RESIBLOC transformers
Product presentation
Dry-type transformers
For customers with high requirements

Does your transformer application requires one of the following characteristic? We have the solution according to your specifications:

- safety for people and property
- no fire hazard
- no maintenance and pollution
- reduced civil works
- enhanced withstand to short circuit stress
- applicable for damp and contaminated areas
- improved performance against seismic phenomena
Dry-type transformers
For your requirement the right solution

From left to right:
- RESIBLOC
- Vacuum cast
- Open wound

- Three different dry-type technologies:
  - RESIBLOC®
  - Vacuum cast coil (VCC)
  - Open wound
Dry-type transformers
Impressive advantages

- Safety for People and Property
- No Fire Hazard
- Environmental Friendly
- No Maintenance and Pollution
- Reduced Civil Works
- Enhanced Withstand to Short Circuit Stress
- Applicable for Damp and Contaminated Areas
- No Specific Fire Detection Systems (compact housings)
- Improved Performance against Seismic Phenomena
# Dry-type transformers

## Low calorific power

### Calorific power of a 1000 kVA distribution transformer

<table>
<thead>
<tr>
<th>Material</th>
<th>Fire energy MJ</th>
<th>%</th>
<th>Flash point °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral oil</td>
<td>30000</td>
<td>100</td>
<td>160</td>
</tr>
<tr>
<td>Silicon oil</td>
<td>26000</td>
<td>87</td>
<td>350</td>
</tr>
<tr>
<td>Vacuum cast resin (epoxy + quartz sand)</td>
<td>2600</td>
<td>9</td>
<td>350</td>
</tr>
<tr>
<td>RESIBLOC (fiber glass reinforced)</td>
<td>1500</td>
<td>5</td>
<td>&gt;470</td>
</tr>
</tbody>
</table>
Dry-type transformers
Dry-type comparison - the advantages of RESIBLOC

All technologies are performing according to international standards

Nevertheless, RESIBLOC has

- stronger resistance against short-circuit stress
- superior behaviour on load changes
- linear distribution of BIL
- highest possible security against cracks on coils
- no silicone during coil manufacturing

- better performance under dynamic Loads
- more flexibility in design (no molds)
- better performance under severe ambiental conditions (exceeding E2)
- more suitability for extreme cold conditions
- vacuum circuit breaker proven
Dry-type transformers
Worldwide transformer production

<table>
<thead>
<tr>
<th></th>
<th>Vacuum cast</th>
<th>RESIBLOC</th>
<th>Open wound</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>KR</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>BR</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA*</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EG*</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN*</td>
<td></td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

ABB’s “Focused Factories” for dry-type transformers

*Assembly-units
RESIBLOC technology
Overview
RESIBLOC technology – Overview
The ABB premium product

- Rated power from 250 kVA to 63,000 kVA
- Primary voltage up to 72.5 kV
- Secondary voltage up to 45 kV
- Frequences: 50 Hz / 60 Hz / 16 2/3 Hz
- Cooling: AN / ANAN / ANAF / AFWF
- Insulation F and H (optional LV-winding)
- Unique technical attributes
- Designed for extreme environmental conditions

RESIBLOC offers a great flexibility according customer wishes to meet the highest requirements
RESIBLOC technology – Overview
Various standards and types

RESIBLOC standard designs
- HV winding material: aluminum / copper wires
- LV winding material: aluminum / copper foils
- insulation class: F and H (optional LV-winding)

Types of RESIBLOC
- standard three phase transformer
- double medium voltage transformer
- multi winding transformer
- low voltage transformer
RESIBLOC technology – Overview
The right solution for every application

Application types of RESIBLOC®
- Distribution transformer
- Substation transformer
- Marine propulsion transformer
- Marine distribution transformer
- VSD transformer
- Windmill transformer
- Traction feeder transformer
- Rectifier transformer
- Booster transformer
- Auto transformer
- Excitation transformer
- Furnace transformer
- …
RESIBLOC technology – Overview
Comprehensive testing

**Routine tests**
(Performed on each unit)
- Gear ratio
- No-load losses and current
- Impedance voltage, short circuit impedance and load losses
- Partial discharge

**Type and special tests**
(Available on request and additional costs)
- Lightning impulse (LI) test
- Temperature-rise test
- Determination of sound levels
RESIBLOC technology – Overview
A broad variety of industrial applications

- Oil & Gas
  - Compressor drive transformers
  - Electrification
  - Thruster drive transformers
  - Refineries

- Mining & Minerals
  - Hoist drives
  - Mill drives
  - Conveyor belt systems

- Marine
  - Propulsions transformers
  - Thruster transformers
  - Auxiliary transformers

- Metals
  - Rolling mills
  - General electrification

- Pulp & Paper
  - LV drive system transform.
  - General electrification
High presence of RESIBLOC Transformers all over the world

Installed kVA

Base: Manufactured RESIBLOC transformers in Brilon only; accumulated since 1988 until 2012

- > 24.200.000 Europe
- > 10.500.000 Asia & Australia
- > 2.010.000 Middle East & Africa
- > 700.000 South America
- > 1.200.000 North America & Canada

More than 38.000.000 kVA at all!
RESIBLOC technology – Overview
Solutions for demanding requirements

RESIBLOC® characteristics

- Unique mechanical strength and short circuit behaviour
- Satisfies different economical and safety requirements
- Certified for many standards and organisations
- High design flexibility and product variety

Customer advantages

- Fits for most demanding applications
- Great variety of applications
- Long service life with minimum maintenance requirements
- Excellent and global ABB service
- Certified for many standards and organizations
RESIBLOC technology
Suitable for harsh conditions
# RESIBLOC technology

## Environmental – Climatic – Fire class acc. VDE 0532 / Part 6 I

### Environment

<table>
<thead>
<tr>
<th>Environment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E0</td>
<td>Normal indoor installation, no condensation, no considerable pollution</td>
</tr>
<tr>
<td>E1</td>
<td>Limited pollution, occasional condensation e.g. off circuit periods</td>
</tr>
<tr>
<td>E2 ✓</td>
<td>Heavy pollution, frequent condensation</td>
</tr>
<tr>
<td>E3 ✓</td>
<td>Intensified conditions for the conductivity of the salt solution (for application of wind turbines)</td>
</tr>
</tbody>
</table>

### Climate

<table>
<thead>
<tr>
<th>Climate</th>
<th>Lowest ambient temperatures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>- ▪ Operation -5°C</td>
</tr>
<tr>
<td></td>
<td>- ▪ Storage and transport -25°C</td>
</tr>
<tr>
<td>C2 ✓</td>
<td>- ▪ Operation <strong>-60°C instead of -25°C</strong></td>
</tr>
<tr>
<td></td>
<td>- ▪ Storage and transport at <strong>-60°C instead of -25°C</strong></td>
</tr>
</tbody>
</table>
RESIBLOC technology
Environmental – Climatic – Fire class acc.
VDE 0532 / Part 6 II

<table>
<thead>
<tr>
<th>Fire</th>
<th>F0</th>
<th>No special requirements except typical characteristics for dry type transformers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F1</td>
<td>Increased demands</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All materials practically free of halogens</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Limited formation of fumes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Limited contribution with calorific energy to the source of fire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Self-extinguishing transformer fire</td>
</tr>
</tbody>
</table>
RESIBLOC technology
Deep Temperature Storage and Thermal Shock I

Test Object
- Order number 14299 1525, Power rating 1500 kVA, Voltage ratio 11 kV / 433 V
- Total weight 4350 kg

Tests
- Requirement for class C2 according to VDE 0532, part 6
- Deep temperature storage test at -25°C
- Thermal shock test with double rated current starting at -25°C

Test of a RESIBLOC® Transformer starting at -60°C.
RESIBLOC technology
Deep Temperature Storage and Thermal Shock II

1st
✓ Thermal shock test with double rated current starting at \(-60°C\) passed

2nd
✓ Thermal shock test with double rated current starting at \(-60°C\) passed

3rd
✓ Thermal shock test with 2.5 times rated current starting at \(-60°C\) passed

The tests performed prove RESIBLOC® transformers are very well suited for operation at low ambient temperatures and with varying loads!
RESIBLOC technology
Reference examples
Ulricehamns Energi
Sweden

Customer need

- 1 x 16000 kVA, 45/11kV OLTC (+/-7x1.67%) with IPX4D enclosure
- Liquid-free transformer due to installation in a sensitive environment

ABB response

- RESIBLOC 16 MVA dry-type transformer for outdoor installation
- Comprehensive ABB support incl. installation

Customer benefits

- Safety for people and environment
- Almost maintenance free
- Easy installation
Customer need

- 1 x 15000 kVA, 42.5 +/- 2x2.5%/3,254 kV (with IP23 enclosure for installation in outdoor transformer cell)
- Liquid-free transformer to reduce fire risk and maintenance
- Introduce new standard for their 15 MVA transformers

ABB response

- RESIBLOC 15 MVA dry-type transformer for outdoor installation with IP23 enclosure with raincover
- Comprehensive ABB support incl. installation

Customer benefits

- Safety for people and environment by reducing fire risk
- Almost maintenance free and easy to install
Stadler Rail
Switzerland/Austria

Customer need
- Traction rolling stock transformer in dry-type technology
- 18 units of 600 // 500 / 100 kVA transformers

ABB response
- Completely new designed traction rolling stock transformers in dry-type technology
- Innovative transformers designed on basis of customer requirements

Customer benefits
- Reliable and non-flammable transformer
- Dry-type transformers that fulfill the strict size requirements
Customer need

- 1 x 800 kVA EcoDry\textsuperscript{Basic} transformers
- 3 x 1000 kVA EcoDry\textsuperscript{Basic} transformers
- 7 x 1600 kVA EcoDry\textsuperscript{Basic} transformers
- 2 x 2000 kVA EcoDry\textsuperscript{Basic} transformers

ABB response

- Ultra-efficient dry-type transformers with amorphous metal as core material
- Amortization figure of only 3 years

Customer benefits

- Reliable and safe dry-type transformers with low maintenance for a sensitive environment (test field)
Preem Lysekil
Sweden

Customer need

- Dry-type transformer for outdoor installation in cold (min -40°C) harsh climate close to the sea
- Parallel operation with existing oil transformer

ABB response

- 1 unit 25 MVA 22 / 11 kV RESIBLOC cast-resin transformer
- IPX4D enclosure for outdoor installation

Customer benefits

- No need for oil pit, easy installation and almost maintenance free
- Fire risk reduced
Olkiluoto Nuklear Power Plant
Finland

Customer need

- High demands on seismic requirements and increased personal safety
- Replacement of open wound technology

ABB response

- 19 units up to 3150 kVA RESIBLOC dry-type transformers
- Tailor-made designs for existing facilities

Customer benefits

- The sophisticated RESIBLOC technology enables to meet the stringent requirements
Sibneft
Siberia

Customer need
- Environmentally safe performance in a remote, harsh climatic and undeveloped location
- Reliable provision of local infrastructure

ABB response
- 6 units RESIBLOC SPT transformers up to 16 MVA, 40.5 kV with on-load tap changers (4 units 10 MVA / 2 units 16 MVA)

Customer benefits
- High safety standard due to usage of dry-type transformers instead of oil transformers (fire risk reduced, leakage of oil)
- Outdoor-placement of transformer; reliable operation even at -60°C
Power and productivity for a better world™