BE1-87G

SCOPE

This test procedure covers the testing and maintenance of the Basler BE1-87G generator differential relay. Refer to IM 9170800990 Rev. N (2/13) for testing support information and component level identification. Especially see pg.1-2 for field wiring examples and pg. 5-3 for one test setup.

SAFETY

In the field, withdraw the lower test paddle first to open the trip circuit. Removing the upper paddle first may cause an inadvertent trip.
Be sure DC power is applied safely to terminals 3-4. Use caution during testing.
Per IM pg. 5-1, do not apply more than 10 amps continuous or 250 amps for 1 second to the relay. If the stabilizing reactor is included in the test circuit, do not apply more than 3 amps.

INTRODUCTION

Type BE1-87G is a high-speed relay used for differential protection of generators. It offers a scaled operate characteristic that varies with the restraint current above the set minimum pick up. The BE1-87G can be used in single- or three-phase applications.

TOOLS, EQUIPMENT, AND MATERIALS

- Two variable ac current, variable phase-angle sources
- Variable dc voltage/current source
- Contact continuity check method

INSPECTION

1. Take the cover off the relay, taking care to not shake or jar other relays around it.
2. Withdraw the lower relay test paddle to disable the trip circuit, then withdraw the upper paddle.
3. Lift the relay out of the case.
4. Visually check the relay for any obvious problems.
5. Clean the relay thoroughly.
6. Check that all relay connections are tight.

TESTING THE MINIMUM PICKUP

1. Set the selectable switch to D (0.4 amps).
2. Apply dc voltage to Terminals 3 and 4 to energize the relay.
3. Connect a current to Terminals 6 and 7. The IM refers to this as circuit 1.
4. Monitor contact continuity at Terminals 1 and 10.
5. Increase the current until the contact closes. The pickup level should be very close to 0.4 amps with the selector switch at D.
6. Decrease the current until the differential unit just drops out. This should be above 90% of 0.4 amps or above 0.36 amps.
7. Determine if the pickup and dropout levels meet specifications. See IM pg. 1-5 for accuracy specifications.
8. Move the current to Terminals 9-8 and repeat the test for circuit 2.
9. If the relay is used in a 3-phase application, repeat Steps 2 – 7 for B and C phases per the chart on in Figure 5-2 on pg. 5-3. The other positions on the sensitivity switch may also be tested.

TESTING THE DIFFERENTIAL CHARACTERISTIC (First Method)

1. There are a two ways to test the differential slope. The IM suggests applying restraint current to the polarity current input terminals (9 and 6 for A phase) and operate current to the operate winding (8 and 6). This method allows you to directly compare restraint and operate current quantities.
2. Monitor the contact continuity at Terminals 1 and 10.
3. Apply 0.1 amps to 9-6 and ramp 8-6 up until the relay picks up (around 0.4 amps for selector switch D). Ramp back down until the relay drops out, should be above 3.6 (90% of selector switch D value).

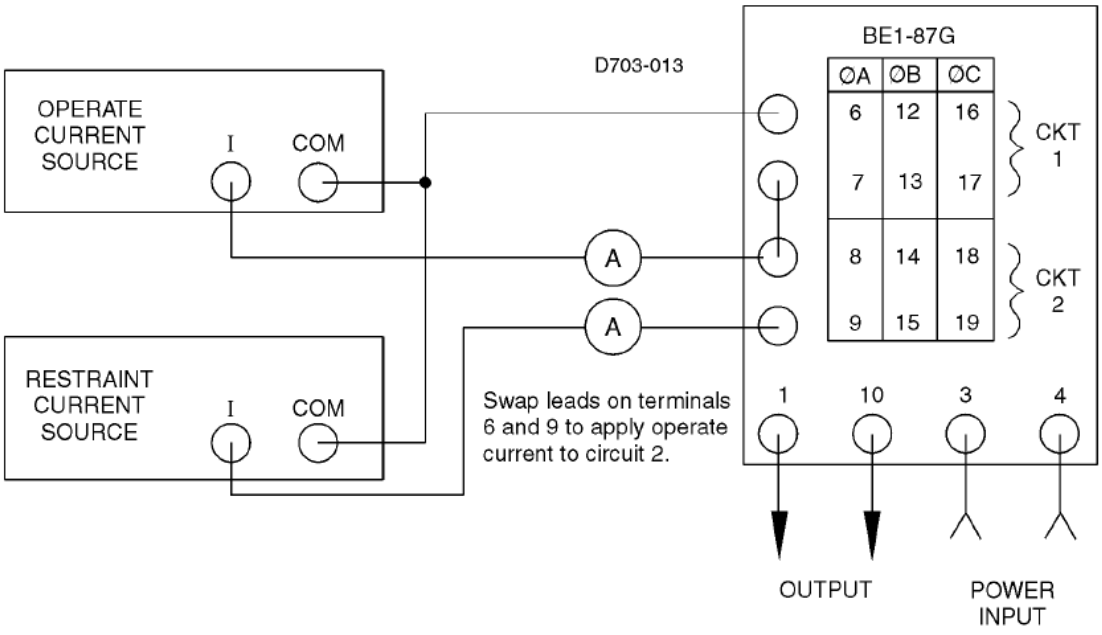

Figure 5-2. Operational Test Setup

TESTING THE DIFFERENTIAL CHARACTERISTIC (Second Method)

1. The second method applies current 1 to input terminals 9 and 8 for A phase and current 2 to terminal 6 and 8. This method allows you to mimic the actual field wiring of the relay.
2. Monitor the contact continuity at Terminals 1 and 10.
3. Ramp current 1 up until the relay picks up, should be around 0.4 amps for selector switch D. Ramp back down until the relay drops out, should be above 3.6 (90% of selector switch D value). Repeat with current 2. Repeat for B phase and C phase.
4. Now apply 1 amp to current 1 (9-8) and 1 amp to current 2 (6-8) and ramp current 2 up until the relay picks up. This should be around 1.4 amps or a difference current of 0.4 amps.
5. Repeat with increasing starting values. You'll reach a point where the characteristic leaves the minimum pickup and slopes up per Figure 5.3.

From IM page 1.5:
"The ideal operating characteristic is approximated by the following equations:
Sensing Input Range 1: For IR ≤ 5 A: IOP = I
For IR > 5 A: IOP = IS + 0.5 (IR − 5)S"

If you have 6 currents available, you can configure the test per Figure 1.2 copied below and run 3 phase tests.

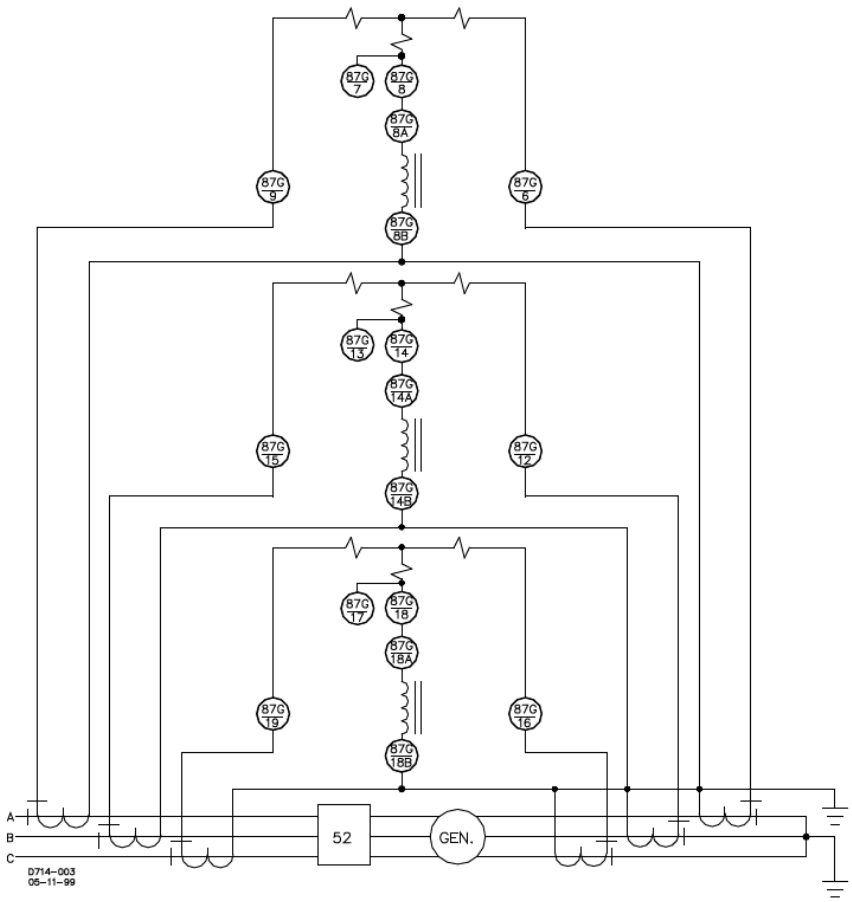

Figure 1-2. Typical Three-Phase Application Scheme