



To Mr. J.R. Leslie
Manager
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CURRENT TRANSFORMER TESTING EQUIPMENT
FOR FIELD USE

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This report describes equipment that may be used to demagnetize in-service current transformers and to determine their excitation characteristics.

Principle of Operation

The equipment operates on the principle that if a current transformer, carrying normal load current, can be loaded with a burden to raise its terminal voltage, and if the change in the secondary current due to this burden can be measured, then the excitation characteristics can be determined and plotted for that current transformer. Provided that the turns ratio is known, the excitation characteristics of a current transformer are related to the errors of the transformer.

The terminal voltage of the transformer is increased by loading the transformer with a resistive burden. Any change in the secondary current, due to the terminal voltage, is measured by a differential ammeter. A second transformer in the same circuit is required to make the differential ammeter operable.

Demagnetization of current transformers is performed by applying a high voltage to the secondary winding of the transformer and then reducing it slowly to zero. For complete demagnetization, the saturation voltage for the winding should be applied (800 volts for a transformer rated at 2.5L800). Demagnetization down to 25 per cent remanence is obtained by applying only 400 volts to a transformer rated at 2.5L800.

The Test Equipment

The schematic diagram for the equipment is shown in Figure 1. It consists basically of a resistor whose reflected impedance is varied by an auto-transformer. In this manner, at any

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particular secondary current, the rotation of the auto-transformer is linear with the current transformer terminal voltage. The test equipment can develop 400 volts across the terminals of a current transformer carrying a secondary current of more than one ampere. Protection to the equipment and operator is provided by means of a triac, a shorting over-current relay, and a push-to-insert resistance switch. Metering is provided by a voltmeter and a differential ammeter.

The test equipment could also be built in reduced capacity, where only one variac and one resistor would be used. This equipment would be suitable for testing transformers up to a terminal voltage of 200 volts, and to demagnetize current transformers down to 50 per cent remanence.

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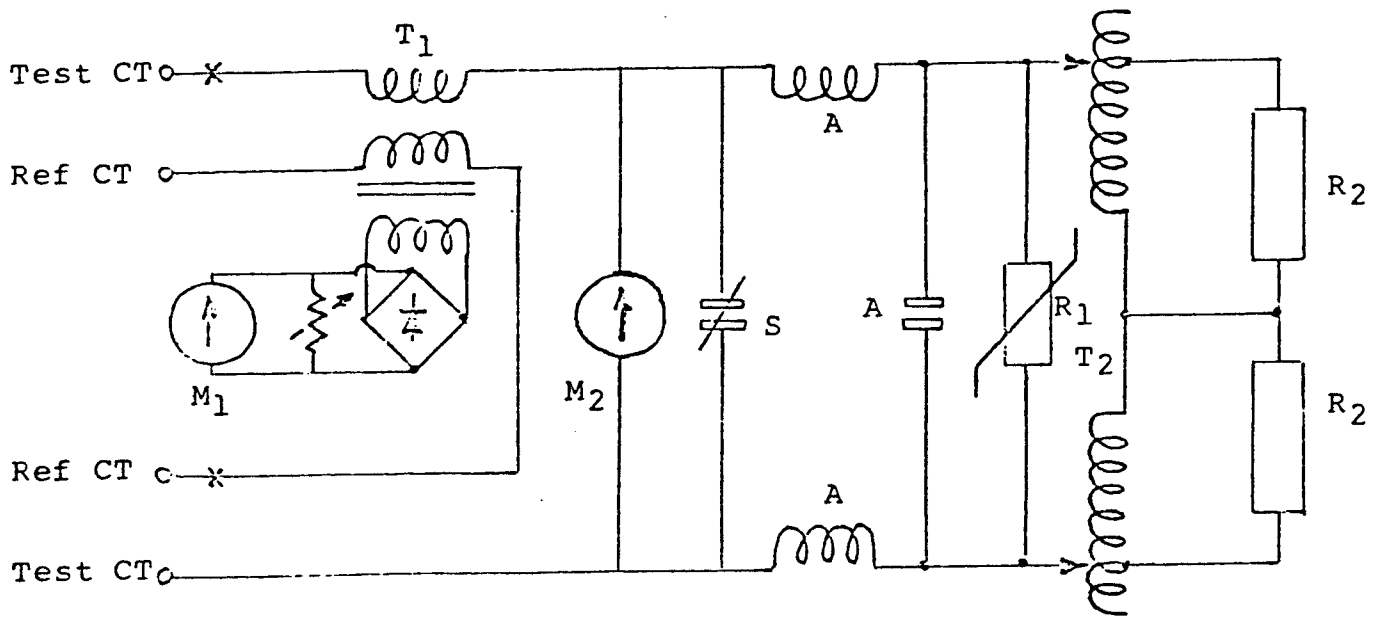
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CT TEST SET



- A - Modified Relay - P&B PR7AY or Guardian IR-220-A
- M₁ - 0-100 μ A panel meter (ac ranges - 10,5,2,1,0.5,0.2,0.1 A)
- M₂ - 0-500 volt panel meter (1000 Ω /V)
- R₁ - Triac Q6010L4
- R₂ - 200 Ω , 2 A, 800 W
- T₁ - Differential Current T_x 10; 10 A to 10 mA
- T₂ - Variac, Superior 22-2
- S - Normally closed, push-to-open, switch

CURRENT TRANSFORMER TEST SET

The current transformer test set (CTTS) can be used to a) demagnetize current transformers and b) determine the excitation characteristics of current transformers. Both of these tests are to be performed with the transformer in service carrying load current. Since the CTTS operates on load current, its presence is necessary for the operation of the CTTS.

Safety Precautions

The CTTS should be grounded to overcome hazards that could occur due to faults on the power system. The CTTS is equipped with an overcurrent relay that will short out the test set should the current exceed 10 amperes.

Principle of Operation

The CTTS demagnetizes current transformers by inserting an addition variable burden in the secondary circuit of the transformer. The CTTS can insert up to 500 ohms or inject a voltage of up to 500 volts maximum. By slowly increasing and then decreasing the injected voltage on the current transformer the transformer is demagnetized. For complete demagnetization the injected voltage should reach the knee point on the excitation characteristics.

To determine the excitation characteristics of a current transformer, a second current transformer of the same ratio and carrying the same load current as the test current transformer is required. By means of a voltmeter, and a differential ammeter, that are provided on the instrument, the excitation characteristics are determined.

Caution

The procedure to be described may cause excessive spill currents and the operation of differential relays. It is therefore necessary to block relays that are supplied by the current transformer that will be connected to the test CT terminals.

Operating Procedure

A. Demagnetization

1. Connect CTTS to the station ground.
2. Connect current transformer to be tested to test CT terminals.
3. The ammeter on the CTTS will now indicate the load current: Select a range that will give an up-scale indication on the ammeter.
4. Set variac to zero - minimum inserted impedance.
5. Depress shorting switch - the voltmeter will now indicate the voltage across the inserted impedance.
6. Advance the variac slowly clockwise to a point where the ammeter reading begins to drop.

7. Slowly return the variac to zero and release shorting switch. The current transformer is now demagnetized.

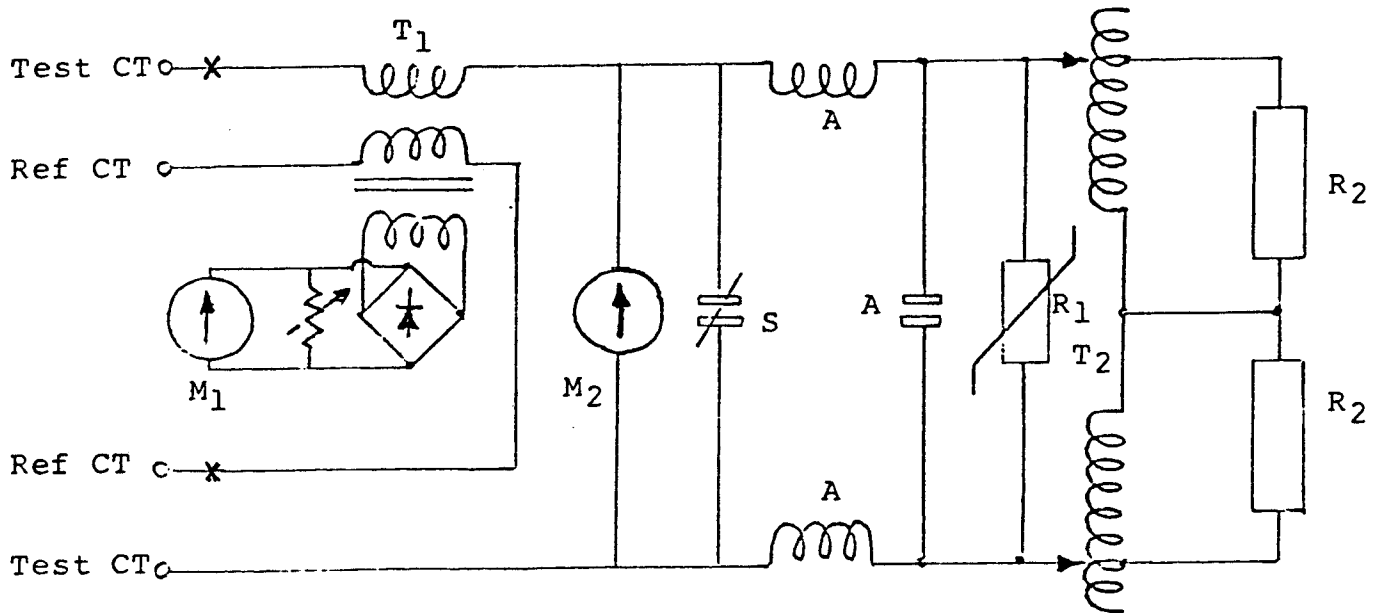
Note: The CTTS can inject a voltage of only about 500 volts. This voltage is not sufficient to completely demagnetize high accuracy current transformers, such as 25L800 on 1200 to 5, operating on high ratios.

B. Excitation Characteristics

1. Connect CTTS to the station ground.
2. Connect current transformer to be tested to the test CT terminals.
3. Connect another current transformer, of the same ratio as the test CT and carrying the same current, to the reference CT terminals. (Observe polarity).
4. The ammeter now reads the difference between the output of the two current transformers which is the difference between the magnetizing currents drawn by the two transformers. Under similar burden condition the ammeter will read zero.
5. Depress shorting switch and advance variac clockwise. The voltmeter and ammeter indications are almost identical to the voltmeter and ammeter indications obtained from a test where the voltage and current are supplied from an external source to an isolated current transformer.

Note: This procedure will also demagnetize the transformer provided the control is smoothly and slowly advanced and returned to zero. For excitation measurements the shorting switch may be released between readings.

CT TEST SET



- A - Modified Relay - P&B PR7AY or Guardian IR-220-A
- M₁ - 0-100 μ A panel meter (ac ranges - 10,5,2,1,0.5,0.2,0.1 A)
- M₂ - 0-500 volt panel meter (1000 Ω /V)
- R₁ - Triac Q6010L4
- R₂ - 200 Ω , 2 A, 800 W
- T₁ - Differential Current T_x 10; 10 A to 10 mA
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