1.0 OBJECTIVE

This procedure provides testing details for electrical installations with specification, quality control and Safety Plan pertaining to this project.

2.0 SCOPE

Method of installation is accordance to latest IEC, IEE, MS, JKR & TNB requirements and local authority standards.

3.0 SAFETY & ENVIRONMENTAL PROGRAM

- All installation works will be carried-out in accordance with Project Safety Plan, Owner Safety Procedures and statutory regulations.
- All necessary personal protective equipment will be provided and worn.
- All the tools and equipment used at site must be compliance to safety requirement.
- The site of all work activities will be kept in clean and tidy manner.

4.0 REFERENCES

MS ISO 9001: 2015 Element 7.1.6.

7.0 TESTING METHOD STATEMENT

I. Testing Procedure for O/C & E/F Protection Relay

General

1 Record all particulars of relay to be tested and its working settings.

2. Change the settings to test settings where appropriate.

3. Check that auxiliary supply voltage connected to the relay corresponds to rated auxiliary voltage stated on its nameplate.

A. Starting Current

1. Connect output of test set to R (red) phase of relay. Turn on auxiliary supply to the relay.
2. Ensure that control know on test set has returned to zero position.
   Then switch on the test set.
3. Increase output current of test set gradually until O/C element of R (red) phase picks up.
   Record the current in test form. Switch off the test set.

B. Timing Test

1. Connect a trip contact to timer stop terminals of the test set. A pair of voltage free contacts are preferred.
2. Switch on the test set, increase current to 1.3 times of setting current. Switch off the test set with control know remaining in the same position.
3. Switch on the test set to inject the current and start timer at the same time. After trip contact has operated, record the relay operating time in test form. Switch off test set.
4. Repeat steps 2 and 3 above for 2 and 3 times of setting current. Check that operating time recorded correspond to timing characteristic of relay.

C. High Set Element

1. **Caution:** Check thermal rating of relay before high set element is tested. Ensure that maximum allowable continuous current is not exceeded.
2. Repeat timing test for the high set elements. Injected current shall be approximately 5% higher than setting. In this case, the operating time will be of definite time delay instead of inverse time characteristic.

Finally

1. Repeat all the above test for Y (yellow), B (blue) and E/F element.
2. Change settings back for all elements (R, Y, B & E/F) to ensure that the start currents now correspond to services settings.
3. Disconnect all wiring between test set and relay. Check that connection to relay is normalised.

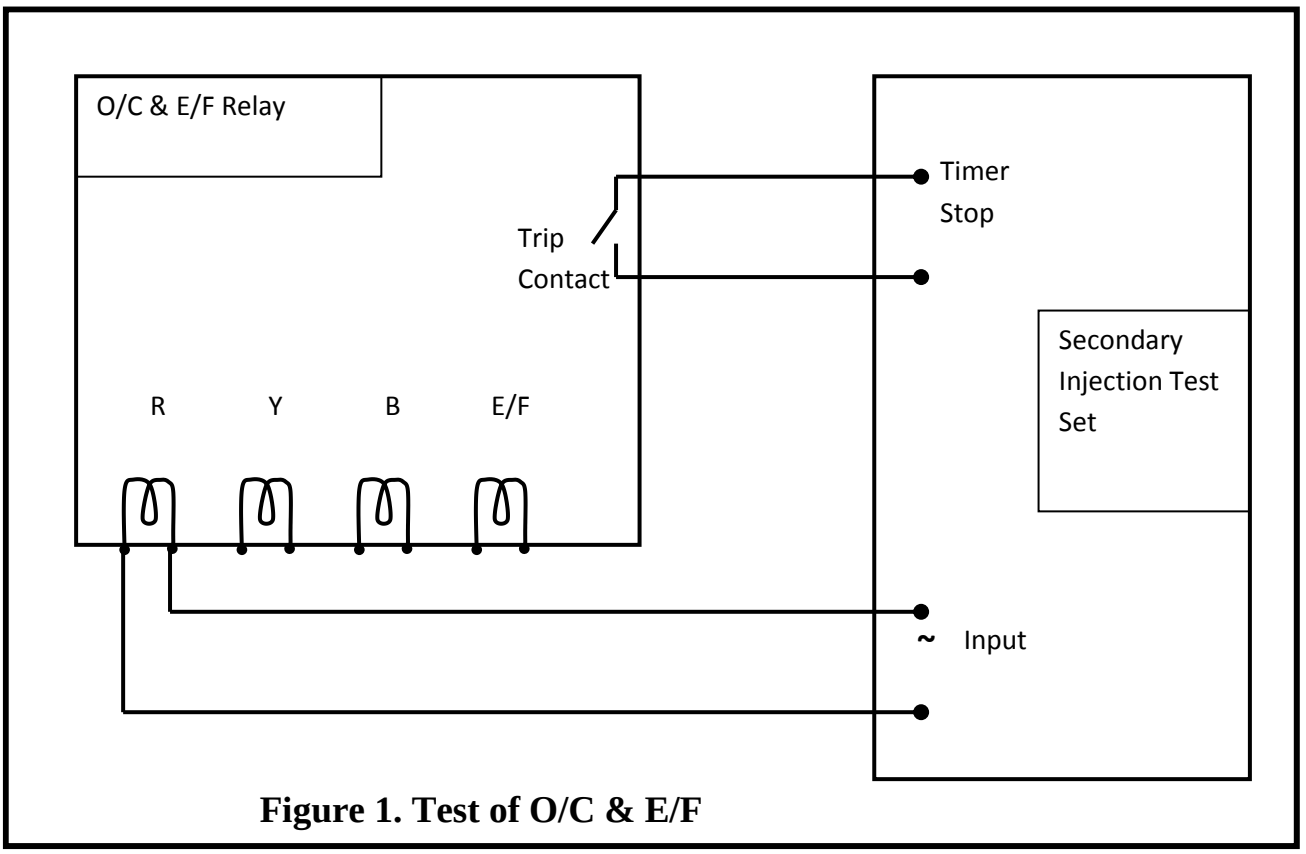


Figure 1. Test of O/C & E/F

II. Testing Procedure for Earth Leakage Relay (ELR)

1. Record all particulars of relay to be tested and its working settings.
2. Check that auxiliary supply voltage connected to the relay corresponds to rated auxiliary voltage stated on its nameplate.
3. Connect output of the test set to input terminals of ELR. Alternatively, single-phase primary current can be injected into one of the conductors to induce a secondary current on the ZCT.
4. Ensure that control knob on test set has returned to zero position. Then switch on test set.
5. Increase the output current of test set gradually until relay picks up. Record the current in test form.
6. Connect a trip contact to timer stop terminals of the test set. A pair of voltage free contacts are preferred.
7. Switch on the test set, increase current to 2 times of setting current. Switch off the test set with control knob remaining in the same position.
8. Switch on the test set to inject current and start timer at the same time. After trip contact has operated, record relay operating time in test form. Switch off test set.
9. Disconnect all wiring between test set and relay. Check that connection to relay is normalised.

III. Procedure for Current Transformer Test

A) Magnetising Characteristic

1. Connect Secondary terminals of the CT to output terminals of a single-phase autotransformer.
2. An ammeter shall be connected in series with secondary winding of the CT.
3. A voltmeter shall be connected in parallel with secondary winding of the CT.
4. Ensure that the autotransformer is turned to zero output position.
   Then switch on power supply to the autotransformer.

5. Increase output of the autotransformer gradually. Record the voltmeter and ammeter reading in each step until the CT saturation point is reached.
6. At least eight readings are obtained and check that the reading obtained would enable magnetising curve to be plotted showing its saturation voltage.

B) Insulation Resistance of CT Secondary

1. Check that all electronic devices such as relays, digital meters etc. in CT secondary circuit are isolated.
2. Remove earthing connection of CT neutral point.
3. Identify the nearest earth point to be used as reference and ensure that it is properly earthed.
4. Connect one terminal of insulation tester to CT secondary and the other terminal to the earth point stated in step 3 above.
5. Switch insulation tester to 500V dc for 20seconds and obtain insulation resistance reading of CT secondary.
6. Switch off insulation tester. Discharge at CT terminal measured. Restore connection of CT earth point and connection to other devices in CT secondary circuit.

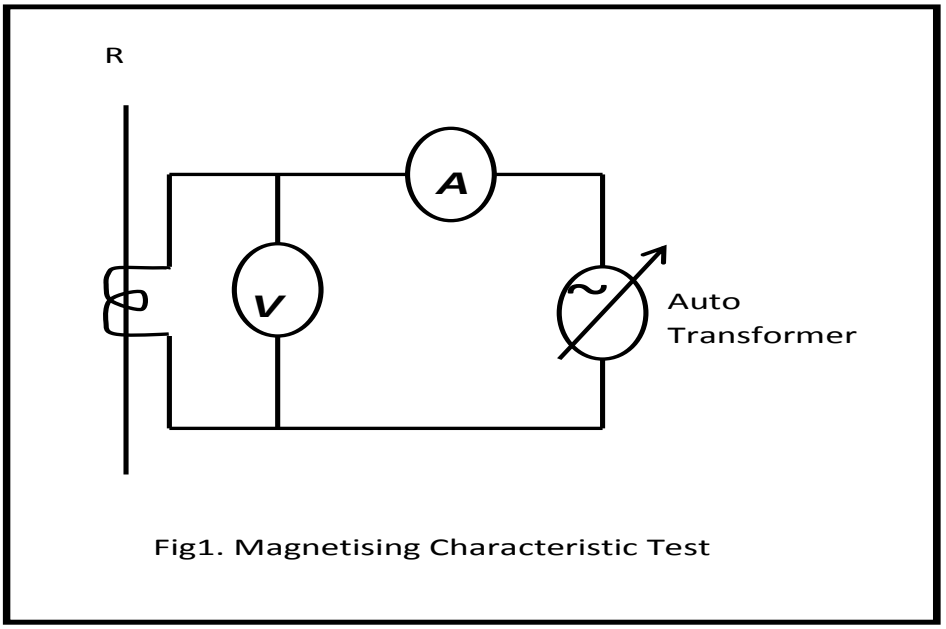


Fig1. Magnetising Characteristic Test

IV. Insulation-resistance test

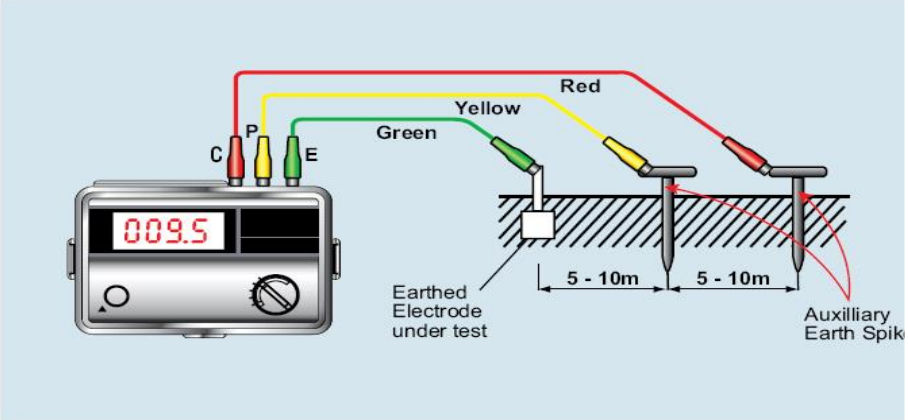
1. Tests should be carried out using the appropriate DC test voltage.
2. Make sure the main switch is off and all fuses in place, switches and circuit-breakers closed, lamp removed and other current-using equipment disconnected.
3. Test should be carried out as below:
   a. Insulation resistance between live conductors
   b. Insulation resistance to earth

The table below indicates the test voltages and the minimum acceptable values of insulation resistance.

Cable Voltage (Working Range)	Test Voltage (Between conductor and to earth)	Minimum Insulation Resistance (Mega Ohms)
Control Wiring	500V	10
450/750V	500V	10
600/1000V	1000V	100
1900/3300V	1000V	200
3800/6600V	1000V	200
6350/11000V	5000V	200
8700/15000V	5000V	200
12700/22000V	5000V	200
19000/33000V	5000V	200
38000/66000V	5000V	200

V. Measurement of Earth Electrode Resistance

A19(a) Measurement of earth electrode resistance



(i) a proprietary earth electrode test device should be used
(ii) auxiliary earth spikes should be applied at least 5 m apart and 5 m distant fr electrode under test
(iii) an earth resistance value of less than 10 ohms is required for a Customer System [see Regulation 6.2].
(iv) an additional number of electrodes may be required (or deeper electrodes) achieve the required earth resistance value
(v) due consideration should be given to future changes in soil condition (e.g. out)
(vi) sufficient time should be allowed if special chemicals or salts are added to ground to improve the earth resistance values

Earth Pit

Earth Test Spike