On Site Repair of Power Transformers

Contents

- ABB brings the factory to the site
- The true value of site repair
- Our unique state-of-the-art repair processes
- Quality assured
- Site repair references and cases
ABB brings the factory to the site

We bring all the key characteristics of a power transformer factory to the site when carrying out a full winding change:

- Clean environment
- Heavy lifting capacity
- Experienced teams of skilled workers
- Special tools and fixtures
- Drying capabilities
- Testing capabilities
The true value of On Site Repair

Reduce down-time and minimize risk

- No heavy transport involved.
- The transformer remains on-site so risk of transport damage is removed.
- Site repair is a faster way to get the unit back into service. Typical time savings range from 30 to 90 days.
- Infrastructure limitations sometimes provide for no other option than site repair.
ABB unique state-of-the-art processes

- ABB has pooled its experience across 36 service centers on 5 continents to identify the latest and most practical technology and processes for quality assured site repair

- We commence with an initial customer consultation:
  - Scope of repair – up to full winding replacement / core rework
  - What environment is available / shall be provided
  - Lifting solutions available / shall be provided
  - Customer preferences e.g. for drying
  - Agree a final test schedule
ABB On Site Repair menu

- Workshop – a range of temporary or permanent structures as required
- Lifting – mobile solution up to 500 tons
- Core – mobile core rework
- Drying – using latest Low Frequency Heating technology as an option
- Testing – leading edge mobile High Voltage test field
Documented depth of process knowledge

- ABB’s site repair of power transformers is a global solution. Our experts around the world access the same source of documented process knowledge:
  - Academic articles
  - Guidelines
  - Process descriptions
  - Technical standards
  - Training modules
Quality assured for site repair

- ABB’s TrafoStar philosophy is carried over to site repair
- All possible care is taken to minimize moisture content in the active part
- Quality assured means zero failures after more than 200 site repairs
- Test failures are also close to zero
The quality rules by which we work - 1

- The quality requirements must be the same as those used in the factory
- All the materials transported from factory to site must be protected and carefully packaged
- All work must be performed correct first time around, no rework
- All of the procedures and processes must be strictly followed

above: windings in transit
The quality rules by which we work - 2

- The active part assembly area shall be a clean environment
  - controlled access
  - controlled environment,
  - shoe protection
- The active part assembly area kept at positive air pressure
- The quality and safety requirements shall be rigidly enforced
- Zero failure on all tests
Site repair references and cases 1

- ABB has repaired more than 200 power transformers on-site globally during the last 15 years
- The largest units have been up to 750 MVA, 800 kV ac and 600 kV dc
- ABB has repaired numerous ABB legacy brands but also many competitors’ units
- In Western Europe, Eastern Europe, Americas, Middle East & North Africa
- Core type, shell type, single phase, 3-phase, GSU, autotransformers, converter, reactors, HVDC
- Utility and industrial customers
### Site repair references and cases 2

- Ref lists...repairing all brands since more than 15 years

#### ABB Transformers - On-Site Repair global reference list

<table>
<thead>
<tr>
<th>#</th>
<th>Year of repair</th>
<th>Qty</th>
<th>Country of installation</th>
<th>Manufacturer Name</th>
<th>MVA</th>
<th>kV</th>
<th>Type</th>
<th>Appl.</th>
<th>ABB Unit</th>
<th>Scope of repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1983</td>
<td>1</td>
<td>Spain</td>
<td>Westinghouse</td>
<td>200</td>
<td>220/132</td>
<td>Shell Transmission</td>
<td>Spain</td>
<td>Replacement of phases</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1985</td>
<td>1</td>
<td>Spain</td>
<td>Westinghouse</td>
<td>123</td>
<td>400/19</td>
<td>Shell Generation</td>
<td>Spain</td>
<td>Replacement of phases</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1986</td>
<td>1</td>
<td>Spain</td>
<td>Westinghouse</td>
<td>65</td>
<td>200/8</td>
<td>Shell Industrial</td>
<td>Spain</td>
<td>Replacement of phases, New rating 600/35/132</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1988</td>
<td>1</td>
<td>France</td>
<td>Westinghouse</td>
<td>160</td>
<td>220/132</td>
<td>Shell Industrial</td>
<td>Spain</td>
<td>Magnetic circuit</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1992</td>
<td>1</td>
<td>Brazil</td>
<td>BBC</td>
<td>300</td>
<td>550</td>
<td>Core</td>
<td>Auto</td>
<td>Brazil</td>
<td>New windings</td>
</tr>
<tr>
<td>6</td>
<td>1993</td>
<td>1</td>
<td>Argentina</td>
<td>BBC</td>
<td>42</td>
<td>31</td>
<td>Core</td>
<td>Auto</td>
<td>Brazil</td>
<td>New windings</td>
</tr>
<tr>
<td>7</td>
<td>1993</td>
<td>1</td>
<td>Argentina</td>
<td>Siemens</td>
<td>100</td>
<td>150</td>
<td>Core</td>
<td>GSU</td>
<td>Brazil</td>
<td>New windings + repair of core</td>
</tr>
<tr>
<td>8</td>
<td>1993</td>
<td>1</td>
<td>Colombia</td>
<td>Mitsubishi</td>
<td>70</td>
<td>230</td>
<td>Core</td>
<td>GSU</td>
<td>Brazil</td>
<td>New windings and bushings + repair of lead</td>
</tr>
<tr>
<td>9</td>
<td>1993</td>
<td>1</td>
<td>Paraguay</td>
<td>Accia</td>
<td>30</td>
<td>230</td>
<td>Core</td>
<td>Regular</td>
<td>Brazil</td>
<td>New windings</td>
</tr>
<tr>
<td>10</td>
<td>1994</td>
<td>1</td>
<td>Argentina</td>
<td>Ansaldo</td>
<td>280</td>
<td>132</td>
<td>Core</td>
<td>GSU</td>
<td>Brazil</td>
<td>New windings</td>
</tr>
<tr>
<td>11</td>
<td>1994</td>
<td>3</td>
<td>Colombia</td>
<td>Accia</td>
<td>115</td>
<td>230</td>
<td>Core</td>
<td>GSU</td>
<td>Brazil</td>
<td>New windings</td>
</tr>
<tr>
<td>12</td>
<td>1994</td>
<td>4</td>
<td>Colombia</td>
<td>BBC</td>
<td>30</td>
<td>150</td>
<td>Core</td>
<td>GSU</td>
<td>Brazil</td>
<td>New windings</td>
</tr>
<tr>
<td>13</td>
<td>1995</td>
<td>1</td>
<td>Colombia</td>
<td>ABB</td>
<td>19</td>
<td>115</td>
<td>Core</td>
<td>GSU</td>
<td>Brazil</td>
<td>New windings</td>
</tr>
</tbody>
</table>
Site repair examples

NEKA Iran
Repaired by ABB/DETFO
4 GSU Transformers
520 MVA, 420 kV
Site repair examples

South Steel Malaysia
Repaired by ABB/DETFO
Rectifier transformer ABB/IT
68 MVA, 33 kV
Site repair examples

NASA Argentina
UHE Rio Grande
GSU Transformer BBC/DE
440 MVA, 550 kV
Site repair examples

NPP, Spain
Almaraz
GSU Transformer
400 MVA, 420 kV
Site repair examples

ENEL Italy
GSU Transformer
100 MVA, 240 kV
Site repair examples

Furnas Brazil
Foz do Iguaçu
Convertor Transformer
314 MVA, 600 kV
Site repair examples

Light, Rio de Janeiro
Refurbishment program
Regulating Transformers
40 MVA, 138 kV