Case Study 2: ALL-TEST Pro 5 and ALL-TEST Pro OL

Condition: 2500 HP, 4160 Volt motor showed insulation problems indicating possible winding cure problems or contaminated insulating varnish.

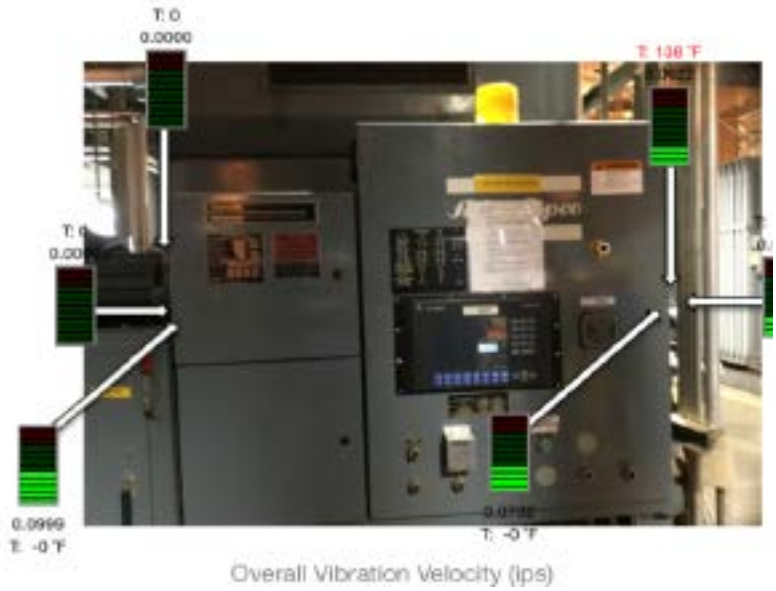

Figure 1: 2500 hp Atlas Copco Motor

The machine was tested with a combination of the ALL-TEST Pro 5 and the data compared to two other similar machines. It had been rewound and had exhibited poor operating conditions including nuisance tripping.

	Z1	Z2	Z3	L1	L2	L3	IR	DF	C
Mtr1	8.63	8.62	8.62	6.87	6.86	6.86	875	7.87%	68.3
Mtr2	8.98	8.99	8.99	7.14	7.15	7.15	>1G	2.61%	60.4
Mtr3	9.63	9.61	9.62	7.67	7.65	7.65	257	n/a	n/a

Figure 2: Comparison of motors MCA with ALL-TEST Pro 5

L is inductance, Z is impedance, IR is insulation resistance in MegOhms (G is GigOhms), DF is Dissipation Factor and C is capacitance.

Mtr1 is the machine in question and Mtr1 and Mtr3 are at operating temperature, Mtr 2 is at room temperature. The lower inductance indicates some type of change in the dimensions or turns of the coils while the impedance and dissipation factor indicate issues with the insulation to ground. To confirm issues with the insulation system, the power factor is compared between machines at similar loads.

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Figure 3: MTR1 Information at 84% load

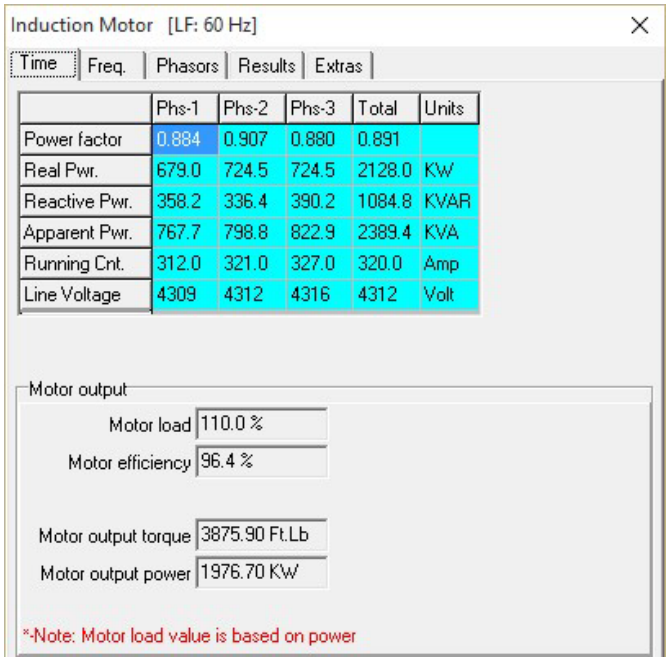

Figure 4: MTR2 Information at 110% load

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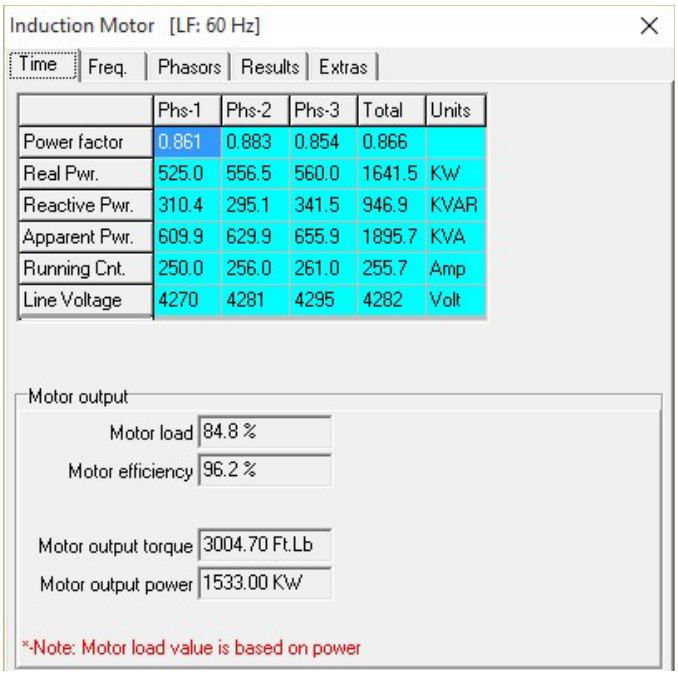

Figure 5:MTR3 information at 84.8% load

Power Factor is an indicator of stator core condition with the lower the number relating to the amount of energy required to generate a magnetic field in the stator core. Power factor is normally a curve starting with a very low value under 0.75, for example, under 50% motor load, leveling off between 75% to 100% and dropping rapidly over 100% load. Figures 3-5 are related to data collected with the ALL-TEST Pro OL Electrical Signature Analyzer.

In the case of Mtr1 (Figure 3) 0.795 PF at 84% load is lower than MTR2 at 0.891 at 110% load and 0.866 at 84.8% load. This would also indicate a core related problem on Mtr1.

The result of the study indicates a problem with the stator insulation in Mtr1, most likely poor varnishing, curing or contaminated varnish. The poor power factor on Mtr1 and lower inductance all relate to increased core losses in the electric machine. This was confirmed with a notation that the motor core temperature is generally 10C hotter than the motor at 110% load. This would relate to excessive stripping temperatures during the repair process causing damage to the core.

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