Power products

Special transformers
Subsea electrification solutions
Specialized systems and services

ABB is a leading supplier of electrification solutions to the oil and gas industry and offers a range of specialized electric power systems, drives and services for critical subsea production equipment.

Topside equipment
For electrical supply from topside facilities to subsea equipment, ABB offers transformers, frequency converters and application control software.

Subsea transformers
Our unique subsea transformers are ideal for a wide range of subsea boosting and separation applications.

Simulation and analysis
By analyzing the results from steady state and start-up calculations, ABB performs dynamic simulations of the complete electrical system including converter model.

Package solutions
By bundling ABB equipment with services such as project management, procurement, engineering, installation, commissioning and testing, customers are assured of total and consistent quality throughout all project areas.
The subsea power experts

Long experience - high competence
Simulating subsea oil and gas reservoirs effectively through boosting, injection and compression is critical for achieving stable production and extending the feasibility of the field. For reservoirs with long step-out distances, powering the subsea equipment that performs these functions is no easy task, and requires electrical equipment that is powerful, rugged and reliable.

Producing oil and gas from reservoirs located at long distances from land is a costly proposition that presents many challenges to offshore operators. Going subsea with long reach from shore or remote platform can be a very cost-efficient solution and it may eliminate the need for a fixed or floating topside installation. To help operators achieve efficient electric power supply and control at long step-out distances, ABB offers a product portfolio of highly developed electrical products and associated services tailored for subsea production application.

Produced and backed by ABB
ABB subsea solutions are based on our standard frequency converters and special designed transformers, adapted to meet the stringent requirements of topside or subsea installation. All ABB subsea equipment is backed by the resources of our global product support organization as well as our dedicated subsea electrification specialists.

Innovative subsea solutions
ABB is an innovator in subsea electrical solutions and has been involved in the development of subsea electrical equipment for many years. Feasibility studies on subsea components began in 1984 and the first commercial subsea transformer was delivered in 1998. Since then, ABB has delivered variable speed drive systems and transformers to some of the largest and most advanced offshore developments in the world.

A highly qualified supply partner
With long experience and in-depth expertise, ABB is a valuable resource to our customers. We offer solutions ranging from straightforward equipment supply to full project management of the total subsea electrification network - from fixed or floating production units to subsea pipelines, wellheads or even downhole. With each ABB delivery, our customers gain a highly qualified service and support partner to ensure that our products perform to our customers expectations throughout the lifecycle of the field.

ABB works continuously to develop new solutions that will allow for subsea operations in deeper waters and at further distances from land or topside facilities that ever before.

1 System design studies 2 Simulations & analysis 3 Package solutions
Topside systems

For subsea applications
For subsea electrical consumption applications, ABB provides topside variable speed drives and transformers designed to extend step-out distances and reduce subsea cabling. Well proven ABB topside electrification systems ensure reliable, efficient power supply to subsea power customers and provide substantial cost savings by reducing subsea component and cabling requirements.

Topside variable speed drives
Based on the market leading ABB ACS800/1000/5000 AC drive series, topside drive systems are air or liquid-cooled and feature high robustness in a compact size. Depending on load characteristics, the topside drive systems provides a step-out distance of up to 47 kilometers. All components are tested, qualified and meet international standards and marine classifications requirements. Typical selection of frequency converters includes:
- ACS800 LV drive for load up to 2 MVA with 14 km reach-out distance, 11 kV transmission voltage.
- ACS1000 MV drive for 2-4 MVA load, 31 km reach-out distance, 25 kV transmission voltage.
- ACS8000 MV drive for 8 MVA load, 47 km reach-out distance, 36-52 kV transmission voltage.

Topside transformer
The input transformer can be for 6, 12 or 24 pulse converter input. The step-up transformer is tuned for optimal voltage in the umbilical. The special developed topside transformer from ABB is combining input and step-up transformer into one single tank. It is of a high temperature design. This gives a significant reduction of weight and volume compared to ordinary transformer solutions. It can be delivered with an integrated earth fault monitoring system for the umbilical. The transformer can be delivered with Ex certificate.

Top side frequency converters
ABB ACS800 LV drives are used for projects with moderate power demands, and ABB ACS1000/5000 MV drives are used in projects, requiring higher power.

Project profile: Nakika, Gulf of Mexico
Facts:
- Field operator: shell
- Application: ready intervention / flowline heating
- Field: Nakika
ABB supply:
- Electrical System with variable voltage output 900 – 11000 V
- Retrievable subsea transformer
- LV and MV switchgears
- Load balancing system
- Control system and operator station
- Design calculations

1 Project profile: Topside electrical system, Nakika, Gulf of Mexico | 2 Location map | 3 Topside frequency converters

Subsea electrification solutions
Subsea transformers

More power where you need it most
Subsea transformers from ABB are engineered to provide great performance and cost benefits for offshore developments that have subsea rotating equipment located at long distances from the power supply point. For subsea installations where increased voltage is required, ABB subsea transformers provide all the power needed in a safe reliable manner.

Subsea transformers
The ABB subsea transformer is a liquid-filled, pressure compensated unit suitable for power supply operations in deepwater fields. The pressure compensating systems keeps the internal pressure close to the outside water pressure by immersing all insulation with liquids and eliminating all air and gas-filled vaults. Cooling is provided inherently through natural convection. The unit can be delivered with a single or double shell and has been qualified for depths to 2500 meters.

Subsea transformers from ABB are used with subsea boosters, pumps compressors, pipeline heating systems, electrical distribution systems, frequency converters and wave hubs.

Project profile: Subsea transformer, Ceiba, West Africa
Facts:
- Field operator: Amerada hess
- Application: Subsea multiphase booster pumps
- Step-out distance: 7.5 – 9 km
- Host platform: FPSO sendje berge
ABB supply:
- Topside VSD system
- Step-down transformer
- Water-cooled ACS600
- Water cooled sine filter
- Step-up transformer for 10.5 kV
- Subsea transformer 10/1.0 kV
- LV and MV switchgears
- Auxiliary transformer
- Load shedding system

Typical configuration - Topside to subsea

Topside step-down three-winding transformer
Frequency converter
Topside step-up transformer
Bundled subsea power cable
Subsea power cable termination head
HV wet mateable connector
Subsea step-down transformers
Pump motor wet mateable connector
AC electric pump motor

4 Project profile: Subsea transformer, Ceiba, West Africa | 5 Location map
Design studies

For subsea electrical systems
Topside drive systems with long subsea cable runs are complex and
difficult to design. ABB has extensive knowledge and experience
with subsea electrical power systems and has conducted studies
and design of subsea cable runs up to 47 km. With electrical
system design studies from ABB, offshore operators can be
assured that the total subsea electrical system, power network and
all components are properly engineered and dimensioned for
optimal short and long-term performance.

ABB subsea electrical specialists have thorough understanding of
the power requirements for subsea applications such as boosting
and separation, and add high-value expertise to both system and
application engineering. Analyzing the system usage under both
steady state and dynamic conditions provides great risk reduction
with regards to dimensioning of the equipment.

Through advance steady state dynamic calculations, ABB design
studies determine:

Steady state calculations
- Fundamental load flow of each system component.
- Voltage drop within the system in steady state for a defined load
  condition
- System impedance curve
- Transfer function of motor voltage/converter voltage
- Flux correction factor

Start-up calculations
- Calculate boost factor motor, subsea transformer and step-up
  transformer for defined breakaway torque
- Verify start current
- Verify that the specified breakaway torque is achieved during
  start-up

Calculations result
- Voltages and currents at different points in the system
- Harmonic analysis of voltages at different points in the system
- Transformer flux at start-up

Project profile: System design studies,
Tyrihans / Norwegian sea
Facts:
- Field operator: StatoilHydro.
- Application: Subsea Raw Sea / Water injection.
- Tie-in distance: 31 km.
- Host platform: Kristin
ABB supply:
- Combined topside transformers.
- Subsea transformers.
- ACS1000 topside frequency converter.
- Application control software.
- Systems studies:
  - Design basis for study
  - Time domain simulations
  - Breakaway torque calculations
  - Load flow calculations
  - Fault analysis
  - THD calculations

1 Project profile, Tyrihans, Norwegian Sea. System design studies
2 Location map

North Sea

Norway

Sweden
Effective tools – deep expertise
Subsea electrical applications with long step-out distances are susceptible to problems such as harmonic distortion and voltage drops, which can result in inadequate performance or even failure of the electrical equipment. To minimize these risks, ABB provides advanced modeling and simulation of the complete subsea electrical system and all components.

Dynamic simulation of subsea electrification systems identifies and simulates conditions that may have an adverse effect on the performance of the equipment, and determines the most efficient way to counteract these situations before they occur. By increasing system performance and availability under all conditions, simulation and analysis of the subsea electrical system can contribute significantly to more stable operations and increased production.

Unique simulations from ABB include the switching pattern in the model, which allows for optimization of the converter control software for the complete system. Dynamic simulations confirm the steady state calculations, as well as:

**Dynamic solution**
- Verify that the specified breakaway torque is achieved during start-up
- Voltage stresses at the various points in the system (peak voltage values)
- Dynamic performance with respect to voltage drops and variations

---

1 Project profile: Asgard minimum flow project – “Subsea gas compression” ABB is proud to be a part of the world’s first full-scale subsea compression test at StatoilHydro’s Kårstø Laboratory (K-lab) at the Kårstø gas processing plant in western Norway. For the asgard minimum flow project, ABB has submitted subsea electrical equipment for full scale testing, analysis and qualification for a subsea compression application to boost gas production from the Midgard and Mikkel area. Project parameters include a tie-in distance of 47 km, an 8 MVA compressor and 200 Hz motor.