Motoring clinic

Most plants depend on electric motors, so when does it make sense to repair and when to replace failing units? Brian Tinham talks to Deritend's Dave Hawley and Whitelegg's Michael Herring

Pointers

- Bearings are responsible for more than half of all motor failures – usually the result of poor specification or maintenance, resulting in overloading, incorrect or excessive grease
- It's usually cheaper and faster to give standard motors an electrical or mechanical overhaul, if that is what's required, rather than purchasing replacements
- By logging motor data, and keeping up to date with technology, plant managers can make sure that the most realistic payback period is always available

Given current low prices for electric motors, compared with high costs of plant downtime caused by a failure, making a repair-versus-replace decision should be easy, shouldn't it? In theory, yes, but while there's no contest for motors rated 11kW or less, it's a different story when it comes to larger motors – and plant engineers are well advised to consider aspects such as reason for failure, severity and repair versus replacement timeframes, as well as costs.

But that's not all. Dave Hawley of maintenance specialist Deritend argues that, while finding the fastest way to get your plant back up and running quickly, following a motor failure, is important, it shouldn't be your start point. "Prevention is better than cure, so condition monitoring is always the first priority. Not only does it help plant managers to schedule repairs and refurbishment on a planned basis, but it minimises recourse to expensive fire-fighting when the proverbial hits the fan," he says.

"Also, using electrical, thermal, noise, vibration and oil analysis should give clues as to why a motor is failing, or has failed. Diagnoses, such as contaminated windings or failing insulation, bearings and lubrication, all tell engineers what they need to know about the likely cost and timescale for repairs," he adds.

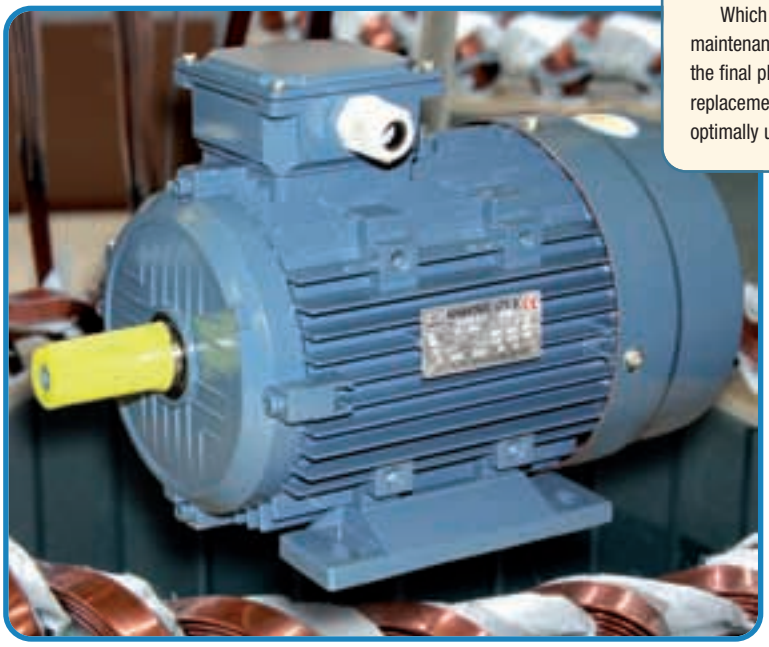
And there's more: given that things will still go wrong, best advice is also to have good information about your plant and all the options, so you're ready to act quickly and effectively. "Conducting a survey of all motors, noting nameplate information, details of the applications and how important they are to production, is a good way of prioritising spares holding and keeping up to date with the quickest and cheapest suppliers. It can also help engineers to assess suitability of motors – perhaps they're burning out because they're inadequately rated, or due to changes in the driven load or gearing," suggests Hawley.

Probability of failure

Probability of failure of electric motors is best calculated as a function of service life, according to Michael Herring, sales manager of condition monitoring specialist Whitelegg Machines. "Failure probability is initially high and declines very quickly during the run-in phase, because installation and assembly errors, existing damage etc usually lead to failure after only a short time," he observes.

"Failure probability then stays very low over a very long portion of the electric motor's service life. Only during the course of the final phase does failure probability rise again, as the service limits of the components are reached."

Which is where condition-based maintenance comes in: "Condition-based maintenance makes optimum use of the equipment's service life, right through to the final phase," says Herring. "Under a time-based maintenance concept, replacement is typically performed during the normal phase, thus failing to optimally utilise the component's remaining service life."



That said, if the issue is minimising downtime, standard 415V motors should be kept on site, probably as consignment stocks to keep cost down. That's not always possible – particularly if your motors are specialised – so, again, assessing suppliers saves time and money. And the same goes for their repair services: at least get prices for basic reconditioning, re-insulating, stator rewinding, stator repair, major lamination repair and new shafts.

Returning to the original question, though, Hawley agrees that, as a general rule, motors of 11kW or less should be replaced. They're stock items, available at short notice and are uneconomic to repair – although testing and dismantling to find

the cause of failure is still a good idea," he says.

Then, depending on the severity of failure, motors of 11kW and above may well be worth repairing – so long as time allows, or engineering can take advantage of a shutdown, or allow the unit to be returned to site as replacement stock. In an emergency, however, the opportunity cost of waiting for an analysis nearly always outweighs any money saved through repair.

250kW threshold

"Standard replacement units in the 11–250kW range are usually available in less than 48 hours," comments Hawley, "although exceptions include servomotors and some for specialist power transmission. EFF1 high-efficiency and ATEX explosive atmosphere certified motors can also prove difficult, as their designs make for expensive replacement, but also more costly repairs."

However, when it comes to standard motors of 250kW and above, unless failure is catastrophic, he agrees they are almost always best repaired, not least because of the lead times for new motors. "Even then, it is often worth repairing a unit and keeping it as a backup," he adds.

Again, a survey keeping account of previous repairs is invaluable in enabling engineers to assess whether damage is recurring and whether previous repairs were up to standard – or if the motor is simply not adequate for the application. Incidentally, if it turns out that a motor has failed due to poor specification – and not only output, but dust, moisture or explosive gas conditions – an upgrade repair is possible.

"Replacing the insulation can allow the motor to operate at higher temperatures, while high-speed bearings, lubricants and balancing can improve rpm performance," says Hawley. "Equally, some repairers can also increase the efficiency of electric motors during winding replacement, allowing the whole life costs of larger motors to be significantly reduced." PE