

High Voltage Accessories. Case studies.



345 kV Transmission Reliability Project

The first 345 kV high voltage project in the U.S. by Brugg Cables was successfully realised at K Street, Hyde Park, Massachusetts, U.S..

Customer

NSTAR, the electric and gas utility serves customers in the Boston area and Eastern Massachusetts.

Background of application

The connection is part of the larger NSTAR "345 kV Transmission Reliability Project" that is designed to enhance the region's electrical capabilities. The 345 kV system consists of two cable circuits between newly installed transformers and 12 terminations installed at "K Street Substation" in South Boston. An XLPE cable solution for the tie lines was chosen due to space limitations and the urban location of the substation.

Scope of supply

Cable:

- 345 kV XLPE cable 1x2750kcmil (1400 sqmm) with a total length of 2'910 ft (900 m).
- 115 kV XLPE cable 1x4000kcmil (2000 sqmm) with a total length of 900 ft (300 m).

Terminations:

- 12 outdoor terminations for 345 kV
- 12 GIS terminations for 115 kV

PD-measurement system:

- UHF sensors in each of the terminations

Technology

The cable is designed for a continuous load of 600 MVA per circuit. It is made with a copper corrugated sheath for added strength and flexibility. The cable is laid in PE conduits and protected by concrete caps.

The terminations are based on reliable technology of silicon rubber (SiR) one-piece prefabricated slip on stress cones. The insulator is porcelain, filled with oil.

Year of commissioning

Mass Electric Construction Co. successfully completed the installation under the supervision of Brugg in 2006.

Customer added value

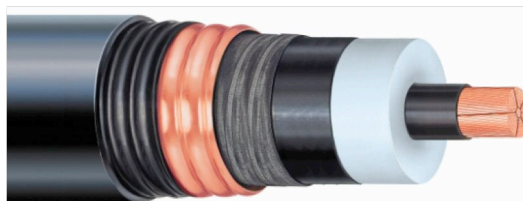
The importance of this installation can be seen by its name. The "345 kV Transmission Reliability Project" puts particular onus on the long-term reliability of the cable system. Brugg Cables was chosen as a partner for this project due to its wealth of experience and high quality products.

To provide additional system protection, each of the 12 terminations was equipped with a newly developed partial discharge (PD) sensor based on UHF technology.

The sensors enable the system operator to monitor and assess the condition of the terminations at any time, to make decisions well in advance during operation.



Brugg Cables' 345 kV outdoor terminations at the substation in South Boston.



Brugg Cables' XDCUW-T cable with XLPE insulation and corrugated copper sheath.

220 kV cables and accessories for Beijing Olympic Games projects

The delivery of high voltage cables and a full range of accessories for the Beijing Olympic Games power supply projects in China.

Customer

The State Grid Corporation of China (SGCC).

Background of application

Since city of Beijing awarded the host of the 29th summer Olympic Games in July 2001, large amount of stadiums and gymnasiums have been newly built or refurbished in Beijing. To ensure the highly reliable electric power supply SGCC has launched tens of important power transmission and supply projects.

Scope of supply

Terminations:

- 19 outdoor terminations type TE 1.245 for 220 kV
- 27 outdoor terminations type FR 1.245 for 220 kV
- 71 GIS terminations type TF 1.245 for 220 kV
- 145 joints type MP 1.245 for 220 kV

Cables:

- Cables of total 4 different manufacturers
- Cables of Brugg: 22040 m of 220 kV XLPE cable 1x1000 mm², 10526 m of 220 kV XLPE cable 1x600 mm² and 6786 m of 220 kV XLPE cable 1x2500 mm², all with lead sheath and copper wired screen
- Several link- and x-bonding boxes IP 54 & IP 68

Technology

The high voltage accessories are based on the reliable technology of silicon rubber (SiR) one-piece prefabricated slip on insulation bodies for the terminations and joints. The outdoor terminations were equipped with porcelain insulators (type TE) and composite insulators (type FR) and both are filled with silicone oil.

The cables are XLPE insulated cables with a lead sheath for 100% moisture protection and with additional copper wire screen for enhanced short circuit capabilities.

Year of commissioning

The successful commissioning of the 12 projects took place between 2005 and 2007.

Customer added value

A reliable power supply was from the beginning the overall priority for these strategic important projects. The customer has taken profit from the wide range of products from Brugg Cables, its reliable behaviour and the excellent track record in numerous countries and climate zones.

High voltage cables of four different manufacturers were involved in 12 projects. For reliability reasons, the customer decided to use the high voltage accessories of one source, from Brugg Cables.



Illumination of Beijing Olympic stadium, known as "The birdsnest".



Illumination of the Olympic area with swimming hall, known as "The water cube" and Olympic stadium at night.

Cables and accessories 66 kV – 420 kV to power the world's largest gas plant

High voltage cables and accessories of Brugg Cables ensure a reliable power supply for the world's largest gas plant in Ras Laffan, Qatar.

Customer

Kahramaa, the Qatar General Electric and Water Cooperation in Doha, Qatar.

Background of application

Ras Laffan is an industrial area about 80 km north-east of Doha, Qatar. The plant was founded in 1997 and covers an area of > 100 km² (2008). More than 30'000 people work in this region to process natural gas. The plant has its own port of about 10 km². Such a huge industrial area requires a large and reliable power supply. The products of Brugg Cables provide a major contribution to this. Since 2005, kilometres of high voltage cables, hundreds of terminations and joints as well as additional equipment and partial discharge (PD) systems have been delivered in the voltage range from 66 kV to 420 kV. High voltage accessories were used together with cables of four (4) different manufacturers.

Scope of supply

Terminations and joints:

- ~ 50 terminations and joints for oil-filled cables for the voltage levels 66 kV and 132 kV
- 6 outdoor terminations and 6 GIS terminations of type TE 1.145 and TF 1.170
- > 100 joints for XLPE cables of type MPCP 1.145
- 23 GIS terminations for XLPE cables of type TF 1.245
- 16 outdoor termin. for XLPE cables of type FR 1.245
- 44 joints for XLPE cables of type MP 1.245
- ~ 70 link- and x-bonding boxes with IP 54 and IP68

PD-measurements:

- UHF sensors for terminations and built-in sensors in joints for after installation PD testing
- After installation tests, carried out by Omicron

Technology

The terminations and joints are based on the reliable technology of silicon rubber (SiR) one-piece prefabricated slip on elements.

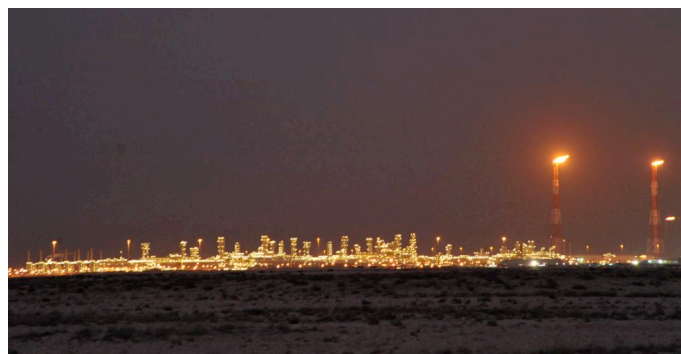
Year of commissioning

The installations were successfully completed between 2005 and 2008.

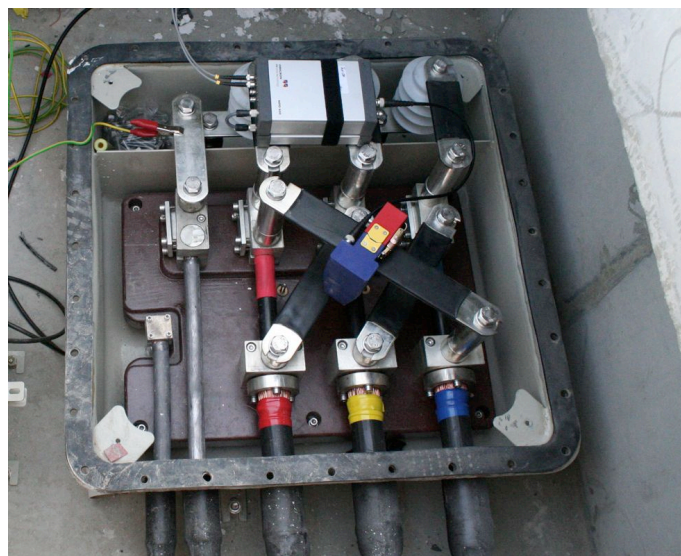
Customer added value

Factories with very complex production processes, such as a gas-processing plant, require a reliable energy supply. The base for a reliable energy supply are products of good quality and reliable performance. This is why the customer chose the high voltage cables and accessories of Brugg Cables.

In order to check the quality of the installation, the customer carried out after-installation tests with PD measurements. It was thereby decided to measure the PD at the terminations with an ultra high frequency (UHF) sensor and at the joints with an inductive sensor that is placed in the cross-bonding box.



Partial view at night of the Ras Laffan gas plant in Qatar.



Cross bonding box of Brugg Cables with inductive PD sensor (blue-red piece in the middle of the picture) and the PDM 600 PD measurement device (grey box in the upper middle of the picture) of Omicron.

36 online monitored GIS terminations 420 kV for cables of two (2) manufacturers

The 400 kV connections at Jebel Ali power station complex in the United Arab Emirates (UAE) were realised with Brugg Cables for reliable power supply.

Customer

Dubai Electricity and Water Authority (DEWA).

Background of application

To meet the ever-growing demand for power and water, DEWA has recently added a power and desalination station at the "Jebel Ali Power Station Complex" close to the city of Dubai. The electrical equipment comprises a new 400 kV substation and 400 kV underground and overhead lines.

Scope of supply

Cable:

- 400 kV XLPE cable 1x630 mm² of Brugg Cables with a total length of 4500 m
- 400 kV cables of Prysmian

Terminations:

- 36 GIS terminations type TF 1.420

PD-monitoring system:

- Delivery, installation and commissioning of on-line partial discharge (PD) monitoring system for all terminations, based on UHF technology

Technology

The high voltage cable carries a copper wire screen below a lead sheath, thus providing a 100% moisture barrier. Each cable system runs through a separate cable trench, filled with special adding and backfilled material in order to prevent the surrounding soil from drying out. The terminations are based on the reliable technology of silicon rubber (SiR) one-piece prefabricated slip on stress cones. They are of the classical well-proven Brugg design with an epoxy insulator and filled with oil.

Year of commissioning

Brugg Cables completed the installation successfully in 2008.

Customer added value

The Because of the requirements for long-term reliability, Brugg Cables was chosen as a partner for this project due to its wealth of experiences and high quality products.

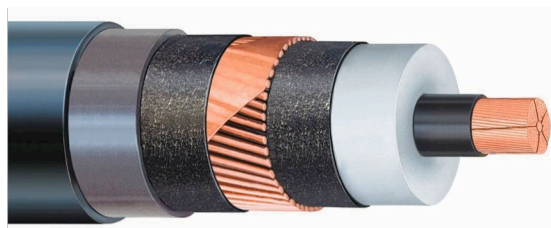
To provide additional system protection, each termination is equipped with a PD sensor. The delivered monitoring system has a user-friendly interface for display and administration of the acquired PD patterns. It allows the customer to monitor and assess the condition of the termination at any time and to make decisions well in advance during operation.



Desalination and power station at Jebel Ali, U.A.E..



Commissioning test of the cable system.



Brugg Cables' XDCUW-T cable with XLPE insulation and corrugated copper sheath.

World's lowest placed terminations – 145 kV technology of Brugg in Jordan

Close to the Dead Sea at about 400 m below sea level, the world's lowest placed terminations from Brugg Cables allow reliable energy supply at the Suweimeh Power Station.

Customer

National Electric Power Company (NEPCO) in Jordan.

Background of application

The Jordan government is currently undertaking tourism development around the Dead Sea. This can be seen in the considerable amount of building and construction in that area. In a first step, the energy supply will be installed. A major knot of this supply is the "Queen Alya Suweimeh 132/33 kV substation" – named after a former queen of Jordan, Queen Alya Baha' ad-Din Tuqan. The circuit consists of outdoor terminations, polymeric cables, a gas insulated switchgear (GIS) substation including GIS terminations and 132/33 kV transformers including transformer terminations.

The high voltage cable was supplied by the customer. It is a 132 kV XLPE cable from LG with lead sheath and a conductor cross-section of 1000 mm².

Scope of supply

Terminations:

- 15 outdoor terminations with porcelain insulators of type TE 1.145
- 18 GIS terminations of type TF 1.170
- 5 transformer terminations of type TT 1.170
- 5 Disconnecting link boxes with IP 68 protection

Technology

The terminations are based on the reliable technology of silicon rubber (SiR) one-piece prefabricated slip on stress cones. The insulator for the outdoor terminations is porcelain and the terminations are filled with silicone oil. All GIS- and transformer terminations come with an insulator of epoxy resin and are filled with silicone oil.

Year of commissioning

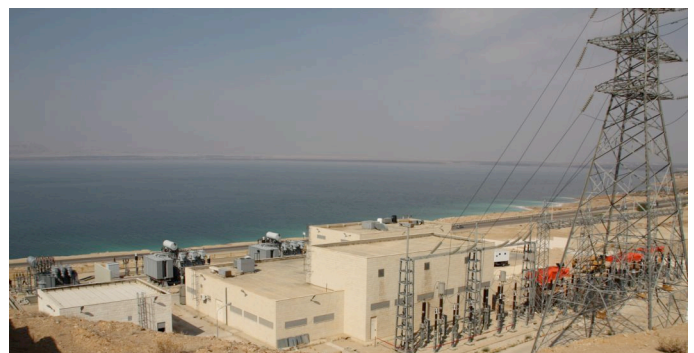
The terminations as well as the whole substation were commissioned successfully in 2009.

Customer added value

The surrounding area determines the importance of this installation. The coast of the Dead Sea often reaches very high temperatures. During the day, the ambient temperatures frequently rise to about 50°C. While the GIS terminations are in an acclimatised building, the outdoor- and transformer terminations are exposed to the high ambient temperatures. This, together with the sun radiation and the losses during current flow in the cable, puts the termination under considerable stress. This is why the customer chose Brugg terminations. It allows a long-term reliable power supply, which is vital for the development of this area.



Installation of the world's lowest placed terminations, at the Suweimeh 132/33 kV power station in Jordan.



The Suweimeh power station at the lowest point on earth (400 m below sea level) by the Dead Sea in Jordan. On the right, the outdoor termination, in the building, the GIS terminations, and to the left in the transformer, the transformer terminations of Brugg Cables.

Brugg high voltage accessories for one of the world's largest steel plants

One of the world's largest steel plants – the ThyssenKrupp steel plant of Santa Cruz, Brasil – is supplied with high voltage accessories of Brugg Cables, ensuring a reliable power supply.

Customer

The end customer is ThyssenKrupp with a steel plant in Brasil. Brugg's customer, ABB, conducted the project management for erecting the power supply of the plant.

Background of application

ThyssenKrupp, one of the world's largest steel manufacturing companies, has decided to erect their largest production site at Santa Cruz, state of Rio de Janeiro, Brasil. At current time, the construction site covers an area of 4 x 8 km² with 27'000 people working on it. ABB took responsibility for the installation of the power supply. The cables were delivered by ABB with a cond. cross-section of 400 mm², 630 mm² and 800 mm². Although ABB provides high voltage accessories itself, they nevertheless, chose Brugg equipment. In addition, the customer ordered a partial discharge (PD) measurement system including training.

Scope of supply

Terminations and joints:

- 122 outdoor terminations with composite insulator of type FR 1.245 for 138 kV
- 7 joints of type MPCP 1.145 for 138 kV
- 36 disconnecting link boxes with IP 54 protection

PD-measurement system:

- UHF sensors for measurements on the terminations
- Inductive sensors for measurements on the joints
- PD measurement system for periodic measurements
- Training of the PD system

Technology

The terminations and joints are based on the reliable technology of silicon rubber (SiR) one-piece prefabricated slip on elements. The terminations have composite insulators filled with silicone oil. The joints are protected with a copper tube and an additional polyester box, filled with an insulating compound.

Year of commissioning

The commissioning of the first phases started successfully in spring 2009. The commissioning of the last phases is planned for 2010.

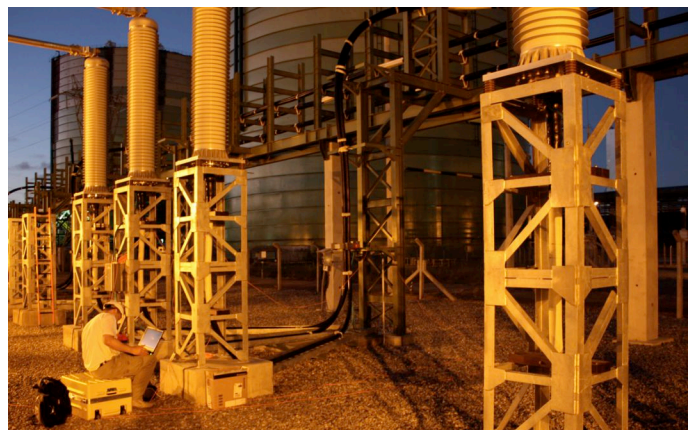
Customer added value

The application in the steel plant is determined by the requirement that the system must be able to run when one phase is out of order. Thus, in the 138 kV systems, all terminations were designed for 245 kV. In addition, a reliable power supply is vital for the processes running in the steel plant. Because of this, the customer chose the terminations and joints of Brugg Cables.

To ensure that the system runs reliably, an internal service crew was formed to carry out measurements on all electric equipment. PD measurements were chosen for the cable, terminations and joints. It was decided to use ultra high frequency (UHF) PD sensors for the terminations and inductive sensors for the cable and the joints. The inductive sensors were placed at the ground path of the terminations and in the cross bonding boxes. It was the task of Brugg to train the service crew in installing PD sensors and performing the measurements.



High voltage substation (in the middle of the picture) at one of the world's largest steel plants (ThyssenKrupp Brasil) during erection.



Partial discharge measurements at the terminations and the cable.

Brugg powers Dubai

For more than two decades, Brugg Cables has been delivering cables, joints and terminations to Dubai to provide a reliable power supply for "1001 wishes".

Customer

DEWA, the Dubai Electricity and Water Authority in Dubai, United Arab Emirates.

Background of application

The background of the application is nothing less than the amazing developments in the city of Dubai and the greater Dubai area. For more than two decades, hundreds of km of cables and more than thousand joints and terminations for voltage levels from 132 kV to 420 kV have been delivered by Brugg Cables.

Scope of supply

Cables:

- 145 kV XLPE cables from Brugg Cables for cross section values of 630 mm² to 1000 mm².
- Cables from several (> 5) other manufacturers

Terminations and joints:

- ~ 50 outdoor terminations with composite insulators of type FR 1.145 and FR 1.170
- ~ 40 outdoor terminations with porcelain insulators of type TE 1.145 and TE 1.170
- > 500 GIS terminations of type TF 1.170
- > 200 transformer terminations of type TT 1.170
- > 500 lapped joints of type MT 1.145 (no longer in the product portfolio for sale)
- > 200 joints of type MP 1.145 and MPCP 1.145 for all types of polymeric cables
- Hundreds of link- and x-bonding boxes IP 54 & IP 68

Technology

Nowadays, terminations and joints are based on the reliable technology of silicon rubber (SiR) one-piece pre-fabricated slip on elements. Until about 2000, the joints were based on lapped tape technology.

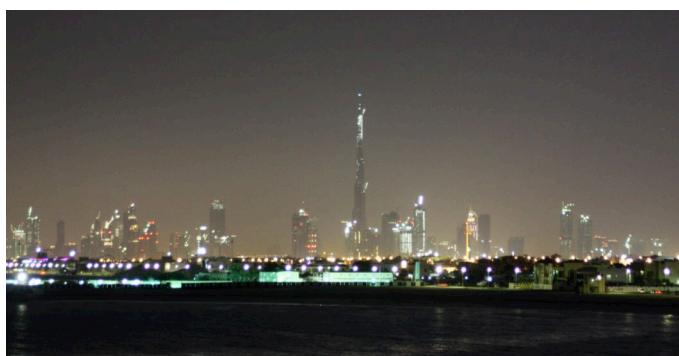
Year of commissioning

Successful installations have been completed for more than two decades, from 1987 to today.

Customer added value

The importance of the installations comes from the application. When building such representative installations like the Burj al Arab and the Burj Dubai (world's most exclusive hotel and the world's highest building, respectively), as well as the numerous businesses and leisure facilities surrounding them, the customer cannot risk any blackouts or failures in the power supply. To guarantee a reliable power supply, a huge number of cables, joints and terminations from Brugg Cables have been used.

The flexibility of Brugg accessories is proven by the fact that high voltage accessories of Brugg Cables have been applied with cables of several (> 5) other manufacturers in the voltage range between 132 kV and 420 kV without any problems throughout the last two decades.



The impressive skyline of Dubai with the Burj Dubai, the world's highest building.



Burj al Arab, the world's most exclusive hotel at night, powered with cables and accessories of Brugg Cables.

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