Saudi Arabia.

for planning, surveying, design and manufacturing of the cable system and the installation and testing thereof. Together with other ABB companies we can also optimize and supply complete distribution and transmission systems, including converter stations and/or substations with overhead line connections. Our products and systems correspond to all internationally approved standards, and they are tailor-made for working together.

During the planning and tender processes we form a designated project team. When awarded the contract this team continues their work until successful completion of the project. This ensures the quality throughout

the project, from the equipment specification, purchasing of raw material, manufacturing, laying and installation operations, to taking over. It also minimizes the final commissioning time and ensures optimum performance of the cable system with the highest possible availability.

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ABB can supply the entire transmission system.



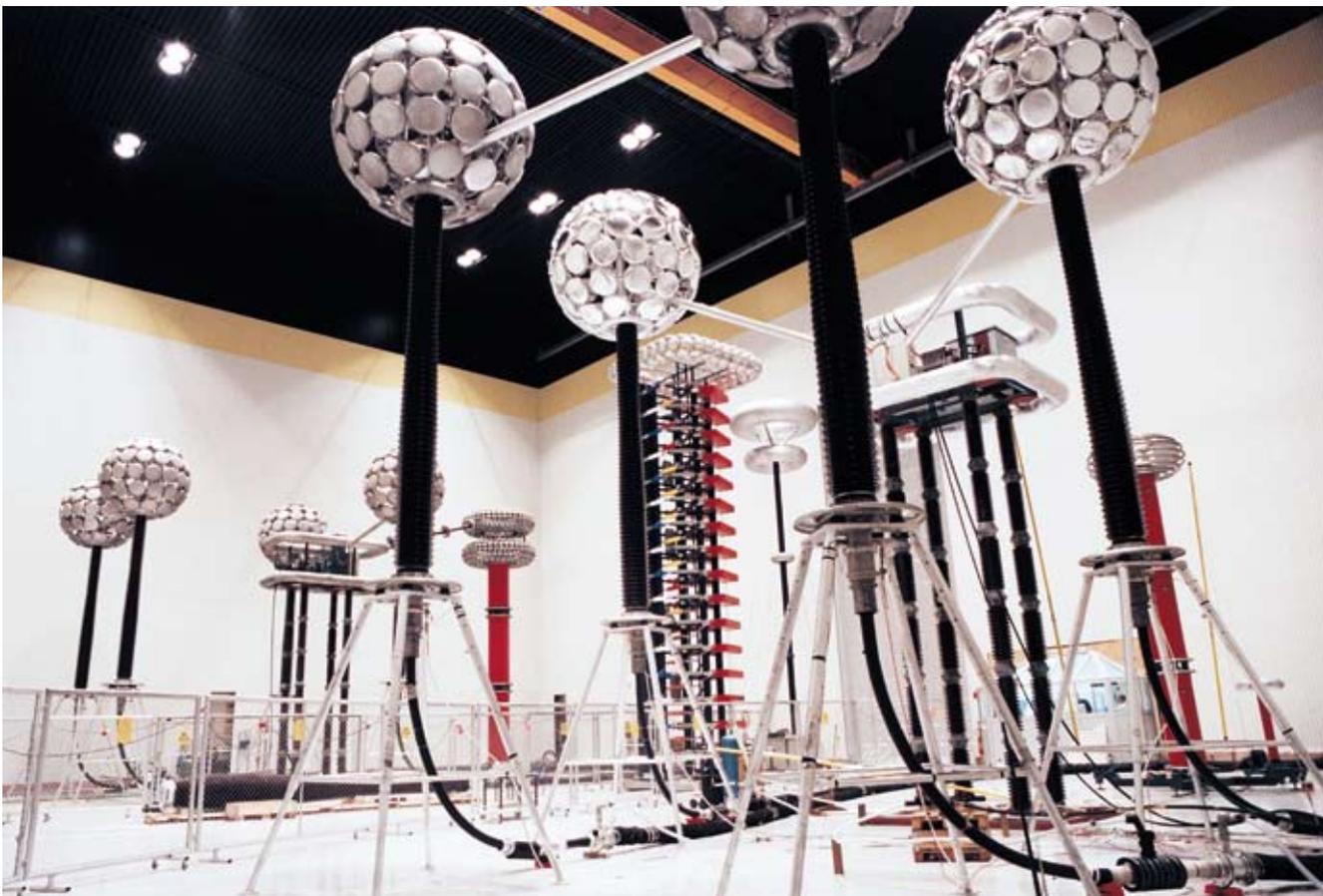
# Purchasing submarine cable systems from ABB provides the following benefits:

- Extensive experience from many previous projects
- Optimised system and plant design utilizing highly sophisticated and advanced computer programs
- Supreme quality in manufacturing and thorough testing of the equipment
- Thoroughly field tested equipment incorporating the latest state-of-the-art technology
- Responsible and highly efficient project management
- Closely monitored delivery schedules to ensure on-time commissioning
- Highest level of reliability and availability
- Continued support and assistance after commissioning



We have developed advanced systems for quality assurance and environmental management, complying with ISO 9001 and ISO 14001.

Type testing of a cable in one of the test bays in Karlskrona



# We manufacture submarine

No two submarine cable projects are identical. Each has to be designed to fulfil its purpose, taking into account transmission distance, water depth, sea currents, risks of damage, etc. Since the cable is the most vital part of an underwater transmission project, it must be of a robust, reliable design

to ensure the longest possible service life. That is why we often produce a pilot length of cable that is then thoroughly tested both electrically and mechanically under realistic operating conditions. This means that both the customer and ABB is assured of reliable subsequent operation. ABB can

supply three different types of submarine cables:

- Extruded XLPE cables for AC
  - Extruded HVDC Light cables for DC
  - Mass-impregnated paper cables for DC
- XLPE-insulated AC cables can be manufactured for system requirements



1 Polymeric HVDC Light cable for DC

2 Paper-insulated mass-impregnated cable for HVDC

# cables of all types

of 420 kV and 1000 MVA for submarine or land applications.

Extruded HVDC Light cables are available for DC voltages up to 300 kV and 1000 MW.

We can offer mass-impregnated HVDC cables for 600 kV and 2000 MW bipole.

Each cable type is being continuously developed in order to meet the market's demand for increased voltage and power capacity. Better materials and improved production and installation techniques have resulted in many world firsts and world records over the years.



3 XLPE-insulated three-core cable for AC    4 XLPE-insulated cable for AC

# The world's most modern

ABB's state-of-the-art plant for manufacturing of paper-insulated and polymeric insulated cables for submarine and underground applications, is located in Karlskrona on the south coast of Sweden. The plant is specially designed for very long submarine cables, which can be loaded in full lengths on board the laying ship in the harbour by the production plant. The cables are manufactured using

the most up-to-date production, quality and testing facilities. Close tolerances, high accuracy and continuous, careful monitoring throughout the entire manufacturing process are essential for the production of reliable cables, thus ensuring maximum availability of the cable link. High voltage and high power testing facilities are also located within the factory.

Modern equipment is important, but even more important are the people who operate it. Our employees are experienced, highly skilled and have specialist knowledge of cables and cable projects.

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The production plant in Karlskrona has lines for paper- and XLPE-insulated cables.



# cable factory

“The cables are manufactured using state-of-the-art production, quality and testing facilities”

ABB's vertical extrusion line for AC and DC cables is a rapid and efficient production line for high voltage cables.



# Transport, laying and prot

Cable installation requires experience and skill

The ABB group can supply complete distribution or transmission projects. The cable system technology is supported by skilled and experienced installation services. Cable installations - deep down in the sea, through bedrock, clay or sands, tunnels or tubes - we have just about done it all, all over the globe.

Our factory has its own deep-sea harbour for efficient loading of submarine cables. The cable is coiled or laid on turntable on board, directly from the production line.

### Laying and protection

By making a pre-study of the cable route and the seabed, we can offer

our customers optimal laying methods and protection for every specific installation. Whether it is a heavy DC or AC cable together with fiber optic cables or smaller medium voltage AC cables or HVDC Light cables,

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Considering cable type and cable route, we choose the most suitable vessel.



# ection

“ABB can offer the most efficient and reliable cable laying and cable protection available”

we offer the most suitable vessel for each project. Advanced positioning systems guarantee that the cable follows the planned route. To avoid risk of damage by dragging anchor and fishing equipment, the cable could be buried in the seabed by means of water jetting or plowing, or be laid directly on the sea bed and covered with concrete or other mechanical protection. In rivers with heavy traffic, the best solution could be to lay the cable in a tube under the river. For such installations we work with experienced sub-contractors for directional drilling. We possess all other equipment needed for all types of cable installations. Key personnel to supervise laying, jointing and erection operations and experienced jointers and erectors for this type of work are readily available within our regular staff.



# ABB - one of the world's most experienced submarine cable contractors

When connecting the island of Gotland to the Swedish mainland with a 100 km long cable in 1953, ABB marked the start of a new era in cable transmission technology - the world's first HVDC scheme was energized. Rated originally 20 MW at 100 kV DC, the cable was upgraded to 30 MW at 150 kV in 1970. After 32 years in service,

the cable was replaced in 1985 with a new 150 MW interconnection. The old cable showed no signs of ageing!

**World leader**

This ABB milestone in cable transmission history has been followed by many more. Especially in the HVDC field, ABB has maintained

its position as the world leader. We have, in fact, supplied the majority of all HVDC submarine power cables installed in the world, including prominent projects such as the Baltic Cable (Sweden – Germany), the SwePol Link (Sweden – Poland)

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Before loaded on the laying vessel the cable is stored on a turntable.



# perienced

and latest, the NorNed cable (Norway - the Netherlands), a 580 km long cable with a transmission capacity of 700 MW at 450 kV. Furthermore ABB is the only cable manufacturer in the world who can offer polymeric insulated HVDC power cables. The HVDC Light system and its light and robust cables, were launched in the end of the 1990's and has proved a very successful concept. The low losses together with the possibility to connect asynchronous networks, make it ideal for connections between mainland and offshore windmill farms

or oil platforms. Today there are submarine HVDC Light cables installed for example between the mainland of Norway and the Troll A gas platform in the North Sea and across the Long Island Sound in the U.S.

Sweden is a country with countless islands and over 2,700 km of coastline. Electrifying the islands has led to an extensive use of submarine AC cables - the majority of which have been supplied by ABB. Also in the high voltage AC field, ABB has been pushing the technology forward.

In 1973 we produced and installed the world's first extruded polymeric insulated HVAC cable, - the 55 km long, 84 kV AC cable to the island of Åland in the Baltic Sea. No false of internal origin occurred during its service life. The high reliability of our cables together with very rigid health, safety and environmental regulations, where some of the reasons why we were chosen to deliver submarine power cables to some of the most demanding offshore oil companies in the world, such as Saudi Aramco in Saudi Arabia and Statoil in Norway.

Cable laying in progress at the Troll A offshore gas platform in the North Sea.



The world's first submarine XLPE cable connecting the Swedish mainland to the Finnish island of Åland. The cable link consists of three cables, 55 km each, for 84 kV. Laid in 1973.



The world's first and longest (100 km) HVDC cable for 100 kV, 20 MW, connecting the island of Gotland to the Swedish mainland in 1953.

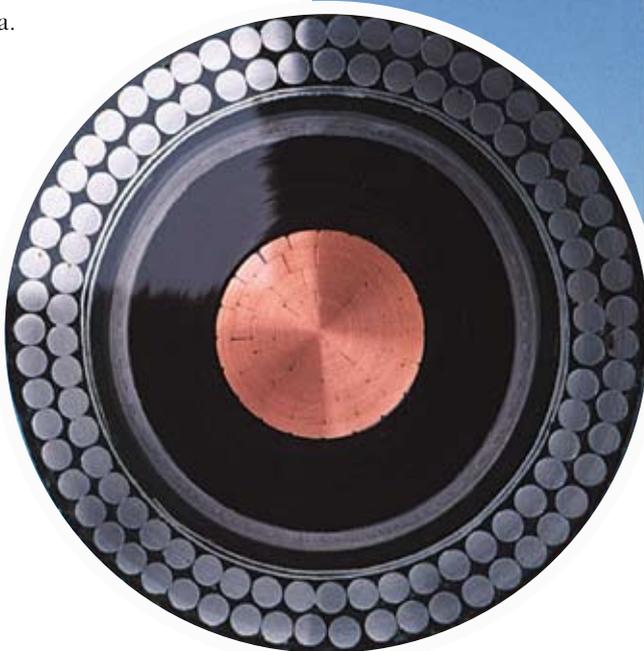


# Using experience to meet future demands

Submarine cables have been increasingly used for power transmission in recent decades. Requirements are increasing regarding more effective use of available energy resources. We are equipped both with resources and skills to meet any future demands for higher voltages, higher power, deeper water and longer distances.

Extensive research, development and experience from past projects represent a good basis for new projects emerging in the future. Vital know-how has also been gained from HVDC equipment for long distance transmissions and power system interconnections. In this field ABB is the most advanced and experienced company in the world.

We are well prepared to meet future demands for any type of power transmission, both on land and at sea.





For additional information please contact you local ABB Sales Office

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