

SCOPE

This test procedure covers the testing and maintenance of the GE CEH51A loss of excitation relay. Refer to IL GEK-27887 for testing support information and component level identification.

DESCRIPTION

The GE CEH51A relay is a single phase, single zone, offset mho distance type relay. The relay is designed to detect a loss of excitation on synchronous machines. An offset mho characteristic was chosen to provide selectivity between loss of excitation and other normal or abnormal conditions that may exist on the system. A 66-83 millisecond fixed time delay auxiliary unit is employed to prevent undesired tripping due to shock, vibration, or sudden complete loss of AC potential.

TOOLS, EQUIPMENT, AND MATERIALS

- Two variable ac voltage / current, variable phase-angle sources
- Variable dc current source

INSPECTION

1. Take the cover off the relay, taking care to not shake or jar the relay or other relays around it.
2. Pull the relay connecting plugs to disable the trip circuit and remove the current inputs and lift the relay out of the case.
3. Visually check the relay for any obvious problems and clean the relay thoroughly.
4. Burnish the surfaces of all contacts, making sure to remove any tarnish.
5. Check that all relay connections are tight.
6. Check that there is end play in the shaft of the rotating structure. Total end play should not be more than 0.012 inch. The lower jewel screw bearing should be screwed in firmly and the top pivot locked in place by its set screw.
7. Check that the, against the backstop, contact gap is between 1/16 and 3/32 inch.
8. Check that the moving contact arm rotates freely and that the control spring provides enough opening torque toward the right hand backstop to hold the contact definitely open. Adjust the control spring as necessary.

SETTINGS

There are two settings that must be made on the CEH51A relay, the offset tap setting and the circle diameter restraint tap setting.

The offset tap is made directly in terms of secondary ohms via the L and H leads on the offset tap block. Settings can be made in the range indicated on the nameplate in 0.5 ohm steps. The offset setting is equal to the difference between the two offset taps used (H – L and the H tap must be on a larger tap)

Example:

Desired offset setting	= 3.5 ohms
L lead	= 0.5
H lead	= 4.0

The circle diameter is set via the upper and lower leads on the restraint tap block. The tap setting is expressed in percent and is a function of the basic minimum diameter of the relay and the desired ohmic diameter in secondary ohms and is adjustable from 0 to 100 percent in 1 percent steps.

NOTE: The setting should never be set below 10 percent

Restraint Tap Setting % = (Basic minimum diameter) * 100 / (Desired diameter)

Example:

Basic minimum diameter (nameplate)	= 5 ohms
Desired diameter	= 27 ohms
Restraint Tap Setting % = 5 * 100 / 27	= 18.5%
Use the next lower tap	= 18%
Upper number one lead	= tap 8
Lower number one lead	= tap 10

In the above example, the restraint tap setting calculated to 18.5% and the next lower tap of 18% was selected creating a diameter of 27.8 ohms. If a closer setting is desired, adjustments to the autotransformer tap settings can fine increase the restraint tap (and fine decrease the diameter) up to 10% in one percent steps. The input tap leads are attached to the restraint tap block with hex head screws. The input tap setting is equal to the sum of the two input taps used usually set to 100% (upper lead at 10 percent and lower lead at 90 percent)

Input tap % = (Restraint tap) * (Desired diameter) / (Basic minimum diameter)

Example:

Input tap = 18 * 27 / 5	= 97.2 %
Upper lead	= 7
Lower lead	= 90 (this lead should not be moved)

Diameter = (Basic minimum diameter) * (Input tap) / (Restraint tap)

Final diameter = 5 * 97 / 18 = 26.94 ohms

PRE-TEST SETUP

1. Connect a variable ac current source to terminals 5 and 4 with the polarity lead going to terminal 5.
2. Jumper terminal 6 to terminal 3.
3. Connect a variable ac voltage source to terminals 7 and 8 with the polarity lead going to terminal 7.
4. Apply rated DC voltage to either terminals 1(+) and 10(-) (higher rated dc voltage) or to terminals 1(+) and 9(-) (lower rated dc voltage). Check the nameplate to determine the control voltage options.
5. Monitor contact continuity at terminals 1 and 2.
6. Initiate rated ac voltage and allow the potential coils to warm up for 15 minute prior to starting the test.
7. When choosing a test fault voltage, choose a level that will prevent an impedance over range of the test set in use and keep the test current in the order of 20 amps or less. The continuous current rating of this relay is 5 amps and the one second thermal rating is 150 amps. The CEH relay utilizes a phase to phase impedance element using the following characteristic formulas:

$$Z = E_{\text{ph to ph}} / (2 * I)$$
$$I = E_{\text{ph to ph}} / (2 * Z)$$

TESTING THE MAXIMUM TORQUE ANGLE

NOTE: Any adjustments made to bring the MTA into tolerance will have an affect on the characteristic diameter. Ensure that the diameter is tested after any MTA adjustments.

1. Adjust the current phase angle so that the current is leading the voltage by 90 degrees.
2. Calculate test values
Choose an impedance point within the characteristic between the offset impedance and the total impedance to the outside diameter.

Example

Diameter	= 27 ohms
Offset	= 1 ohm
Total impedance to outside of diameter	= 28 ohms
Midpoint of characteristic	= 14.5 ohms
Selected voltage	= 115 volts
$I_{\text{pickup}} = 115 / 2 * 14.5$	= 3.97 amps

3. Initiate voltage and current at the selected values.

4. Vary the current phase angle until the relay drops out in the clockwise and counterclockwise directions. The average of the two drop out angles is the maximum torque angle and should be in the range of 88 to 92 degrees.
5. If the MTA does not meet specifications the following adjustments can be made:
 - Adjust variable reactor X21 (top adjustment screw, lower left front) in the polarizing circuit
 - Increasing reactance (cw) will decrease the MTA
 - Decreasing reactance (ccw) will increase the MTA
 - Adjust variable resistor R22 (upper right) in the shading coil circuit
 - Increasing the resistance (cw) will decrease the MTA
 - Decreasing the resistance (ccw) will increase the MTA

TESTING THE DIAMETER

1. Adjust the current phase angle so that the current is leading the voltage by 90 degrees.
2. Calculate test values
 - The total impedance to the outside of the diameter will equal the diameter setting plus the offset setting. (see Figure 1)

Example

Diameter	= 27 ohms
Offset	= 1 ohm
Total impedance to outside of diameter	= 28 ohms
Selected test fault voltage	= 115 Vac
$I_{pickup} = 115 / 2 * 28$	= 2.05 amps

3. Initiate voltage at the selected value.
4. Pulse initiate current below expected pickup and pulse raise until the relay just picks up.
5. If the measured pickup current varies by more than 10% (+/-) adjust variable resistor R13 (bottom adjustment screw, lower left front) in the restraint coil circuit.
 - Decreasing resistance (ccw) will decrease the diameter
 - Increasing resistance (cw) will increase the diameter
6. Configure a timer to start when the current is applied the relay and stop when the output contact from terminals 1 and 2 close.
7. Initiate voltage at the selected value and current at 2 times the outside diameter pickup. The time delay should range from 66 to 83 milliseconds and is designed to prevent inadvertent tripping due to shock, vibration or loss of AC potential.
 - This is a fixed time delay in the auxiliary unit. There is no adjustment. Testing has shown that this time may as much as 100 ms at lower pickup currents and will be in tolerance with higher multiples (4 times and up)

TESTING THE OFFSET

1. Adjust the current phase angle so that the current is leading the voltage by 90 degrees.
2. Calculate test values
The offset impedance is the point at which the inside diameter contacts the y axis.
(see Figure 1)

Example

Offset impedance	= 1 ohms
Selected voltage	= 40 Vac
$I_{pickup} = 40 / 2 * 1$	= 20.0 amps

3. Initiate voltage at the selected value.
4. Initiate current just below the expected pickup (the contacts will close), raise until the relay just drops out, then lower the current to the pickup point.
5. The measured pickup current should not be more than 10% (+/-) from the calculated current. There is no adjustment to the offset impedance. The offset taps are determined by the turns of the current transactor.

CHECKING THE CLUTCH

The induction cup assemblies are designed with a slipping clutch mechanism that allows the cup and shaft to slip with respect to the moving contact whenever the torque in the opening or closing direction becomes greater than 50 grams pressure. Specialty tools are required for this test.

If testing or adjustments to the clutch are deemed necessary, refer to IL GEK-27887 page 19, "CLUTCH ADJUSTMENT" for specific instructions.

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.
2. Disconnect the DC voltage.
3. Close the main relay contacts manually or by applying sufficient ac voltage and current quantities.
4. Manually pickup the auxiliary unit
5. Apply DC current below the pickup setting to terminals 1-2 and ramp up until the target unit picks up.

6. For the 0.2 amp setting, the pickup should be between 0.14 and 0.195 amps DC.
For the 2.0 amp setting, the pickup should be between 1.40 and 1.950 amps DC.
7. Open the relay contacts manually or by removing test quantities and drop out the auxiliary unit.
8. Verify that the target unit remains sealed in.
9. Determine the drop out by ramping the DC down until the seal-in contacts open.
Drop out should be no lower than 30% of the seal-in tap (0.06 for the 0.2 setting, 0.6 for the 2.0 setting).

Figure 1

CEH51A relay characteristics with various restraint taps and one ohm offset

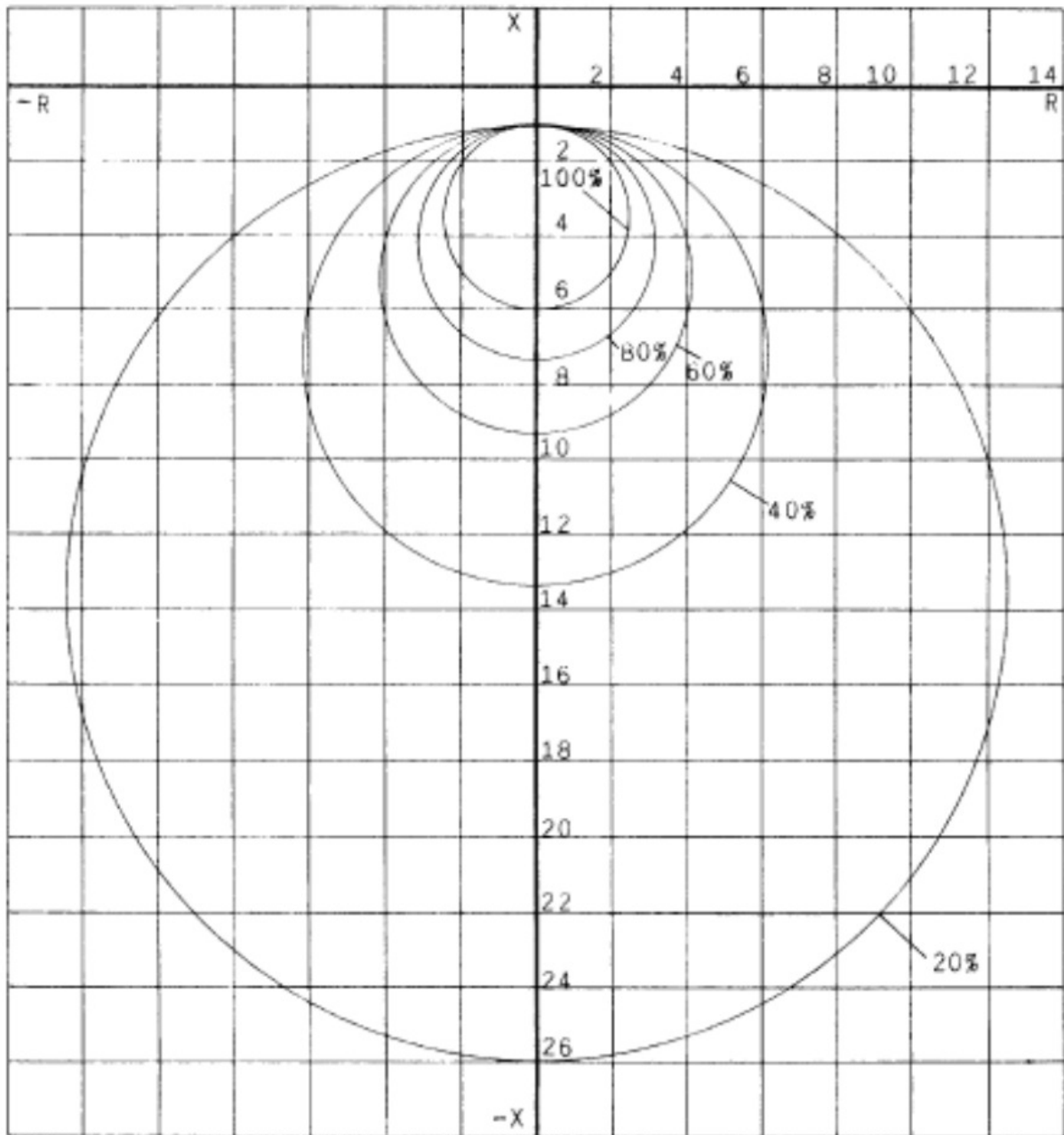


Figure 2

CEH51A internal schematic

