

**PART B-06: TRANSFORMERS**

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**PART B-06**

**TITLE:                   TRANSFORMERS**

**SPECIFICATION NO:   B-06**

**INCEPTION DATE:     AFTER GAZETTING (WORKING DOCUMENT FOR A 2 YEAR PERIOD)**

**AMENDMENTS/REVISIONS**

DATE	PAGE	PARAGRAPH	DESCRIPTION	ORIGINATOR	APPROVED

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## 1. SCOPE

This document provides a guide for the minimum maintenance requirements for transformers including:

- a) Power transformers
- b) Current Transformers
- c) Voltage Transformers
- d) Instrument Transformer
- e) Pole mounted transformer installations
- f) Ground mounted transformer installations

## 2 GENERAL REQUIREMENTS

Proper ventilation should be provided when transformers are installed in doors. There should be adequate space around the transformer to enable adequate dissipation of heat.

## 3 ROLES AND RESPONSIBILITIES

### 3.1 The Licensee should be responsible for:

- a) Ensuring that equipment job plans are available and issued for specific maintenance.
- b) Ensuring that the maintenance feedback information that is available in the maintenance management system is analysed.
- c) Ensuring that staff carrying out maintenance tasks is trained, competent and authorized to perform maintenance on the specific equipment;
- d) Ensuring that instructions are implemented and adhered to and equipment is maintained in accordance to relevant work instructions.
- e) Ensuring that the maintenance feedback information / data is captured and recorded into the system for future maintenance planning.
- f) Ensuring that trained, competent and authorized staff is available to perform maintenance / tests on equipment out on maintenance when scheduled;

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- g) Ensure that the relevant staff is available on site to isolate the equipment AC / DC supply.

## 4 GENERAL MAINTENANCE

The cause of breakdown of transformers may be classified as follows:

- a) Faulty design or workmanship
- b) Incorrect installation or use
- c) Overload
- d) Neglect, Wear and Tear and other deterioration
- e) Accidents

A rigorous system of inspection and preventative maintenance will ensure long life, trouble-free service and low maintenance cost. Maintenance should consist of regular inspections, testing and reconditioning where necessary.

Records should be kept of the transformer, giving details of all inspections and tests made, and of any unusual occurrences.

### 4.1 Safety Precautions

Before commencing any maintenance work the transformer should be isolated from the supply and the terminals earthed. One should be mindful of the oil level in the transformer when undoing nuts and bolts and before unsealing the tank. No fire is to be kept near the transformer while maintenance work is being carried out.

### 4.2 Oil

The oil levels vary with the oil temperature. The transformer should be topped up as necessary with clean transformer oil. If the oil level drops appreciably over a short period, the tank should be checked for leaks. In case there is a leak on a welding joint, it should be re-welded. A leaking gasket may be remedied by tightening the bolts. If this proves to be ineffective, the gasket should be removed.

### 4.3 Possible reasons for transformer failure

- a) Inadequate lightning protection
- b) Continuous over loading of the transformer beyond rated capacity

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- c) Improper tap position can cause excessive core losses and consequently excessive heating
- d) Outgoing cable faults if not cleared in specific time
- e) Improper contact of fuses/over capacity fuses
- f) Cable connection to LT bushing terminal loose
- g) Improper/loose earthing connection
- h) Unbalanced load conditions
- i) Improper maintenance/ checking of oil levels in the transformer and not topping up when required

## **5 SURGE ARRESTERS**

The surge arresters shall be connected line-to-ground, in parallel to the equipment to be protected. The arresters used shall be of the same rating, same manufacturer and same batch of manufacture.

### **5.1 Maintenance**

A failed arrester will be identifiable by a disconnected earth terminal at the bottom of the unit. If the disconnecter fails to operate, it will blow the installation fuse or repeatedly cause the earth-fault or sensitive earth-fault protection to operate.

#### **5.1.1 Replacing failed Surge Arresters**

When one surge arresters has failed, on the phase, it should be replaced with a unit of the same make and rating as the original arrester. If a unit is recovered it shall be tested to ensure that they are operational. If operational the arresters may be used elsewhere.

### **5.2 Installation**

Surge arresters shall be installed at all primary equipment; this includes transformers, auto-reclosers, CT/VT metering units, voltage regulators and sectionalizers. Arresters shall also be installed on both ends of the underground cable that is interconnecting with an overhead line. Positioning of the surge arrester brackets shall be such that, the operation of the surge arrester disconnectors will not be hampered.

## **6 MAINTENANCE OF VOLTAGE AND CURRENT TRANSFORMERS**

### **6.1 Responsibilities**

#### **6.1.1 The Licensee is responsible for:**

- a) Ensuring that all Voltage transformers, Current transformers and auxiliaries, are included in the maintenance plan and are subjected to RCM analysis;

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- b) Ensuring that all maintenance is carried out against an approved job plan, which should form part of the maintenance records;
- c) Ensuring that any defects and conditions are rectified and that actions taken are recorded against the history of the VT and CT.

**6.1.2 Each Field Services unit is responsible for:**

- a) Ensuring that VT and CT maintenance is carried out in accordance with the relevant Work Instruction and reporting back on work done and materials and spares used;

**6.2 Condition Monitoring**

To monitor the condition of the VT and the CT, the following should be done:

**6.2.1 Visual Inspections**

The following should be checked and recorded:

- a) Check all porcelain for chips, cracks or broken sheds. A maximum of 20% of chipped, cracked or broken sheds is permitted on an insulator.
- b) Check pollution levels on porcelains.
- c) Check for any insulating oil leaks.
- d) Check oil levels in all CT's, VT's (taking into consideration the effect of ambient temperature). Oil levels must be clearly marked on all gauge glasses.
- e) Check all gauge glasses to be clean and legible.
- f) Check seals on all connection boxes.
- g) Listen for any audible discharges.
- h) Check that the operating labels are securely mounted and legible from the operating point.
- i) Check that the earth straps are in good condition and effectively connected.

**6.2.2 Infra-red scanning**

- a) Infra-red scanning should be carried out in accordance with applicable standards.
- a) Any defects found should be recorded and reported to the respective supervisor for immediate attention.

**6.3 Condition Based Maintenance**

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All defects should be analysed and correlated on a monthly basis so that maintenance outages can be timeously scheduled.

Prior to a scheduled outage all defects should be identified via condition monitoring to ensure that the correct equipment, material and personnel are available on site.

**6.3.1 Reactive maintenance - Items for Immediate Action**

- a) Repair or replace seals on all connection/terminal boxes doors.
- b) Refit the operating labels so as to be legible from the operating point.
- c) Check the earth straps to be in good condition and should be effectively connected.

**6.3.2 Preventive Maintenance - Scheduled Actions**

All scheduled work should be carried out in accordance with the requirements of the specific job plan and the relevant work instruction.

All oil levels that are close to or below the minimum level must be corrected in all VT's and CT's (taking into consideration the effect of ambient temperature).

**6.3.2.1 Hot connections**

Any hot connections on the panel/bay as identified by the infra-red scanning report should be repaired.

**6.3.2.2 Cleaning**

- a) When a CT or VT is taken out of service for maintenance purposes clean off any dirt or oil that may have collected on the CT or VT. Steam cleaning or high pressure cleaning may be necessary.
- b) An anti-pollution medium should be applied in accordance with requirements.

**6.3.2.3 Oil leaks**

- a) Where oil leaks are present on a CT or VT, the CT or VT should be replaced and the faulty unit sent to the workshop for repairs.

## **7 MAINTENANCE DOCUMENTATION**

- a) A work order with the applicable job plan and work instruction will be issued for any work to be carried out. Feedback required for each specific job will be stipulated on the job plan.
- b) The following information on the work order should be checked at each inspection. Any change in the information must be noted and returned to the Maintenance Service Provider via the Work Coordinator who is to update the information in Maintenance management system.

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- Make
  - Type
  - Serial No
  - Ratio
- c) The following failure/feedback should be recorded at each inspection and returned to the Work Coordinator who is to add this information to the equipment history:
- All oil levels;
  - Any defects or abnormalities found and details of repairs;
  - Date and time of the inspection; and
  - The name of the person who carried out the inspection.