Case Study

Thermography prolongs motor winding life, prevents costly process failure

Infra-red thermography is widely accepted as a valuable tool to determine the health of electrical components in distribution boards, panels and transformers but can often be overlooked for mechanical application.

Mechanical Thermography

As part of our routine condition monitoring programme at Pragmatic, we conduct mechanical thermography on electric motors, gearboxes, pumps, fans, etc. It takes just a few seconds and can provide valuable information.

A quick scan of a large DC motor recently revealed a case temperature in excess of 90°C (Figure 1). Motor windings and bearings typically run around 20 - 25°C hotter than the case meaning that this motor had internal temperatures in the region of 110°C.

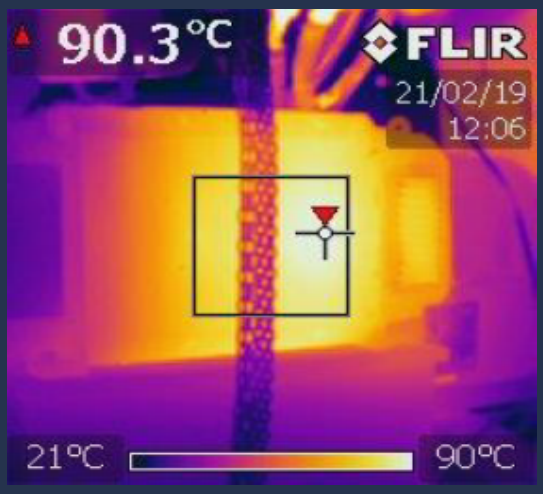

Figure 1 - Thermal image of the motor

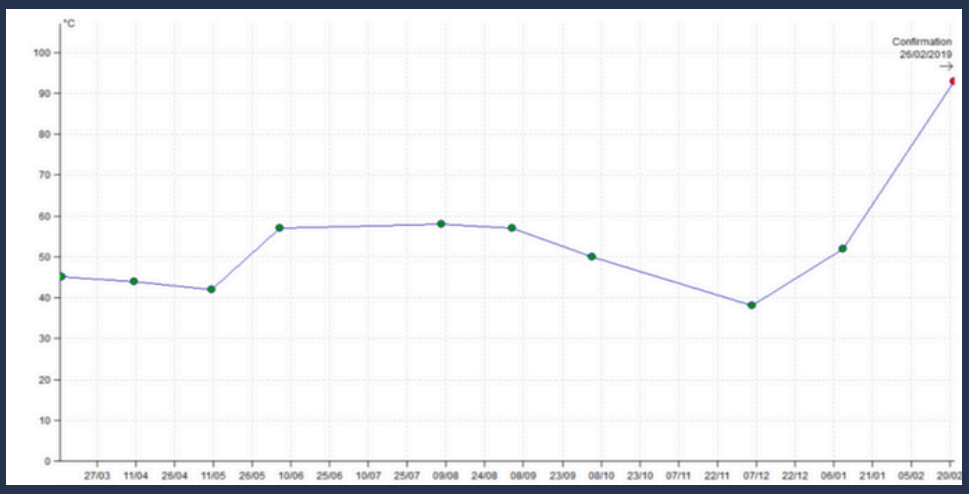

Figure 2 - Maximum motor case temperature trend for the previous 12 months

A quick check against the motor's history (Figure 2) revealed that the case temperature had not exceeded 60°C in the previous 12 months indicating that a significant change had occurred

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The discovery of the high motor case temperature prompted investigation of the asset. The large DC motor has a small AC-driven cooling fan attached to force air through the windings to provide cooling. The air enters the non-drive end of the motor after passing through an air filter (see Figure 3 adjacent) and exits at the drive end via vents.

It was noticed that the airflow out of the drive end of the motor was minimal. Further investigation found that the air filter was blocked and therefore significantly restricting the volume of air flow through the motor.

Figure 3 - DC motor with cooling fan

A quick scan with the thermal camera subsequently allowed the maintenance team to respond promptly and prevented damage to the motor windings and bearings.

Running hot - so what?

Electric motors generate heat. There's no getting away from it, however they are designed with this in mind and are capable of running at various predefined temperatures above ambient, depending upon the insulation classification. As motors get hotter several things happen and none of them are conducive to a long and happy life...

- **Windings** – Increased temperature causes the motor winding insulation to deteriorate at an accelerated rate. A half life 'rule of thumb' is often quoted that for every 10°C increase in running temperature, the windings life is halved.

- **Bearings** – A similar story is true with rolling element bearings, operation at increased temperatures drastically shortens bearing life.

- **Lubrication** – Increased temperatures also affect the lubrication, typically grease in motor bearings. Grease is specified with a working temperature range and if that is exceeded the oil can separate from the soap and leak out of the bearing. The viscosity of the grease is reduced with an increase in temperature and can lead to an insufficient lubrication film on the bearing race resulting in metal to metal contact and ultimately bearing failure.

- **Efficiency** – As the temperature increase the resistance in the windings increase resulting in a reduction in efficiency and therefore an increase in running cost.

Condition monitoring engineers have a multitude of tools at their disposal, however, they often focus on just one technique. Pragmatic adopts a multi-disciplinary approach to maximise the opportunity to find faults.

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