400 kV AC substation

Outdoor AIS AC substations
High-voltage components
Stand-alone current transformers
2000/1000
ETS-50-06-08-C1 Rev. 2
### REVISION VIEW

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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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</thead>
<tbody>
<tr>
<td>400</td>
<td>1000/500 2000/1000</td>
<td>1</td>
<td>Measuring cores Relay cores</td>
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</table>

Current transformers shall be re-connectable on their primary side and shall upon delivery be connected for 2000/1 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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<tr>
<td>400</td>
<td>2</td>
<td>0.2s</td>
<td>10</td>
<td>5</td>
</tr>
</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**
Metals 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 connections**
High-voltage connection terminals for current transformers:

![Diagram of high-voltage connections](image1)

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

![Diagram of support interface](image2)