

# Mobile calibration of instrument transformers in the field

## Calibrating split-core current transformers

To comply with the legal framework conditions for charge measurement of power plants, calibrated current transformers are used in high-voltage switchgear. The use of split-core current transformers represents the best and most affordable means of retrofitting here. Until the OMICRON CT Analyzer became available a practical testing process for calibration of split-core transformers in the field could not be developed. This testing process was one of the key pre-requisites for these current transformers to be awarded national type approval in Germany.



**CT Analyzer:**  
Fast and economical  
on-site testing and  
calibration

### Split-core current transformers in legal metrology

The special feature of split-core current transformers lies in their core, which allows them to be mounted around a cable at any time. Yet this benefit comes at a price, since an additional magnetic resistance occurs on the two halves of the core and this can have a negative impact on the accuracy of the measurements. However, using the CT Analyzer and a new testing method, it became possible to determine this influence extremely precisely. This in turn allows split-core current transformers to be calibrated in the field.

### Calibration in multiple stages

"During calibration, a test is first performed in the test field to determine the condition of the equipment," explains Ralf Catholy, deputy director at Vattenfall's state-recognized EC11 test center. Besides the inspection of the labeling and the nameplate with the approval symbol, checks are also performed to determine any external damage and ensure that the core or the halves of the transformer are connected at the right torque using the calibrated torque wrench. After this, the insulation is tested in the test field. Since the tests are for low-voltage transformers, which are fitted on the outer insulation of the high-voltage cable, they are performed at a voltage of 3 kV. This so-called winding test is used to determine whether a conductive connection exists between the winding and the conductive parts on the housing (for example, the mounting and fixing elements).

### Metrological testing in the test field

The subsequent metrological testing in the test field determines whether the transformer complies with the legally stipulated calibration error limits at various primary transformer currents and secondary loads. The temperature  $T_1$  also needs to be recorded in the test field using a calibrated thermometer. "It is important for the transformer to have been kept at test field temperature for at least 8 hours prior to testing. This ensures that all transformers are at the same temperature," explains Ralf Catholy.

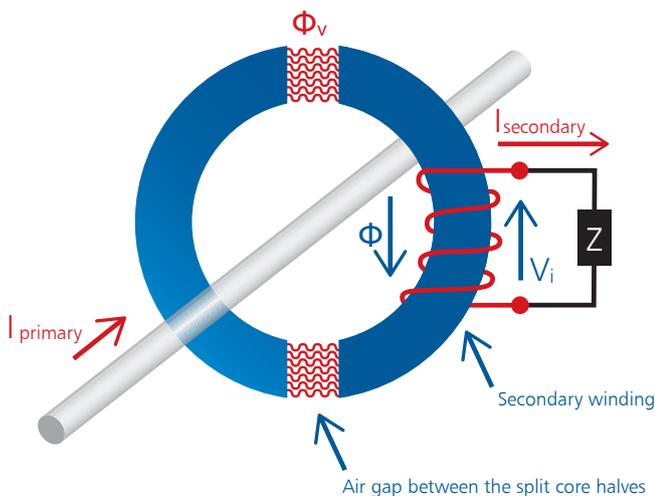


Diagram of the split-core current transformer





**Ralf Catholy**

- > Employed at Vattenfall and its predecessor organization BEWAG since 1979
- > Active in the field of meter measurement since 2004
- > Deputy director at the state-recognized EC11 test center since 2006

#### Testing procedure for split-core transformers

**Mobile calibration of instrument transformers in the field**  
Calibration of split-core current transformers with national type approval (No. 20.27)

#### CT Analyzer – Approved for mobile transformer testing

The metrological test is first performed on the stationary transformer testing device. The ratio errors and loss angles must be within the calibration error limits at all test points here. The first reference measurement is then taken using the CT Analyzer. Comprehensive tests at the Federal Institute of Physics and Metrology (PTB) in Braunschweig, Germany concluded that the CT Analyzer provides sufficiently precise, reproducible measurement results and thereby fulfills the requirements of a mobile transformer testing facility.

"Working with the CT Analyzer is really easy," confirms Ralf Catholy: "Transformer data can be effortlessly entered in its extensive and well laid out menu. Connecting the transformer is also easy and supported further by automatic polarity detection."

#### Testing at the place of installation

"Once the split-core transformers have been attached to the high-voltage cable, another test is performed to determine the condition of the equipment," explains Ralf Catholy further. Attention must be paid to ensure that the cable is centered in the round opening. "In the second reference measurement, a check must be performed so that the temperature  $T_2$  is within limits. It must not deviate

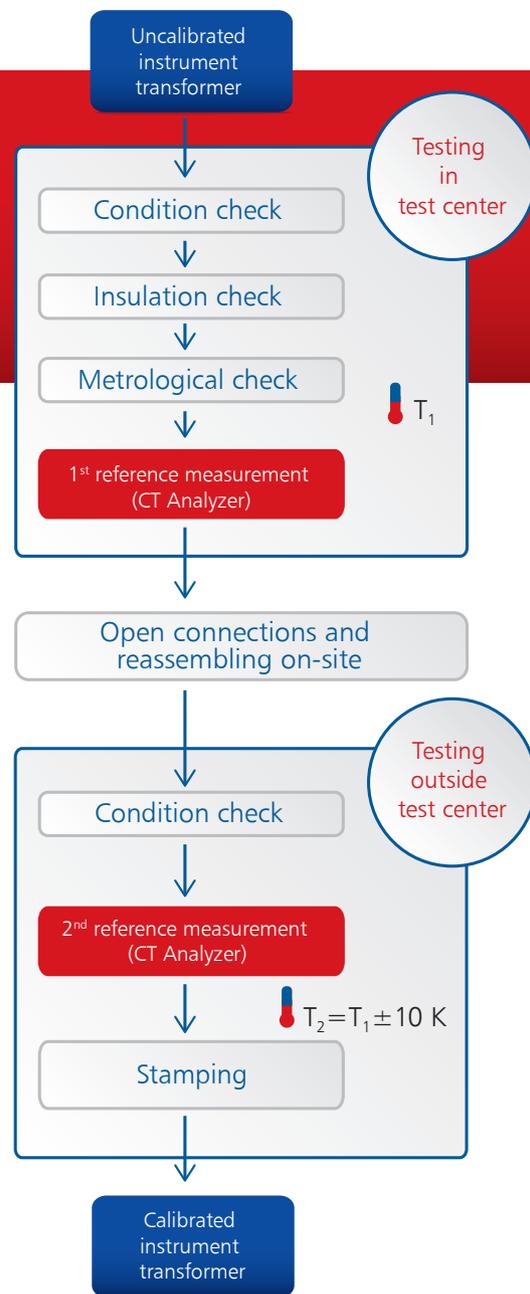
from the first reference measurement by more than 10 K," Ralf Catholy adds. The automatic test with the CT Analyzer then begins on the de-energized cable. The ratio errors and loss angles determined in this way are then subjected to repeat evaluation.

#### Compliance with the calibration error limits

The results of this test, minus the results of the first reference test, must not exceed one fifth of the respective calibration error limits for the test point in question. The transformer must also comply with the calibration error limits, taking into account the difference from the second reference measurement and the correction (stationary measurement minus first reference measurement). The final step then involves the calibration mark and seal being attached at the assigned sections.

#### Low-cost retrofit

Using calibratable split-core current transformers is an affordable way of retrofitting calibrated instrument transformers in switchgear, particularly in gas-insulated switchgear systems (GIS). The CT Analyzer, and a testing procedure developed specifically for use with it, also enables calibration in the field and therefore approval of these transformers.



#### Vattenfall Europe Metering GmbH

Vattenfall Europe Metering GmbH is based in Hamburg, Germany and has around 260 employees. The company covers all fields of intelligent and conventional metrology. It also operates the state-recognized EC11 test center as a company authorized to fulfill state functions.

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