400 kV AC Substation

Outdoor AIS AC Substations
High-voltage Components
Capacitor Voltage Transformers
ETS-50-06-10-C1 Rev. 4
## REVISION VIEW

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1. Introduction

This standard specifies the minimum requirements for capacitor voltage transformers for outdoor substations for the 400 kV voltage level.

2. Standards and regulations

Capacitor voltage transformers shall comply with the following standards and regulations.

- Outdoor AIS AC substations common conditions and technical requirements for high voltage apparatus, ETS-50-00
- EN 60044-5: ‘Instrument transformers - Part 5: Capacitor voltage transformers’
- Other standards referred to in the above standards.

3. Functional requirements

For capacitor voltage transformers the following apply:

- The capacitor part and the magnetic part shall be integrated.
- It shall be possible to install an additional external capacitor between the earthed (bottom) part of the capacitive voltage divider and earth.
- Shall not be fitted with a discharging gap on the primary terminal.
- Shall be hermetically sealed.

4. Technical requirements

The voltage transformer shall be fitted with two electrically separate windings on the secondary side:

- Winding 1. (measuring winding)
- Winding 2. (winding for relay protection)

Each winding shall be loadable up to the rated load, independently of the loading of the other winding.

The voltage transformer shall be protected from secondary short circuits by fuses in the secondary circuits. These fuses shall be of the type ‘DO1’, and mounted in fuse holders in the terminal box. There shall be one fuse in each secondary circuit, with an appropriate breaking current, i.e. 6 A. The manufacturer must ensure that the voltage transformer can deliver a sufficient short circuit current to break the fuse.

See Appendix 3 for an illustration of the requested type of fuse and holder.

4.1 Primary rating

The primary winding shall be based on:

400/√3 kV

Rated voltage factor = 1,5/30s

4.2 Secondary winding (winding 1, measuring winding)

Secondary winding 1 shall be selected on the basis of the following values:
### 4.3 Secondary winding (winding 2 for relay protection)
Secondary winding 2 shall be selected on the basis of the following values:

<table>
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<tr>
<th>Nominal voltage [kV]</th>
<th>Secondary voltage [V]</th>
<th>Class</th>
<th>Rated burden [VA]</th>
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<tr>
<td>400/$\sqrt{3}$</td>
<td>100/$\sqrt{3}$</td>
<td>3P</td>
<td>25</td>
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</table>

### 4.4 Burden
If the burdens mentioned in 4.2-4.3 are not standard values, the nearest higher burden shall be offered for winding 1 while a smaller burden for winding 2 may be acceptable.

### 4.5 Test
The voltage transformer shall be tested in accordance with EN 60044-5, and a declaration of conformity concerning type conformity shall be available from the manufacturer. A test protocol for each voltage transformer shall also be available. The test protocol shall specify all test points in relation to EN 60044-5.

### 4.6 High-voltage terminals
Ø30 mm tap placed centrally on the equipment. See Appendix 1
Material: Aluminium or aluminium alloy.

### 5. Design requirements

#### 5.1 Interface for support
It shall be possible to install voltage 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
Flexible earthing shall be designed to prevent corrosion, damage due to wear and tear etc. when in contact with other materials.
6. **Documentation**

The voltage transformer shall be delivered with the following documentation: Data sheets stating manufacture, type, description and drawings. This shall include:

- Measuring fault curve as a function of load and voltage
- Dynamic properties
- Verification of ferroresonance properties
- Excitation curves and material data
- Mechanical core and winding dimensions
- Capacities
- Equipotential curves
- Equivalent diagram
- HF properties
- Detailed drawings
- Installation manuals
- Operating manuals
- Maintenance manuals
- Mechanical data, strength, deflection etc.
- Storage information
- Instructions for disposal
7. Appendices

7.1 Appendix 1 High-voltage terminals
High-voltage connection terminal for Capacitor Voltage Transformer:

![Figure 1 Ø30 tap](image1)

7.2 Appendix 2 Interface to support
Foot print for support of Capacitor Voltage Transformer:

![Figure 2](image2)
7.3 Appendix 3 Fuse and holder

Below is an example of the requested D01 fuseholder and fuse.

*Figure 3 Fuse and holder*