Vacuum Cast Coil Dry Type Distribution Transformers

The reliability in your hands.

ABB is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact.

Mission

ABB is a global leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact.

Introduction to ABB

ABB is the worlds leading supplier of Distribution Transformers. We offer :

- All technologies (Dry/Liquid)
- All standards (IEC, ANSI, etc)
- Applications up to 72,5 kV

Facts and figures (approx)

- Production facilities around the world : 30
- Countries with Sales and Services centers : 140
- Number of units sold yearly : 400.000

Working with us, you have access to a worldwide network of factories and facilities serving you locally with a full range of products and solutions.

Our warranty provides one ABB quality and service. Working together gives you access to production facilities using Industrial IT and the most up to date technologies, providing the highest quality for standard and specialty products as well as solutions.

Introduction to Industrial IT

Industrial IT is ABB's name for a powerful commitment to solutions for Real-Time Auto-mation and Information.

Industrial IT guides every step ABB takes going forward in technology, business processes, and more. All ABB Distribution Transformer products are Industrial IT certified, which guarantees structured, easy accessible and on-line documentation.

It can be viewed on its own but also as a part of a larger system.

Quality statement

Our production facilities are ISO 9001/14001 certified. Our aim is to deliver your distribution transformers fast, on time and conform to your specifications.

ABB Vacuum Cast Coil dry transfomer- a leader in its category

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.

ABB Vacuum Cast Coil dry transformers are manufactured in accordance with the international quality standard ISO 9001 and ISO 14001.

ABB Vacuum Cast Coil dry 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 95 % as well as at temperatures down to -25 °C.

With more than 100.000 dry transformers working around the world, produced in specialised dedicated focus factories summing the largest production capacity than any of our competitors, ABB is the technology leader providing the broadest experience and application range of ABB Vacuum Cast Coil dry transformers.

ABB Vacuum Cast Coil is the only cast resin transformer certified by UL with a Thermal Index at least 180 °C (Class H) according to ANSI C57.12.60 - IEEE Trial-Use Standard Test Procedures for Thermal Evaluation of Insulation Systems for Solid-Cast and Resin-Encapsulated Power and Distribution Transformers.

Closer to the user – dry transformers are the only one that can be installed close to the utilisation point which allows to optimise installation design reducing to the minimum the low voltage circuits with the corresponding savings in losses and low voltage connections. In many countries it is mandatory to install dry transformers when substations are located inside public buildings.

The most economical

- Less space needed
- Less civil work needed
- No special safety features required (fire detection)
- Maintenance free
- Longer transformer life due to low thermal and dialectic ageing
- Can be installed closer to the point of consumption reducing load cable losses
- Optimal design subject to constant improvements in design as new materials become available.
- Produced in high throughput, specialised and efficient ABB Focus Factories

Safe and Environmental friendly

- Reduced environmental contamination
- Zero risk of leakage of flammable or contaminating substances
- Environmental safe in production (closed system)
- Well suited to damp and contaminated areas
- No fire hazard

The lowest partial discharge value thanks to the most advanced casting technology.

Epoxy resin casted under vacuum avoids entry of moisture and protects against aggresive environments. Fiberglass reinforcement provides superior mechanical strength.

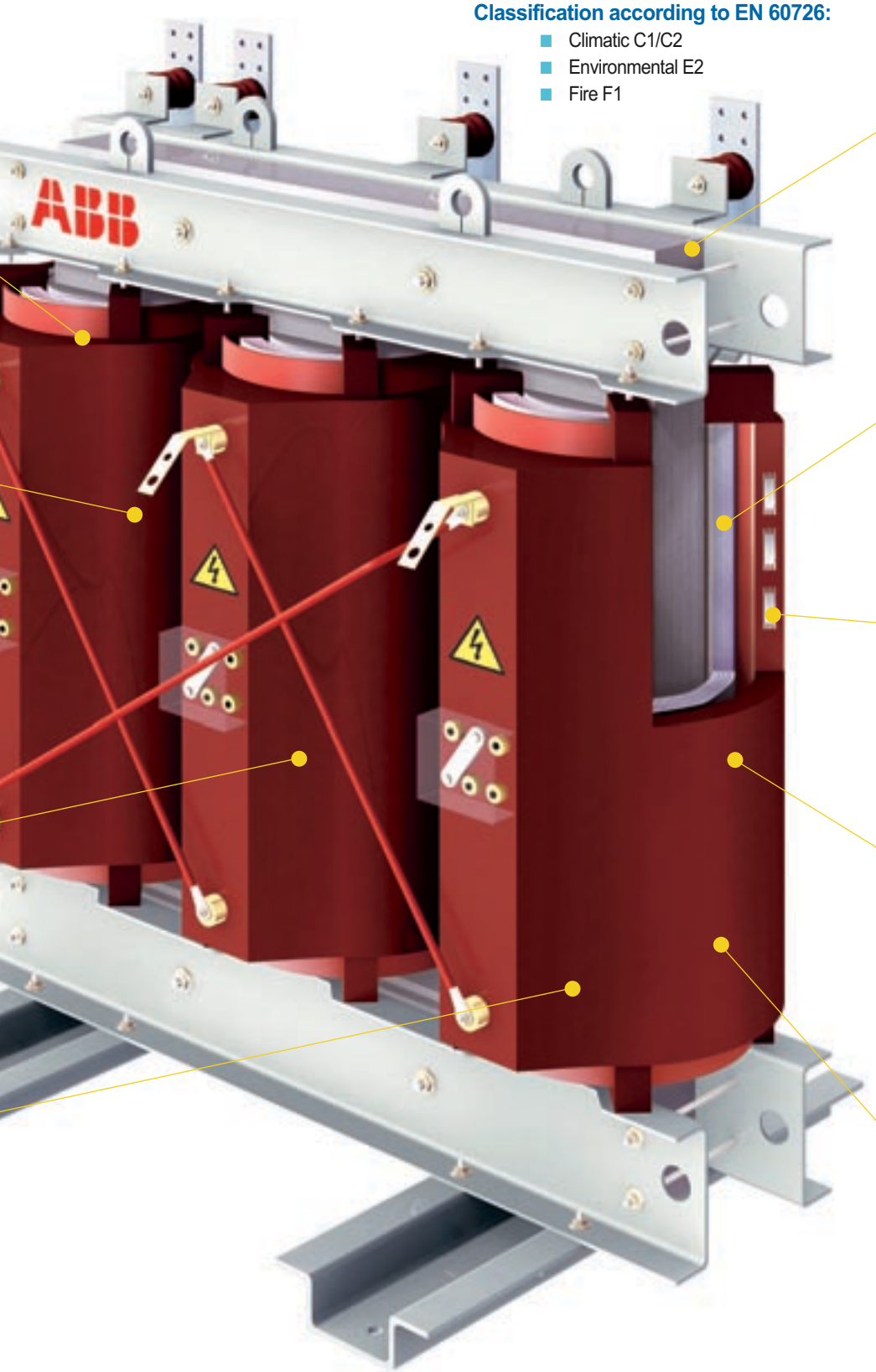
Unique coil finishing provides **smooth surface** eliminating dust accumulation.

Self-extinguishing in the event of fire or arcing and no gases released with danger potential.

ABB Vacuum Cast Coil dry transformers range from 50 kVA up to 30 MVA with operating voltages up to 52 kV.

Classification according to EN 60726:

- Climatic C1/C2
- Environmental E2
- Fire F1



Step lap core configuration granting lower values of no load losses, no load current and noise level.

Aluminium foil-disk in high voltage winding (copper optional)

Aluminium foil in low voltage winding (copper optional)

High impulse withstand through foil-disk winding, providing a linear voltage distribution

High capacity to withstand overloads due to high thermal inertia.

Consistent quality with the most efficient production process

The magnetic core has a miter step-lap joint to ensure optimum performance and minimum sound levels. The magnetic steel is cut to length in a sequential way and automatically stacked, ensuring dimensional accuracy and single sheet interlacing within the full stack.

The magnetic core

The high voltage winding has a continuous drop down disc with an aluminium strip conductor and double layer insulation. Windings are casted under vacuum with epoxy resin. Transient analysis test have been performed to verify the electrical stress distribution through the windings confirming the highest strength of our design.

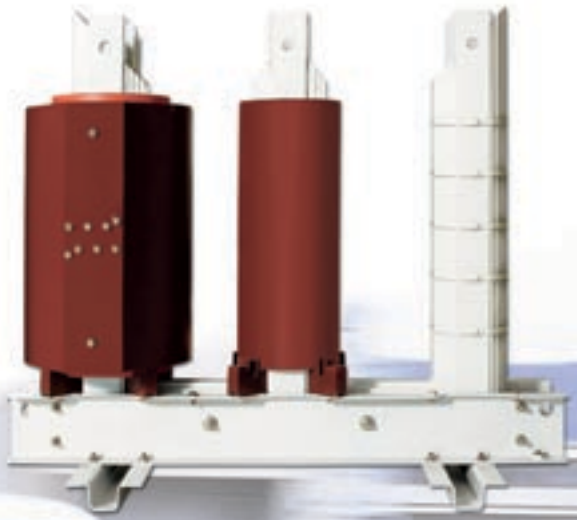
The low voltage windings are made of aluminium foil, and insulating foil preimpregnated with resin.
After the winding process the coil is cured into an oven resulting in an extremely compact winding which can withstand the dynamic stresses produced by a short-circuit.

The latest European standard applicable to the design of Vacuum cast coil Transformer, the EN 60726 (2003) specifies a maximum level of partial discharges of 10pC. Partial discharges are measured in each and every ABB transformer. Our statistics show that the average value measured is always lower than 10pC and in 90% of the cases partial discharges are lower than 5pC. This low level of partial discharge can be granted thanks to the efficient design of ABB Vacuum Cast Coil dry transformers, to the high quality of the material used and to the most modern encapsulation technology.

The encapsulation process is a fundamental operation in the manufacturing procedure and should be carried out and controlled under the most strict conditions in order to ensure optimum insulating and mechanical characteristics. On the one hand, the windings, are put through a preheating oven and kept inside until the mould temperature reaches the encapsulation temperature. On the other hand, the resin mix is prepared in a continuous mixing plant. Components are mixed together just before the encapsulation process. In the next step, the preheated coils are moved into the vacuum casting chamber.
Once the vacuum in the chamber has been reached, the resin is poured in the moulds. Components are mixed together just before the encapsulation process. In this way the viscosity of the resin mix when poured in the moulds is very low, filing interstices allowing to reach the lowest level of partial discharges. After the casting is finished the coils are placed into the curing oven for the resin compound gel to cure, and achieve its final properties.

Computer aided winding process

But ABB leadership does not only rely on above production steps. In ABB transformer factories the whole tendering, design and production process is controlled and planed with the most sophisticated Industrial IT software ensuring the highest productivity and reducing production time down to the lowest level ever achieved keeping the highest quality standards. Once the order is confirmed it is automatically logged in our system allowing us to automatically coordinate commercial, engineering, procurement, production, laboratory, logistics and order handling departments. We are using the most advanced production technology and the most demanding control system to guarantee the highest product quality and the total product reliability.



Assembling phases

High voltage winding

Low voltage windings

6 MVA ABB Vacuum Cast Coil dry transformer designed to withstand seismic conditions.

We have a proven solution to your needs

With more than 100.000 units working around the world, ABB is by far the most experienced supplier of dry type transformers and is determined to keep this position thanks to its active investment strategy.

A large variety of sites demand ABB Vacuum Cast Coil dry transformers: Public and high rise buildings such as hospitals, shopping centers, multipurpose cultural centers feel highly safe with ABB Vacuum Cast Coil technology. Contribution to fire hazard reduction, no need of oil pit, no polluting liquids makes them ideal.

ABB Vacuum Cast Coil dry transformer is the technology leader for windmill applications with more than 5000 units working. ABB has accumulated a wide experiencee in this particular demanding application: presence of harmonic content, transient phenomenons, high number of disconnections.

ABB Vacuum Cast Coil dry transformers are used to provide electrical power for marine propulsion and distribution system. Demanding installation requirements including reduced noise and vibration levels, limited space, special cooling systems, high degree of security to avoid human risks are reasons to choose ABB Vacuum Cast Coil dry transformers.

ABB Vacuum Cast Coil dry transformers are connected to a large range of drives, frequency converters and rectifiers to provide complete solutions for pumps, fans, compressors, conveyors, drilling packages, mills, thrusters, gas turbines, generators, mixers. The mechanical strength and overload capacity of the ABB Vacuum Cast Coil technology turns them into the most suitable product to withstand all solicitations from the service.

Railway fixed traction installations, underground stations, cranes at seaports, offshore platforms amongst other applications are the right scenario where the high reliability of ABB Vacuum Cast Coil dry transformers is appreciated.

Thanks to ABB Vacuum Cast Coil technology a wide range of applications is covered, becoming one of the largest dry type transformer supplier improving the manageability, efficiency and energy economic processes.

ABB Vacuum Cast Coil dry transformer ***for marine*** *applications. AFWF (air forced/water forced) cooling by hydrocoolers. Design and manufacturing approved by LLOYD'S Shipping Register, Bureau Veritas, DNV, RINA, ABS*

ABB Vacuum Cast Coil dry transformer for windmill application in the endurance vibration test platform: with two independent biaxial actions, one horizontal and the other vertical.

ABB Vacuum Cast Coil dry transformers were the first to be installed inside the latest design of wind power generators. They were selected because their safety, efficiency and eco-friendly design. They form part of thousands of wind turbines set worldwide.

On load tap changer with motor drive for the uninterrupted and automatic adjustment of the transformation ratio under load conditions.

All the accessories needed to customize our products to your needs

ABB enclosures are made of bolt on steel sheets with removable panels to access connections and tapings. Finishing can be galvanised, painted or galvanised and painted depending on the application and your requirements. The design has been optimised in order to secure the requested cooling of the transformer for all levels of protection degree. Enclosures can be shipped assembled on the transformer or flat packed for assembly on site. Cable entry is from the bottom and optionally from the top or on the side through air insulated cable boxes.

Manufacturing options

- Reduced losses transformers
- Copper winding
- Low voltage/low voltage transformers
- Layer windings for special application
- Class H transformers
- Temperature rise below 100 K/above 100 K
- Double primary voltage
- Double secondary winding
- Encapsulated low voltage
- Low voltage connections at the bottom
- Frequency 50 Hz, 60 Hz and 16 2/3 Hz
- Special connection groups
- Sealed low voltage winding

Other accessories

- Antivibration pads
- Space heater
- Electrostatic screen
- Current transformers
- Delta connection encapsulated
- Plug in bushings
- High voltage switch
- Surge arrestors
- Cooling fans with up to 50 % power increase

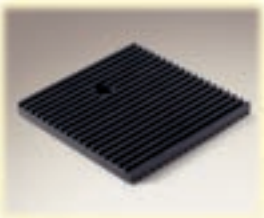
Enclosure IP21

*Full capacity **off load tap changer** to adjust the voltage by means of copper bolted bridges.*

Digital thermomete (D-33)

LV Terminal

HV Terminal



Anti-Virbration pad

The most demanding control procedures to grant you the highest reliability

Coil Impulse withstand Test

High voltage winding is the most critical part of a cast coil transformer and where high manufacturing quality drives the difference.

ABB Power Technology assures the total reliability of its product through the use of the most demanding manufacturing control. High voltage coils are tested after winding and before casting by means of a repetition impulse test where the coil is put to 200 impulses of 8 kV during one minute in order to verify that no dielectric problems are present before casting. Once this is assured, the coil is encapsulated under vacuum. After the encapsulation, the partial discharges level is measured confirming the absence of bubbles or gaps, thus proving the long life of the whole high voltage insulation.

ABB Vacuum Cast Coil dry transformers are designed and built to meet all the applicable Standards as well as the client's specifications.

Each and every ABB Vacuum Cast Coil dry transformer is submitted to a complete set of routine test. Each result is automatically compared to the design and guarantee values and statistical analysis are performed. This process allows us to ensure a consistent quality and to improve on a permanent basis our engineering and design tools.

Routine tests

- Measurement of windings resistances
- Transformation ratio measurement and connection checking
- Load loss and short-circuit impedance measurements
- No load loss and current measurements
- Separate source voltage-withstand test
- Induced over voltage withstand test
- Partial discharges measurements

Other tests such as type test can be carried out. These tests are used to be performed in case of important design modification in order to confirm that the quality of the product is maintained or improved. They can also be performed on order when requested by our clients.

Type Tests

- Temperature rise test
- Lightning impulse test

Special tests

Always performed under customer request:

- Noise level test
- Measuring zero-sequence impedance.
- Measuring insulation resistance.
- Measuring of harmonics of the no-load current.
- Measuring of the parallel capacity of windings and tag δ
- Anti-corrosion protection measurement.
- Short circuit test

These tests are carried out in accordance with the relative IEC, EN, and/or IEEE/ANSI standards.(*)

Our test laboratory is certified according to the standard **UNE-EN-ISO/IEC 17025:2000**. This accreditation gives the authority to the certified company to act as an independent official laboratory and to test and issue the corresponding test reports as an independent third party. This is a unique service ABB can provide since no other transformer manufacturer has been certified according to this norm showing that our products are submitted to the most demanding control procedures.

Additionally our transformers have the following certificates:

- The class F1 "Fire behavior" certificate
- The class C1 and C2 "Climatic" certificate
- The class E2 "Condensation and humidity" certificate

(*) IEC : International Electrotechnical Commission.
EN : European Standards, harmonizes all relevant European Standards NF, BS, VDE, DIN, CEI, UNE,…

Overload Capacity

Experience has shown us that a dry type transformer usually lasts several decades. However, the exact figure is impossible to calculate, because it depends on the conditions it has been exposed to.

Life of a dry type transformer depends specifically on the overload suffered during its lifetime. These overloads can create a fluctuation of temperature during the winding that degrades the insulation because of thermic ageing.

However, a transformer can function with some overloads without affecting its lifetime. This is possible if the normal charge is smaller than the nominal power. These admissible overloads (K2) are limited on time (tp) according to the previous functioning rate (charge factor, K1) and depend on the average ambient pondered temperature θ_a.

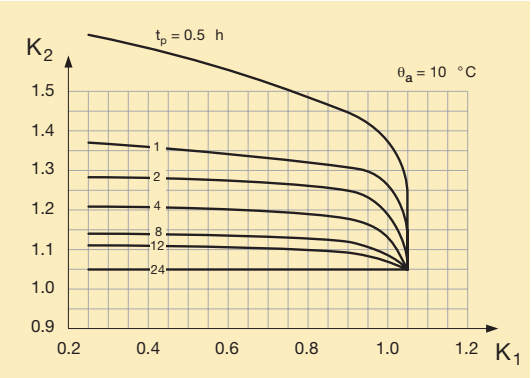
Transformers are manufactured for a nominal power functioning, at a normal ambient temperature according to the standard IEC 60726:

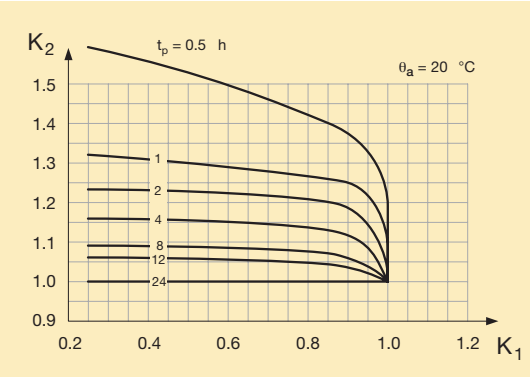
- Maximum temperature: 40 °C
- Daily average temp.: 30 °C
- Annual average temperature: 20 °C

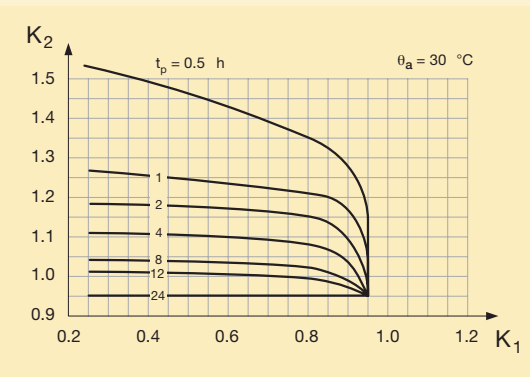
The reference temperature, if not specified other, will be the annual average temperature 20 °C.

A transformer, which has been designed to work under an annual average ambient temperature of 20 °C can be used in ambient under higher or lower temperatures, reducing or increasing the power according to the following figures:

Annual Average Ambient Temperature :	Considerd Power (% according to P_{ncm})
-10℃	116%
0℃	110%
10℃	104%
20℃	100%
25℃	97%
30℃	94%
35℃	90%

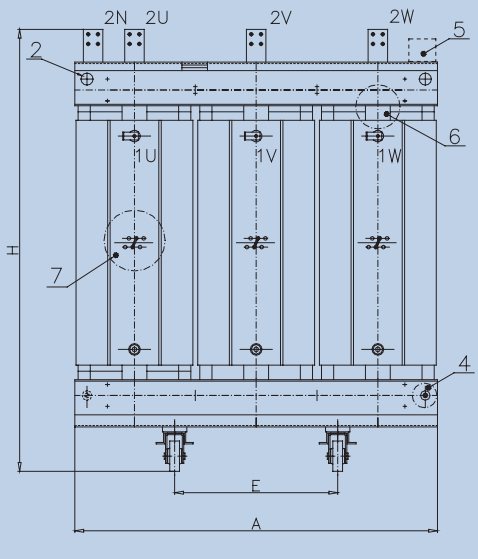


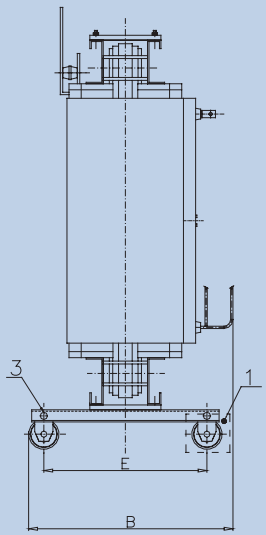




Technical Data IP 00, IP 21 up to 33
(higher protection level on demand)

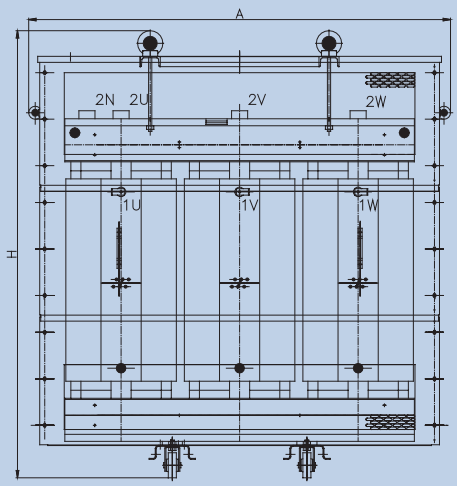
Outline drawing - ABB Vacuum Cast Coil dry transformers IP 00

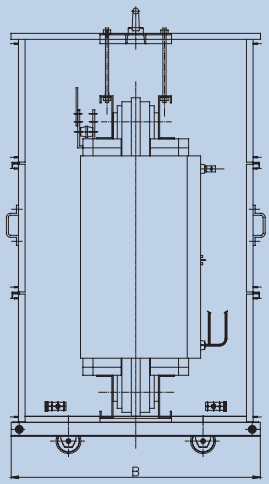




1 Bidirectional wheels
2 Lifting lugs
3 Pulling eyes
4 Earthing terminals
5 Rating plate
6 Temperature control sensor
7 Off-load tap changer

Outline drawing - ABB Vacuum Cast Coil dry transformers IP 21 up to 33





1 Bidirectional wheels
2 Lifting lugs
3 Pulling eyes
4 Earthing terminals
5 Rating plate
6 Temperature control sensor
7 Off-load tap changer

Technical Data IP 00

■ HIGHEST VOLTAGE FOR EQUIPMENT (Um) 12 kV

RATED POWER (Sr)	KVA	50	100	160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
No load losses (Po)	W	350	440	610	820	1100	1150	1350	1370	1800	2000	2500	2800	3600	4300	6000
Load losses (Pk) 75ºC	W	1230	1760	2380	3080	3780	4310	5630	6690	8010	8900	11130	12460	16200	18900	22500
Load losses (Pk) 120ºC	W	1400	2000	2700	3500	4300	4900	6400	7600	9000	10000	12500	14000	18000	21000	25000
Shortcircuit Impedance	%	4	4	4	4	4	4	6	6	6	6	6	6	6	6	6
Sound power level (LWA)	dB	58	59	62	65	66	68	69	70	71	73	74	76	78	81	83
Lenght (A)	mm	1000	1020	1200	1290	1290	1380	1380	1530	1470	1590	1650	1800	1830	2040	2250
Width (B)	mm	770	770	770	850	850	850	850	900	900	900	1000	1000	1000	1250	1250
Height (H)	mm	1080	1130	1130	1180	1320	1350	1480	1520	1750	1750	2000	2100	2430	2500	2680
Weight	Kg	520	620	845	1230	1310	1660	1570	2060	2170	2620	3100	4020	4630	5500	6900
Distance between rollers (E)	mm	520	520	520	670	670	670	670	670	670	670	820	820	820	1070	1070
Rollers diameter	mm	125	125	125	125	125	125	125	125	125	125	200	200	200	200	200
Rollers width (G)	mm	40	40	40	40	40	40	40	40	40	40	70	70	70	70	70

■ HIGHEST VOLTAGE FOR EQUIPMENT (Um) 24 kV

RATED POWER (Sr)	KVA	50	100	160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
No load losses (Po)	W	350	500	750	880	1150	1200	1500	1650	2100	2300	2900	3100	4200	5000	7000
Load losses (Pk) 75ºC	W	1320	1850	2550	3340	4050	4840	6160	6860	8370	9790	12020	14240	17550	20700	24300
Load losses (Pk) 120ºC	W	1500	2100	2900	3800	4600	5500	7000	7800	9400	11000	13500	16000	19500	23000	27000
Shortcircuit Impedance	%	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Sound power level (LWA)	dB	58	59	62	65	66	68	69	70	71	73	74	76	78	81	83
Lenght (A)	mm	1050	1200	1380	1450	1450	1500	1470	1590	1530	1620	1680	1830	1890	2040	2220
Width (B)	mm	780	780	780	850	850	900	900	900	900	900	1000	1000	1000	1250	1250
Height (H)	mm	1100	1150	1180	1220	1320	1350	1500	1520	1750	1750	2080	2150	2480	2550	2720
Weight	Kg	505	650	865	1150	1250	1470	1575	1910	2100	2445	2930	3860	4460	5565	6645
Distance between rollers (E)	mm	520	520	520	670	670	670	670	670	670	670	820	820	820	1070	1070
Rollers diameter	mm	125	125	125	125	125	125	125	125	125	125	200	200	200	200	200
Rollers width (G)	mm	40	40	40	40	40	40	40	40	40	40	70	70	70	70	70

■ HIGHEST VOLTAGE FOR EQUIPMENT (Um) 36 kV

RATED POWER (Sr)	KVA			160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
No load losses (Po)	W			960	1280	1500	1650	1950	2200	2800	3100	3700	4200	5000	5800	7500
Load losses (Pk) 75ºC	W			2550	3520	4220	5020	6250	7040	8630	10240	12280	15130	18900	22500	26100
Load losses (Pk) 120ºC	W			2900	4000	4800	5700	7100	8000	9700	11500	13800	17000	21000	25000	29000
Shortcircuit Impedance	%			6	6	6	6	6	6	6	7	7	8	8	8	8
Sound power level (LWA)	dB			66	67	68	69	70	71	72	73	74	76	78	81	83
Lenght (A)	mm			1550	1580	1640	1740	1700	1760	1760	1880	1880	2060	2120	2270	2510
Width (B)	mm			840	930	940	1000	1000	1000	1000	1050	1100	1150	1150	1300	1300
Height (H)	mm			1300	1450	1450	1500	1650	1750	1880	1950	2220	2280	2560	2650	2880
Weight	Kg			1120	1400	1610	2100	2120	2550	3020	3250	3680	4480	5200	6200	7900
Distance between rollers (E)	mm			520	670	670	670	670	670	670	670	820	820	820	1070	1070
Rollers diameter	mm			125	125	125	125	125	125	125	125	200	200	200	200	200
Rollers width (G)	mm			40	40	40	40	40	40	40	40	70	70	70	70	70

Technical Data IP 21 up to 33

■ HIGHEST VOLTAGE FOR EQUIPMENT (Um) 12 kV

RATED POWER (Sr)	KVA	50	100	160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
Lenght (A)	mm	1290	1310	1490	1580	1580	1670	1670	1820	1760	1880	1940	2110	2140	2350	2560
Width (B)	mm	1020	1020	1080	1110	1110	1140	1140	1190	1170	1210	1230	1280	1290	1360	1430
Height (H)	mm	1380	1430	1440	1510	1650	1680	1810	1850	2080	2100	2350	2470	2800	2890	3070
Weight	Kg	670	770	990	1380	1480	1830	1740	2270	2420	2870	3390	4310	5010	5880	7370

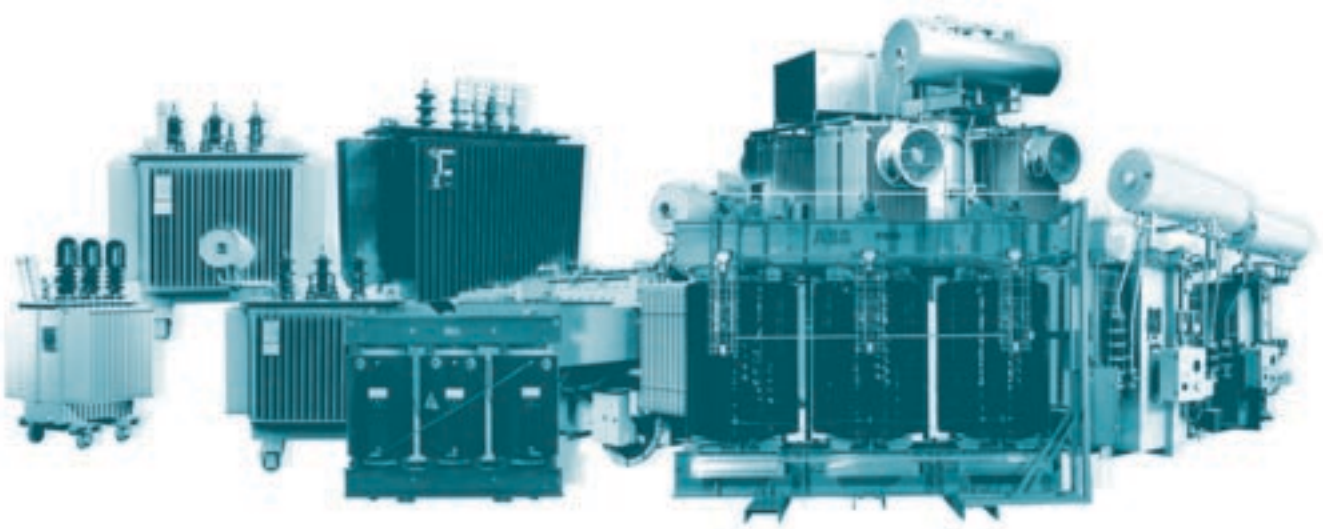
■ HIGHEST VOLTAGE FOR EQUIPMENT (Um) 24 kV

RATED POWER (Sr)	KVA	50	100	160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
Lenght (A)	mm	1410	1560	1740	1810	1810	1860	1830	1950	1890	1980	2040	2210	2270	2420	2600
Width (B)	mm	1150	1200	1260	1290	1290	1300	1290	1330	1310	1340	1360	1410	1430	1480	1540
Height (H)	mm	1400	1450	1490	1550	1650	1680	1830	1850	2080	2100	2430	2520	2850	2940	3110
Weight	Kg	650	800	1030	1360	1460	1680	1820	2160	2390	2740	3220	4220	4840	5940	7110

■ HIGHEST VOLTAGE FOR EQUIPMENT (Um) 36 kV

RATED POWER (Sr)	KVA			160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
Lenght (A)	mm			2050	2080	2140	2240	2200	2260	2260	2380	2380	2580	2640	2790	3030
Width (B)	mm			1580	1590	1610	1640	1630	1650	1650	1690	1690	1750	1770	1820	1900
Height (H)	mm			1630	1780	1780	1830	1980	2100	2230	2300	2590	2650	2950	3040	3270
Weight	Kg			1320	1650	1860	2350	2410	2840	3350	3580	4010	4920	5640	6640	8440

Losses based according to CENELEC HD 538 Standard and aluminium windings. Other losses and conductor material available under request.



Distribution transformers offered by ABB

Liquid filled distribution transformers :

- up to 72,5 kV
- single phase and three phase
- ground mounted, pole mounted or pad mounted

Dry transformers:

- Open Wound
- Vacuum Cast Coil
- RESIBLOC®

Transformers for special applications like:

- Railway application
- Marine: propulsion and distribution
- Carrier Vessel Nuclear
- Rectifier Transformers
- Variable Speed Drive
- Excitation Transformers
- HVDC Converter
- Transformers for windmills
- Autotransformers
- Grounding/Earthing Transformers
- Neutral Earthing Reactors
- Current Limiting Reactors
- Arc Furnace
- Boostertransformers

Services offered by ABB Distribution Transformers

- Environmental Services - PCB Elimination Services
- Installation and Commissioning
- Training
- Testing and maintenance
- Retrofits, Revamping and up-grading
- Spare parts procurement
- Technical information available from abb.com/distributiontransformers

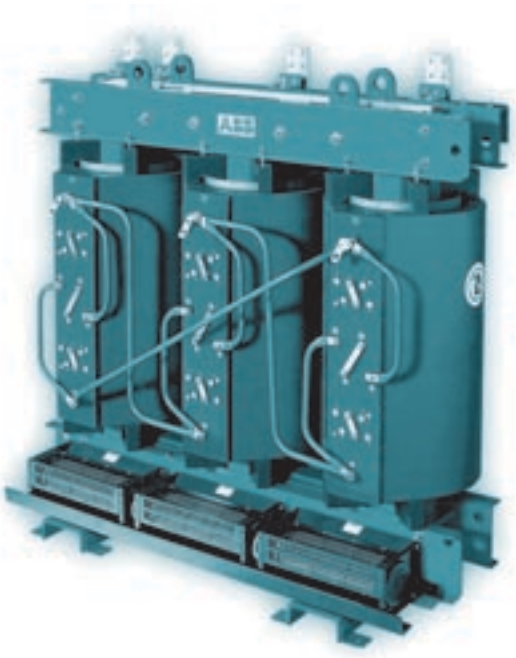


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ABB Ltd.

Oksan Bldg. 8th.
157-33, Samsung-dong Kangnam-ku, Seoul, Korea
(zip code 135-090)
Phone : +82 2 528 3048 Fax : +82 2 528 3122