

## Case Study of Medium Voltage Motor Trending

**Abstract:** Enhanced results are often obtainable if care is taken with record keeping of previous tests. Taking into consideration previous condition monitoring results is a vital step. In this case study, degradation was discovered, not by the results of the present test, but by comparing recent results obtained against the entire test history.

**Background:** A large electric motor repair company located in Virginia, USA performs periodic condition monitoring for several power generation facilities. Part of the condition monitoring work that is performed is periodic electrical testing of the critical 4160V electric motors. In this case, an automated Kelvin resistance, Insulation Resistance and Surge tester was used to gather test results about the electrical insulation qualities. One item that makes this trending capability easier, is the tester has an onboard database, that makes “on the spot” trending and analysis rapid and doubt free.

**Motor details and test sequences:** During annual periodic testing, on the process critical 4160V induction motors, some erratic, yet interesting results were obtained.

*Motor nameplate: Siemens-Allis, 4160V, 400HP, 1185RPM, frame 507US in an ODP enclosure, this is one unit of 6 roof mounted motors, each driving an ID Fan.*

The test sequence selected for this particular machine was as follows:

- A) Kelvin Resistance Bridge, using the “4 wire” technique for enhanced accuracy. Temperature correction was also used to cancel effects of winding temperature deviation.
- B) Insulation Resistance, using an automated meg-ohm meter. Target Voltage 2500V. Pass/Fail results are attained with this particular tester type.
- C) Polarization index test was performed. These results are where the motor specialist who performed the test became concerned. Large deviation was seen between present and past results.
- D) Step Voltage test, using an automated step voltage tester. Target voltage for final step: 9.300 Volts
- E) Surge test using an automated surge/surge comparison tester. Target voltage for final step: 9,300 Volts

The out door temperature was noted as 27.8 degrees C (~82°F) Tests were performed from the motor control center, as this is a less labor intensive method to gather the data.

### **Test Results:**

When tested last year @ 5/25/2011 11:09:01 pm, test was done at MCC. Test was fine. PI result was 2.4

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When tested it this year @ 6/13/2012 9:40:50 am, test was done at MCC .PI was below 2.0, in this most recent case it was 1.7

Insulation Resistance =177 @ 40 deg C. During Step Voltage the automated test device protectively halted at 7350 volts because of minimum Meg ohms. In other words, the Meg ohm results were lower than the acceptable minimum, so the test was stopped.

### Troubleshooting steps:

The motor specialist repeated the test at motor connection box @ 6/13/2012 10:57:59 am. The DC Step Voltage test was completed . There was no twice doubling of the leakage current in the DC Step Voltage test but it was evident that the DC Step Voltage leakage current results plot graph was not linear.

The motor specialist was concerned about the very big difference in PI for last and this year and also stated he was worried about the DC Step Voltage results. Because of these findings, the motor specialist recommended that the motor should be taken out of service.

He made this call because of instability in ground wall insulation based on the review of trending (PI) and instability (DC Step Voltage) results.

Upon further investigation the motor specialist found a puddle of oil in the motor frame, and the stator core was somewhat wet with oil. The customer was notified of the findings, and plans for corrective action were discussed.



Photo of oil puddle in the motor base:



### **Photo of oil inside stator:**

In the above photo you can see where the oil is dripping through the stator. This contamination will eventually lead to electrical tracking because of the ODP type motor enclosure.