Guide Specification

Single Phase IEC Style

Polemounted Transformers

Document No. 1LIE900005-SPC
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Specification

1. Scope
This specification covers the design, manufacture, testing, supply, and performance of single phase two winding oil immersed naturally cooled pole mounted transformers for use on overhead distribution networks.

Any departure from the provision of the specification should be disclosed at the time of tender under the title “Deviation from Specification”.

2. Standards
The transformers shall conform to the specifications listed in the table below.

- General design and Testing IEC 76
- Bushings for alternating voltages above 1000V IEC 137
- Loading guide for oil immersed power transformers IEC 354
- Radio interference test on high voltage insulators IEC 437
- Artificial pollution tests on high voltage bushings IEC 507
- Determination of transformer sound level IEC 551

3. Service Conditions
Transformers may be exposed to marine atmospheric conditions – excessive rain, excessive humidity or salt spray. Therefore, outdoor material and equipment shall be designed and protected for use in expose, polluted, salty, corrosive and humid coastal atmosphere.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude (above sea level)</td>
<td>1000 metres</td>
</tr>
<tr>
<td>Maximum outdoor temperature</td>
<td>40°C</td>
</tr>
<tr>
<td>Minimum outdoor temperature</td>
<td>-25°C</td>
</tr>
<tr>
<td>Annual mean Temperature</td>
<td>10°C</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>75 – 85%</td>
</tr>
<tr>
<td>Maximum wind velocity</td>
<td>50 m/s</td>
</tr>
</tbody>
</table>

4. System Conditions
The transformers are intended for outdoor pole top installation on 11kV or 33kV, 3 wire AC 50Hz system.

Technical Performance Requirements

5. Voltage Ratio and Tapping Range

1 phase 11kV/250V
Tolerance on the voltage ratio shall be ±0.5% as specified in IEC 76.

For all transformers, a 3 or 5 position external tap changer shall be provided on the HV winding in the form of an off circuit switch. Each tapping shall represent a step of + or - 2.5% at no load primary voltage.
6. KVA Rating
The transformer shall be capable of supplying a load equal to its kVA rating, under the following conditions:

- The rated secondary voltage shall be held constant by increasing the primary voltage to allow for regulation;
- Continuous steady load;
- Constant ambient temperature of 20°C
- 60°C average winding temperature rise and 60°C top oil temperature rise.
- Maximum winding hot spot temperature of 98°C

7. Overload Capacity
The transformer shall be capable of operating in accordance with the loading guide of IEC 354 without exceeding the normal daily use of life.

8. Short Circuit Rating
The transformer shall be capable of withstanding the thermal and dynamic effects of short circuits, as specified in IEC 76-5: Ability to withstand short circuit.

- The short circuit current shall be 25 times the full load current for all units;
- The X/R ratio shall conform to IEC 76-5;
- The short circuit duration shall be 0.5 seconds;
- Initial temperature of copper or aluminum shall be 98°C
- The final max temperature of copper shall be 250°C and for aluminum 200°C

9. Impedance
The guaranteed value of impedance measured at 75°C and center tap (subject to a tolerance of ±10% as specified in IEC 76) shall be 4% for all units.

10. Vector Group / Polarity
Single phase transformers shall be connected so as to give a negative polarity arrangement.

11. Losses
The guaranteed losses shall be stated by the tender and shall be subject to IEC 76 tolerances

<table>
<thead>
<tr>
<th>Loss Type</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Load Loss</td>
<td>±15%</td>
</tr>
<tr>
<td>Load Loss</td>
<td>±15%</td>
</tr>
<tr>
<td>Total Loss</td>
<td>±10%</td>
</tr>
</tbody>
</table>

12. Winding Insulation
The insulation levels of the bushings, terminations and windings shall be suitable as to meet the requirements of the appropriate insulation class as specified in IEC 71-1.
13. Regulation
The tenderer shall guarantee the% regulation at full load unity power factor and full load 0.8 power factor.

Tank Design

14. Tank Fabrication
The transformer shall be of sealed construction and shall not leak. The tank shall be designed so that the completed transformer can be lifted and transported without deformation or oil leakage. The tank shall be fabricated from mild steel or stainless steel.

For single phase transformers, the minimum thickness of steel tank shall be 2.5mm for mild steel or 2mm for stainless steel.

The tank shall preferably be of a rigid type construction and capable of withstanding the required internal pressures, without permanent deformation. Non rigid tanks may also be considered provided that no permanent deformation of the tank occurs over the full range of the transformer loads.

15. Surface Treatment
The transformer tank and its steel attachments shall be, preferably, hot dip galvanised to the standards set out in BS 729 to a minimum thickness of 80µm. Followed by painting with a special weatherproof paint to a minimum thickness 30µm. The outside of the tank shall be painted grey, colour RAL 7035.

Alternatively transformers offered in stainless steel shall use a grade not less than 304L. All fittings and fasteners shall be of an equivalent grade of stainless steel.

16. Tank Fittings & Attachments
All pole mounted transformers shall be fitted with the following fittings and attachments.

- Pressure relief device
- Oil level gauge

<table>
<thead>
<tr>
<th>Fitting or Attachment</th>
<th>Position on Tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>HV Bushings and terminals</td>
<td>Cover plate</td>
</tr>
<tr>
<td>LV Bushings and terminals</td>
<td>Cover plate</td>
</tr>
<tr>
<td>Earthing terminal</td>
<td>Right hand tank wall</td>
</tr>
<tr>
<td>Lifting hooks</td>
<td>Front and back wall</td>
</tr>
<tr>
<td>Rating and connection plate</td>
<td>Front wall</td>
</tr>
<tr>
<td>Tapping switch</td>
<td>Cover plate</td>
</tr>
</tbody>
</table>

The pressure relief device shall operate when internal pressure reaches a level of 10 p.s.i for rigid tanks and 5 p.s.i for fin walled tanks.

The oil level gauge used shall be a standard prismatic oil level gauge. These valves shall be equipped with non-detachable handles and protecting plugs.
Each transformer shall be provided with a rating plate of weatherproof material fitted in a visible position showing the appropriate items as specified in IEC 76-1.

17. HV & LV Bushings
Bushings shall be outdoor porcelain type and easily replaceable. They may be either brown or grey in colour. There shall be a locking feature to prevent rotation of parts when making connections. The bushings shall have an applied voltage level and a dry impulse level voltage that complies with IEC 137 and IEC 507.

18. Oil
The transformer shall be supplied filled with class 1 mineral oil conforming to IEC 296. The oil shall not be contaminated by PolyChlorinated Byphenls (PCB).

19. Routine Tests
The routine tests are to be carried out on each transformer. The range of routine tests carried out is detailed in IEC 76-1.

20. Type Tests
The type tests are to be carried out on a representative sample of transformers. The range of type tests carried out is detailed in IEC 76-1.

21. Drawings and Data
The following minimum information shall be provided with the tender for each transformer rating:
- Outline of the transformer showing envelope dimensions and the location of fittings
- Completed data sheet