

Section A: Using Formulas to Determine Time Delay, described the procedure for calculating the expected time delay using an SEL manual. The GE relay manual also provides formulas to calculate the expected time delay, and we can use the following calculation from the manual to make sure our interpretation of the chart is correct.

$$T = \text{TDM} \times \left[\frac{A}{\left(\frac{I}{I_{\text{pickup}}} \right)^p} + B \right] = 4.5 \times \left[\frac{28.2}{\left(\frac{7.0}{3.5} \right)^2} + 0.1217 \right]$$

$$T = 4.5 \times \left[\frac{28.2}{(2)^2 - 1} + 0.1217 \right] = 4.5 \times \left[\frac{28.2}{4 - 1} + 0.1217 \right]$$

$$T = 4.5 \times \left[\frac{28.2}{3} + 0.1217 \right] = 4.5 \times [9.4 + 0.1217] = 4.5 \times [9.5217]$$

$$T = 42.848 \text{ seconds}$$

D) Timing Test Procedure

- Determine which output the 51-element trips and connect the test-set timing input to the relay output.
- Check the maximum per-phase output of the test-set and use the appropriate connection from the previous section. For example, if the 51-element timing test is 35A and your test-set can only produce 25 Amps per phase; use “High Current Connections #1.” If the pickup setting is greater than 50 Amps, use “High Current Connections #2.” If the pickup is higher than 75A (3x25A), you will have to use another test-set or temporarily lower the setting. Remember, setting changes are a last resort.
- Set the fault current to the 51-element test current. Set your test-set to stop when the timing input operates and to record the time delay from test start to stop.
- Apply test current, ensure timing input operation, and note the time on your test sheet.
- Compare the test time to the 51-element timing calculations to ensure timing is correct.
- Repeat for other two phases.
- Set test current to 2nd test level.
- Apply test current, ensure timing input operation, and note the time on your test sheet.
- Compare the test time to the 51-element timing calculations to ensure timing is correct.
- Repeat for other two phases.
- Set test current to 3rd test level.
- Apply test current, ensure timing input operation, and note the time on your test sheet.
- Compare the test time to the 51-element timing calculations to ensure timing is correct.
- Repeat for other two phases.