ABB green transformer - reducing environmental impact without compromising reliability
ABB Hefei Transformer Co., Ltd

- Distribution Transformer
  - 30kVA~10000kVA up to 35kV Oil Immersed Distribution Transformers
  - Padmounted Transformers

- Insulation & Components
  - Oil treatment plants
  - On load tap changers
  - RIP condenser bushings
ABBB Hefei Transformer Co., Ltd
Distribution Transformer

- Established: July 14th, 2000
- Employees: 210* (Till to March 2011)
- Power range: 30kVA to 10000kVA
- Primary voltage: Up to 35kV
- Conduct material: Cu, Al
- Available fluids: Mineral oil, refer to IEC 296 (Silicon oil, Midel oil, Biotemp)
- Available standards: China Standard GB1094,6451; IEC 60076
- Certificates: ISO9001, ISO14001, OHS18001, China Energy Conservation Product Certificate, SSE-L2 (Safety Standardization Level 2)
- Standard version: 3 Phase Hermetically sealed oil immersed
- Option: Galvanized Type, Gas Gap Type, Equipped with on-load tap changers, cable box, oil conservator, Eco-transformer with silicone oil & protection devices

*Till to March 2011
Liquid filled distribution transformers
Production and technologies

- Two major technologies
  - Stacked core with one global design platform (CDS)
  - Wound core with another global design platform (LWCT)

- Global technology lead centers
  - Stacked core  Lodz, Poland
  - Wound core  Jefferson City, USA
  - 2,5-10 MVA, LMDT  Istanbul, Turkey

- ABB common technology concept based on global tools and standards
  - Common design systems (CDS and LWCT)
  - Common technical, material and production standards
Liquid filled distribution transformers
The main features

- High efficiency and energy saving
- Operation cost is low
- Safety for persons and property
- Good anti-short circuit ability
- Excellent load capacity
- Resistance to lightning
- Low noise
- Easy installation
- Free maintenance
Our focus is to define optimized, customized solutions based on today’s requirements and evaluation criteria’s, and participate in defining customer solutions addressing the green agenda and setting new standards for the future.

- Modularization choices support high speed customization
- Windings: Copper or Aluminum, Paper or enamel insulated conductors
- Cores: Step lap stacked cores or wound core technology, All available GO steel, ranging from M5 to DR (Laser) in different thicknesses or the ultimate in low losses using amorphous metal.
- Tank solution: Hermetically sealed or conservator type, Corrugated fin walls or radiators
- Liquids: BIOTEMP® fluid and FR3, Silicon oil, Midel, or other biodegradable fluids, Mineral oil
- Surface treatments: Water based or powder painting in different RAL, Hot dip galvanized for aggressive environmental conditions.
Hefei Transformer Co., Ltd
Lower losses products

<table>
<thead>
<tr>
<th>Base on S11</th>
<th>Reduce percentage for No load losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB20052 Or</td>
<td>0%</td>
</tr>
<tr>
<td>JB/T3837</td>
<td>S11</td>
</tr>
</tbody>
</table>

Reduce percentage for load losses:
- 0%: S11, S12, S13, S14, SH15, SH16
- 15%: S12, S13, S14, SH15
- 30%: S13, S14, S15*

Case for 400kVA yearly losses (10000 kWh)

Voltage: 35kV
Capacity Range: 30 - 10,000kVA

The advantage of stacking core:
- Tradition structure
  - Mature Technology
- Higher ability for short circuit
- Lower losses
  - Better for any running condition
- Small outline
- Lower noises
  - S11 less than GB standard about 12 dB
  - S13/S14* less than GB standard about 17 dB
- Lower no load current
Hefei Transformer Co., Ltd
AMDT product

Voltage: 35 kV
Capacity Range: 50 - 630kVA

The advantage of amorphous:

- Energy savings and increased efficiency
  - No-load losses 40 - 70% less than with e-steel
  - Efficiency increase by 0.5% to 1%, depending on rating

- Lower Total Ownership Cost (TOC)
  - Continuous, guaranteed energy savings from the moment of installation

- Mitigation of generation needs to meet growing demand
  - Environmental benefit accrue from less greenhouse gas emissions

- Less heat generation due to lower losses, leading to a favorable reduction of cooling capacity and fluid

- Savings do not require end user behavior modification nor a sacrifice of comfort

- Amorphous material can be reused and recycled
Voltage: 6 - 10kV

Capacity Range: 30 - 500kVA

Adjustable capacity: Load or no load

Scope of application: Adjusting power transformer is mainly used to seasonal consumption bigger differences and the place of the average load rate is low

The advantage of product:

- Replace the simple
- Economic and security
- Energy-saving and total loss of small capacity less than total loss of the same standard distribution transformer capacity
- Easy to operate, only adjust the switch
Hefei Transformer Co., Ltd
Pad-mount transformer

- Voltage: 35 kV
- Capacity Range: 30 - 3,300 kVA
- PMT structure is compact and easy to installation in the ground, facilitate and underground cable connection, safe and reliable and is widely used to city power supply and wind power

The advantage of PMT:
- Compact structure and low cost
- Safe environmental protection, reliable power supply
- ABB CDS technologies
- Strong ability of corrosion resistance
- Good ventilation and heat dissipation performance
- Inside prevention measures for condensation
- A variety of low-voltage alternative
ABB have developed the Slender transformer for applications where dimensional access is limited. It is a liquid filled transformer defined by the very narrow width dimension.

Location:

- Tower
- Nacelle

- On-shore or off-shore installations => humid and salty environment
- High and low temperature performance
- Strong vibrations – 100 m high towers
- Liquid - biodegradable fluids (natural or synthetic esters)
With BIOTEMP® and FR3, ABB aims at offering a complete and sustainable solution for both distribution and power transformer applications associating environmental friendliness (high biodegradability), safety (superior fire resistance), reliability and efficiency (high overload capacity).
Hefei Transformer Co., Ltd
ABB converter transformer

- Voltage: 35kV
- Capacity Range: 400kVA – 2500kVA
- The secondary voltage: 500V~3000V
- Scope of application: Electrolysis, traction, transmission, dc transmission, magnetic, electroplating, electrostatic dust removal, etc.
- Product application: 6 pulse, 12 pulse
- Product features:
  - Highly reliable
  - Strong resistance to short circuit and overload ability
  - Low noise
  - Free maintenance
  - 40 year design life
  - Environmental and safety
Voltage: 35kV
Capacity Range: 30 - 10000kVA

The advantage of ABB AI product:

ABB aluminum wire transformer has a long history and mature production technology, ABB transformer production of aluminum wire and copper wire distribution transformer has the same technical parameters and use of performance, concrete manifestation in:

- The same no load loss/load loss
- Basically the same size
- The same 40 years design life
- Has a good cost performance
## Customer Segment

<table>
<thead>
<tr>
<th>China</th>
<th>Export</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Utilities</strong></td>
<td><strong>Industries</strong></td>
</tr>
<tr>
<td>Electrical Power Company</td>
<td>Minerals &amp; Mining, Chemical, Consumer, Metals and Foundry, Petrochemicals, Oil and Gas, Pulp and Paper, Rail Transportation, Water Supplying</td>
</tr>
<tr>
<td>Subsidiary Power Supply Bureaus</td>
<td></td>
</tr>
</tbody>
</table>

December 9, 2014
ABB Hefei Transformer Co., Ltd
Customer values

- High Efficiency
- Lower TOC
- Energy Saving
- Environmentally Friendly
- Lower Noise
- Longer Lifetime
- Safe
Transformer Main manufacture process
Manufacture process
Tank manufactory

- High quality material
  - Cold rolling
  - Free breath

- Fin folding machine
  - 1 meter line and 1.6 meter line
  - Higher quality
  - High strength

- Automatic welding
  - Gas protect welding process
  - High quality

- Tank welding
  - Gas protect welding process
  - High quality

- Leakage testing
  - Reduce oil leakage opportunity

December 9, 2014
Manufacture process
Core manufacture

- Silicon steel
  - High quality
  - Laser

- DEORG Cutting machine
  - Lower tolerance
  - No burr

- with pre-stacked legs
  - High efficiency
  - Stacking neat

- 6 Steps
  - Low No Load Current
  - Low Noise Level

- Glue
  - Tighten

- Core assembly table
  - Positioning accuracy
  - Assembly precision is high

December 9, 2014
Manufacture process
LV winding manufactory

- Foil
  - No load losses

- Winding Machine
  - Automatic LV winding machines

- Foil & Strip
  - High short circuit withstand ability

- Thermo-setting epoxy resin
  - Mechanical strength

- Winding on leg
  - No core and coil assembly process
  - High short circuit withstand ability

- Cold press welding
  - Clean
  - Mechanical strength
## Manufacture process
### HV winding manufactory

<table>
<thead>
<tr>
<th>Step 1: High quality wire</th>
<th>Step 2: TUBOLY</th>
<th>Step 3: Wire Flattening Machines</th>
<th>Step 4: Winding on LV</th>
<th>Step 5: High Frequency welding</th>
</tr>
</thead>
<tbody>
<tr>
<td>- No load losses</td>
<td>- High efficiency</td>
<td>- $\leq 630$kVA</td>
<td>- $\geq 800$kVA</td>
<td>- Better quality</td>
</tr>
<tr>
<td></td>
<td>- Tension Control</td>
<td>- Tension Control</td>
<td>- Coil tightness</td>
<td>- Clean</td>
</tr>
<tr>
<td></td>
<td>- Consistent Performance controlled copper losses</td>
<td>- Improved Space Factor</td>
<td>- Improved Space Factor</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Large conductor area in contact with glue gives high Short circuit strength</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Manufacture process
Active part manufactory

Stacking table
- No load losses
- Noise

Core tighten
- ≥ 800kVA
- Metal strip

Active part assembly
- Protect loose

Active part tighten
- Self-locking nut tight

Cold press welding
- Clean
Manufacture process
Final assembly

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
</table>
| Automatic Oven| • Less 630kVA
                • Constant temperature                                                    |
| Vacuum oil filling | • Less 630kVA
                      • ≤0.1mm Bar
                      • 55 ºC oil
                      • remove air and moisture from the transformer |
| Vacuum oil filling | • ≥ 800kVA
                      • ≤0.1mm Bar
                      • 55 ºC oil
                      • remove air and moisture from the transformer |
| Tank seal     | • Higher quality seal
                • Be heated to 200ºC
                • Longer lifetime                                                        |
| Leakage test  | • 24 Hours
                • To prevent leakage                                                     |
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