400 kV AC substation

Outdoor AIS AC substations
High-voltage components
Stand-alone current transformers
3000/1500
ETS-50-06-08-C2 Rev. 2
## REVISION VIEW

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<th>Document no.:</th>
<th>222155/13</th>
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<td>Version</td>
<td>Author</td>
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<td>JAS</td>
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<tr>
<td>1</td>
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<td>Document status/change</td>
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<td>EHN, JLY, HOI</td>
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1. **Introduction**
This standard specifies the minimum requirements for stand-alone current transformers designed for outdoor substations for the 400 kV nominal voltage range.

2. **Standards and regulations**
The current transformer shall be in compliance with the following standards and regulations.

- Danish legislation
- Outdoor AIS AC substations common conditions and technical requirements for high voltage apparatus, ETS-50-00
- Other standards referred to in the above standards.

3. **Functional requirements**
Current transformers shall be hermetically sealed.

The terminal block in the terminal box shall be designed to enable short-circuit of each separate secondary winding without interrupting the secondary circuit. The terminal box shall be located at the same side as main terminal P2.
4. Technical requirements

4.1 Ratio

<table>
<thead>
<tr>
<th>Nominal voltage [kV]</th>
<th>PRIMARY CURRENT [A]</th>
<th>SECONDARY CURRENT [A]</th>
<th>COMMENT</th>
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<tbody>
<tr>
<td>400</td>
<td>1500/750</td>
<td>1</td>
<td>Measuring cores</td>
</tr>
<tr>
<td></td>
<td>3000/1500</td>
<td>1</td>
<td>Relay cores</td>
</tr>
</tbody>
</table>

Current transformers shall be re-connectable on their primary side and shall upon delivery be connected for 3000/1 A (relay cores).

4.2 Measuring cores

<table>
<thead>
<tr>
<th>Nominal voltage [kV]</th>
<th>NUMBER OF CORES</th>
<th>ACCURACY CL.</th>
<th>OUTPUT [VA]</th>
<th>INSTRUMENT SAFETY FACTOR FS</th>
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</thead>
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<tr>
<td>400</td>
<td>2</td>
<td>0.2s</td>
<td>10</td>
<td>5</td>
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</tbody>
</table>

Measuring cores: Secondary winding resistance shall be ≤ 2 Ω at 20°C.

4.3 Relay cores

<table>
<thead>
<tr>
<th>Nominal voltage [kV]</th>
<th>NUMBER OF CORES</th>
<th>CLASS</th>
<th>OUTPUT [VA]</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>3</td>
<td>5PR30</td>
<td>30</td>
</tr>
</tbody>
</table>

Relay cores: Secondary winding resistance shall be ≤ 4 Ω at 20°C.

4.4 Overcurrent

The relay windings shall be designed for a continuous current of 120% and measuring winding shall be designed for a continuous current of 240% of the primary current.

4.5 Test

The current transformer shall be type tested in accordance with EN 60044-1 and a declaration of conformity concerning type conformity shall be available from the manufacturer. A test protocol for each current transformer shall also be available. The test protocol shall specify all test points in accordance with a routine test as described in EN 60044-1.

The fault curves for the measuring cores shall be recorded down to 5% of the rated current and, if possible, at even lower currents.

4.6 High-voltage terminals

For 400 kV high-voltage terminals, one of the following is required:

Plate terminal with 3x3, Ø14 mm holes and a 40 mm hole centre spacing.
See Appendix 1.
Material: Aluminium or aluminium alloy.
Plate terminal with 2x4, Ø14 mm holes and a 50 mm hole centre spacing.
See Appendix 1.
Material: Aluminium or aluminium alloy.

5. Design requirements

5.1 Installation
It shall be possible to install the current transformers on a support using the footprint specified in Appendix 2.

5.2 Corrosion protection
External parts shall be made of corrosion-resistant materials. Steel components shall be stainless or hot-dip galvanized. If surfaces are processed, they shall be protected in a permanent way.

5.3 Colours
All corrosion-protected surfaces that are given a paint finish shall be painted in the colour Grey RAL 7033.

5.4 Earthing

Metal cabinets shall have protective earthing.
Cabinets of insulating material shall have a common earthing terminal to which all internal separate metal parts shall be connected.

There shall be terminals for protective earthing of control cabling.

6. Documentation
The current transformer shall be accompanied by the following documentation:
Data sheets stating manufacture, type, description and drawings. This shall include:

- Measuring fault curve as a function of load and current
- Dynamic transfer characteristic (with DC component)
- Secondary resistance
- Excitation curves and material data
- Mechanical core dimensions
- Equipotential curves
- Equivalent diagram
- HF properties
- Detailed drawings
- Operating manuals
- Maintenance manuals
- Mechanical data, strength, deflection etc.
- Storage instructions
- Instructions for disposal
7. Appendices

7.1 Appendix 1 High-voltage terminals
High-voltage connection terminals for current transformers:

7.2 Appendix 2 support Interface
Foot print for support for current transformer installation