

ABB Transformers

Power Transformers - The largest installed base worldwide



ABB

ABB Transformers. Unified power for your success.

Customized solution by dedicated people in focused factories.

Large Power Transformers

Most of the transformers supplied to the market by ABB use Core Type Technology. They are mostly used in customer applications as generator step up and system intertie power transformers.

Large Power Transformers are defined within ABB as units with a three phase power rating higher than 200 MVA or with voltage ratings higher than 275 kV. ABB supplies three phase units up to 1100 MVA and single phase units up to 500 MVA. Power transformers for system voltages up to and including 800 kV have been delivered to the market since the 1970's.

HVDC Converter Transformers

The HVDC converter transformer is a key component in an HVDC transmission system. In addition to its normal application to provide transfer of power between two voltage levels, it serves a number of additional functions like galvanic separation between the AC and DC systems. A fairly large tapping range permits optimum operation also for a large variation in load without loss of efficiency.

Polytransformer

ABB has developed a new product in the transformer world, The Polytransformer. This transformer is designed with multiple voltage ratings on the HV, the LV and tertiary side that allow it to work in substations and power plants at different voltages.

Impedances and MVA ratings are chosen to cover most of the applications.

Single phase and three phases units are available.

Its compactness and flexibility of use make the Polytransformer the ideal universal transformer for any transmission and generation system.

Transformer Services





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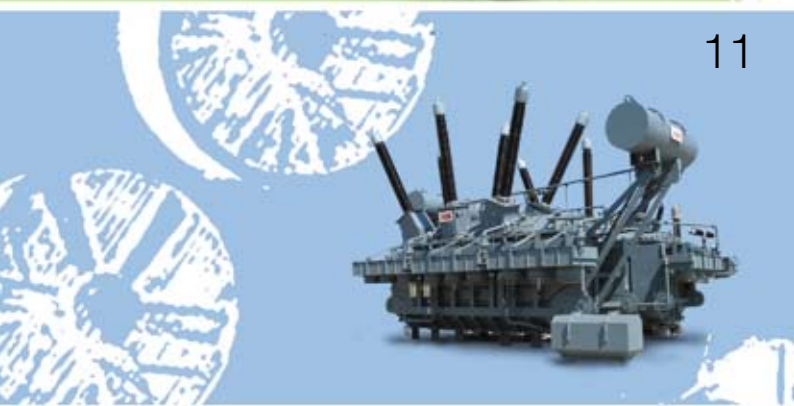
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ABB TrafoStar™

The worldwide concept for core type power transformers

Shunt Reactors

Shunt reactors are a vital part of the efficient operation of long transmission or AC cable high voltage power lines. The shunt reactor compensates the capacitive generation on power lines to avoid non-controlled voltage rise especially on lightly loaded lines. The proven design and robust build-up makes the shunt reactor the most cost efficient mean to absorb the capacitive generation.



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Phase-Shifting Transformers

Phase-shifting transformers help control the real power flow in transmission lines and systems interties. Existing transmission systems are often operated and stressed to the limit of the performance capability of their original design in order to maximize asset utilization. To ensure that under these conditions the economical, reliable and secure operation of the grid is maintained, the need for various aspects of power flow management within the power systems is becoming evident. Phase-shifting transformers help control the real power flow in transmission lines and systems interties. They allow for better utilization of existing networks concerning load growths.



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Shell Type Transformers

With Shell Type, ABB uses a completely proven technology concept for manufacturing power transformers covering voltages up to 525 kV.

Shell technology is implemented in ABB Power Technology. It means simple, robust and reliable construction.

All processes and quality are supervised by a 6-Sigma system. Shell Type transformers have the natural ability to withstand short-circuit and transport stresses, and exceptional compactness. Design flexibility allows us to match existing units both mechanically and electrically and supply universal transformer spares with multi-rated high and low voltage ratio for different power stations.



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ABB Transformers

the solution for a cleaner future

Customized solution by dedicated people in focused factories.



Experience

ABB is the leader in power transformers and the largest transformer manufacturer worldwide. ABB offers a complete range of power and distribution transformers, associated products and services.

When you buy an ABB transformer, you get more than just a piece of metal. You buy a combined experience of 700 years of transformer manufacturing.

ABB provides the most extensive short circuit test record on power transformers.

Reliable delivery partners

We are committed to being a flexible and knowledgeable partner for you – worldwide. Our technology, coupled with a highest integrity sales force, result in an unbeatable combination. Together with the customer, we analyze individual needs and help to ensure that the customer will receive the optimal transformer and the best quality – on time!

One global factory

Wherever your transformer has been produced, you can expect the highest quality.

Our global manufacturing capabilities and our back up factory strategy enable us to offer you the most suitable solution – in terms of factory, on-time delivery and product.

Our focused factory concept enables us to source our products from highly specialized factories - increasing operating efficiencies and achieving worldwide excellence.

Due to our global presence we are an experienced partner across the globe – being a local customer interface, talking the customer's language and providing local service.



Quality

The right quality – right from the start – is our ultimate goal. Quality is a vital element of the product and can never be achieved by checks and control alone. Built-in quality procedures are implemented even before design work begins – ensuring correct interpretation of customer requirements.

ABB has a common global design and manufacturing concept in place. The ABB TrafoStar™ concept is based on core type technology and is the common ABB concept for the design and manufacture of power transformers – covering voltages from 72.5 up to 800 kV. ABB TrafoStar™ is implemented in our power transformers factories worldwide. It is a modular system with common design rules supported by 6-Sigma quality system. It guarantees uniform quality, high reliability and low maintenance requirements.

R&D

The ABB transformer team has direct access to all the combined transformer, technical experience and expertise within the ABB Group. The ABB transformers R&D supports customers in solving their present and future challenges.

ABB Transformers R&D supports our customers in solving their present and future challenges. Questions concerning critical factors such as return on investments, reduced operation, maintenance costs, and the management of aging assets need answers. We have the solutions through our backup network with compact substations, power flow control, on-line monitoring, the replacement of mineral oils and smart equipment with built-in intelligence.

One major R&D initiative is the support of high quality conventional oil insulated power transformers: TrafoStar™. Our development is directed towards providing efficient low loss, low sound transformers with low life cycle costs. Our expert teams are active in all areas starting from low life cycle costs to new transformer concepts. One company with all around solutions.

ABB TrafoStar™

The worldwide concept for ABB Core Type Power Transformers



1. A proven concept

TrafoStar™ transformers are the product of a modularized system in both design and manufacturing. It is based on the best ABB practices.

2. Robust design features

One of the main features of TrafoStar is the robust design confirmed by a rigid clamping of core and windings, well established insulation system, leak proof gasketing system and longlasting surface protection.

3. Test records demonstrate continuous quality improvements

Worldclass test laboratories in all ABB factories as well as 6-Sigma quality process ensuring a high quality supply as well as a continuous improvement of quality is guranteed.

4. First-class suppliers

Key components for total ABB transformer solutions are built within ABB, like bushings, tap changers and insulation material.

5. Outstanding short-circuit strength test record

No other manufacturer has performed as many independent short-circuit tests as ABB.

6. Reduced lead times, with ABB quality guaranteed

Thanks to modularized design, manufacturing and assembly, first class sub-suppliers and 6-Sigma quality control ABB succeeds in meeting its delivery commitment.

7. Low life-cycle costs

Efficiency, high quality insulation and controlled hot spots, are the key elements contributing to TrafoStar™'s high availability.

8. A life time of trouble-free operation

ABB's full-service, monitoring and diagnostic contracts are an important part of the TrafoStar™ trouble-free concept.

9. ABB has the resources to develop even more efficient solutions

As the world leader in transmission technology, ABB spends more than any other competitor on R&D.

10. Built-in systems know-how

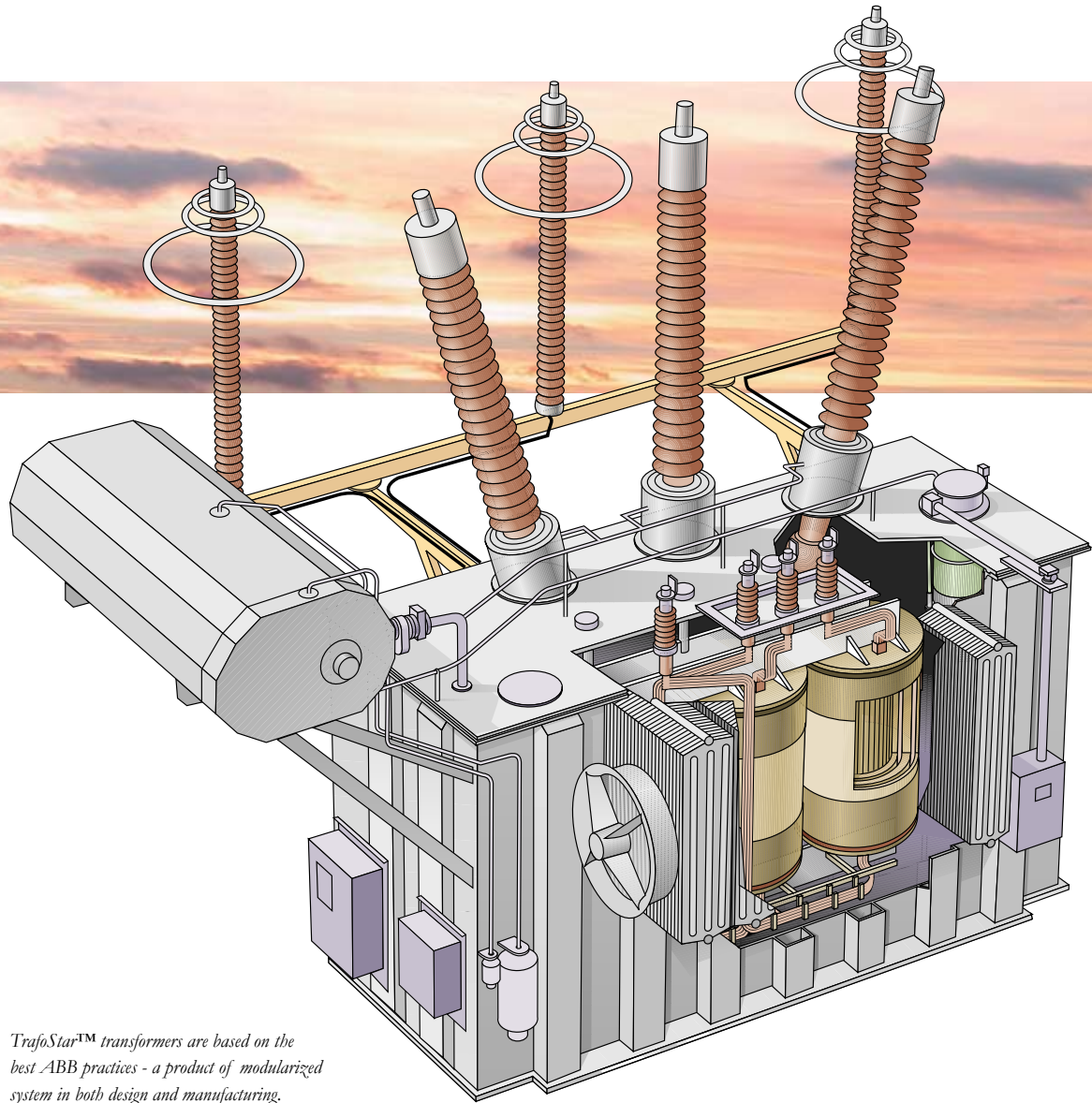
ABB has more than 100 years of experience in transmission and distribution technology.

11. Creative financing solutions

ABB has its own financing organization that acts as an advisor and organizer for financial transactions on cross-border leasing agreements.

12. The same transformer available from state-of-the-art plants worldwide

With over 1.3 Million MVA in power transformers delivered over the past 10 years from its worldwide production plants, ABB is the by far market leader in consistency and quality.



TrafoStar™ transformers are based on the best ABB practices - a product of modularized system in both design and manufacturing.

Large Power Transformers



Applications

Generator Step Up transformers.

GSU transformers are electrically “gearing up” the voltage from a power generator to a suitable higher voltage for the transmission of power.

System intertie transformers.

System intertie transformers connect transmission systems with different voltages. Some transformers have fixed rating and other units are equipped with tap changers for voltage regulation.

Duty

Normally a GSU carries full current load when energized. For large power transformers, the current on the low voltage side has a magnitude of several of tens of kilo amperes whereas a system intertie transformer has variable load very seldom reaching rated load. Of course the design is made for a continuous maximum load.

Design

The TrafoStar™ technology concept is used in all ABB factories all over the world manufacturing large power transformers. Our worldwide presence has led to global design criteria based on best practices within ABB. This means optimal material utilization, world class production facilities and trouble-free transformer operation for the customer.

Design GSU

- LV winding arrangements: Due to high current levels the winding is designed with effective current compensation.
- HV winding arrangements: Due to high voltage levels the winding is electrically stabilized to minimize electrical stresses.

- High current housing: When very high LV currents are present the delta connection is made outside the tank to avoid risks for high temperatures in the tank.
- Magnetic shielding: Due to high electromagnetic flux different types of magnetic shielding measures are made on active part and tank walls to avoid temperature hot spots.

Design system intertie transformers

- Different types: The transformer can be either double wound with separate high and low voltage windings or auto connected where a common winding is used for both the low- and high voltage. With the latter arrangement less material is needed to build the transformer. An autotransformer requires a common neutral point for the high and low voltage power systems whereas a double wound transformer can have separate neutral point systems for the different voltage systems.
- Location of the voltage regulation: When needed the regulated winding in an autotransformer could be located at three different places:
 - 1: In the series winding (HV winding) for HV regulation.
 - 2: In the LV line terminal for LV regulation.
 - 3: In the neutral of the common winding (LV winding) for either HV or LV regulation.
- Tertiary voltage: The transformer can be equipped with a tertiary winding that can be loaded or just acting as a stabilizing winding.

Technical features

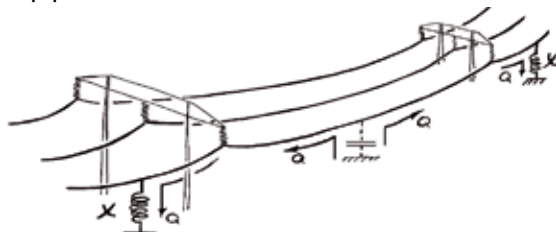
Unit ratings, three phase	up to 1100 MVA
Unit ratings, single phase	up to 500 MVA*
System voltages	up to 800 kV*

*ABB has built a single phase unit rated 1700 kV and 333 MVA.

Shunt Reactors



Applications

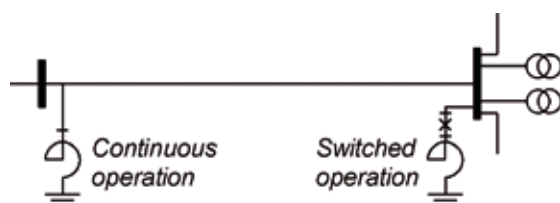


The reactors (X) consume the generated reactive power (Q) from the line.

The shunt reactor is the most cost efficient piece of equipment to compensate the capacitive charging of high voltage AC-lines and cables, thus keeping the voltage stability on the transmission line. The reactor is a static device often with direct connection to a high voltage line, the primary generator of reactive power. The possibility to build for the highest transmission voltages makes the reactor the most efficient way to compensate reactive power in terms of losses and cost of installation. There is no need for an intermediate transformer, which increases losses and ties the reactor to a transformer substation. The reactor can be installed in a suitable location in terms of system configuration.

Duty

Depending on system requirements the reactor can be connected for continuous operation or switched in and out based on the reactive power balance in the system.



The reactor can operate in continuous or switched mode depending on system requirements.

Design

The ABB reactor is based on the gapped core type concept. This is a concept for low environmental impact in terms of losses, sound and vibrations. Design similarities with large power transformers permit an efficient use of long time experience in building large transformers for instance in the area of insulation build up, handling in production and so on.



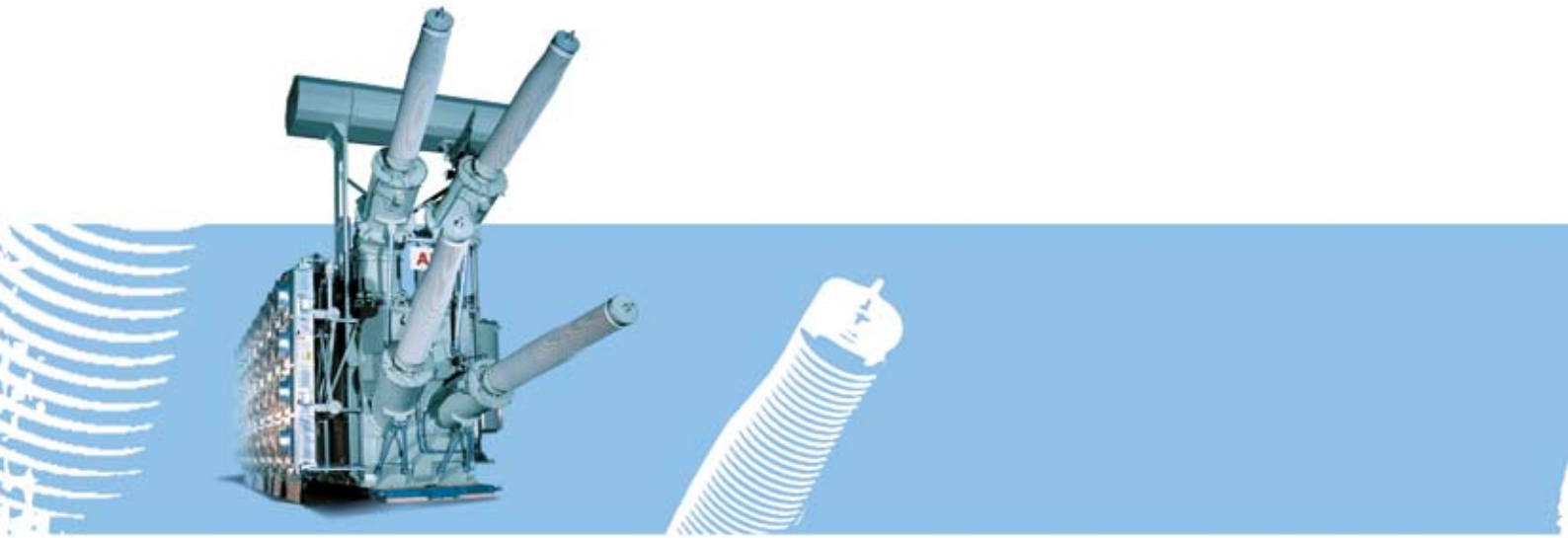
150 Mvar, 400 kV, 3-phase Shunt Reactor for the Swedish power transmission network.

Shunt reactors for system voltages up to and including 500 kV can also be equipped with load tap changer to regulate the reactive power from the reactor. The possible regulating range is approximate from 50 to 100 % of the maximum rated power of the reactor.

Technical features

Unit ratings, three phase	up to 250 Mvar
Unit ratings, single phase	up to 130 Mvar
System voltages	up to 800 kV

HVDC Converter Transformers



Applications

ABB supplied the converter transformers to the world's first commercial HVDC (High Voltage Direct Current) transmission, commissioned in the mid 1950's. Since that time ABB has built up the competence and experience to design and manufacture transformers for any voltage and power application. In early 1980's, ABB delivered the 600 kV HVDC transmission in Brazil and recently ABB has manufactured the largest converter transformer ever built with a unit rating of 621 MVA.

In an HVDC system the converter transformer serves several functions. Its primary functions are:

- Supply of AC voltages in two separate circuits with a relative phase shift of 30 electrical degrees for reduction of low order harmonics, especially 5th and 7th harmonics.
- Act as a galvanic barrier between the AC and DC systems to prevent the DC potential to enter the AC system.
- Reactive impedance in the AC supply to reduce short circuit currents and to control the rate of rise in the converter valve current during commutation.
- Voltage transformation between the AC supply and the HVDC system.
- A fairly large tapping range with small steps to permit optimum operation also for a large variation in load without loss of efficiency.

Duty

Due to its connection to the HVDC system the converter transformer is subjected to a high DC voltage level and harmonics in the loading current, which is normally not the case for a large power transformer for other conventional AC application. The DC voltage affects the design of the total insulation system in the transformer. The harmonics contribute to extra load losses that have to be considered.

Design

With an experience of more than fifty years ABB has gained a very good technical and manufacturing knowledge to build these transformers. During the years ABB has delivered more than 300 units to the market with all types of designs regarding single as well as three phase transformers needed to adapt to the HVDC Converter valves.

ABB has delivered units designed for 50 up to 600 kV DC voltage stresses. For the future ABB has the ambition to design transformers for even higher DC voltages.

To make all this possible ABB has all the technical expertise and design tools to fulfill the needs of reliable converter transformers on the HVDC market today and for the future.



The world's largest HVDC transformers are installed at Sylmar East converter station, U.S.A. 620 MVA, 230 kV, single phase.

Phase-shifting Transformers



Applications

Existing transmission systems are often operated and stressed to the limit of their performance capability of their original design in order to maximize asset utilization. To ensure that under these conditions the economical, reliable and secure operation of the grid is maintained, the need for various aspects of power flow management within the power systems is becoming evident.

Phase-shifting transformers help control the real power flow in transmission lines and systems inerties. Main benefits of phase-shifting transformers include the protection of lines and transformers from thermal overload and an improvement of transmission system stability. They allow to control the power flow between different networks, for parallel long distance overhead-lines or for parallel cables. In addition, a phase-shifting transformer is very often the most economic approach to power flow management.



Phaseshifter Activepart, 450 MVA, 138 kV, shift angle 50 degree.

Duty

Phase-shifting transformers (PST) are used to control the flow of real power in transmission lines by manipulating the phase angle difference. The phase angle shift is obtained by combining the voltages from different phases in the PST. Phase-shifting transformers, when combined with standard capacitors and reactors, can even provide control of reactive power and fault current limitation. The solution then becomes an ABB-patented Interphase Power Controller (IPC).

Design

Remove transmission bottlenecks

The natural impedances and phase angle differences in a network often lead to unequal utilization of parallel lines. Phase-shifting transformers redirect the power flow. Existing lines can thus be exploited closer to their thermal limits.

Short pay-back times

Transmission bottlenecks and unscheduled power surges prevent power companies from delivering at full capacity. Companies who invest in removing these bottlenecks and in protecting transmission lines against power surges often see their investments paid back in just two or three years.

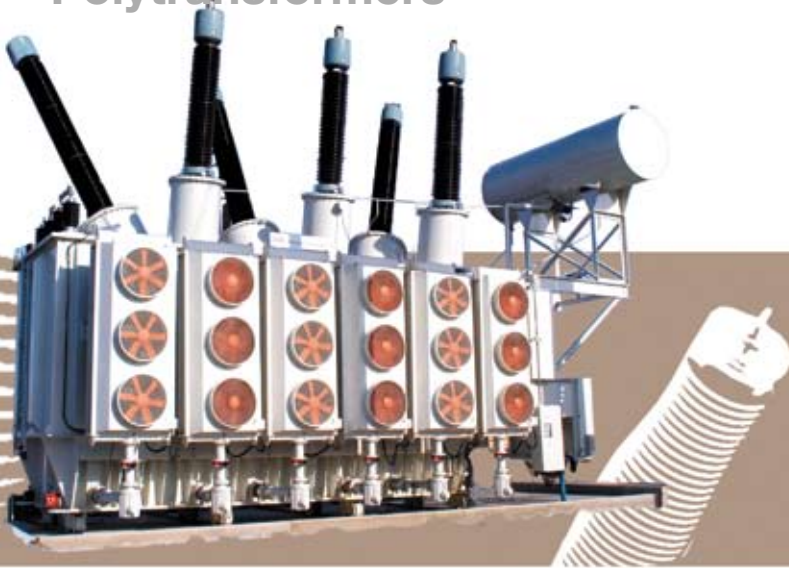
One stop solution competence

PSTs and IPCs are designed to meet the specific needs of your application. Minimum and maximum impedance, phase angle regulation range, transportation and installation restrictions are taken into account. We offer assistance in identifying and specifying the best power flow solution, as well as guidance in protection and control of PSTs and IPCs in close cooperation with our ABB partners. We can offer you a turnkey solution from the initial study to the commissioning of the equipment.

Technical Features

System voltages	up to 420 kV
Through-put rating	up to 1630 MVA
Shifting angle	70 degrees

Polytransformers



Applications

A polytransformer's main application is universal spare. It is a compact, multifunctional power transformer that helps utilities to secure the transmission grid at minimal asset investment. It has multiple voltage ratings for high, low and tertiary voltages.

Its unique flexibility enables customers to use a single transformer for a variety of voltage ratings and as a solution to a broad spectrum of requirements. It can be moved from one substation to another according to need - in an emergency if a power transformer fails, to boost supply during peak periods, as a temporary replacement for unreliable equipment, and as a source of income for renting or leasing to other companies.



Spare Polytransformer in parallel operation with a 450 MVA unit, 400 kV.

Duty

The Polytransformer is conceived for high voltage transmission grids with a variety of voltage ratings.

Design

Designed with internal taps, the Polytransformer can be connected to a variety of ratings – for instance, 400 kV to 230 kV, 400 kV to 138 kV, 400 kV to 115 kV, 230 kV to 138 kV, 230 kV to 115 kV, and with 33 kV, 26.4 kV and 24 kV in the tertiary system. The voltage rating is selected by changing connections internally prior to moving the transformer to a new location.

Short circuit impedance is designed taking into consideration the impedances of existing transformer fleet. Parallel connectivity with other units is achieved by setting the appropriate tap in the on load tap changer.

Technical Features

Maximum Power Rating limited only by transportation restrictions.

Voltages: Up to 550 kV. Multiple voltages in high, low and tertiary.

Transformer Type: Shell Form

Minimum installation dimensions to optimize substation space requirements.



Compact Polytransformer ready for shipment.

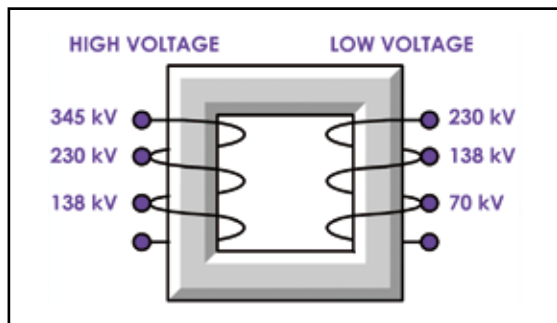
Shell Type Transformers



Applications

The characteristics of the ABB Shell Type Transformer become relevant in the upper range of large power GSU and Substation Transformers. Within this range, the optimal applications are:

- When there is a need of a Power Transformer with multiple high and low voltages (Universal GSUs or Polytransformer).



Multiple voltages in high, low and tertiary can be achieved with ABB Shell Polytransformers and Universal GSUs.

- For the replacement of existing Shell Form Transformers.
- When keeping the same impedance, or special impedance required.
 - a. Matching odd impedances of existing transformer for parallel installation.
 - b. Low impedances (<10%) High to Low.
 - c. High impedances to tertiary winding (>25%).
- When you have dimensional limitations in transportation or hauling, i.e. need to match hauling size in a substation.



ABB Shell Transformers can be transported and installed laid down.

Design

The active part configuration, with the magnetic core enclosing the windings, provides robustness to short circuit and transportation efforts, and compactness of the design to match transportation and hauling restrictions.

Vertical coils with flexible arrangement high-low voltage provides excellent cooling performance, and a high serial / low ground capacitance, thus a uniform distribution of voltages along the turns.

The windings (high voltage, low voltage, tertiary) in ABB shell transformer can be fractioned in groups. This fact, together with the interleaving of these groups, allows a natural method to achieve a wide range of impedance values.

Technical Features

Maximum Power Rating: Up to 1100 MVA

Voltages: Up to 550 kV. Multiple voltages in high, low and tertiary can be achieved.

Transformer Services



The ABB transformer care program ensures that your transformers are operating at optimal performance. With our unique processes of investigation, detection, prevention, and damage limitation, ABB can ensure maximum utilization.

The Mature Transformer Management Program for fleet Assessment and the ABB Life Assessment program, which are the cornerstone of our full service program, delivers an objective insight to the health, fitness and life expectancy of the transformer. The result is that the right capital expenditure decisions can be made.

ABB's unique diagnostics tools are drawn from its global design library.

These tools provide an assessment of the health, fitness and life expectancy of the transformer, quantify the impact of changes in operating condition, and ensure the correct decisions regarding overloading.



ABB's full service package ensures complete customer support and service.

ABB offers a total service solutions Whether it is Field Service, Factory Repair or Advanced Engineering Analysis, ABB's service capabilities are unparalleled when it comes to transformers. From installation, repair to removal, ABB has the team, the equipment and the solutions to provide a total transformer care.

The right equipment, people, resources and solutions on site ensures that your transformer is functional on the date promised. ABB has the logistics experts and within 24 hours, one of our fully trained field service experts can be on-site working with you.

Let us work with you to establish a fully integrated program of diagnostics, prevention, and damage limitation to recovery for your transformer fleet.

- Diagnosis + Life Assessment
- Preventive Maintenance
- Refurbishment + Enhancement
- On site repair
- Transformer fleet management

ABB Transformers

the solution for a cleaner future



Environment

ABB is working globally as well as locally to ensure that environmental awareness moves from a sideline topic to a central theme.

ABB is continuously improving its product range towards cleaner standards that it shares with its customers. Technology along with expertise means progress towards a better future.

We are also the first power transformer manufacturer in the world to have an Environmental Product Declaration (EPD).

We have clear strategies and principles backed up by on site certified management systems.

These systems provide regular reports concerning environmental performance that form the basis for deriving concrete solutions. Our aim is to change today's ideas into reality.

We have a clear list of initiatives for the future. Total incorporation means that we regard ourselves as a catalyst for change. Product improvement, customer awareness, advanced solutions, and permanent on-line contact with our partners are the key to our future.

The health and safety of our employees, contractors, customers and others affected by our activities is a key priority for ABB. Our long-term goal is to have zero injuries in our factories worldwide. To achieve this goal, everyone must work together to prevent unsafe behaviours and conditions.

ABB Transformers: A never ending responsibility.



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