APPLICATION NOTE

Medium/High Voltage Motor Testing

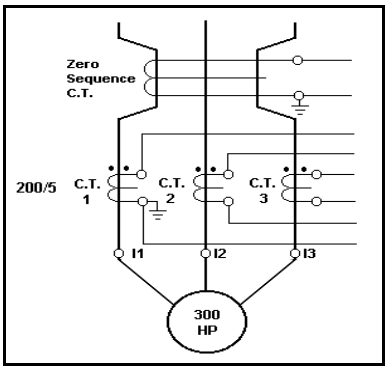
Note 0303

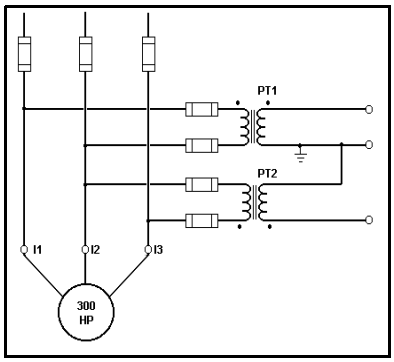
Description

EMAX test equipment has a limit of 600 volts, but much of the testing performed is on motors that are operating on 2300 volts or greater. When faced with testing a medium to high voltage motor utilize the secondary circuit to access the current and voltage information. Although the common secondary circuit consists of two or more current transformers (CT's) and potential transformers (PT's), you may find a variety of circuit configurations and must know the basics to acquire a valid test.

Applications

CT's installed into the secondary switchgear usually consist of wire wrapped around an iron core. They are wound in a circular fashion and connected around the power lead feeding the motor. These are step down CT's, which take the actual current flowing through the power leads and step it down to a 1 to 5 amp level. This smaller current is used to operate current meters, power meters, and trip relays and can also be used by EMAX for testing purposes. A CT diagram is shown on the right.





PT's installed into the secondary switchgear usually consist of two independent sets of windings, each connected across two phases of the power leads. This configuration is commonly called an open delta PT configuration. The first PT is connected between phases 1 and 2. The second PT is connected between phases 3 and 2. Note that phase 2 is common between both PT's and is grounded. These transformers, like the CT's are step down transformers, which drop the voltage down to 120 volts. A PT diagram is shown on the left.

Test Considerations

CT's

- If only two CT's are installed, for Power Analysis testing ensure that you make a selection from the Missing Currents option on the Test Selection window before testing. On the Test Selection window, select EMAX Testing then select Phase to Phase in the Phase Configuration section. The Missing Currents drop down list appears.
- Although testing all three current signals is preferred for optimizing troubleshooting; the Low Res, High Res, Eccentricity, and In-Rush/Start-Up tests can all be performed on just one current signal.
- Ensure the current probe is connected on the side of the CT supplying positive power to the meter. This location is designated by the "dot" seen in the previous CT diagram. Connecting a current probe to the wrong side of a meter can't be corrected by the software due to a significant phase shift developed by the meter.
- Make sure that the arrow on the current probe is pointing away from the CT and toward the meter being supplied with the current.
- Do not pull or tug excessively on the CT leads.
- Due to the very low amperage (1 to 5 amps) developed by the CT's, current probes delivering 100mv/amp are required in order to acquire accurate current information with a high signal-to-noise ratio.

PT's

- When attaching the voltage leads to the PT connections on a terminal board, use caution not to short across phase connections on the terminal board.
- In the absence of a schematic, verification of an open delta design can be performed using a multi-meter. With the multi-meter selected to AC volts, connect it independently across each PT connection and ground. For an open delta configuration, expect to see 120 volts on PT1-to-ground, 0 volts on PT2-to-ground, and 120 volts on PT3-to-ground. Always connect the blue phase 2 test lead to the PT2 connection.
- For normal open delta configurations, ensure that the Common/Phase 2 ground switch on the tester is in the Phase 2 ground position and the Phase Configuration on the Test Selection Window is Phase to Phase. If three PT's are installed, leave the Common/Phase 2 ground switch on the tester in Common and the Phase Configuration on the Test Selection Window as Line to Neutral.
- PT connections are not always available in each starter cabinet. Occasionally there is a dedicated PT cabinet with voltage indicating meters and selector switches at the end of a row of cabinets in an MCC. Extended voltage leads may be necessary to connect the EMAX to the PT connections for simultaneous power analysis acquisition.

Other

- If only one PT and at least one CT are installed, the Power Analysis test is limited. A review of the Power Analysis results page must include only those items acquired from the phase with the PT (THD, CF, pf, V_{L-N}, etc.).
- Voltage information may be acquired on a voltage selector switch or power meter as available.

Data Interpretation

Whether connecting directly on the line or through CT's and PT's, the evaluation of valid test data is the same. However, additional considerations should be made in verifying that the test data is valid, given the increased number of variables existing with the addition of PT's and CT's in the circuit.

Voltage or current imbalance may be caused by CT's or PT's. Correlation with current measurements taken directly on the insulated power leads may be required. **Do not** connect the EMAX directly to the power leads if they exceed 600 volts.

PT connections are not dedicated to each motor, but are instead used for reference on many motors. If a voltage imbalance exists on a PT connection, the problem must be upstream of the location where the PT's are connected. If a current imbalance exists without a voltage imbalance, the possibility of a connection problem creating a voltage drop somewhere downstream of the PT connections cannot be ruled out.