

## **MOTOR CONDITION & POWER QUALITY TESTING SPECIFICATIONS**

### **POWER QUALITY**

#### **Tests performed:**

- Total Harmonic Distortion - energized motor test
- Crest Factor - energized motor test
- Voltage Unbalance - energized motor test

#### **Possible faults:**

- Incoming voltage and current distortion
- Distortion in power caused by non-linear loads (VFD's, lighting, computers & printers)
- Spikes caused by variable frequency drives and load switching

### **POWER CIRCUIT**

#### **Tests performed:**

- Resistive imbalance measured in microhms - de-energized motor test
- Inductive imbalance measured in mH over rotation - de-energized motor test

#### **Possible faults:**

- Loose or weak terminal connections for cables and in-line components such as
- Over loads or disconnects
- Corroded connections at motor connection box
- Weak contact connections or pitted surfaces
- Improper Materials or repairs

### **INSULATION**

#### **Tests performed:**

- Resistance to ground measured in Megohms (temperature compensated) – de-energized motor test
- Dielectric Absorption ration with plot - de-energized motor test
- Polarization Index with plot - de-energized motor test

#### **Possible faults:**

- Current leakage paths to ground
- Old or embrittled insulation condition
- Moisture contamination

-Corrosive or solvent aerosols

-Heat

## **STATOR**

### Tests performed:

-Impedance Unbalance - energized motor test

-Resistive imbalance measured in microhms - de-energized motor test

-Inductive imbalance measured in mH over rotation - de-energized motor test

### Possible faults:

-Deteriorated or improper connections between coils

-Turn to turn and phase to phase leakages

-Stresses from mechanical vibration or unbalanced magnetic forces

-Partial discharges in voids of high voltage motors

## **ROTOR**

### Tests Performed:

-Three phase motor current signature analysis (>70% load recommended) – energized motor test

-Inductive imbalance measured in mH over rotation - de-energized motor test

### Possible faults:

-Broken or cracked rotor bars

-Manufacturing flaws such as porosity in cast aluminum rotors

-High resistance connections between bars and the end rings

## **AIR GAP/ ECCENTRICITY**

### Tests performed:

-Three phase motor current signature analysis (>70% load recommended) - energized motor test.

-Inductive imbalance measured in mH over rotation - de-energized motor test

### Possible faults:

-Dynamic eccentricity due to rotor

-Static eccentricity from misalignment or out of round stator

-Mishandled or dropped motors

-Warping caused by uneven heating

## **ITEMIZED LIST OF TESTS ON A DE-ENERGIZED MOTOR:**

### **RESISTANCE TO GROUND:**

- The test of measuring resistance between each phase and ground.
- The measurement shall be made using an optional 500 or 1000 VDC.
- The tester shall charge the circuit to a minimum of 500 VDC potential for a minimum of fifteen seconds prior to taking the resistance measurement.
- The test shall perform a monitored voltage discharge of the circuit after making the measurement.
- As an additional feature, the tester shall be capable of measuring and calculating a polarization index and dielectric absorption ratio with graphing available.
- The measured value of resistance shall be recorded in megohms.
- The test shall be capable of testing each phase separately to ground.

### **CAPACITANCE TO GROUND:**

- The test of measuring the capacitance between each phase and the motor circuit ground connection.
- The measured value of capacitance shall be recorded in picofarads.

### **DC RESISTANCE:**

- The test measures the resistance between each of the circuit connections on an AC induction motor: phase 1 to 2, 1 to 3 and 2 to 3. Test leads 1 and 2 shall be used to measure the resistance values of DC circuits in testers supplied with the option of DC testing. As an additional test, the tester may provide special DC commutator test leads which will allow the technician to perform DC bar to bar testing.
- The measured value of resistance shall be recorded in ohms.

### **AC INDUCTANCE:**

- The test measures the inductance between each of the circuit connections: phase 1 to 2, 1 to 3 and 2 to 3. The measured value of inductance shall be recorded in millihenries.

### **ROTOR INFLUENCE CHECK:**

- The purpose of the Rotor Influence Check is to chart the reflected inductance of the rotor that appears through the stator windings to be able to identify rotor faults.
- The test performs a rotor diagnostic test by plotting sequential inductance measurements

taken from indexing a rotor position in a motor while measuring the inductance from phase to phase.

**DIELECTRIC ABSORPTION RATIO:**

-The test will record and graph resistance to ground measurements over a one minute period. These readings shall automatically be taken every five seconds. A ratio between the reading at sixty seconds to the reading at thirty seconds will be calculated.

**POLARIZATION INDEX:**

-The test will record and graph resistance to ground measurements over a ten minute period. These readings shall automatically be taken every five seconds. A ratio comparing the reading at ten minutes to the reading at one minute will be calculated.

-The measured value of resistance shall be recorded in megohms.

**ITEMIZED LIST OF TESTS ON AN ENERGIZED MOTOR**

**VOLTAGE MEASUREMENTS:**

-The test will record and graph three phases of voltage simultaneously and display both line to line voltage and line to neutral voltage. This will be recorded as engineering data as well as in a graphical format and will also include:

-Crest Factor

-Total Harmonic Distortion, average voltage

-%Voltage Imbalance.

-NEMA derating associated with voltage imbalance will be calculated and recorded.

-All of this data will be trendable in a history chart and graphical format.

**CURRENT MEASUREMENTS:**

-The test will record and graph 3 phases of current simultaneously.

-This will be recorded as engineering data as well as in graphical format

-The test will also include Crest Factor, Total Harmonic Distortion, Average current, %Full Load Amp, % Current Imbalance.

-All of this data will be trendable in a history chart and graphical format.

**POWER DATA:**

-The test will record power information including KW, KVAR, KVA and Power Factor for each individual phase and total.

-All of this data will be trendable in a history chart and graphical format.

#### **EFFICIENCY CALCULATIONS:**

-The test will record the Calculated Efficiency, including the power out (HP) and the power out (kW).

-All of this data will be trendable in a history chart and graphical format.

#### **IMPEDENCE SEQUENCE DATA:**

-The test will record zero, positive and negative sequence data for both self and mutual impedance as well as the angle associated with each.

-All of this data will be trendable in a history chart and graphical format.

#### **IMPEDENCE IMBALANCE:**

-The test will record the Impedence Imbalance. All of this data will be trendable in a history chart and graphical format.

#### **HARMONIC DATA:**

-The test will record and display the harmonics up to the 50th harmonic in a graphical format.

#### **CURRENT SIGNATURE ANALYSIS:**

-The test will record and graph 3 phases of current simultaneously in an FFT (spectral) format with the ability to use cursor functions to highlight and label multiple peaks, automatically calculate the speed, automatically identify eccentricity and assist in determining the magnitude of broken or cracked rotor bars.

-This data will be trendable in a history chart and graphical format.

#### **INRUSH / START-UP ANALYSIS:**

-The test will record the inrush and startup current for all three phases.

-It will be stored in a graphical format and compared to the baseline on the same graph.

-The various times available for recording the inrush / start-up will be 15 seconds, 30 seconds, 45seconds and 60 seconds.