WINDING SYMMETRY TEST

IDENTIFIABLE FAILURE MODES

- High resistance connections in motor terminal box's, local isolators and cable junction box's.
- Shorted turns in AC stator windings.
- Shorted turns in DC field coils (DC motor field coils and synchronous rotor field coils)
- Rotor defects in squirrel cage motors.
- Uneven air gap and electrical misalignment.

DESCRIPTION

Individual phase readings are taken and the resistive and inductive imbalances calculated. Resistive imbalance is measured using a DC voltage where inductive imbalance is measured using a high frequency AC voltage signal.
Phase to phase resistance tests the stator coils for resistance, calculates resistive imbalance and indicates hot spots, high resistance connections, or coil shorting in the stator.
Phase to phase inductance tests the circuit, stator coils, iron and rotor components for inductive imbalances and indicates when the imbalances are unsatisfactory. High inductive imbalances may indicate possible rotor defects and winding faults.
The tests can be applied to stator and rotor windings on asynchronous motors, stator and rotor windings on synchronous motors and the armature and field windings on DC motors (DC motor readings are trended or compared to known values).

ANALYSIS APPLICATION

In AC motors phase to phase resistance and inductance values are used for trending, troubleshooting and quality control. In DC motors trending and relative comparison of the recorded results is used to determine the condition of the windings.
Consideration must be given to the components in the circuit such as local isolators, terminal block connections, cable junction box connections.
Resistive imbalance readings taken at the stator leads should have a resistive imbalance <1%.
Power factor capacitors and surge capacitors should be disconnected when taking inductive imbalance readings.
Analysis of inductive imbalance readings needs to take into consideration such factors as rotor construction, rotor position, and motor manufacture.

An inductive imbalance reading with an upward trend should be further investigated to determine if the cause of the imbalance is due to the stator or the rotor.

APPLICABLE STANDARD / ACCEPTANCE CRITERIA

There is no applicable standard for these tests.

Test results need to be interpreted based on the motor characteristics and the circuit configuration.

Test D	05/27/2003	05/28/2003	01/02/2004	04/12/2005
Test Time	04:09:19 PM	10:42:58 AM	08:15:15 AM	01:12:55 AM
		Baseline		
Frequency	1200	1200	1200	1200
Mohm Ph 1 to Gnd				
Charge Time	60	60	60	60
Voltage	1000	1000	1000	1000
Motor Temp	10	10	10	22
Measured Mohm	3500.0	2623.0	2601.0	1944.0
Corrected Mohm	438.0	328.0	325.0	560.0
pF Ph 1 to Gnd	122000	122250	123750	125750
ohm Ph 1 to 2	0.01272	0.00986	0.00988	0.01024
ohm Ph 1 to 3	0.02200	0.01004	0.00997	0.01034
ohm Ph 2 to 3	0.01280	0.00995	0.00989	0.01025
mH Ph 1 to 2	0.385	0.300	0.300	0.310
mH Ph 1 to 3	0.610	0.305	0.305	0.305
mH Ph 2 to 3	0.370	0.305	0.300	0.305
Avg. Inductance	0.455	0.303	0.302	0.307
% Res. Imbalance	38.89	0.90	0.57	0.62
% Ind. Imbalance	34.07	1.10	1.10	1.09
$ Power Loss	2186.45	42.41	21.20	23.56
Test Location	Top Fuses LD	Top Fuses LD	Top Fuses LD	Top Fuses LD

350 kW Boiler Feed Motor on VSD – Initial testing indicated a resistive imbalance of 38.89 % and an inductive imbalance of 34.07 % when tested from the MCC.

The terminal box cover was removed for a visual inspection with burning clearly evident due to a loose connection on the back of the terminal block.

The terminal block was repaired and the motor re-tested with the new readings recorded as the new baseline readings