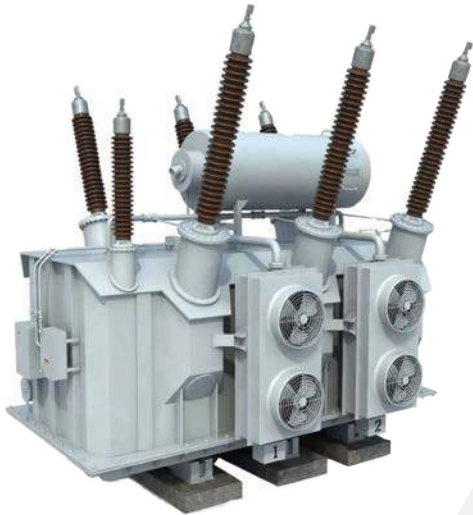


TRANSFORMERS

- Power Transformer
- Dry Type Transformer
- Distribution Transformer
 - * Hermetic Type
 - Distribution Transformer
 - * Distribution Transformer with Conservator Tank
- Box Type Transformer
- Furnace Transformer
- Marine Type Transformer
- Earthing Transformer
- Converter Transformer
- Reactors
 - * Shunt Reactor
 - * MCR (Magnetic Controlled Reactor)
- NER (Neutral Earthing Resistor)
- Auto Transformer

POWER TRANSFORMER



TECHNICAL DATA

Voltage Range: Up to 765kV

Power Range: Up to 1,250MVA

Core: Grain-oriented steel.

Windings: The windings are wound from aluminium or copper upon the customer's request.

Drying: The vapour phase drying & vacuum process is used for each winding and active part in order to ensure stabilization and drying.

Cooling:

- ONAN (Oil Natural and Air Natural Cooling)
- ONAF (Oil Natural and Air Forced Cooling)
- OFAF (Oil Forced and Air Forced Cooling)
- OFWF (Oil Forced and Water Forced Cooling)

Tank & Cover: The tank is made of steel plates which are blasted and protected from corrosion of various environmental conditions. (Heavy industrial, salty, tropical, etc.)

Product Standard: IEC 60076, DIN 42500-BS 50464

APPLICATION

- High Voltage Substations
- Medium Voltage Substations
- Hydro Power Plants
- Wind Parks
- Combined Cycle Power Plants
- Thermal Power Plants
- Solar Power Plants

ADVANTAGES

- Controlling and stabilizing the voltage transmission.
- It does not require any starting time.
- It is highly efficient with less capital investment and low maintenance.
- They provide isolation to the ground.
- There are no moving parts in Power Transformers.



DRY TYPE TRANSFORMER

TECHNICAL DATA

Voltage Range: Up to 72,5kV

Power Range: Up to 40MVA

Core: Magnetic cores are made from grain-oriented electrical steel. The core legs are bound with insulation tapes.

Windings: The Low-voltage winding is wound from copper sheets.

** LV Coils with the cast under vacuum are available upon customer request.

The high-voltage windings are wound from aluminium or copper.

Drying: The vapour phase drying & vacuum process is used for each winding and active part in order to ensure stabilization and drying.

Product Standard: IEC 60076-11, HD 464 S1, HD 538.1 S1
EN 60726, VDE 0532, ANSI C57.12.01

APPLICATION

- Chemical, Oil and Gas Industry
- Fire-risk Areas (e.g. forests)
- Indoor and Underground Substations
- Renewable Generation
- Generation Step-up Units (GSU)
- Transmission Substations
- Distribution Substations
- Industrial Plants
- Oil & Gas
- Chemicals & Petrochemicals
- Mining

ADVANTAGES

- High mechanical strength.
- Void free insulation.
- No temperature fluctuation.
- Easy maintenance.
- Less prone to fire hazard.



HERMETIC TYPE DISTRIBUTION TRANSFORMER



TECHNICAL DATA

Voltage Range: Up to 72,5kV

Power Range: Up to 20MVA

Core: Cold Rolled Grain-Oriented Silicon Steel

Windings: The windings may either be copper, aluminium upon the customer's request.

Drying: The active parts of transformers are dried under a high vacuum in a furnace. The process of drying varies according to the transformer type, power, and voltage. Oil is filled under a high vacuum.

Tank: Tanks and top covers for transformers are made of mild steel. Cooling surfaces of distribution transformers are constructed with corrugated walls and they also form the lateral surfaces of the tank. The bottom plate, sides, and frame are sealed by welding.

Product Standard: IEC 60354, DIN 42500-BS 50464

APPLICATION

- Generation Step-up Units (GSU)
- Oil & Gas
- Transmission Substations
- Distribution Substations
- Industrial Plants
- Mining
- Desalination Plants
- Cement
- Chemicals & Petrochemicals
- Rolling Mills

ADVANTAGES

- Long-lasting (It is closed from the atmosphere)
- Easy Maintenance
- Dimensionally reduced height as there is no expansion tank. This is an advantage in transformer centers where the height is a problem



DISTRIBUTION TRANSFORMER with CONSERVATOR TANK

TECHNICAL DATA

Voltage Range: Up to 72,5 kV

Power Range: Up to 20MVA

Core: Cold Rolled Grain-Oriented Silicon Steel

Windings: The windings may either be copper, aluminium upon the customer's request.

Drying: Achieved by admitting the outside air in the conservator through a desiccating device containing silica-gel crystals.

Tank: Equipped with an expansion tank or conservator mounted above the main tank.

Product Standard: IEC 60354, DIN 42500-BS 50464

APPLICATION

- Distribution Networks
- Private Properties
- Agriculture and Irrigation Areas
- GSM Base Stations
- Industrial Buildings

ADVANTAGES

- No pressure problem in overload
- Deformation in the metal will be less because there is no expansion
- A suitable structure for on-site maintenance or repair



BOX TYPE DISTRIBUTION TRANSFORMER

TECHNICAL DATA

- Voltage Range:** Up to 72,5kV
Power Range: Up to 20MVA
Core: Cold Rolled Grain-Oriented Silicon Steel
Windings: The windings may either be copper, aluminium upon the customer's request.
Drying: The active parts of transformers are dried under a high vacuum in a furnace. The process of drying varies according to the transformer type, power, and voltage. Oil is filled under a high vacuum.
Tank: Tanks and top covers for transformers are made of mild steel. Cooling surfaces of distribution transformers are constructed with corrugated walls and they also form the lateral surfaces of the tank. The bottom plate, sides, and frame are sealed by welding.
Product Standard: IEC 60354, DIN 42500-BS 50464
** It can be produced IP 23 Box type or with a fan according to customer demands.

APPLICATION

- Generation Step-up Units (GSU)
- Transmission Substations
- Distribution Substations
- Industrial Plants
- Chemicals & Petrochemicals
- Mining
- Desalination Plants
- Distribution Networks
- Private Properties

ADVANTAGES

- Due to the high pressure in control and protection of electrical transformer cabinets, no exposed live parts, safe and reliable. Excellent performance with energy saving type transformers, energy-saving effect.
- Because the transformer cooling surface state in the outdoor natural cooling, cooling conditions, it is generally box-type transformer capacity of up to 1600kVA and below.
- May be needed as a terminal substation substation or ring.
- Inadequate modular box-type substation
- Due to high voltage switches in transformer cabinets, and therefore no obvious break point and earthing switches. (Points, closing state is not intuitively obvious)
- Backup protection for high-voltage fuse in the transformer cabinets, the relative difficulty replacement fuse blows.



FURNACE TRANSFORMER



TECHNICAL DATA

Voltage Range: Up to 72,5kV

Power Range: Up to 150MVA

Core: Cold Rolled Grain-Oriented Silicon Steel

Windings: The windings may either be copper, aluminium upon the customer's request.

Cooling:

- OFWF (Oil Forced and Water Forced Cooling)
- ODWF (Oil Directed and Water Forced Cooling)
- ONAN (Oil Natural and Air Natural Cooling)
- ONAF (Oil Natural and Air Forced Cooling)

Product Standard: IEC 60076, IEC 61378-1, IEC 60146, IEC 60214, IEEE C57.12.00, IEEE C57.12.90, IEEE C57.18

APPLICATION

- Steel Furnace, Ladle Furnace & Ferro alloy Furnace

ADVANTAGES

- Cost
- Dimension
- Flexibility(Limitations due to current)
- Special tap changers for the furnace applications



MARINE TYPE TRANSFORMER



TECHNICAL DATA

Voltage Range: Up to 20kV

Power Range: Up to 20MVA

Core: Step-lap cores made of M5, M4, or M3 sheet metal whose magnetic circuit is arranged gradually are used. Core and coils are fixed with stainless steel studs against the mechanical stress of short circuits.

Windings: The conductive material is a strip or plate made of copper. Coils; it is wound in multi-layered cylindrical or overturned windings.

Cooling:

- ONAF (Oil Natural and Air Forced Cooling)
- ONAN(Oil Natural and Air Natural Cooling)

APPLICATION

For ships or ports:

- Lighting
- Urgent need
- Heating
- Rectifier
- Hospitals

Other application fields:

- Automation
- Communication
- Elevators and Cranes
- Neutral - sensitive machines with soil problems

ADVANTAGES

- Durable
- Long-lasting (Compare to other transformers for marine using)
- High Efficiency



EARTHING TRANSFORMER

TECHNICAL DATA

Voltage Range: Up to 36kV

Power Range: Up to 2MVA

Core: Cold Rolled Grain-Oriented Silicon Steel

Windings: The windings may either be copper or aluminium upon the customer's request.

Drying: The active parts of transformers are dried under a high vacuum in a furnace. The process of drying varies according to the transformer type, power, and voltage. Oil is filled under a high vacuum.

Tank: Tanks and top covers for transformers are made of mild steel. Cooling surfaces of distribution transformers are constructed with corrugated walls and they also form the lateral surfaces of the tank. The bottom plate, sides, and frame are sealed by welding.

Product Standard: IEC 60076, ISO 9001:2008, EN 50216-4, BS EN 10025:2004

APPLICATION

- Isolated System Ground
- Distribution Systems

ADVANTAGES

- The neutral potential of the system remains at or very close to the ground potential.
- They limit the magnitude of the transient over voltages that occur when an earth arc fault occurs for any reason.
- They form a source for fault current in phase-earth faults.
- They allow the connection of phase-neutral connected loads.
- They form a measuring point to measure fault currents.
- A grounding transformer also functions in case of an unbalanced load on the circuit.



CONVERTER TRANSFORMER

TECHNICAL DATA

Voltage Range: Up to 20kV

Power Range: Up to 10MVA

Core: The magnetic circuit is core-type with mitred joint. M5, MOH or M4 grain oriented, magnetic steel is commonly used.

Windings: The windings may either be copper, aluminium upon the customer's request. Low voltage windings are always fail windings in these transformer sizes. Fail windings are mechanically extremely strong, which is important in transformers for converter duty. An earthed screen is installed between the primary and secondary windings.

Cooling: HVDC systems often run close to their capacity, a highly sophisticated cooling system for HVDC converter transformers is the most economical solution. It applies more efficient DC motors which are speed-controlled, cutting down both noise level and low losses. In the operation mode maximum cooling, it extends the transformer's lifetime by reduced aging. It is preferred to use directed oil flow, granting that the cool oil is led by a predetermined, optimum path through the core and windings, reducing both size of the active part and the cooling system.

Tank: The tank is cylindrical-shaped with a flat cover, which can withstand the mechanical strength tests under vacuum pressure and positive pressure. On its inner wall, aluminium shielding or cooper shielding is applied.

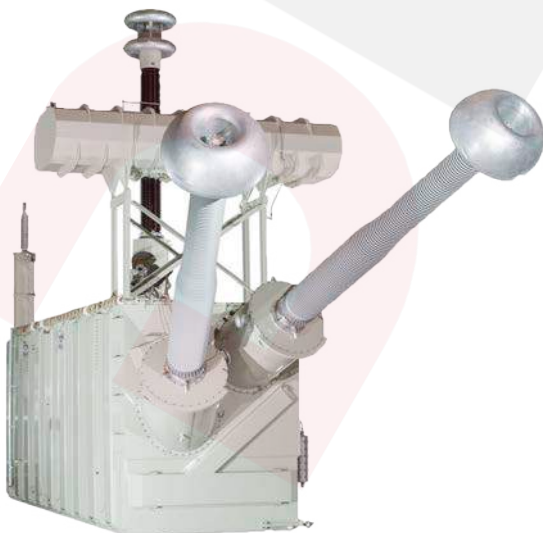
Product Standard: IEC 60076, IEC 61378-1, DIN EN 61378-1:2012-05; VDE 0532-41:2012-05, DIN ISO9001:2008

APPLICATION

- Offshore Wind Power
- Power Transmission
- High Voltage Distribution Lines
- To Separate Voltage Regulation Units
- Aircraft DC Bus Power
- Business Aircraft
- Local & Business Jets
- Aircraft used in military

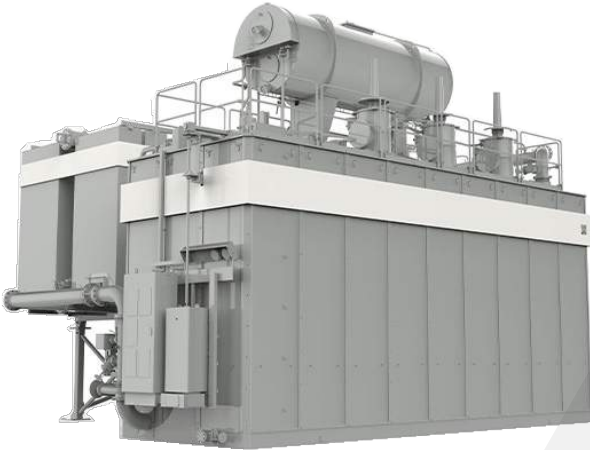
ADVANTAGES

- Fewer copper losses. (The transformer can be made more ideal with a much higher magnetizing inductance and no air gap.)
- The output voltage ripple is less.
- Due to much larger magnetizing inductance lower active device peak current



SHUNT REACTOR

TECHNICAL DATA



Voltage Range: Up to 550 kV

Power Range: Up to 300 MVar

Core: Gapped Core is generally used in shunt reactor. The core is constructed from Cold Rolled Grain Oriented Silicon Steel sheet to reduce hysteresis losses

Windings: The windings wound from copper.

Cooling:

- ONAN (Oil Natural Air Natural)

Tank: The main tank is often of bell tank type. Both the bottom tank and the bell tank are manufactured by steel sheets of suitable thickness. The steel sheets of suitable pieces are welded together to form both of the tanks. The tanks are designed and constructed to withstand full vacuum and positive pressure of one atmosphere.

Conservator: A conservator is provided at the top of the tank with the main tank to the conservator connecting pipeline of suitable diameter. The flexible separator between air and oil or air cell is provided in the conservator for the said purpose. The conservator tank is also equipped with a magnetic oil gauge to monitor the oil level in the reactor.

Product Standard: IEC 60076-7



APPLICATION

- Transmitter Systems
- High Voltage Transmission Lines
- Inductive Load Test Systems
- Base Stations
- Cable Systems
- Laboratories, Hospitals and Stores (Where Fluorescent and LED lighting is used frequently)

ADVANTAGES

- Cost efficient solution for reactive power supply
- Less purchase of reactive power
- Reduced losses (line & connected equipment)
- Increased active power capacity of line
- Minimal space requirements
- Better network voltage control
- Reduced reactive power loading of the grid
- Compliance with contractual reactive power limits
- Optimized reactive power compensation (VSR)



MCR (MAGNETIC CONTROLLED REACTOR)

TECHNICAL DATA

Voltage Range: Up to 550 kV

Power Range: Up to 300 MVAR

Structure:

- Electromagnetic part of a three-phase or single-phase reactor
- Magnetising system
- Automatic control system
- A MCSR can include the following additional elements:
 - A reserve phase of a single-phase reactor
 - An earthing reactor
 - A monitoring system
 - Process control signals and protective apparatus monitoring signals
 - A fire fighting system

Product Standard: IEC 60076-7

APPLICATION

- Voltage Stabilization
- Transmission & Distribution Networks
- Mining Industry
- Cement Industry
- Railway Transmission Systems

ADVANTAGES

- Lower price
- High operational safety
- No need for powerful harmonic filters
- Easy maintenance
- No need for additional maintenance staff training
- No need for water cooling of powerful thyristor valves
- Service conditions similar to those of conventional transformer equipment



NER (NEUTRAL EARTHING RESISTOR)

TECHNICAL DATA

Voltage Range: Up to 110 kV line to line systems

Power Range: Up to 5000A

Structure:

- Ambient Temperature: Up to 55°C
- Stainless-steel resistor elements
(Resistance Alloy: Stainless-steel (CrNi or CrAl))
- Current transformer (EN 61869-2)
- Bolted resistor element connections
- 2mm Hot-dip galvanized steel enclosure
- High thermal capacity to absorb high currents
- High altitude ratings
- Solid top cover sloped to prevent water accumulation

Product Standard: IEC 60137, IEC 60529, EN 10346

APPLICATION

- High-Resistance Neutral Grounding System
- Neutral Resistor Monitoring System

ADVANTAGES

- Reduce the single phase fault currents for securing each equipment in MV electrical networks,
- Reduce the transient over voltages which can occur during an earth fault, and be monitored and used to activate the earth fault relay
- Increase protection of generators, transformers and related equipments
- Reduced operation/maintenance costs
- Increase safety
- Provide simple, reliable, selective means of protection,
- Allows the use of equipment, and in particular cables with lower insulation levels than for an insulated neutral scenario
- Reduce the step voltage



AUTO TRANSFORMER

TECHNICAL DATA

Voltage Range: Up to 231V

Power Range: Up to 400kVA

Core: Cold Rolled Grain-Oriented Silicon Steel

Windings: Autotransformer has only one single voltage winding which is common to both sides. The windings are wound from aluminium or copper upon the customer's request.

Drying: The active parts of transformers are dried under a high vacuum in a furnace. The process of drying varies according to the transformer type, power, and voltage. Oil is filled under a high vacuum.

Product Standard: EN 61558-2-13

APPLICATION

- Distribution Systems (Compensating voltage drops by boosting supply voltage)
- Auto transformers with a number of tapping are used for starting induction and synchronous motors.
- The Laboratory or where continuous variables over broad ranges are required (Autotransformer is used as variac)

ADVANTAGES

- The Autotransformer is smaller in size and cheaper.
- The Autotransformer has higher efficiency than two winding transformers.
- The Autotransformer has better voltage regulation as voltage drop in resistance and reactants of the single winding is less.

