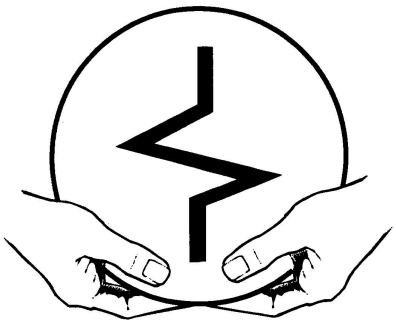
CA TRANSFORMER



SCOPE

This test procedure covers the testing and maintenance of the Westinghouse CA relay. The Westinghouse Protective Relay Division was purchased by ABB, and new relays carry the ABB label. Refer to IL 41-332 for testing support and component level identification.

SAFETY

Current-shorting test switches used for the CA relay may malfunction and develop high voltage levels. Use caution when using the test switches; make sure they are functioning properly.

INTRODUCTION

The type CA percentage differential relay for transformer protection is designed for the protection of power transformers. This relay can be applied where the magnetizing inrush current to the transformer is not severe. The type CA relay consists of a percentage differential unit and an indicating contactor switch.

The IL is helpful in understanding the relay settings and connections. Fig 14 of IL 41-332 shows the schematic of a set of 3 CA relays protecting a wye-delta transformer. Note that relay terminals 7 and 9 are connected to the polarity sides of the CTs, while terminal 5 is connected to the wye CT common. Under normal operation, the currents from terminals 7 and 9 to 5 *cancel* each other in the operate winding, but during an internal fault, they *add* in the operate winding.

TOOLS, EQUIPMENT, AND MATERIALS

- Two variable ac current, variable phase-angle sources
- Variable dc current source and latch timer

INSPECTION

1. Take the cover off the relay, taking care to not shake or jar the relay or other relays around it.

2. Open the relay test switches to disable the trip circuit and remove the voltage and current inputs.

3. Lift the relay out of the case.

4. Visually check the relay for any obvious problems.

5. Clean the relay thoroughly.

6. Burnish the surfaces of all contacts, making sure to remove any tarnish.

7. Check that all relay connections are tight.
   NOTE: The current input hardware on Westinghouse relays is frequently loose and requires special attention.

TESTING THE MINIMUM TRIP CURRENT

1. Set the relay winding taps on 5 and 5 (Be sure that the taps are vertically aligned).

2. Connect a variable AC current source to terminals 9 and 5 and ramp the current up. The disk contacts should close between 2.7 and 2.8 amps.

3. Move the current leads to terminals 7 and 5 and ramp the current up. The disk contacts should close between 2.9 and 3.2 amps.

4. If the pickup current does not meet specifications, adjust the tension on the spiral spring.

   NOTE: Tightening the spring (turning it counterclockwise [CCW] from the top) increases pickup current. Loosening the spring (turning it clockwise [CW] from the top) decreases pickup current.

TESTING THE TRIP TIMING

1. A timing test can be performed by setting the Time Dial to 1 (for those CA relays with a time dial) and applying 20 amps to terminals 9 and 5.

2. The relay should operate between 0.08 and 0.10 seconds.

3. If the measured response time does not meet expectations and the relay has an adjustable drag magnet, adjust the drag magnet slug and time dial. Be sure the drag magnet is not touching the relay disk.

   NOTE: The drag magnet is used for coarse adjustment. Turning the slug in increases the response time. Turning the slug out decreases response time. The time dial is used for fine adjustment. Increasing the time setting on the time dial increases response time; decreasing the time setting decreases response time.

   CAUTION: The current should be removed from the relay as soon as the timer stops. Leaving the current on the relay for an extended period of time may damage the time overcurrent unit.

   If the test set in use restricts current output, other points on the time curve may be tested using this test connection. Refer to Figure 1 for alternate expected timing results.

TESTING THE PERCENTAGE DIFFERENTIAL UNIT

1. Connect one variable current source (I1) to terminals 9 and 7 with polarity going to terminal 9 (through current).

2. Connect another variable current source (I2) to terminals 5 and 7 with polarity going to terminal 5 (operate current).

3. Momentarily initiate 20 amps of I1 current and verify that the relay does not pickup for through current.

4. Pulse initiate 20 amps of I1 and increasing amounts of I2 until the relay operates. The relay should operate with between 28.5 and 31.5 amps.
   NOTE: Do not leave the currents on continuously; damage to the relay may occur.

5. Reverse the terminal 7 and 9 current connections.

6. Pulse initiate 20 amps of I1 (now 7 to 9) and increasing amounts of I2 (now 5 to 9) until the relay operates. The relay should operate with between 29 and 33 amps.
   NOTE: Do not leave the currents on continuously; damage to the relay may occur.

7. If the test set in use restricts current output, other points on the percentage differential curve may be tested using these test connections. Refer to Figure 2 for expected results. The test error may exceed the expected tolerance of +/- 7% at lower current testing.
   EXAMPLE:

   With 1 per unit current in terminal 9 (I1) the relay should operate with 2 per unit current on terminal 7 (I1 + I2) with relay taps of 5 and 5.

   If 5 amps is injected from 9 to 7 (I1) the relay should operate with a current injected from 5 to 7 (I2) of 5 amps +/- 7 % or 4.65 to 5.35 amps.

TESTING THE TARGET AND SEAL IN

1. Determine whether the relay is set for 0.2 amps or 2 amps by observing the tap block in the front of the target unit. Older CA models do not have a target tap setting and are designed for a 2 amp pickup.

2. Close the induction disk contacts manually.

3. Apply DC current to terminals 1-10 and ramp up until the target unit picks up.

4. For 0.2 amp setting, the result should be between 0.15 to 0.195 amps DC. For the 2.0 amp setting, the result should be between 1.50 to 1.95 amps DC.

5. Open the disk contacts manually and verify that the target unit remains sealed in.

6. Determine the drop out by ramping the DC down until the seal-in contacts open. For 0.2 amp setting, the result should be 0.05 amps or more. For the 2.0 amp setting, the result should be 0.55 amps or more.

Figure 1

CA Typical Time Curves

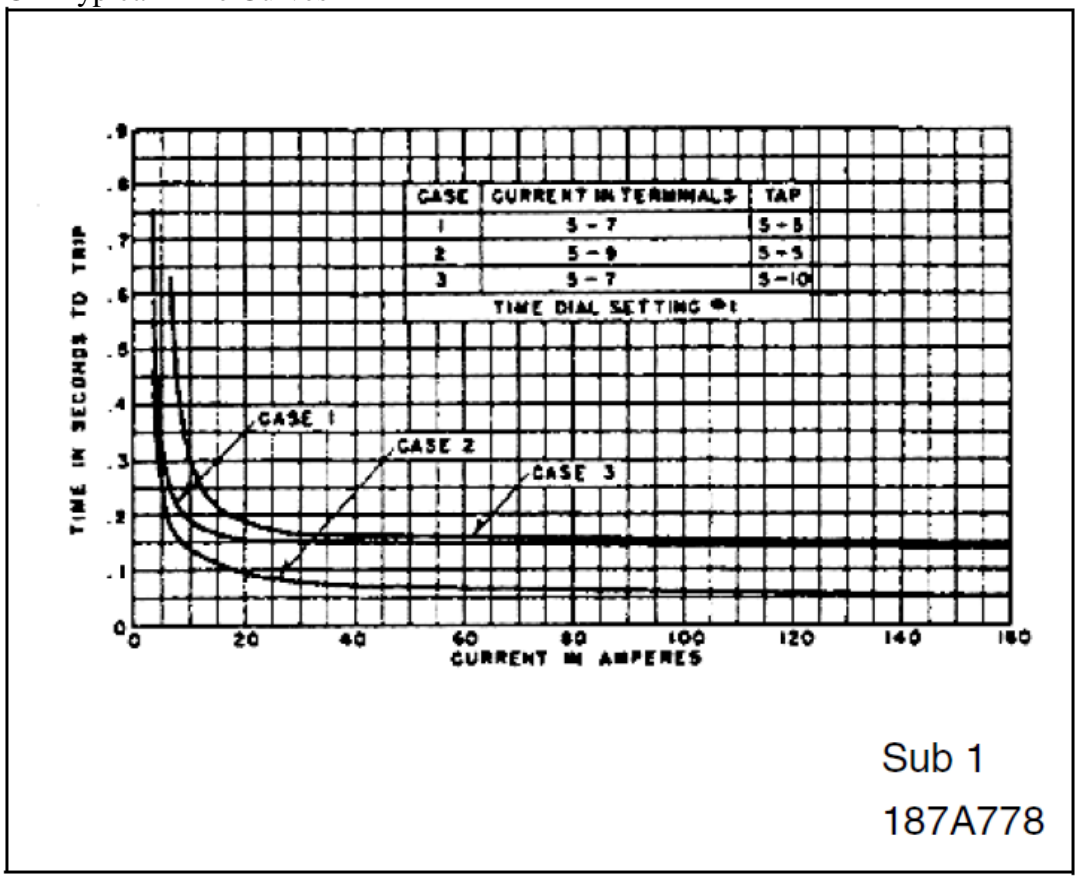


Figure 2

CA Sensitivity Characteristics

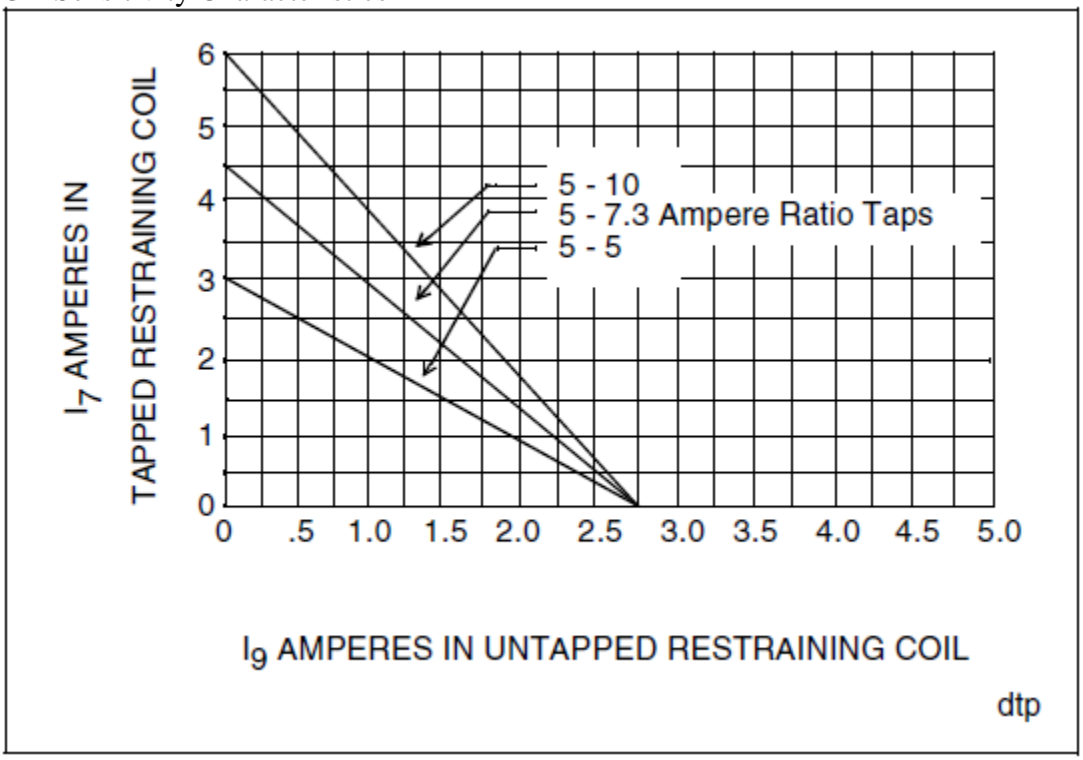


Figure 3 **CA Internal Schematic**

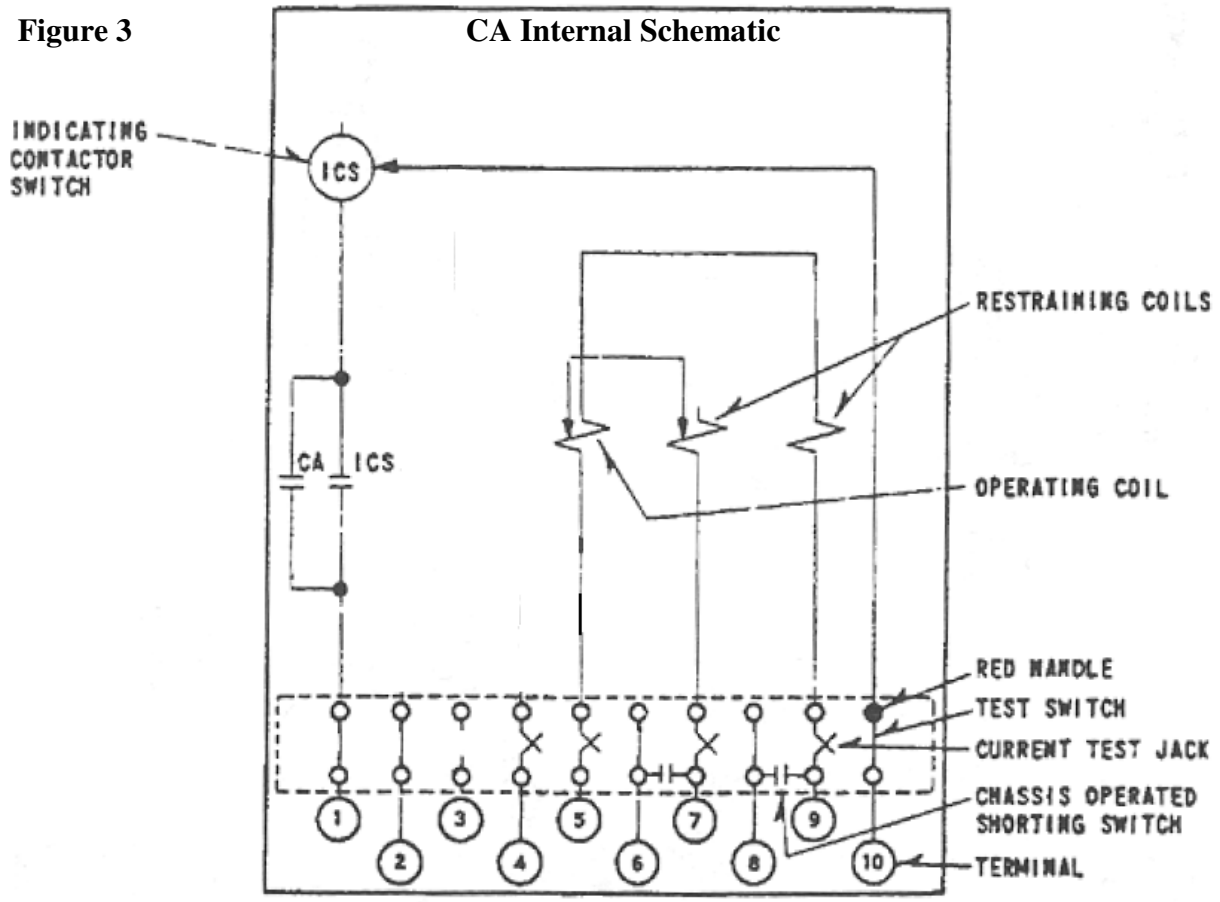


Figure 4 **CA Internal Schematic with IIT**