



When it comes to refurbishing plant, it makes a lot of sense to consider its operating conditions today, not just those when it was installed. Brian Tingham takes sound engineering advice from David Bates

and was asked to quote on rectifying a broken down grit rake. Managing director Dave Bates takes up the story: "Grit rakes are simple, but essential pieces of reciprocating plant. They're designed to remove grit coming into the works before it can damage pumps and other works equipment. We sometimes replace them with our ram pumps, but, to some authorities, they're like old reliable friends."

On this site, he explains, grit was removed at the works inflow, with a conventional cross-flow detritor, equipped with a rotating scroll scraper that pushes settled grit out to the circumference where it drops into a hole, out of harm's way. From that point, it is the job of the grit rake to extract the material, transporting it off to a skip, ready for disposal.

However, what Bates' team found was symptomatic of the change from old style everyday maintenance to plant managers' expectations of

Where old

Plant and machinery has changed enormously in the last 40 to 50 years. That's partly due to improved engineering right across the disciplines (mechanical, electrical, electronic, hydraulic etc), partly better automation and partly better computer software – making equipment more fit for purpose. But one of the unintended by-products of these improvements has been that, in some cases, good, solid examples of British engineering from the 1960s and 70s are failing prematurely and catastrophically.

Why? Because when such machinery was designed, installed and commissioned, it was the era of peripatetic maintenance engineers. Their job was to walk around the plant in their bailiwicks every day, checking for smooth operation, making adjustments here, providing lubrication there. And the plain fact is that there are very few of this breed left. Advances in technology have rendered them redundant, at least in the eyes of too many plant managers faced with cost-cutting mandates.

So what happens when an old faithful machine finally gives up the ghost for lack of regular maintenance? Yes, no doubt it can be repaired, but is it sensible to carry out a refurbishment with like-for-like replacement, knowing that the maintenance regime isn't going to improve any – meaning that your shiny new plant will also fail, and probably sooner, rather than later? Clearly not.

Such was the situation encountered by EMS Industries when the company's engineering team was called to a UK water company's remote sewage plant – which had become unmanned –

modern machinery. "A grit rake is triangular in shape and about 15 metres long by three metres deep at the detritor end. It scoops the grit from the hole, dragging it up an incline to the skip, using a crank and a series of linkage mechanisms that convert rotary into linear motion," he explains.

Catastrophic failure

"But when we looked at the crank shaft, the big end bearing clearly hadn't been lubricated in a very long time, so the crank had worn right through the bearing and the con rod had just fallen off. Astonishingly, even though it would have been excruciatingly noisy over a considerable period of time, nobody had apparently heard it fail. In fact, when a newly appointed site engineer came to inspect the works, he simply found the grit rake not running, with no one aware of why or particularly concerned – even though there were problems of blockages and machinery getting damaged."

So there was the dilemma: Bates' company could have rebuilt the machine, with a new crankshaft, bearings and general refurbishment, but there were two indications that this was not the way to go. "On the one hand, the machine had been stuck in that channel for years, so we didn't know what condition the structure was in. And, on the other, being called back on a warranty claim in a few months' time is not my idea of good business."

The refurbishment had to be done in such a way that the operational characteristics of the machine did not change, yet it also had to be capable of running for long periods, with little or no

Pointers

- Much good but ageing British-engineered plant is failing prematurely
- One key reason is the demise of peripatetic maintenance engineers
- When refurbishing plant, use designs that require little or no maintenance
- Split plain bearings, for example, can be difficult
- Self-aligning spherical roller bearings are better
- Cooper split bearings work well on large big ends, but they're costly
- Do your machine risk assessment before making difficult decisions

maintenance, in line with so much modern plant.

Bates' solution was to go for a full refurbishment, removing all plant and equipment, and transporting it back to EMS's workshops for review. "We sorted out all the documentation, risk assessments etc, and worked out how we were going to do the job and when. You can't just take out plant like this in mid winter. Then we got the heavy lifting equipment on site in the spring, drained down the detritor, stripped out the crank shaft, its big counterbalance weight and all the other plant, looking for damage as we went and using that information to guide our thinking on how to overcome those problems."

With the dismantled grit rake transported safely back at base, Bates says it was clear that the whole fabrication would have to be replaced, because it was rotten at its foundations. "So we used it as a pattern for manufacturing the frame and hot dip

regarding the amount of angular misalignment they can tolerate. Installation is not the same as for self-aligning roller or ball bearings."

So far, so good. But, as with all items of plant, lubrication remains important, yet is often neglected. Bates reminds us that water treatment works are damp and invariably involve slow-moving machinery. "The point about our design was that it will accommodate a distinct lack of maintenance. However, when you assemble components like these, you must select the correct type of lubricant.

Practical advice

"My advice is get your supplier involved, but do not let them dictate. Do the risk assessment before making your decision and beware of company policies, such as those that restrict you to food grade, synthetic etc. For this machine, the bearing



meets new

galvanised it to withstand the environment. As for the rotating and moving components, although the drive gear systems were in good order, every single bush and pivot pin on the rocking mechanism had to be replaced. So we manufactured new bronze bushings and steel pins, as per the originals, and replaced all retaining plates and fasteners."

What about that crankshaft? "The original machine had been constructed with split plain bronze bearings, which provide an excellent method for supporting and locating shafts, but can also present big problems. Unfortunately, many engineers today do not have the skill required either to manufacture or align them. It can take considerable time and effort to set the diametral clearance, cut the oil distribution grooves, scrape the bearings to give the required coverage and align them correctly. Even maintenance of plain bearings is a skilled job, so we were faced with the choice: repair as-is, but risk premature failures; or upgrade to accommodate modern maintenance policies."

EMS chose the latter and redesigned the crankshaft for self-aligning spherical roller bearings, using two units mounted on taper adaptor sleeves to provide support – one either side of the crank webs, with the bearing next to the drive gear located. That solved the rebuild and operational issues. As for the big end, the team chose a Cooper split bearing. Bates explains: "We had to modify the con rod, but that was pretty straightforward. You have to be careful with split rolling bearings, because their tolerance for misalignment is small. If you do use them, check with the manufacturer

housings were half filled with Morris K323 premium blue grease, which has the EP additives, but is also water repellent, making it suitable for heavy-loaded, slow-moving equipment in damp atmospheres.

"For me, it's all about keeping lubrication systems simple and easy to maintain. Also, if the plant or machine is critical, stay well clear of automatic lubrication systems, because unfortunately they tend to fail. If your plant is that critical, it's worth paying somebody to go and look at it on a pre-determined schedule.

"Finally, if you need to install instrumentation because your plant is difficult to get at, or it's in areas where you don't want people, then make sure you protect it. And do your risk assessment for the machine to see what level of condition monitoring equipment and/or attendance you need." **PE**

Left, above and below: before, during and after installation: the works grit rake transformed for operation in a maintenance-averse plant world

