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General

ABB LoadBreak AutoLink Sectionalizer was tested according to ANSI IEEE C37.63 (IEEE Standard Requirements for Overhead, Pad-Mounted, Dry-Vault, and Submersible Automatic Line Sectionalizers for AC Systems).

The following design test report confirms that ABB LoadBreak AutoLink Sectionalizer meets or exceeds all specifications per ANSI IEEE C37.63.

The tests were performed in new units as requested by the standard.

ABB LoadBreak AutoLink Sectionalizer is based on ABB Single Phase Electronic AutoLink Sectionalizer. Please refer to the ABB Single Phase Electronic AutoLink Sectionalizer Design Test Report for further information on other type tests.

**Ratings**

<table>
<thead>
<tr>
<th>Model</th>
<th>AL41</th>
<th>AL42</th>
<th>AL44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Voltage</td>
<td>kV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated Power frequency dry withstand voltage (60 s)</td>
<td>kV</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Rated Power frequency wet withstand voltage (10 s)</td>
<td>kV</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Insulation Level (BIL)</td>
<td>kV</td>
<td>110</td>
<td>125</td>
</tr>
<tr>
<td>Insulator</td>
<td></td>
<td>Porcelain / Silicone</td>
<td>Silicone</td>
</tr>
<tr>
<td>Frequency</td>
<td>Hz</td>
<td>50 / 60</td>
<td>50 / 60</td>
</tr>
<tr>
<td>Nominal Current</td>
<td>A</td>
<td>200</td>
<td>200 (*)</td>
</tr>
<tr>
<td>Manual Load Break</td>
<td>A</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Short time current, 1 s (rms value)</td>
<td>kA rms</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Asymmetrical Initial (Peak)</td>
<td>kA</td>
<td>10 (**)</td>
<td>10 (**)</td>
</tr>
</tbody>
</table>

(*)The 15/27 kV version is applicable on systems of 15 kV max phase-earth.

(**) Duty test: capable of non automatic closing into 4,18kA peak short circuit current at 15kV.
Dielectric Tests

Standard: ANSI IEEE C37.63
Clause: 6.2 Withstand voltage tests
Laboratory: PowerTech Labs. Inc. – Surrey – BC – Canada
Dates: October 26th – 37th, 2009
Witnesses:
- Natalia Moizzes (ABB Argentina)
- Gary Haynes (ABB US)

The following tests were performed:
- Power frequency dry withstand voltage test
- Power frequency wet withstand voltage test
- Lightning impulse withstand voltage test

Figure 1: LoadBreak AutoLink.
**Power frequency dry withstand voltage test – 15 kV**

Atmospheric conditions:

<table>
<thead>
<tr>
<th></th>
<th>Silicone insulation</th>
<th>Porcelain insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>18.7°C</td>
<td>18.7°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>35%</td>
<td>35%</td>
</tr>
<tr>
<td>Barometric pressure</td>
<td>757.2 mmHg</td>
<td>757.2 mmHg</td>
</tr>
</tbody>
</table>

Test Voltage: 50kV applied for 60 seconds.

Test procedure: The sectionalizer was mounted on a wooden cross arm by means of standard brackets. The test voltage was applied to the sectionalizer in all required configurations. The mounting brackets were grounded in all test positions.

Results: No flashovers or insulation failures were recorded during the test. The sectionalizer complied with power frequency dry test requirements of the standard.

Test Report Ref:

Silicone insulation: 19488-27 – October 27th, 2009

Porcelain insulation: 19488-27 – October 27th, 2009
**Power frequency dry withstand voltage test – 27 kV**

Atmospheric conditions:

<table>
<thead>
<tr>
<th></th>
<th>Silicone insulation</th>
<th>Porcelain insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>16.4°C</td>
<td>16.4°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Barometric pressure</td>
<td>757.5 mmHg</td>
<td>757.5 mmHg</td>
</tr>
</tbody>
</table>

Test Voltage: 60kV applied for 60 seconds.

Test procedure: The sectionalizer was mounted on a wooden cross arm by means of standard brackets. The test voltage was applied to the sectionalizer in all required configurations. The mounting brackets were grounded in all test positions.

Results: No flashovers or insulation failures were recorded during the test. The sectionalizer complied with power frequency dry test requirements of the standard.

Test Report Ref:

Silicone insulation: 19488-27 – October 27\textsuperscript{th}, 2009

Porcelain insulation: 19488-27 – October 27\textsuperscript{th}, 2009
**Power frequency wet withstand voltage test – 15 kV**

Atmospheric conditions:

<table>
<thead>
<tr>
<th></th>
<th>Silicone insulation</th>
<th>Porcelain insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>16.4°C</td>
<td>16.4°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Barometric pressure</td>
<td>757.5 mmHg</td>
<td>757.5 mmHg</td>
</tr>
</tbody>
</table>

Test Voltage: 45kV applied for 10 seconds.

Test procedure: The sectionalizer was mounted on a wooden cross arm by means of standard brackets. The test voltage was applied to the sectionalizer in all required configurations. The mounting brackets were grounded in all test positions.

Results: No flashovers or insulation failures were recorded during the test. The sectionalizer complied with power frequency dry test requirements of the standard.

Test Report Ref:

Silicone insulation: 19488-27 – October 27th, 2009

Porcelain insulation: 19488-27 – October 27th, 2009
**Power frequency wet withstand voltage test – 27 kV**

Atmospheric conditions:

<table>
<thead>
<tr>
<th></th>
<th>Silicone insulation</th>
<th>Porcelain insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>16.4°C</td>
<td>16.4°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Barometric pressure</td>
<td>757.5 mmHg</td>
<td>757.5 mmHg</td>
</tr>
</tbody>
</table>

Test Voltage: 50kV applied for 10 seconds.

Test procedure: The sectionalizer was mounted on a wooden cross arm by means of standard brackets. The test voltage was applied to the sectionalizer in all required configurations. The mounting brackets were grounded in all test positions.

Results: No flashovers or insulation failures were recorded during the test. The sectionalizer complied with power frequency dry test requirements of the standard.

Test Report Ref:

Silicone insulation: 19488-27 – October 27th, 2009

Porcelain insulation: 19488-27 – October 27th, 2009
**Lightning impulse withstand voltage test – 15 kV**

Atmospheric conditions:

<table>
<thead>
<tr>
<th></th>
<th>Silicone insulation</th>
<th>Porcelain insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>14.2°C</td>
<td>14.2°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>42%</td>
<td>42%</td>
</tr>
<tr>
<td>Barometric pressure</td>
<td>757.0 mmHg</td>
<td>757.0 mmHg</td>
</tr>
</tbody>
</table>

Test Voltage: 110kV peak, 1.2/50 microsecond voltage impulse.

Test procedure: The switch was mounted on a wooden cross arm. Three positive polarity waves and three negative polarity waves were applied to the switch in all required configurations. The mounting frame was grounded in all test positions.

Results: The switch withstood the three positive and three negative polarity waves in all test configurations. No flashovers or insulation failures were recorded during the test. The switch complied with the lightning impulse test requirements of the standard.

Test Report Ref:

Silicone insulation: 19488-27 – October 27th, 2009

Porcelain insulation: 19488-27 – October 27th, 2009
**Lightning impulse withstand voltage test – 27 kV**

Atmospheric conditions:

<table>
<thead>
<tr>
<th></th>
<th>Silicone insulation</th>
<th>Porcelain insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>16.2°C</td>
<td>14.2°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>52%</td>
<td>42%</td>
</tr>
<tr>
<td>Barometric pressure</td>
<td>748.9 mmHg</td>
<td>757.0 mmHg</td>
</tr>
</tbody>
</table>

Test Voltage:

Silicone insulation: 125kV peak, 1.2/50 microsecond voltage impulse.

Porcelain insulation: 150kV peak, 1.2/50 microsecond voltage impulse.

Test procedure: The switch was mounted on a wooden cross arm. Three positive polarity waves and three negative polarity waves were applied to the switch in all required configurations. The mounting frame was grounded in all test positions.

Results: The switch withstood the three positive and three negative polarity waves in all test configurations. No flashovers or insulation failures were recorded during the test. The switch complied with the lightning impulse test requirements of the standard.

Test Report Ref:

Silicone insulation: 19488-27 – October 26th, 2009

Porcelain insulation: 19488-27 – October 26th, 2009
Figure 2: LoadBreak AutoLink at PowerTech High Voltage Lab – Dielectric Tests.
**Mechanical Tests**

<table>
<thead>
<tr>
<th>Standard</th>
<th>ANSI IEEE C37.63</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clause</td>
<td>6.8 Mechanical operation tests</td>
</tr>
<tr>
<td>Laboratory</td>
<td>ABB Greensboro – US</td>
</tr>
<tr>
<td>Date</td>
<td>June 2010</td>
</tr>
<tr>
<td>Witness</td>
<td>Gary Haynes (ABB US)</td>
</tr>
</tbody>
</table>

Test Requirements: IEEE Std C37.41-2000 for cutout type sectionalizers. Perform 200 mechanical operations and comply with the required after test conditions.

Test Procedure: The LoadBreak AutoLink sectionalizer was set in standard mounting position. Current higher than actuating current was applied, allowing to count and operate when it reached the setting.

20A was applied from a low voltage source, no high voltage is required. The sectionalizer was subjected to 200 automatic operations.

The test was performed on the following types of LoadBreak AutoLink:

- 15kV – 110kV BIL – porcelain.
- 15kV – 110kV BIL – silicone.
- 15/27kV – 125kV BIL – silicone.
- 15/27kV – 150kV BIL – porcelain.

Results: All testing was done in accordance with IEEE C37.63-2005 and the tested devices passed mechanical operation tests performing 200 operations with no visible defects.

Test Report Ref:

Switching Tests

Standard  
ANSI IEEE C37.63

Clause  
6.4 Switching

Laboratory  
PowerTech Labs. Inc. – Surrey – BC – Canada

Dates  
October 30th, 2009

Witnesses  
Natalia Moizzes (ABB Argentina)
Gary Haynes (ABB US)

Test Requirements: Switching tests shall be performed as given in 8.3 if IEEE Std 1247-1998.
The tests are the following:

100% Load switching, 10 operations.
5% Load switching, 20 operations.
100% Line-charging switching, 20 operations.

NOTE:
Loop switching switching tests and shunt capacitor switching tests are not required.
Cable charging and unloaded transformer switching tests are not applicable.

Test Procedure: The test was performed on 15kV – 110kV BIL sample, being this type the. The test results are applicable to other versions: 15/27kV – 125kV BIL and 15/27kV – 150kV BIL. The

100% Load switching tests at 15kV, 217Arms, 10 operations.
5% Load switching tests at 15kV, 11,7Arms, 20 operations.
100% Line-charging switching tests at 15kV, 2,2Arms, 20 operations.

Results: Tests were conducted in accordance with IEEE C37.63-2005, and IEEE 1247-2005. The tests were passed.

Test Report Ref:
Figure 3: LoadBreak AutoLink at PowerTech High Power Lab – Switching test.
Operation Duty Tests

Standard: ANSI IEEE C37.63
Clause: 6.11.1 Operation Duty
Laboratory: PowerTech Labs. Inc. – Surrey – BC – Canada
Dates: June 21st – 25th, 2010
Witnesses: Natalia Moizzes (ABB Argentina)
Gary Haynes (ABB US)

Test Requirements: Operation duty tests for load-interrupting sectionalizers shall be performed as stated in IEEE std C37.63-2005, clause 6.11.1. All tests shall be conducted in one sample.

Test Procedure:

Operation duty test was performed in a 15kV – 110kV BIL sample, this being the highest solicitation. The tests are applicable to 15/27kV – 125kV BIL and 15/27kV – 150kV BIL LoadBreak sectionalizer types.

a) Twenty automatic lockout operations at actuated by a current pulse or pulses of 4kArms (five operations each at one- and two-shot lockout and ten operations at three-shot lockout).

b) Eighty automatic lockout operations actuated by a current pulse or pulses of 4kArms (fourty operations at three-shot lockout, twenty operations each at one- and two-shot lockout).

c) Fifty nonautomatic operations at 15kVrms and interrupting 210Arms.

d) Three closing operations at 2kArms.

e) One nonautomatic opening operation at 15kVrms interrupting 210Arms.

Results:

Test Report Ref:
Figure 4: LoadBreak AutoLink at PowerTech High Power Lab – Operation Duty test.