

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**IEC 60076-11**  
Edition 2.0 2018-08

### **POWER TRANSFORMERS –**

#### **Part 11: Dry-type transformers**

### **INTERPRETATION SHEET 1**

This interpretation sheet has been prepared by IEC technical committee 14: Power transformers.

The text of this interpretation sheet is based on the following documents:

DISH	Report on voting
14/1052/DISH	14/1054/RVDISH

Full information on the voting for the approval of this interpretation sheet can be found in the report on voting indicated in the above table.

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#### **14.3.2 Temperature-rise test**

##### **Question**

The independent certification body in Poland "Instytut Energetyki" carries out the testing of transformers or its inspectors witness this testing at the manufacturers' premises. The description of resistance measurement during the temperature rise test has caused a dispute between a manufacturer and the inspector on where exactly the resistance should be measured. The inspector requested that the resistance be measured on "winding lead exits" inside the enclosure, while the manufacturer argued for the measurement to be made on "winding terminals" which in its opinion were the bushings on the enclosure cover.

Subclause 14.3.2.1 General, states:

The winding temperature rise shall be established by the rise in resistance method or by superposition method. For the determination of the average winding temperature rise the measured temperatures of the cooling air or of the water intake of the cooling equipment shall be used.

For three-phase transformers, the resistance measurements shall be made between the central and an outer phase line terminals.

NOTE When the temperature rise is performed it is advisable to measure the windings resistance close to the windings.

Where should the measurements be made?

### **Interpretation**

Testing of the winding resistance at transformer terminals (bushings) includes leadwork or busbars and often also multiple connections. Because of this, the tested winding resistance and its change due to heating is affected by the resistance of all these leads and connections. Consequently, the derived winding temperature rise if measured at the transformer terminals could be lower than if the winding resistance were tested directly on the winding lead exits. That is why the standard suggests (in the NOTE) that measurement of the windings' resistance be carried out close to the windings. That way, the accuracy of the indirect winding temperature measurement by resistance is higher.

In the case of dry-type transformers without enclosures, it is possible to have access close to the winding lead exits and not only to the transformer line terminals. Therefore, measurements shall normally be made at such locations.

On the other hand, if the dry-type transformer is equipped with an enclosure, the resistance measurement close to the winding lead exits requires opening the enclosure to have access to carry out the test (hence, affecting the normal cooling efficiency of the unit). Nevertheless, the advice to measure the resistance normally close to the winding lead exits holds. Limiting the enclosure opening by using special through elements for the cabling and/or by closing the required opening by temporary means as well as possible will minimize the impact on the normal cooling efficiency.