

Distribution Transformers

The most comprehensive range of solutions
for distribution transformer applications



ABB

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The most comprehensive range of solutions
for distribution transformer applications

Even our standard solutions are special

In almost every place where people live and work you will find at least one transformer. But as long as it keeps working and supplying power to the escalator in the department store, the hotel lift, the office computer, the oven in the local bakery, the farm machinery or the petrochemical plant nobody gives it a second thought.

However, transformers are one of the most important units in every production process. Without them the core activities of nearly every business and factory would come to a standstill – with serious financial consequences.

After nearly 100 years in the development and manufacture of transformers we are well aware of this dependence. This is why, we never compromise on the performance, security or reliability of our products. Nor on design, materials, manufacturing methods, environmental protection or recycling.

Our objective is to support you and to add value to your activities, by offering a comprehensive range of top quality transformers. We also provide top class service and support.

With this approach we can tailor the most appropriate technical solution to every problem. A high quality solution with better service and support, better for the environment and yet with greater availability and a lower total cost of ownership than our competitors.

All over the world, in underground railways, in amusement parks and in every kind of factory you will find ABB transformers at work. In the following pages ABB invites you to find the optimal solution to your application and to see with your own eyes that even our standard solutions are special.



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Oil Type Transformers

Single-phase and three-phase transformers for the range above 16 kVA and up to 72.5 kV.

These units are designed for power centres, substations and networks; also for pad-mounts.

They are used in public distribution systems, commercial buildings and industrial complexes.

The unique core and coil designs and the use of special turn insulating materials make these units extremely compact, reliable and durable.

A wide range of transformer fluids is available including BIOTEMP™, which is biodegradable, less flammable and thermally efficient – ideal for densely populated or environmentally sensitive areas.

Dry Type Transformers

For the range 30 kVA to 30 MVA with primary operating voltages up to 41.5 kV and secondary operating voltages up to 36 kV. These units are designed for operation in difficult conditions – environmental contamination, fire hazard, high humidity or extreme climates.

They provide high level security and are found in hospitals and other public areas, on oil platforms, in ships, underground railways and mines.

They are extremely tough and resilient and are resistant to the effects of vibration. They should be considered for earthquake prone areas.

RESIBLOC® transformers have a special resin-encapsulated construction which is unique to ABB. This construction provides great strength and flexible design dimensions.

Special Applications

Pad Mounted Transformers: These units are delivered from the factory in tamper-resistant housings designed to prevent access by unauthorised personnel.

Transformers for variable speed drives: These units can be supplied with primary power ratings up to 30 MVA. They can be supplied as oil type or dry type. Converter transformers can be used for the variable speed drives of high-load, low-speed equipment such as mine hoists, rolling mills and ship propulsion systems. A correctly designed installation will provide impressive savings from reduced down-time, extended equipment life and lower power costs.

Reactors: Single-phase and/or three phase for a wide range of applications.

Boosterformers™: Boosterformers™ are used in order to improve the function of electrical power systems and protect the environment from dangerous stray currents near an electrical railway.

Product Selection Guide

Oil Type Transformers

Product	kVA	Primary Voltage (kV)	Features
Small Distribution Transformers	≤ 250	up to 36	Used for indoor or outdoor applications, can be provided with off-load tap changers.
Medium Distribution Transformers	> 250 ≤ 2000	up to 36	Used for indoor or outdoor applications, can be provided with on-load tap changers or off-load tap changers.
Large Distribution Transformers	> 2000	up to 72.5	Used for indoor or outdoor applications, can be provided with on-load tap changers or off-load tap changers.
Single Phase Transformers	≤ 100	up to 36	Small distribution transformers for pole mounting.

Dry Type Transformers

Product	MVA	Primary Voltage (kV)	Features
Vacuum Cast Coil	≤ 30	up to 36	Provides the ultimate in winding protection for the most demanding applications when efficiency and reliability are critical.
RESIBLOC® Resin-encapsulated	≤ 30	up to 41.5	Provides the ultimate resistance to mechanical stress associated with heat and short circuit conditions in the most demanding applications.

Transformers for Special Applications

Product

Pad Mounted Transformers

Transformers for Variable Speed Drives

Reactors

Boosterformers™

Oil Type Transformers

ABB's liquid filled Power Distribution Transformers range from 16 kVA upwards, with primary voltages up to 72.5 kV.

ABB supplies the widest range of power distribution transformers, including specific designs for power centres, substations, networks and padmounts.

Transformers are an integral part of power systems with applications in industrial facilities, commercial buildings and utility transmission and distribution networks.

The core and coil design is a unique characteristic of ABB's oil type transformers, which generate the reliability, durability and reduced dimensions required for their application in utilities, industrial installations and public distribution. ABB oil type transformers are manufactured in accordance with the international quality standards ISO 9001 and ISO 14001.

Standard features

Standard features include aluminium or copper windings, epoxy or porcelain bushings, gauges, alarm packages, fans and special signs and tags.

For heavily polluted environmental conditions ABB offers special paint finish cycles in epoxy-coating for the protection of metallic components and electrical equipment.

Selection Guide

Product	kVA	Primary Voltage (kV)	Features
Small Distribution Transformers	≤ 250	up to 36	Used for indoor or outdoor applications, can be provided with off-load tap changers.
Medium Distribution Transformers	> 250 ≤ 2000	up to 36	Used for indoor or outdoor applications, can be provided with on-load tap changers or off-load tap changers.
Large Distribution Transformers	> 2000	up to 72.5	Used for indoor or outdoor applications, can be provided with on-load tap changers or off-load tap changers.
Single Phase Transformers	≤ 100	up to 36	Small distribution transformers for pole mounting.

Construction features

Core

The core is a series of laminations made from high-quality, grain-oriented silicon steel. The stacked core provides a superior flux path by utilising a step-lap that joins the core legs to the top and bottom yokes. The effective support for the core together with a step-lap joint have reduced existing currents by up to 40%, sound levels by up to 3 dB and iron losses by up to 10%.

The core efficiently fills the opening in the coil, leaving a minimum of unused space. The short yoke between the legs of the core reduces the external flow between the active leg core material, resulting in an increase in efficiency. The rectangular shape of the core can be more uniformly and firmly supported to prevent movement of the laminations so as to improve sound level characteristics.

Coils

The coil features a low voltage rectangular wire or sheet conductor extending along the full height of the coil. The layer to layer insulation, Insuldur, is a thermally upgraded kraft paper. The layer insulation is coated with a diamond pattern of B-stage epoxy adhesive, which cures during processing to form a high strength bond. This bond keeps the windings from moving during operation or under short circuit stresses. The high to low insulation is fitted over the low voltage winding and the wire of the strap wound high voltage is wound directly over the low voltage to form a high strength coil assembly. Generous oil ducts extend along the height of the coil to provide cooling in the winding. The staggered, diamond epoxy bonds help assure free oil flow through the winding.

Accurately located taps and a large winding cross section keep unbalanced ampere-turns to a minimum. Unbalanced ampere-turns create forces during short circuits that push the high voltage and low voltage coils apart vertically. By minimising this imbalance vertical forces are correspondingly reduced, thus making the design stronger under short circuit stresses.

The large areas presented by the layer-type winding result in a low ground capacity, which gives a nearly straight line surge distribution throughout the winding. A compact, high-impulse-strength coil is the result.

Turn insulation

ABB power distribution transformers are designed to meet specific performance criteria defined by the customer. Some design considerations may require the use of traditional crepe paper or Nomex[®] tape as turn insulation. Most designs, however, utilise DuraBIL[®], which is a tough, flexible and inert turn insulation. It reduces the most prevalent cause of transformer failure – deterioration of turn insulation.

DuraBIL[®] is a single layer of epoxy powder deposited electrostatically and baked on a strap conductor. The process is closely controlled and monitored to ensure a continuous, uniform coating. The result is a compact turn insulation with superior characteristics including adhesion, flexibility, abrasion resistance and thermal and chemical stability.

Since DuraBIL[®] is chemically stable, it does not degrade or contaminate the transformer fluid with moisture. As a result, DuraBIL[®] maintains its dimensional stability and the coil's structural integrity.

Layer insulation

The Insuldur system of chemical stabilisers thermally upgrades the cellulose insulating materials to permit 12% higher load capacity. Insuldur can be used with all fluids offered by ABB for small power transformers. Chemical stabilisers delay insulation breakdown under elevated temperature conditions. Dimensional changes in the insulating materials are minimised to ensure a tighter structure. The result is greater strength and coil integrity throughout the life of the transformer.

The Insuldur system allows a unit rated at 55°C to be operated at a 10°C higher temperature with a 12% increase in kVA capacity.

Transformer fluids

A choice of transformer fluids, including oil, silicone, MIDEL and BIOTEMP™, is offered with most ratings. Mineral oil is usually recommended for outdoor applications. Silicone and R-Temp are classified as less flammable fluids and are used when flammability is a concern.

Transformers designed with less flammable fluids can be used to meet specific requirements of non-flammability. BIOTEMP™ is a new, fully biodegradable, environmentally friendly dielectric fluid that is also classified as less flammable. BIOTEMP™ has been shown to be 97% biodegradable within 21 days by underwriters, laboratories. BIOTEMP™ is suitable for indoor applications and in areas of high environmental sensitivity where any insulating fluid spill would require expensive clean-up procedures.



Small Distribution Transformers (≤ 250 kVA)

Construction features

Description

ABB Distribution Transformers manufactures three phase oil type small distribution transformers within the range up to 250 kVA and 36 kV. The transformers are adaptable for pole mounting or assembly in substations.

Standard features

Hermetically sealed transformers completely filled with oil:

- *Corrugating tanks*
- *High and low voltage bushings in accordance with DIN 42531 and DIN 42530*
- *Off-circuit tap changer in 5 positions*
- *Lifting lugs*
- *Earthing terminals*
- *Thermometer pocket in accordance with DIN 42554 (standard from 100 kVA)*
- *Filling plug*
- *Drain cock*
- *Rating plate*
- *Inhibited oil*

Transformers can also be manufactured with conservators.

Other product types with different dimensions and technical specifications can be designed and manufactured on request.



Core

The magnetic circuit is of the three column type with mitred joints. It is manufactured with first-rate, grain oriented silicon iron sheets insulated with carlite. The mounted core is clamped down in order to reduce vibrations and minimise noise levels.

Windings

The windings are made of either copper or aluminium; they are insulated with either pure cellulose or double enamel. Furthermore, the complete columns are manufactured to withstand short circuit stresses.

Off-circuit tap changer

The tapplings ($\pm 2 \times 2.5\%$) of the HV winding, are connected to the off-circuit tap changer located horizontally between the yoke and the tank cover. The handle is located on the cover and should be operated when the transformer is deactivated. The design prevents setting the off-circuit tap changer to intermediate positions. The mechanism can also be padlocked during normal transformer operation.

Insulating oil

The mineral oil with its electrical and chemical characteristics is in compliance with the IEC Standards and is P.C.B. and P.C.T. free.

Tank and cover

The sides of the tank are made of corrugated cooling surfaces. The bottom plate, side and frames are of a welded construction. The welds are tested for oil tightness. The thermometer pockets, bushings, tap switch drive and lifting lugs are fitted on the tank cover. The cover is bolted to the tank frame. The undercarriage is welded to the bottom plate and the rollers are suitable for either longitudinal or transverse movements.

Painting and surface treatment

Transformers are either hot-dip galvanized or painted. The metal parts are carefully sand-blasted. The painting system is a single coat one pack epoxy. The top coat is RAL 7033 or customized. The hot-dip galvanizing is 70 µm minimum.

Options and accessories

- Plug-in bushings on HV
- Max thermometer
- Dial type thermometer with two contacts
- Oil level indicator for hermetically sealed transformers
- Thermometer pocket in accordance with DIN 42554 (standard from 100 kVA)
- Off-circuit tap changer with 3 or 7 positions
- Sparking gaps
- Pressure relief device
- Cable boxes
- Integrated pole brackets on tank
- Skid base
- Bi-directional rollers
- Total enclosure on cover over HV and LV bushings

Testing

The transformers are manufactured in accordance with ISO 9001 and ISO 14001. At the end of the manufacturing process the transformers are individually tested in accordance with the IEC Standards.

The routine tests are:

- Measurement of the winding resistance
- Measurement of the voltage ratio and check of the vector group
- Measurement of the impedance voltage and measurement of load losses
- Measurement of no load losses and no load current
- Dielectric tests

Upon request, witnessed type/special tests can be carried out.



Oil Type/Small Distribution Transformers

kVA	HV1 (V)	HV2 (V)	LV1 (V)	Vector Group	Impedance (%)	No-Load Loss (W)	Load Loss (W)	Noise level (dB)	Total weight (kg)	Oil weight (kg)	Length (mm)	Width (mm)	Height (mm)	Wheel base (mm)	Tank description
30	20500	0	410	Yzn11	4	100	585	0	395	115	840	770	1005	0	▲
40	15750	0	400	Yzn5	4.5	90	900	48	340	90	790	580	970	420	▲
40	15750	0	400	Yzn5	4.5	130	900	48	330	90	790	580	970	420	▲
50	10000	0	400	Yzn5	4	125	1100	47	375	90	760	650	885		▲
50	10000	0	400	Yzn5	4	190	1100	50	365	90	760	650	885		▲
50	10000	0	400	Yzn5	4	125	875	47	425	100	820	625	885		▲
50	20500	0	410	Dyn11	4	140	885	0	440	125	840	770	1055	0	▲
50	16800	0	420	Dyn5	4	125	900	51	390	120	820	645	1010		▲
50	20000	0	400	Yzn11	4	190	1100	44	465	125	870	650	1400	670	▲
50	22000	0	420	Dyn11	4	115	940	48	415	110	810	585	1040	0	▲
50	11000	0	420	Dyn11	4	115	920	48	370	90	760	600	945	0	▲
50	20000	0	400	Yzn5	4	125	875	47	375	95	860	600	975		▲
50	10000	0	400	Dyn5	3.7	115	850	50	425	115	800	480	1200	0	▲
50	20000	0	400	Yzn5	4	125	1350	47	350	90	790	580	955		▲
63	22000	0	420	Yzn5	4	190	1350	51	465	105	1280	630	1650	420	▲
63	22000	0	420	Yzn5	4	160	1350	48	465	105	1280	630	1650	420	▲
63	15750	0	400	Yzn5	4.5	130	1130	48	430	100	945	665	970	420	▲
63	16800	0	420	Dyn5	4	130	950	51	460	110	820	645	1030		▲
63	15750	0	400	Yzn5	4.5	180	1130	48	430	100	945	665	970	420	▲
63	21000	0	400	Yzn5	4.5	180	1280	48	460	100	830	680	1150	420	▲
63	15750	0	400	Yzn5	4.5	180	1160	48	470	100	830	680	1150	420	▲
100	10000	0	400	Yzn5	4	320	1750	50	585	130	820	775	1030		▲
100	10000	0	400	Yzn5	4	210	1750	49	670	145	1120	725	1090		▲
100	20500	0	410	Dyn11	4	220	1485	0	510	120	850	610	1080	0	▲
100	10500	0	400	Dyn11	3.8	215	1700	48	490	110	870	500	1170	0	▲
100	16800	0	420	Dyn5	4	180	11800	52	730	160	930	645	1200		▲
100	21000	0	400	Yzn5	4.5	240	1720	49	585	120	870	670	1200	420	▲
100	20000	0	400	Dyn11	4	500	1700	48	800	0	950	650	1270	520	▲
100	10500	0	400	Dyn11	4	165	1700	48	535	110	870	500	1220	0	▲
100	21000	0	400	Dyn11	4.2	165	1760	48	580	140	920	520	1295	0	▲
100	11000	0	420	Dyn11	4	185	1520	48	510	95	860	600	1070	0	▲
100	22000	0	420	Dyn11	4	185	1525	48	545	125	850	610	1115	0	▲
100	10500	0	420	Dyn5	3.4	165	1240	54	600	135	920	540	1220	0	▲
100	22000	0	420	Dyn11	3.6	245	1550	48	540	150	920	520	1245	0	▲
160	22000	0	420	Dyn5	4	375	2350	57	765	165	1000	720	1400	520	▲
160	15750	0	400	Yzn5	4.5	280	2200	50	830	165	970	805	1110	520	▲
160	10000	0	400	Dyn11	4	460	2350	50	840	180	1040	675	1140	670	▲
160	20000	0	400	Dyn11	4	460	2350	50	880	205	1000	700	1210	670	▲
160	20000	0	400	Dyn11	4	300	2350	50	880	205	1000	700	1210		▲
160	16800	0	420	Dyn5	4	265	1750	53	890	190	1010	645	1180		▲
160	15750	0	400	Yzn5	4.5	300	2350	50	1000	220	1080	790	1290	520	▲
160	15000	0	400	Dyn11	4	650	2400	48	900	0	1100	670	1350	520	▲
160	10000	0	400	Dyn11	4	300	2000	50	870	180	1040	675	1140	520	▲
200	20500	0	410	Dyn11	4	420	2295	0	995	235	1080	730	1250	0	▲
200	10500	0	400	Dyn11	3.8	320	2450	53	870	180	950	625	1345	0	▲
200	22000	11000	420	Dyn11	3.6	370	2280	53	870	180	950	625	1495	0	▲
200	11000	0	420	Dyn11	4	365	2225	53	840	160	1030	655	1170	0	▲
200	22000	0	420	Dyn11	4	370	2250	53	940	200	1020	700	1245	0	▲
200	10500	0	400	Dyn11	3.8	360	2700	53	840	200	950	625	1295	0	▲
250	22000	0	420	Dyn5	4	425	3250	55	1180	260	1100	780	1500	520	▲
250	22000	0	420	Dyn5	4	440	2750	55	1250	260	1100	800	1600	520	▲
250	10000	0	400	Dyn5	4	425	3250	50	1110	205	1300	750	1190		▲
250	22000	0	420	Dyn5	4	530	3250	60	1180	260	1100	780	1500	520	▲
250	10000	0	400	Dyn5	4	425	2750	50	1160	200	1000	700	1220		▲
250	20000	0	400	Dyn5	4	425	3250	50	1130	220	1060	760	1190		▲
250	15750	0	400	Dyn5	4.5	360	2350	51	1010	200	1150	975	1260	520	▲
250	15750	0	400	Dyn5	4.5	460	3200	51	1030	205	1040	950	1185	520	▲
250	25000	0	400	Dyn11	4.5	780	3500	52	1245	300	1210	860	1605	1070	▲
250	16800	0	420	Dyn5	4	345	2230	55	1450	270	1150	715	1310		▲
250	22000	0	420	Dyn1	4	290	5000	46	1120	0	1450	900	1500	520	▲
250	21000	0	400	Dyn5	4.5	460	3260	51	945	175	990	720	1340	520	▲

Please note that this table only shows a small sample of all product designs and ratings we supply.

▲ Hermetically sealed with corrugated tank ● Corrugated tank with conservator

Passenger safety in focus

For airports such as Sweden's Hultsfreds Airport, passenger safety comes before all else. ABB's Small Distribution Transformers ensure that runway lights, radio beacons and air traffic control communications all function reliably.





Medium Distribution Transformers (> 250 kVA, ≤ 2000 kVA)



Construction features

Description

MDT transformers are used to step down three-phase high voltage to low voltage for power distribution, mainly in metropolitan areas and for industrial applications. The transformers in standard versions are designed for use in moderate climates and can be installed both outdoors and indoors. The loading is in accordance with IEC 354. MDT transformers are hermetically sealed (the tank is completely filled with oil) or equipped with oil conservator. Both types are equipped with flexible corrugated tank walls enabling sufficient cooling of the transformer. They also compensate for the changes in the oil volume during operation. An advantage of the hermetically sealed transformers is that the oil is never in contact with the atmosphere thus avoiding periodic oil analysis.

Standard features

Hermetically sealed. (Rated power <1000 kVA):

- Oil filling plug on the cover
- Oil-level indicator
- The two lifting lugs on the cover are made for lifting the transformer or its removable part
- Corrugated tank
- Undercarriage with bi-directional rollers
- Oil drain valve
- Off-circuit tap changer handle
- Earthing terminals
- Sparking gaps for voltages 15 kV and above
- Rating plate

Additionally, for transformers with conservator (Rated power ≥1000 kVA):

- Max thermometer
- Magnetic oil-level indicator
- Oil filling plug on the conservator
- Buchholz relay
- Dehydrating breather
- Conservator

Core

The cores of the transformers are made of grain-oriented magnetic, cold-rolled silicon steel laminations with low losses.

Windings

The windings of the transformers are made of high grade electrolytic copper or aluminium. The High Voltage windings are wound either with round, enamel insulated, or shaped, paper insulated wire. The Low Voltage windings are wound with shaped, paper insulated wire or foil. The winding construction is characterised by high dielectric strength with high resistance, to atmospheric surges and to the effects of short-circuits. Neutral points of the Low Voltage windings are brought to the tank cover.

Off-circuit tap changer

The off-circuit tap changer is of a 5-position type connected on the High Voltage side with a handle located on the cover. The tap changer should be operated only when the transformer is deactivated.

Insulating oil

The mineral oil with its electrical and chemical characteristics complies with the IEC Standards and is P.C.B. and P.C.T. free.

Tank and cover

The cover is bolted to the tank frame. The transformer undercarriage is provided with bidirectional rollers turnable by $\pi/2$ rad (90°) to allow longitudinal and transverse movement on flat surfaces.

Painting and surface treatment

All metal parts are carefully sandblasted. The painting is made with a single coat of one-pack epoxy paint. The finishing paint is made with two or three coats. If requested a hot-dip galvanized corrugated steel tank can be provided.

Options and accessories

- Plug-in bushings
- Dial type thermometer with two contacts
- DGPT2 control device
- Pressure relief valve with or without contacts
- Tap changer with more than five positions
- Cable boxes
- Spark gap meter
- Air insulated housings
- Galvanized tank
- Additional thermometer pocket
- Dual voltage transformer

Specifications

- Standards: IEC, DIN, BS, UNE, PN etc.
- 301–2,000 kVA, three-phase, 65°C maximum windings temperature rise
- 50 Hz standard, 60 Hz optional
- High Voltages 3,000 - 35,000 V
- Low Voltages 100 - 15,750 V
- Vector group: Dy, Yz, Yy, Dd, Yd
- Impedance voltage: 4-7%
- Voltage regulation: $\pm 2 \times 2.5\%$; $\pm 2 \times 5\%$; $+2.5 \%$, $-3 \times 2.5\%$



Hard Rain

Power failure is a nightmare scenario for any healthcare institution, and Hermann Hospital in Texas experienced one in June 2001, when the tropical storm known as Alison hit Houston.

On 26 June, the hospital ordered a 1000 kVA Distribution Transformer from ABB. Just 60 hours later, the new transformer was designed, built and dispatched. This helped to ease the consequences of the disaster, already known in history books as “the rain of terror”.

Oil Type/Medium Distribution Transformers

kVA	HV1 (V)	HV2 (V)	LV1 (V)	Vector Group	Impedance (%)	No-Load Loss (W)	Load Loss (W)	Noise level (dB)	Total weight (kg)	Oil weight (kg)	Length (mm)	Width (mm)	Height (mm)	Wheel base (mm)	Tank description
315	26000	0	400	Dyn11	4	980	4130	64	1550	370	1300	900	1700	670	▲
315	20000	8000	400	Dyn11	4	1050	4200	53	1300	0	1240	800	1400	670	▲
315	15000	0	400	Dyn11	4	1050	4200	53	1300	0	1240	800	1400	670	▲
315	10000	0	400	Dyn11	4	1050	4200	53	1300	0	1240	800	1400	670	▲
400	35000	0	400	Dyn1	6	620	5000	50	2050	0	1300	900	1800	670	▲
400	21000	0	420	Dyn5	4	750	4600	63	1560	340	1300	900	1600	670	▲
400	15750	0	400	Dyn5	4.5	570	4100	52	1520	320	1210	850	1480	670	▲
400	10500	0	420	Dyn5	4	475	3480	0	1730	320	1140	820	1495	0	▲
500	22000	11000	420	Dyn11	4.4	710	5000	0	1750	320	1140	880	1600	0	▲
500	20000	0	400	Dyn5	4	730	5500	50	1660	365	1300	920	1860		▲
500	11000	0	420	Dyn11	4.5	710	4600	0	1690	320	1140	880	1450	0	▲
500	10000	0	690	Dyn5	4.6	500	4000	0	2200	350	1470	850	1560	0	▲
500	10000	0	400	Dyn11	4	1450	5800	53	1750	0	1450	970	1500	670	▲
630	35000	0	400	Dyn1	6	840	7000	52	2600	0	1450	900	1800	670	▲
630	22000	0	420	Dyn5	6	800	5600	60	2500	510	1400	1050	1700	670	▲
630	15750	0	400	Dyn5	4.5	720	6100	54	2035	400	1270	900	1600	670	▲
630	10000	0	400	Dyn5	6	800	8700	54	2040	445	1530	950	1690		▲
800	26000	0	400	Dyn11	6	1700	8500	68	2650	525	1700	950	2100	670	▲
800	21000	0	400	Dyn11	4.8	1030	6800	0	2300	380	1520	900	1700	0	▲
800	15000	10000	400	Dyn11	5	1940	8200	53	2200	0	1630	1080	1600	670	●
800	10000	0	400	Dyn5	6	1400	8500	56	2320	530	1400	1050	1890		▲
1000	35000	0	400	Dyn1	6	1600	9700	0	3100	0	1800	1050	1860	820	▲
1000	21000	0	400	Dyn5	6	1300	10200	56	2800	550	1970	980	1980	820	●
1000	15750	0	400	Dyn5	6	1300	10200	56	2790	550	1970	980	1980	820	●
1000	10000	0	400	Yyn0	5.3	1300	12200	0	2420	470	1670	1030	1590	0	▲
1250	26000	0	400	Dyn11	6	2360	13500	70	3550	760	2000	1100	2250	820	▲
1250	20000	15000	400	D(D)yn11	7.19	1320	16900	0	4140	1190	2345	1370	2310	820	●
1250	15000	10000	400	Dyn11	6	2600	13000	65	3600	0	1860	1250	1640	820	●
1250	10500	0	400	Dyn11	5.4	1460	13400	0	3000	580	1830	1150	1720	0	▲
1600	35000	0	400	Dyn1	6	2400	14000	0	4000	0	2000	1100	1900	820	▲
1600	20000	0	400	Yyn0	5.5	1780	16700	0	3320	680	1890	1170	1860	0	▲
1600	15750	0	400	Dyn5	6	1700	16000	58	3995	820	2100	1130	2250	820	●
1600	10000	0	690	Dyn5	5.7	1580	13500	0	3680	775	1910	1120	1970	0	▲
2000	30000	0	6300	Dyn5	6	3200	21000	71	5000	1100	2250	1300	2350	1070	●
2000	20000	0	400	Yyn0	6	2200	20100	0	4020	850	2010	1220	1910	0	▲
2000	15750	0	400	Dyn5	6	2100	19000	0	4710	900	2330	1360	2320	1070	●
2000	10000	0	6300	Dyn5	6	3200	21000	71	5000	1100	2250	1300	2350	1070	●

Please note that this table only shows a small sample of all product designs and ratings we supply.

▲ Hermetically sealed with corrugated tank ● Corrugated tank with conservator

Construction features

Description

ABB has been manufacturing transformers for almost a hundred years. The production is based on the development and research carried out in the design department and at the ABB Research Centre in close cooperation with our customers. This long experience combined with research and development, guarantees high quality, long life and reliability.

Standard features

The transformers are manufactured and tested in accordance with the IEC Publication 76. They are also in compliance with several national standards e.g. BS 171, VDE 0532, SS 4270101 etc.

The transformers can be overloaded in accordance with IEC Publications 354 (1972). The on-load tap-changer and bushings have been chosen so as not to limit the overload capability. The cooling methods are ONAN or ONAN/ONAF.

Construction features

The transformers are of the breathing, conventional type provided with an oil conservator. Two types of transformers are manufactured:

- *Transformers with off-load tap changer*
- *Transformers with on-load tap changer*

Core

The three legged bolt-less core is constructed of grain oriented steel laminations. The joints between the leg and yoke are mitred at 45° and interleaved. The cross section of the leg is circular.



Windings

The material of the windings is either copper or aluminum. The windings are made of paper insulated rectangular wire in the form of multi-layer, disc or helical windings. Transformers provided with on-load tap-changer usually have a separate tap winding.

Off-load tap-changer

The transformers are normally equipped with a 5-position off-load tap-changer on the High Voltage side, with its handle located on the cover. When changing the tap position the transformer has to be un-energized.

Position 1 of the tap-changer (+ position) corresponds with the highest ratio, which gives the lowest voltage on the Low Voltage side. Position 5 of the tap-changer (- position) corresponds with the lowest ratio which consequently gives the highest voltage on the Low Voltage side. Transformers having dual primary (or secondary) voltages are usually equipped with a selector switch with the handle on the cover.

On-load tap changer

The on-load tap-changer is mounted on the cover of the main transformer tank. The tap-changer works as a selector switch combining the features of a diverter switch and a tap selector. The selector switch is located in a separate oil compartment which is connected to its own conservator. The selector switch is of the high-speed spring operated type with resistive transition impedances. The tap-changer is equipped with a protective relay. The selector switch can be lifted for inspection and the oil in the compartment can be changed separately.

The on-load tap-changer is provided with a motor drive mechanism for remote and local control. Normally the motor drive is three-phase and the control and the heating circuits are for single phase AC supply. When re-quested, DC circuits can be supplied.

Insulating oil

The mineral oil used in the transformers complies with IEC 296 and several national standards. The oil slows down the ageing process. Transformers with off-load tap changers can be delivered filled with silicone oil or MIDELE fluid if requested.

Tank

The transformer tank is usually of the rigid type provided with removable radiators connected to the tank by means of a shut-off valve. On request, the tank can be made vacuum proof. Transformers up to 5 MVA can be supplied with a compact tank with corrugated cooling fins.

Painting and surface treatment

Prior to the painting of the tank, the cover and oil conservator are sandblasted. External surfaces are painted immediately after pretreatment with a two-pack epoxy primer coat.

The finishing is carried out by applying a two-pack polyurethane paint to a total thickness of 180 µm. The colour of the paint is RAL6013 (rush green).

The inside of the transformer tank is painted with a two-pack epoxy primer to a thickness of approx. 30 µm. The external surfaces of the radiators are hot dip galvanized to a thickness of approx. 60 µm. Corrugated tanks are flow painted with alkyd primer and acrylic finish to a total thickness of 80 µm. The conservator and the bottom part of the tank are painted internally.

Options and accessories

The transformers are fitted with the following standard accessories:

- *Bushings*
- *Oil conservator with oil level indicator*
- *Filling and drain valves*
- *Oil sampling device*
- *Earthing terminals*
- *Lifting lugs*
- *Jacking pads (radiator tanks)*
- *Rating plate*
- *Silica-gel breather*
- *Buchholz relay*
- *Top oil thermometer*

Additional accessories can be fitted in accordance with the customer's specifications.

Vacuum treatment

Drying and vacuum treatment takes place in a special oven, where the windings are heated electrically while simultaneously the air is evacuated from the oven, reaching an absolute pressure of 1 mbar. The transformer is filled with oil while it is still under vacuum. In this way moisture and gases are effectively removed from the windings and oil.

Bushings

The bushings are of a solid porcelain type and located on the cover. Bushing insulators can be changed without opening the transformer. The bushings comply with IEC 137.

The terminals can be provided with an air insulated enclosure. The enclosure can be on the primary and/or on the secondary side and may be constructed for cable or bus duct connection. Alternatively the transformers can be provided with plug-in bushings.

Testing

All transformers are manufactured according to the ISO 9001 Quality System. The transformers are individually tested according to IEC standards.

1. Routine tests

- 1.1 *Measurement of winding resistance*
- 1.2 *Measurement of voltage ratio and testing of voltage vector relationship*
- 1.3 *Measurement of impedance voltage, short-circuit impedance and load loss*
- 1.4 *Measurement of no-load loss and current*
- 1.5 *Dielectric tests:*
 - 1.5.1 *Separate source voltage withstand test*
 - 1.5.2 *Induced overvoltage withstand test*

Witness type/special tests can be carried out on request.

2. Type tests

- 2.1 *Temperature rise test*
- 2.2 *Dielectric tests:*
 - 2.2.1 *Lightning impulse test*

3. Special tests

- 3.1 *Dielectric tests:*
 - 3.1.1 *PD-test*
 - 3.1.2 *Chopped wave test*
- 3.2 *Measurement of zero-sequence impedance on three phase transformers*
- 3.3 *Short circuit test*
- 3.4 *Measurement of sound level*
- 3.5 *Measurement of harmonics in the no-load current*
- 3.6 *Tests of auxiliary equipment and wiring*
- 3.7 *Tests on load tap-changer*
- 3.8 *Leakage test for transformer tank*





Less time, more money

Many of the “Paradise Islands” might not seem so paradisaical without electricity. Wärtsilä NSD, one of the world’s leading manufacturers of gas and diesel engines for power generation and for off-shore applications would definitely not want to be without our fast deliveries of 8, 12 and 16 MVA Large Distribution Transformer units. Without that speed their greatest sales advantage for diesel power plants would be lost. Neither Wärtsilä nor their customers would be able to reach their rewards so quickly. And for the rest of us, those islands might no longer seem such idyllic places to visit.

Large Distribution Transformers

Rated power	Primary Voltage	BIL, HV	Secondary Voltage	BIL, LV	Tank Description
kVA	kV	kV	kV	kV	
2001-5000 2001-5000	up to 72.5 up to 72.5	up to 350 up to 350	up to 15 up to 15	up to 110 up to 110	Hermetically sealed Corrugated tank
5000 and above	up to 72.5	up to 350	up to 15	up to 110	Radiator tank with conservator

Large Distribution Transformers

Typical datas for 20/10 kV transformer with off-load or on-load tap-changer						
Rated power	Tap-changer	No-Load Loss	Load Loss	Impedance	Total Weight	Oil
kVA		W	W	%	kg	kg
3150	±2x2.5%	3500	25000	6.35	6250	1210
	±9x1.67%	3800	25500	6.35	10000	2780
4000	±2x2.5%	4200	29000	6.35	7500	1440
	±9x1.67%	4500	31000	6.35	12100	3220
5000	±2x2.5%	4900	35000	7.15	9300	1670
	±9x1.67%	5000	39000	7.15	13400	3620
6300	±2x2.5%	6000	45000	7.15	13200	2750
	±9x1.67%	6200	45000	7.15	15400	3960
8000	±2x2.5%	7000	56000	8.35	15300	3140
	±9x1.67%	7200	56000	8.35	18100	4760
10000	±2x2.5%	8100	65000	8.35	17200	3480
	±9x1.67%	8200	68000	8,35	20600	5090

Other product types with different datas and specifications can be supplied on request.
Please note that this table only shows a small sample of all product designs and ratings we supply.

Single Phase Transformers (≤ 100 kVA)

Construction features

Description

ABB Distribution Transformers manufactures single-phase, oil type small distribution transformers for pole mounting. These represent an economical option for certain networks. They are suitable for serving residential overhead distribution loads, as well as for lighting, commercial loads, industrial and diversified power applications. ABB's core design provides optimal efficiency and better mechanical, thermal and electrical performance. These transformers are designed for the duties normally encountered on electric utility power distribution systems.

Ranges

15 kVA to 100 kVA with voltages up to a maximum of 36 kV.

Standard features

Two types of transformer are manufactured:

- *sealed construction*
- *free breathing construction*

Standard features for EATS or ANSI can be provided.

All units are supplied with hot-dip galvanised tanks including:

- *lifting lugs*
- *cover mounted, high voltage porcelain bushing(s) with eyebolt terminal or spade terminal*
- *fibreglass reinforced polyester or porcelain low voltage insulators*



Options and accessories

Bushings mounted on lid or on turrets. 2 or 3 view options. Internal HT fuses can be fitted. ANSI or DIN bushings. Single or dual ratio. Tap-switch or internal link board. Can be fitted with arcing horns or surge arrestors.

Standard and type tests

Can be supplied in accordance with IETS, IEC or ANSI standards. All units have been type tested according to IEC.



Planning minimised the impact of Dennis and Floyd

When the hurricanes Dennis and Floyd struck, Carolina Power & Light (CP&L) and ABB were prepared. Within 48 hours, 225 pole-type, single phase distribution transformers were shipped from ABB's stock to CP&L, with a further 2,600 transformers shipped 12 days later.



The Olympics have a bright future

RESIBLOC® transformers from ABB will be in the spotlight at the Olympic Games in Sydney. 100,000 spectators in the grandstands and over a billion people viewing television can count on ABB to make sure everything works faultlessly – from timekeeping to arena lighting.

Dry Type Transformers

ABB's dry type transformers range from 30 kVA to 30 MVA, with primary operating voltages up to 41.5 kV and secondary operating voltages up to 36 kV.

With the aim of minimising environmental contamination and fire hazards, customers are increasingly requesting dry type transformers. These transformers meet strict parameters with respect to electrical system demands and functioning in areas with extreme climatic conditions.

Applications include high-density office buildings, nuclear power plants, offshore drilling platforms, nuclear-powered navy vessels and high-volume industrial process plants.

ABB dry type transformers fulfil the requirements of international standards IEC 60726, as well as the European HD464 and HD538.

ABB's dry type transformers are virtually maintenance free and are manufactured in accordance with the international quality standards ISO 9001 and ISO 14001.

Applications

ABB dry type transformers are most suitable for installations that require a high degree of safety, such as: hospitals, shopping centres, multipurpose cultural centres, car factories etc. ABB dry type transformers are also the most technologically advanced, designed for the severe conditions present in:

- Chemical processing, offshore platforms for oil wells, offshore drilling platforms, marine applications, container cranes at seaports.
- Heavy industrial applications: wind power generation, underground railways, stations and underground mines in non-classified areas. Rectifiers and frequency converters for AC motors. Power plants for auxiliary services and excitation transformer systems.

Dry Type Transformers

Product	MVA	Primary Voltage (kV)	Features
Vacuum Cast Coil	≤ 30	up to 36	Provides the ultimate in winding protection for the most demanding applications when efficiency and reliability are critical.
RESIBLOC® Resin-encapsulated	≤ 30	up to 41.5	Provides the ultimate resistance to mechanical stress associated with heat and short circuit conditions in the most demanding applications.



Standard features

Core

ABB's dry type transformers utilise a step-lap mitred core construction to ensure optimum performance and minimum sound levels. The mitred core joint allows efficient flux transfer along natural grain lines between the core legs and yoke. The step-lap construction further enhances the efficiency of the joint by reducing joint fringing which reduces core losses and exciting currents.

The core is designed and built to provide the lowest possible losses from the effects of magnetic hysteresis and eddy currents. All possible steps are taken to prevent local circulating currents and to avoid built-in bending stresses.

ABB starts with non-ageing highly permeable cold-rolled, grain-oriented silicon steel, and constructs the core with step-lap mitred joints. Magnetic flux densities are kept well below the saturation point. The steel is precision cut to assure that it will be smooth and burr-free. For rigidity and support, the upper and lower yokes are solidly clamped to a sturdy metal frame. The finished core is coated with a corrosion resistant sealant which provides lamination cohesion and environmental protection.

Windings

ABB's windings construction depends on operating voltage, basic impulse level and current capacity of the individual winding. Typically, ABB's Low Voltage windings, insulation class 1.1 kV, are wound using sheet conductors. This construction allows free current distribution within the axial width of the coil which eliminates the axial forces developed in other types of windings under short circuit conditions.

During the assembly process each Low Voltage winding is blocked radially and axially against the core using a combination of solid and resilient mounts for sound suppression and thermal expansion compensation.

ABB's winding construction may be either round or oval up to 2500 kVA. Windings on transformers with a rating greater than 2500 kVA are generally round.

An experienced and dedicated work force ensures quality transformers and customer satisfaction with the product.

Vacuum Cast Coil Transformers (≤ 30 MVA)

Construction features

Description

ABB vacuum cast coil transformers range from 50 kVA up to 30 MVA with primary operating voltages up to 36 kV and secondary operating voltage up to 6 kV.

Customers demand dry type transformers more frequently in order to minimise environmental contamination and fire hazard. These transformers are not flammable, they are self-extinguishing and in the event of a breakdown there is no risk of leakage of flammable or contaminating substances.

The emission of toxic substances and fumes is minimised. The use of cast resin, combined with our latest manufacturing technique allows us to build a stronger compact transformer capable of withstanding severe rolling and vibration.

Vacuum cast coil transformers are virtually maintenance free. They do not require any special civil works prior to installation and due to the particular design they can be repaired on site. ABB vacuum cast coil transformers are manufactured in accordance with the international quality standard ISO 9001.

Vacuum cast coil transformers are moisture-proof, suitable for operation in humid or heavily polluted environments. They are the ideal transformers for operation in environments with a humidity higher than 75% as well as at temperatures lower than -25°C .

Standard features

- HV coils vacuum cast in epoxy resin.
LV windings pre-impregnated
- Casting process utilises high performance filled epoxy
- Aluminium windings, copper optional
- Step-lap mitered core
- 155°C insulation system and 100°C average temperature rise
- Four full capacity taps on HV winding rated $\pm 2 \times 2.5\%$



- Provisions for lifting core and coil assembly
- Rating plate
- Temperature control device
- Earthing terminals
- Base equipped with bidirectional rollers or designed for skidding

Options and accessories

Design options:

- 80°C average temperature rise (or other according to requirement)
- Copper windings
- Cast coil LV windings
- Increased basic impulse levels
- Dual primary-secondary voltage
- Loss optimised designs
- Retrofit designs
- Other designs available on request

Accessories

- Three-phase electronic temperature monitor
- Anti vibration pads
- Optional ventilated enclosure with removable front and rear panels (IP20 to IP65)
- Electrostatic screen
- Forced cooling package with three-phase electronic temperature monitor
- Air-filled terminal chambers
- Special paint colours
- Plug-in terminals (quick connectors)

Standard tests

- Transformation ratio at all taps and polarity
- Applied voltage
- Induced voltage
- Partial discharge test
- Resistance of all windings
- Vector group
- No-load loss and no-load current
- Load losses and impedance voltage test

Type tests

- Temperature rise test
- Lightning impulse test
- Measurement of noise level
- Insulation resistance

Humid or heavily polluted environments

- Use of epoxy resins – not hygroscopic
- Conductor protected from corrosion
- E2 class certified (tested for ambient 90% humidity and 50°C)
- C2 class certified (operation down to -25°C)
- Minimum dust accumulation

Partial discharge tests

- Routine test for partial discharge
- Below 5 pC

Fire hazards

- Neither dioxins nor hydrohalogen compounds
- Non toxic materials used
- F1 class certified
- Self-extinguishing
- Light transmission factor of fumes >60%

Electrical and mechanical design

- Impulse test withstands voltage up to 200 kV
- Mechanically stronger, safe against vibrations and earthquakes
- Withstands thermal and dynamic short circuit effects

Specifications

- Self-Cooled Power Rating: 50 kVA – 25 MVA
- Primary Voltage: Withstands up to 36 kV
- Primary Lightning impulse voltage: Withstands up to 170 kV
- Secondary Voltage: Withstands up to 6 kV
- Secondary Lightning impulse withstand voltage: Withstands up to 60 kV
- Temperature Rise: 100/100°C

Vacuum Cast Coil Transformers: AL/AL Windings. Cenelec losses

Highest voltage for equipment		12 kV	AC 28 kV	LI 75 kV	
Rated power	Load loss at 120°C	Load loss at 75°C	No-load loss at 100% Ur	Short-circuit impedance	Sound power level
kVA	W	W	W	%	dB
50	1400	1230	350	4	58
100	2000	1760	440	4	59
160	2700	2380	610	4	62
250	3500	3080	820	4	65
315	4300	3780	1100	4	66
400	4900	4310	1150	4	68
500	6400	5630	1350	6	69
630	7600	6690	1370	6	70
800	9000	8010	1800	6	71
1000	10000	8900	2000	6	73
1250	12500	11130	2500	6	74
1600	14000	12460	2800	6	76
2000	18000	16200	3600	6	78
2500	21000	18900	4300	6	81

AC: Power frequency withstand voltage LI: Lightning impulse withstand voltage.

Please note that this table only shows a small sample of all product designs and ratings we supply.



Energy for leisure

Few applications place higher demands on transformers than those aboard large cruise liners. This is why the liners Disney Wonder and Disney Magic use Vacuum Cast Coil transformers from ABB.

Vacuum Cast Coil Transformers: AL/AL Windings. Cenelec losses

Highest voltage for equipment		24 kV	AC 50 kV	LI 125 kV	
Rated power	Load loss at 120°C	Load loss at 75°C	No-load loss at 100% Ur	Short-circuit impedance	Sound power level
kVA	W	W	W	%	dB
50	1500	1320	350	6	58
100	2100	1850	500	6	59
160	2900	2550	750	6	62
250	3800	3340	880	6	65
315	4600	4050	1150	6	66
400	5500	4840	1200	6	68
500	7000	6160	1500	6	69
630	7800	6860	1650	6	70
800	9400	8370	2100	6	71
1000	11000	9790	2300	6	73
1250	13500	12020	2900	6	74
1600	16000	14240	3100	6	76
2000	19500	17550	4200	6	78
2500	23000	20700	5000	6	81

AC: Power frequency withstand voltage LI: Lightning impulse withstand voltage.

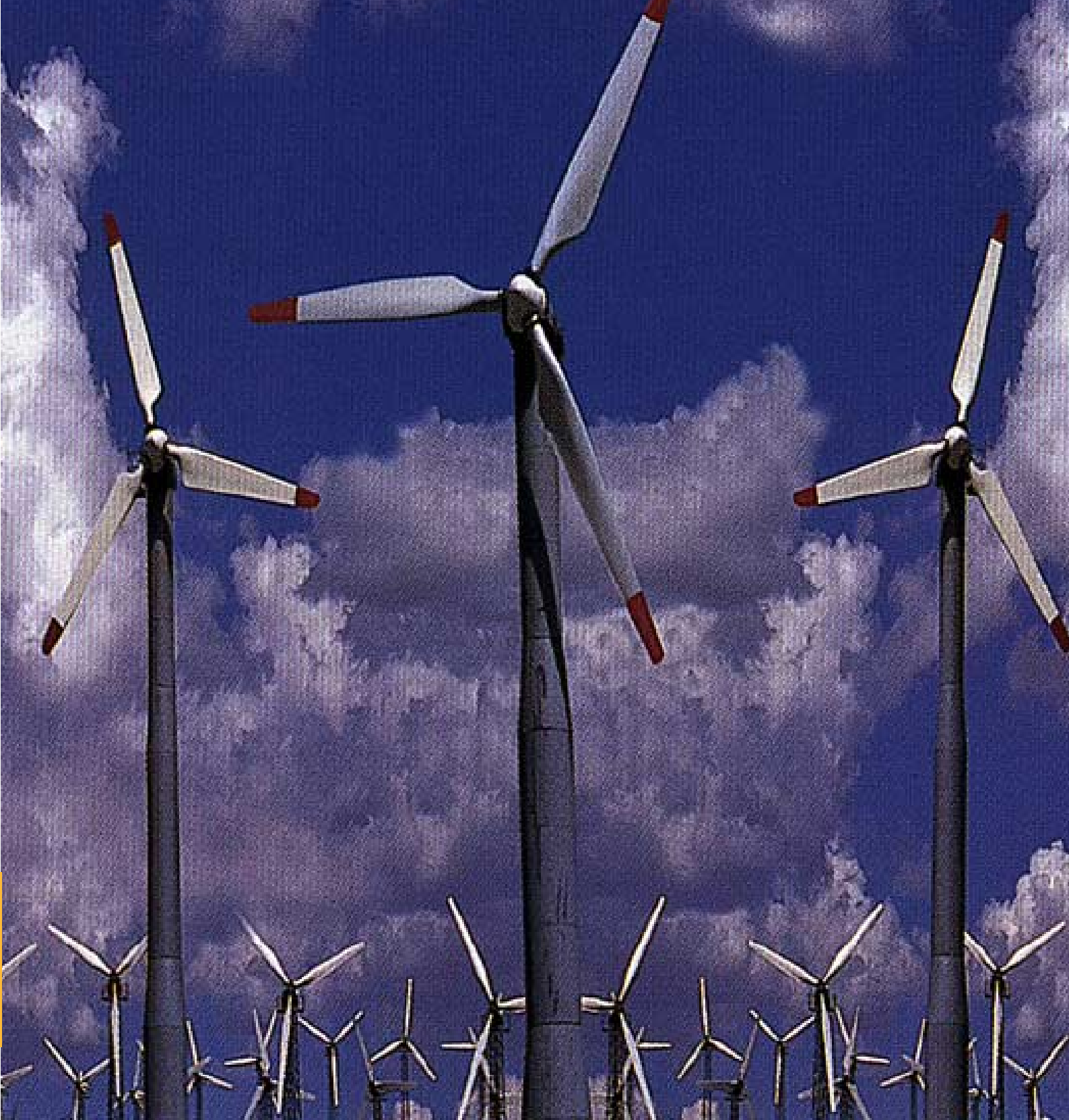
Please note that this table only shows a small sample of all product designs and ratings we supply.

Vacuum Cast Coil Transformers: AL/AL Windings. Cenelec losses

Highest voltage for equipment		36 kV	AC 70 kV	LI 175 kV	
Rated power	Load loss at 120°C	Load loss at 75°C	No-load loss at 100% Ur	Short-circuit impedance	Sound power level
kVA	W	W	W	%	dB
160	2900	2550	960	6	66
250	4000	3520	1280	6	67
315	4800	4220	1500	6	68
400	5700	5020	1650	6	69
500	7100	6250	1950	6	70
630	8000	7040	2200	6	71
800	9700	8630	2800	6	72
1000	11500	10240	3100	7	73
1250	13800	12280	3700	7	74
1600	17000	15130	4200	8	76
2000	21000	18900	5000	8	78
2500	25000	22500	5800	8	81

AC: Power frequency withstand voltage LI: Lightning impulse withstand voltage.

Please note that this table only shows a small sample of all product designs and ratings we supply.



Good as gold

With reliable and environmentally safe transformers from ABB, a windy location in Denmark can become a gold mine.

Vacuum Cast Coil Transformers: AL/AL Windings. Cenelec losses

Highest voltage for equipment 12 kV IP00									
Rated power	A	B	H	B1	B2	E	Ø	G	weight
kVA	mm	mm	mm	mm	mm	mm	mm	mm	kg
50	1020	800	1240	300	450	520	125	40	520
100	1100	800	1240	300	450	520	125	40	730
160	1270	800	1290	300	475	520	125	40	860
250	1280	850	1440	375	475	670	125	40	1230
315	1350	850	1480	375	495	670	125	40	1310
400	1440	850	1520	375	495	670	125	40	1660
500	1440	850	1630	375	525	670	125	40	1570
630	1550	900	1650	375	525	670	125	40	2060
800	1550	900	1880	375	575	670	125	40	2170
1000	1620	900	1900	375	575	670	125	40	2620
1250	1680	1000	2200	490	610	820	200	70	3100
1600	1840	1000	2250	490	610	820	200	70	4020
2000	1860	1000	2480	490	635	820	200	70	4630
2500	2050	1250	2500	615	635	1070	200	70	5500

AC: Power frequency withstand voltage LI: Lightning impulse withstand voltage.

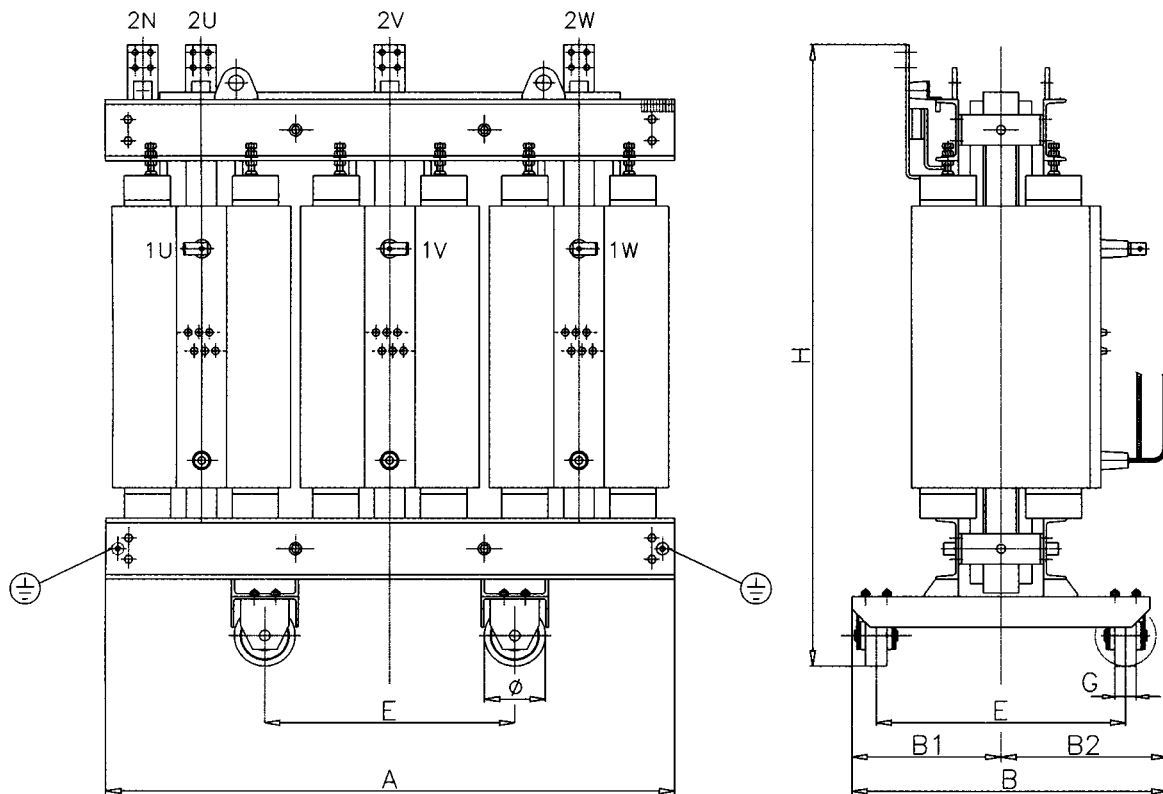
Please note that this table only shows a small sample of all product designs and ratings we supply.

Vacuum Cast Coil Transformers: AL/AL Windings. Cenelec losses

Highest voltage for equipment 24 kV IP00									
Rated power	A	B	H	B1	B2	E	Ø	G	weight
kVA	mm	mm	mm	mm	mm	mm	mm	mm	kg
50	1020	800	1300	300	450	520	125	40	540
100	1100	800	1300	300	450	520	125	40	750
160	1270	850	1350	300	475	520	125	40	970
250	1480	850	1500	375	475	670	125	40	1320
315	1550	850	1550	375	495	670	125	40	1440
400	1620	900	1560	375	495	670	125	40	1760
500	1620	900	1700	375	525	670	125	40	1800
630	1670	900	1730	375	525	670	125	40	2260
800	1680	900	1950	375	575	670	125	40	2450
1000	1770	900	1980	375	575	670	125	40	2910
1250	1800	1000	2270	490	610	820	200	70	3380
1600	1920	1000	2320	490	610	820	200	70	4240
2000	2000	1000	2550	490	635	820	200	70	4900
2500	2150	1250	2580	615	635	1070	200	70	5900

AC: Power frequency withstand voltage LI: Lightning impulse withstand voltage.

Please note that this table only shows a small sample of all product designs and ratings we supply.



Vacuum Cast Coil Transformers: AL/AL Windings. Cenelec losses

Highest voltage for equipment 36 kV IP00

Rated power kVA	A mm	B mm	H mm	B1 mm	B2 mm	E mm	Ø mm	G mm	weight kg
160	1450	925	1450	300	625	520	125	40	1150
250	1550	1000	1600	375	625	670	125	40	1420
315	1600	1000	1650	375	625	670	125	40	1650
400	1800	1000	1700	375	625	670	125	40	2100
500	1800	1000	1800	375	675	670	125	40	2120
630	1850	1000	1850	375	675	670	125	40	2550
800	1920	1000	2050	375	725	670	125	40	3020
1000	1950	1050	2100	375	725	670	125	40	3250
1250	2000	1100	2400	490	760	820	200	70	3680
1600	2100	1150	2450	490	760	820	200	70	4480
2000	2200	1150	2600	490	785	820	200	70	5200
2500	2350	1300	2650	615	785	1070	200	70	6200

AC: Power frequency withstand voltage LI: Lightning impulse withstand voltage.

Please note that this table only shows a small sample of all product designs and ratings we supply.

Construction features

Description

The ABB resin-encapsulated dry-type transformer, RESIBLOC®, offers specific advantages. For more than a quarter of a century we have been using only epoxy resin and fibre-glass to encapsulate the wire layers. Epoxy resin moulding reinforced with fibre-glass rovings is a material of outstanding strength. Furthermore we manufacture RESIBLOC® transformers without the addition of extenders or plasticizers. Electronically controlled winding processes ensure uniform distribution of the glass rovings and precise tracking.

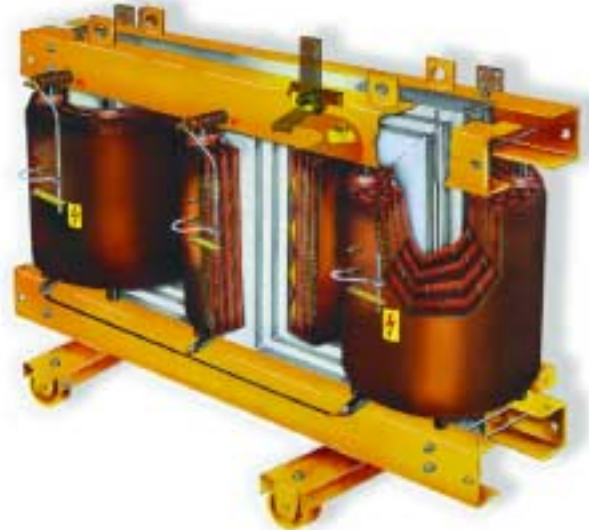
The Low Voltage and High Voltage windings are joined adhesively by way of bars to form a compact block winding. The favourable impulse voltage distribution – resulting from the costly multilayering of the High Voltage winding – in conjunction with the outstanding strength of the coil makes RESIBLOC® resin-encapsulated transformers short-circuit proof.

The fibre-glass reinforcement of the resin-encapsulated RESIBLOC® windings is so robust that we have no hesitation in guaranteeing the crack resistance of the High Voltage coil for the entire life of the transformer.

We also guarantee that no silicone is used at any time in RESIBLOC® coil manufacture. This is a further key point for those operators who demand absolutely silicone free manufacture from their transformer suppliers.

Standard features

- Ratings: from 30 kVA to 30 MVA
- Primary Voltages: up to 41.5 kV
- Secondary Voltages: up to 36 kV
- BIL: According to standards
- HV Winding: Copper
- LV Winding: Aluminum
- Step-lap mitred core
- Tapping 2 x 2.5%
- Temperature device
- Fire class F1
- Environmental class E2
- Climatic class C2



- Built-in cooling channels to dissipate heat
- Environmentally friendly
- Linear distribution of lightning impulse voltage
- Base equipped with bi-directional rollers or designed for skidding arrangement

Options and accessories

- Dimensions adaptable to specific requirements
- Loss optimised design
- Special designs as traction, rectifier and converter transformer, multiwinding transformers
- Enclosure IP20 to IP65, indoor and outdoor, galvanized without painting
- Fans for forced cooling (up to 140% of AN rating), including control
- Anti-vibration pads, (1 set=4 pieces)
- Earthing bolts (1 set=3 pieces)
- PTC sensors, with relay
- Dial type thermometer (with capillary tube 2 m)
- Thermo-resistor PT100
- Copper for LV windings
- Reduced temperature rise on request

Certified test results

- Safe to store and transport at -60°C (standard test requirement only -25°C)
- Tested with twice rated current at -40°C (standard test requirement only -25°C)
- Vibration tested for installation in seismic areas. Acceleration tested to 12.5 g
- All components tested for non-toxicity
- Repeated thermal shock with hot air 120°C and cold air -10°C (over 10 times)

Fire proof

- Approx. 80% fibreglass in winding insulation
- Only non-toxic materials
- Max 5% calorific energy of comparable oil type unit
- No halogens, nor sulphur (fluorine/chlorine/bromine)
- Every unit guaranteed to be self-extinguishing. Fire class 1 certified

Short circuit proof

- High mechanical stability of coil structure
- Diagonally and radially fibreglass braced (HV-winding)
- Turns glued to each other with prepreg (LV winding)
- HV and LV windings form a singular coil
- Coil structure will withstand radial forces in short circuit conditions

Moisture and pollution proof

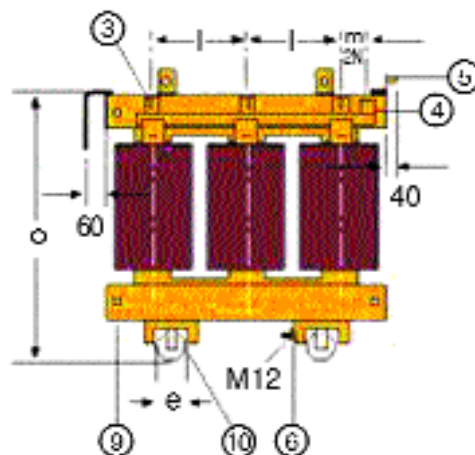
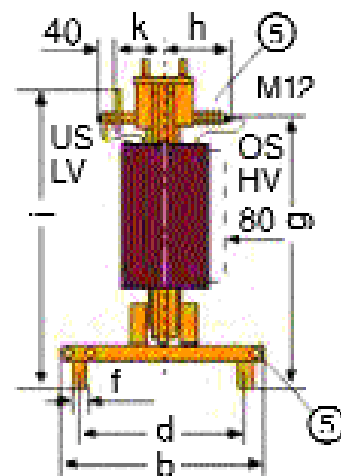
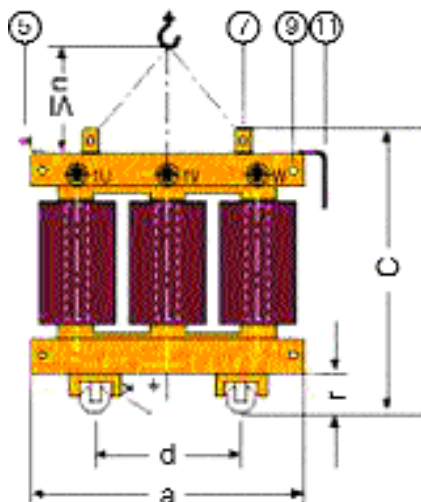
- 100% humidity and condensation proof
- Strong presence in off-shore applications
- High resistance to chemical pollution
- Long-term molecular stability due to absence of flexibilisers

Crack proof

- Severe thermo-shock tested
- Severe hot/cold dip tests
- Physical and mechanical properties of coil components optimised
- High resistance to extremely low ambient temperatures
- Performance stability under extreme load conditions
- Not a single crack registered to date

Minimal dust accumulation

- Vertical cooling channels with chimney effect
- Minimum dust settles
- No horizontal ducts
- Small upper coil surface
- Surface structure non-adhesive to dust



RESIBLOC® Resin-encapsulated Transformer

Standard transformers 12 kV					
Rated power	Load loss at 120°C	Load loss at 75°C	No-load loss at 100% Ur	Short-circuit impedance	Sound power level
kVA	W	W	W	%	dB
100	2000	1700	440	4	59
160	2700	2300	610	4	62
250	3500	3000	820	4	65
315	4200	3650	950	4	67
400	4900	4300	1150	4	68
500	6300	5500	1300	4	69
630	7300	6400	1500	4	70
250	3900	3400	690	6	65
315	4700	4100	820	6	67
400	5730	5000	1000	6	68
500	6530	5700	1200	6	69
630	7600	6600	1370	6	70
800	8820	7700	1700	6	72
1000	10000	8800	2000	6	73
1250	12000	10500	2400	6	75
1600	14000	12700	2800	6	76
2000	18000	15500	3500	6	78
2500	21000	19000	4300	6	81

RESIBLOC® Resin-encapsulated Transformer

Standard transformers 24 kV					
Rated power	Load loss at 120°C	Load loss at 75°C	No-load loss at 100% Ur	Short-circuit impedance	Sound power level
kVA	W	W	W	%	dB
100	1750	1550	600	4	59
160	2500	2150	870	4	67
250	3450	3000	1100	4	65
400	4900	4250	1450	4	68
630	6900	6000	2000	4	70
100	2050	1750	460	6	59
160	2900	2500	650	6	62
250	3800	3300	880	6	65
315	4580	4000	1050	6	67
400	5500	4800	1200	6	68
500	6870	6000	1400	6	69
630	7800	6900	1650	6	70
800	9280	8100	1900	6	72
1000	11000	9600	2300	6	73
1250	13100	11500	2700	6	75
1500	16000	14000	3100	6	76
2000	19100	19000	4000	6	78
2500	23000	20000	5000	6	81

AC: Power frequency withstand voltage LI: Lightning impulse withstand voltage.

Please note that this table only shows a small sample of all product designs and ratings we supply.

RESIBLOC® Resin-encapsulated Transformer

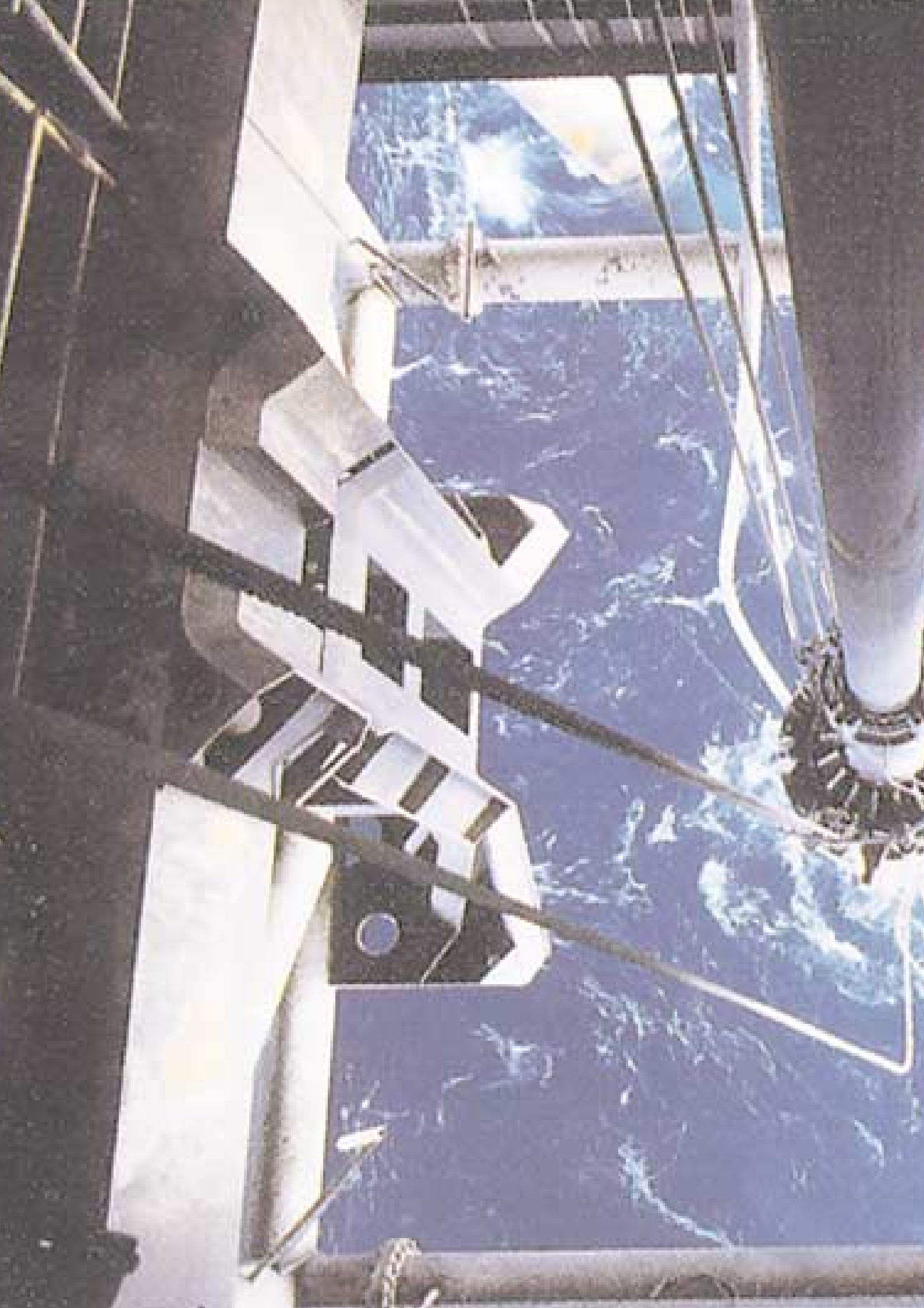
Reduced no-load loss transforming 12 kV					
Rated power	Load loss at 120°C	Load loss at 75°C	No-load loss at 100% Ur	Short-circuit impedance	Sound power level
kVA	W	W	W	%	dB
100	2000	1700	320	4	51
160	2700	2300	440	4	54
250	3500	3000	600	4	57
315	4200	3650	730	4	59
400	4900	4300	880	4	60
500	6300	5500	1000	4	61
630	7300	6400	1150	4	62
250	3900	3400	540	6	57
315	4700	4100	640	6	59
400	5730	5000	780	6	60
500	6530	5700	940	6	61
630	7600	6600	1100	6	62
800	8820	7700	1330	6	64
1000	10000	8800	1500	6	65
1250	12000	10500	1880	6	67
1600	14000	12700	2100	6	68
2000	18000	15500	2750	6	70
2500	21000	19000	3000	6	71

RESIBLOC® Resin-encapsulated Transformer

Reduced no-load loss transforming 24 kV					
Rated power	Load loss at 120°C	Load loss at 75°C	No-load loss at 100% Ur	Short-circuit impedance	Sound power level
kVA	W	W	W	%	dB
100	1750	1550	400	4	51
160	2500	2150	580	4	54
250	3450	3000	800	4	57
400	4900	4250	1100	4	60
630	6900	6000	1600	4	62
100	2050	1750	340	6	51
160	2900	2500	480	6	54
250	3800	3300	650	6	65
315	4580	4000	820	6	59
400	5500	4800	940	6	60
500	6870	6000	1100	6	61
630	7800	6900	1250	6	62
800	9280	8100	1460	6	64
1000	11000	9600	1800	6	65
1250	13100	11500	2080	6	67
1600	16000	14000	2400	6	68
2000	19100	16700	3100	6	70
2500	23000	20000	3600	6	71

AC: Power frequency withstand voltage LI: Lightning impulse withstand voltage.

Please note that this table only shows a small sample of all product designs and ratings we supply.





Offshore of course

About 200 RESIBLOC® transformers are installed on offshore platforms, ensuring that there is a continuous flow of gas and oil. Among our supplies in 1999 was another 15 MVA unit for Statoil's Veslefrik field.

Special Application Transformers

Customers demand a wide range of excellent products. These should be manufactured competitively. Customers also expect accurate information and expert advice.

ABB supplies a complete range of distribution transformers from single phase, oil-filled or dry, pole-mounted units through all standard units to meet all power requirements. But sometimes situations arise in which even the widest range of transformers currently available cannot meet the customer's needs. In those cases we design and build customised transformers to fulfil the customer's requirements in every respect.

Due to our long experience, our deep and wide engineering skills and our close co-operation with our customers we can find a practical solution to every problem. So it is little wonder that ABB has the most advanced transformers in operation around the world – from the very smallest to the largest and most sophisticated custom built units.

Transformers for Special Applications

Product

Pad Mounted
Transformers

Transformers for
Variable Speed Drives

Reactors

Boosterformers™

Pad Mounted Transformers

Construction features

Description

ABB padmounted transformers feature a tamper resistant construction with no externally accessible bolts, hinges, screws or fasteners, thus providing a safe, self-contained unit which cannot be accessed by unauthorised personnel. Unsightly fences or other forms of protective devices are not necessary. Completely factory assembled, the units are shipped in one piece. These units feature a rectangular core and coil design which is a distinguishing characteristic of ABB's oil type transformers. This proven design offers reliability, durability and reduced dimensions. Nearly 40 years of service and scrupulous testing confirm the consistency of the design.



Standard features

1. *Tamper resistant*
2. *Copper or aluminium windings*
3. *Special core and coil design*
4. *65°C average temperature rise*
5. *Tap changer for deactivated operation*
6. *Four full capacity taps on winding rated 2.5% 2-FCAN - 2-FCBN on units with voltage above 601 V*
7. *Liquid preservation system with sealed tank*
8. *Tank rated 5 psig for oil-filled units*
9. *Tank rated 8 psig for silicone filled units*
10. *Lifting lugs for moving complete units*
11. *Pressure relief valve*
12. *Two copper-faced steel ground pads on tank*
13. *Weather-resistant cabinet bolted to the front of the transformer*
14. *HV/LV compartment barrier bolted in place*
15. *Three-point terminal compartment latching*
16. *HV compartment located on left side of unit:*
 - a) *Live front-cast resin bushings, or universal bushing wells for dead front*
 - b) *Provision for distribution-class LAs*
 - c) *Space for stress cones*
 - d) *Interlocked door which can be opened only after opening LV compartment door*
17. *LV compartment located on right side:*
 - a) *Compartment door with provision for pad-lock*
 - b) *Ground pad*
 - c) *Provision for dial-type thermometer*
 - d) *Provision for vacuum-pressure gauge*
 - e) *Pressure relief valve*
 - f) *Liquid level gauge*
 - g) *Diagrammatic stainless steel rating plate*
18. *Different paint finishes available*
19. *Base designed for rolling the unit in accordance with ANSI-IEC-DIN segment centre lines*

Options and accessories

- *Copper windings*
- *55°C average winding temperature rise*
- *Dead front primary entrance*
- *Basic impulse level adjustable on request*
- *Dial-type thermometer*
- *Liquid level valve*
- *Pressure vacuum gauge*
- *Radiator valves*
- *Sudden Pressure surge relay*
- *CTs and PTs*
- *Special ambient conditions*
- *Special altitudes*
- *Non-standard HV taps*
- *Special impedance*
- *Special noise levels*
- *Electrostatic shields*
- *Special paint finishes*

Transformers for Variable Speed Drives



Introduction

With the increasing use and complexity of variable speed drives for different applications, selecting the correct converter transformer has become of vital importance. Choosing the correct converter transformers for different converters and drive systems means reduced downtime, extended equipment life, reduced harmonic distortion and last, but not least, energy saving.

ABB offers you a wide range of converter transformers. The transformers have been developed in close co-operation with converter manufacturers and with the aim of achieving the highest possible reliability and efficiency.

ABB offers converter transformers for your every need:

● Input transformers for supply of drive systems

6-, 12- or 24-pulse supply for different converters, e.g.

- *load commutated inverters*
- *PWM inverters*
- *six step inverters*
- *cycloconverters (see opposite)*
- *cascade drives*
- *diode and thyristor rectifiers*

● Output transformers

Transformers for voltage step-up from converter to motor (see opposite).

● Transformers for converter starting applications

Transformers are manufactured as oil-filled, either mineral, silicone or MIDEI fluid, or as dry type transformers. They can be manufactured with an output of up to approx. 30 MVA (primary power). A symmetrical impedance and the capacity to withstand short circuiting are essential.

Input transformers

Why add an input transformer?

Voltage adaptation

Converter drives are normally fed by medium voltage networks from 6 kV up to 36 kV. The converter supply voltage usually ranges from 400 V up to 4 kV. The input transformer adapts the medium network voltage to the converter supply voltage.

Galvanic isolation

The input transformer isolates the converter from the feeding network and reduces short circuit currents to the converter.

EMC

A specifically designed shield between transformer windings reduces transferred radio interference from the drive to the network. The earthed shield also protects the drive from transient over-voltages coming from the feeding network.

Harmonics reduction

Network regulations require reduction of harmonic distortion. The transformer impedance acts as a commutating reactor and thus reduces harmonics. Different transformer connections are used to achieve multi-pulse systems with substantial harmonic reduction.

Transformers for cycloconverter supply

Cycloconverters are used for high power, low speed synchronous motor drives such as:

- *Rolling mill drives*
- *Ship propulsion (see below)*
- *Mine hoist drives*
- *Wind tunnel drives etc.*

The main parts of a cycloconverter drive are supply transformers, the cycloconverter, high speed circuit breakers and the synchronous motor. The following types of transformers are used:

- *2 winding transformers*
- *3 winding transformers*
- *4 winding transformers*

Output transformers for converters

Converters are available for only a limited range of standard motor voltages, the highest being 4 kV. A specially designed transformer can be used to transform the converter output voltage to match any motor rated voltage. Normally the voltage is raised from the Low Voltage converter to feed an HV motor. (Thus the name “converter step-up transformer”, which is also commonly used.)

A standard transformer cannot be used due to variation in frequency, the harmonic distortion and the DC component existing during transients in the output voltage of the frequency converter. A special step-up transformer has therefore been developed for this application in co-operation with converter manufacturers.

Typical applications

Most typical applications are for submersible oil pump drives, rolling mill drives and similar equipment where only HV motor applications are available. Output transformers can also be applied to reduce the voltage at the end of a long transmission system to be more appropriate for a motor. The output step down transformers in the latest applications are submersible i.e. they are placed on the seabed close to the motor.

Typical applications for output transformers are when:

- *The motor does not have a standard voltage converter (retrofit or by-pass application required)*
- *Distance from the converter to the drive is long and a high voltage motor is used to reduce cabling costs, or where low voltage cabling would not be feasible due to losses and voltage drop*
- *Cost of a high voltage converter is too high compared with a low voltage converter and an output transformer (low end rating of the converters)*
- *Tappings are required to match the drive to different motor voltages or different cable lengths*

Output transformers are produced in oil type and dry type configurations up to 6 MVA ratings for various types of converter and output voltages up to 15 kV. Transformers are individually designed and manufactured according to system requirements.

Ship propulsion systems

Electric propulsion for marine applications was initially used on holiday cruises for reasons of comfort (i.e. lower vibrations compared to mechanical propulsion). Nowadays it is also applied to cargo ships, icebreakers, ferryboats etc. due to the installation and manoeuvring flexibility of motor groups and for space rationalisation as well as for the improvement in the system's global performance.

These transformers adapt the generated voltage to the voltage of the static converters which control the motors. They are designed to particular specifications to meet specific space problems (e.g. height limitations) and the presence of high harmonic currents as well as mechanical vibrations coming from the ship's structure.



Converter transformer.



Converter transformer.



Converter transformer.



Converter transformer, 19400 kVA, three-windings supply of LCI-drives.



13.2 MVA, 4-windings, water cooled RESIBLOC® transformer for ship-propulsion.



Converter transformer.



Ship propulsion transformer 6.6 kVA – 6.6-2.1 kVA-AFWF.



Converter transformer.



Duplex reactor for ship-propulsion.

Construction features

Introduction

Single-phase and/or three-phase reactors are characterised by a wide range of solutions found in several High Voltage and/or Medium Voltage installations for both oil-type and dry purposes.

Reactors for cycloconverter drives

Zero sequence reactors

Zero sequence reactors are used to limit zero sequence current on motors with galvanically separated windings. The reactors are individually designed and manufactured according to system requirements. Therefore no standard types are listed.

Commutation reactors

Direct cycloconverters without supply transformers (e.g. propulsion and other drives where space and weight limitations are important) are usually fitted with commutation reactors. The reactors reduce the commutation currents and notches in the system voltage. The commutation reactors are normally dry-type but can also be manufactured as oil immersed.

Two basic designs are used:

- 1. Saturable gapped core reactors*
 - no short circuit current limitation is needed*
- 2. Non-saturable type reactors*
 - the reactor also works as a short circuit limiting reactor*

The commutation reactors are individually designed and manufactured according to system requirements.

Duplex reactors

Duplex reactors are special commutation reactors used in propulsion drives to achieve distortion free voltage in the auxiliary circuits. The most efficient harmonic reduction is achieved when the duplex reactors are connected to the generators, one to each generator. In this way the effect on harmonics does not depend on the operation. The duplex reactors are individually designed and manufactured according to system requirements. Single-phase and/or three-phase reactors are characterised by a wide range of solutions found in several high voltage and medium voltage installations for both oil and dry purposes.

Fields of application

- Cycloconverter drives*
- Shunts*
- Current-limiting*
- Neutral-earthing current-limiting*
- Damping*
- Tuning (filter)*
- Earthing-transformer (neutral coupler)*
- arc-suppression*
- Smoothing*



Submarine converter transformer to be used to supply power and oil pumps. Can be placed at a depth of 2000 meters below the sea level.



Earthing transformer for limitation of short-circuit current to earthfault. 24 MVA/10 s – Single Phase – 76 kV/ 8 kV-60 H₂. Extremely robust design (both electrical and mechanical).



Reactor for reduction of harmonic currents and transient over – currents in DC Systems. Highly line are magnetic characteristics and withstand of over-voltages caused by lightning and switching.



Coreless, air-insulated, smoothing reactor to comply with transformer in railway applications.

Boosterformers™



Cable Boosterformer™
for electric railway system.

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