Shell form transformers
Welcome to ABBs factory in Drammen (Norway)
Shell form manufacturing
The factory in Drammen
Our HSE efforts are compliant with ABB’s HSE management system.

For all ABB employees we provide:
- HSE training
- HSE handbook
- Personal protective equipment
- Trousers, jacket, helmet, hardtoe shoes, safety harness
- Annual training in Norwegian regulations regarding safety of electrical systems including ABB’s 7 steps course for all site workers
- Annual first-aid training for all site workers

- ID-cards for all site workers according to Norwegian regulations
- Medical examinations
- Risk analysis of processes and site activities
- Safe job analysis
- System for reporting of near misses (RNM/RUH)
ABBs Shell form transformers
Why choose a solution from ABB?

**HSE**
ABB is dedicated to HSE in all levels of the organization, both in the factory and at site. We are approved by the international standards ISO 14001, OHSAS 18001, ISO 9001.

**Finance**
ABB in Norway has yearly revenues of more than 1.1 BEUR, giving a financial security for project execution and security for the warranty period.

**Operational life**
ABB in Drammen use the best quality material available, and the processes like the drying of the active part in the vapor phase system ensures maximum operational life during tough conditions.

**Strong reference list**
- ABB in Norway has delivered more than 500 units with the Shell form design, most of them still in operation
- The largest Shell form furnace transformers for industrial purpose are delivered by ABB in Drammen
- Customers are frequently coming back to ABB based on the positive operational history of the previous deliveries

**Project execution at site**
ABB in Drammen has approximately 150 site projects per year. Long experience in performing and planning of projects with focus on short delivery execution time within power industry, utilities, power plant HVDC converter stations etc.
**ABBs Shell form transformers**
The number one choice for reliable operation

**What makes a Shell form transformer from ABB different?**
Transformers suited for furnace operation are more frequently exposed to secondary short circuits than normal power transformers. It is therefore extremely important that the transformer can withstand the mechanical stresses caused by a short circuit without any movement of the coils.

The Shell form technology from ABB has been continuously developed and improved during the last 60 years making it a favourite for many customer seeking reliable transformer operation in furnace operation.

ABB in Drammen is the Center of Excellence within ABB for these transformers utilizing the competence and inheritance from Richard Pfeiffer, National Industri, EB National Transformer and lately ABB.

ABB in Drammen has technical resources, experienced supervisors/operators and a factory layout securing the manufacturing of a high quality transformer with long and trouble free operational life.

ABB always use quality suppliers for material and never compromise on critical parts like tap-changer and transformer coolers.
ABBs Shell form transformers
Key strengths and benefits

Special demands. Furnace transformers
- High secondary current
- Low short circuit impedance
- Reasonable overload capability
- High short circuit strength and mechanical stability
- Large secondary voltage regulating range with many steps
- Particular ability to withstand switching over-voltage

Design features. Shell form transformers
The design features a rectangular shaped coil system made up of a series of inter connected pancake coils. The core is positioned horizontally around the outside of the winding and acts as a protective “shell” around the coil.

The cold oil from the coolers is forced and directed through the windings securing excellent cooling of the windings. The Shell form insulation system consists of high dielectric strength pressboard sheets and precisely located oil spaces designed to control voltage stress concentration.
ABBs Shell form transformers
Key strengths and benefits

Core and coil design
The magnetic core is of rectangular shape protecting the windings as a “shell” given the design the Shell form name. The leakage flux from the windings is absorbed in the core, eliminating typical local heating problems. The core clamp system is designed in a rigid way, with sufficient strength to resist any movement during short circuit.

The coils in a Shell form transformer are large area pancake coils. This geometry will create high capacitance between the coils and a low capacitance to ground, giving a linear voltage distribution across the winding.

Impedance and short circuit forces
The windings are divided in several parallel groups. Each group represent a complete amperturn balance, leading to reduced leakage flux and impedance. As the transformers get larger, more groups are added. This controls the magnitude of the total force since the forces in successive groups in a Shell form transformer acts in opposite direction and tends to cancel each other out.
ABBs Shell form transformers
Key strengths and benefits

The Shell form design offers a combination of controlled maximum stress and high mechanical strength to withstand the forces produced by heavy operational challenges.

Efficient cooling capability
In Shell form transformers, the oil is directed from the coolers and guided into the windings. Channels for the oil are obtained by spacer blocks on the winding insulation washers, securing uniform cooling of the windings. Oil flow, on both sides of the core, adequately cools this area.

This efficient cooling arrangement allows for a lower hot spot temperature compared to a core form design, adding longer life to the insulation system and providing greater ability to handle short term overloading.

Current distribution
Symmetrical winding arrangement assures an even current distribution between the low voltage groups. Splitting the windings in many parallel groups, connected right outside, makes it easier to control the current distribution all the way to the furnace.
ABBs Shell form transformers
Key strengths and benefits

Large regulating range
It is easy to lead out taps from any high voltage winding, due to the interleaved arrangement of the coils. The tappings may be connected to the coils giving the required secondary voltage and step voltage. Unequal step voltage is an option as well.

Compact size
ABBs Shell form design provides a robust transformer with a compact footprint. In situations where an existing shell form transformer should be replaced with a new one, the new shell form transformer can easily fit the existing foundation, reducing costs related to installation.
What puts the transformer at risk?
Even though the Shell form transformers are designed to withstand extreme service conditions, failures may occur. Given the high degree of loading, the insulation material will deteriorate during years in service and may eventually lead to failure. Factors speeding up this process will be the operational temperature, moisture content in insulation, acidic component, sludge etc. formed by the chemical ageing process.

Installed base knowledge
All the design information from previous deliveries from Richard Pfeiffer, National Industri, EB National Transformer and subsequencely ABB is neatly stored in ABBs archive. There is an excellent knowledge, in terms of both design and manufacturing of these unique units.

Repair and uprating
In many cases, there will be a possibility to repair a failed unit in a good and economical way. Repair and refurbishment is utilization of non damaged material. ABB will only change the failed parts. By changing the paper insulated high voltage windings and refurbish of the major transformer components, the transformer will be given additional 10-20 years of operational life.
Design studies can reveal the possibility of obtaining a higher rating, within the same footprint (tank dimensions). New, high temperature resistant insulation materials can be offered upon request. After the repair, a FAT test will secure the quality. Reuse of material such as steel, oil and copper is all contributing to a better global environment. In addition, the best part is that there will be economical benefits as well, without compromising the quality.

**Identical replacement/spare units**

ABB in Drammen is in position to make spare units 100% identical to original units, both in terms of size and functionality. This means less rework at site, and the reassurance of a well-known and proven design. Since the design and specification is already available, the solution will give a quick turnaround compared to a new designed unit.

**Spare parts**

All necessary spare parts can be supplied for the units delivered historically from Norway. Many parts are on stock in the factory.
ABBs Shell form transformers
Upgrade for safe operation (reference)

**Customer need**
- Spare unit for 3 pcs 100 MVA shell form transformers delivered from Norway in 1996 and still in service
- Identical footprint and electrical parameters
- 10% increased rating

**ABB solution**
- Design study, new design established (110 MVA) utilizing new technology
- Tailor-made core and winding design meeting the new requirements

**Value for customer**
- Reduced risk by having a spare unit available
- Smooth and quick replacement of spare transformer with no modification on system interphase
- Reduced risk of loss of production in case of failure
- Proven and well known transformer technology
- 6 months project execution time
ABBs Shell form transformers
Why choose a solution from ABB?

Service
In terms of service and emergency needs, ABB in Drammen has a well developed process for handling emergency requests with short response time.

The Shell Form Technology
ABB in Drammen has continuously developed and maintained the design originally developed by Richard feiffer/National Industri/EB National Transformer and ABB Kraft. The design is in particular improved in terms of improved electrical stress withstandment imposed in service.

Responsibility
ABB is a solution provider including design, manufacturing, testing, transportation, installation and commissioning. ABB can assist in environmental friendly disposals of obsolete transformers.

ABB internationally
ABB is today the global leader in transformer manufacturing, and ABB in Drammen has access to a huge network of competence and experience when needed.

ABB - Quality in every step!
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Contact Center offers you a single point of contact for all your inquiries to ABB. Your inquiries will be routed to correct person or registered for further follow-up.

Customers with a service agreement may contact our dedicated Service Desk on a separate number.