

Beyond Routine

Mention “routine maintenance,” and most people think of oil changes. But scheduling regular preventive maintenance goes beyond an ordinary oil change. Keeping an eye on wear parts can mean the difference between productivity and expensive downtime.



By Lori Lovely

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The benefits of scheduling routine maintenance are clear: longer life of wear parts, less “emergency” downtime, greater productivity, optimal performance, and improved cost-efficiency. In a tough economy with tight profit margins and competitive bidding for jobs, all costs of doing business become critical. Ensuring uptime by keeping equipment in good running condition figures into that financial calculation.

It’s all about uptime, summarizes Brian Bergman, operations manager for CW Mill Equipment Co., manufacturer of tub, horizontal and feed-style industrial grinders. “Loss of operation is costly; time spent maintaining equipment is less costly than downtime.” Illustrating the benefit of routine maintenance, he says, “Our first Hogzilla is still out there, 20 years later.”

Every machine owner wants to use equipment to its full potential. The impact of lack of maintenance can be hard to measure unless you have a major event. At that point, the consequences of neglecting routine maintenance can be “severe and costly,” emphasizes Ron Miller, product support manager for Case Construction Equipment, and include downtime, lost productivity, lost revenue, unexpected costs such as machine rental and reduced trade-in values. “Any one of these factors is a strong argument for a focused effort on maintenance.”

It’s a Man(ual) Thing

With so many different pieces of equipment in a fleet and so many wear parts and maintenance intervals to consider, scheduling routine checks can become overwhelming. Where to start?

Start with the owner’s manual, advises Mike Kamp, senior marketing research consultant for Caterpillar. It suggests service interval schedules, which can range from daily or weekly to 250-, 500-, 1,000- or 2,000-hour services.

“Have, read, and understand the manual,” Bergman emphasizes. Then, follow the maintenance guidelines provided, adds Paul Moore, senior marketing manager for Komatsu parts. It covers filter changes, fluids, and wear items, including bushings, bearings, pumps, drives, engines, and transmissions.



In case the manual goes missing, John Deere attaches a periodic maintenance chart to all machines, says Dan Drescher, product-marketing manager for crawlers. "If you make it easy, it will get done. If there is no routine maintenance program, the company will pay for it with increased unscheduled maintenance downtime."

The second step is to develop a program unique to your company that goes beyond the manual, based on usage and goals (needed performance), Bergman continues. "The most important step in developing a policy is to develop a policy. Interpret the manufacturer's recommendations; there are a lot of variations. Interpret the use of the machine and customize a program to suit the situation."

Normal wear and tear is factored by hours of usage, but some component parts are affected by the material being processed. Product contact areas are influenced by the wear properties of the material being handled. For example, sand imposes a greater wear factor than dirt; likewise, hardwoods wear out components more rapidly than brush. "You have to measure wear in variable conditions, such as rough grading versus fine grading," Drescher explains. "In rough conditions, you have to pay extra attention to things like end bits and cutting edges on dozers, ripper shanks, teeth, and the undercarriage of crawlers."

Beyond the Manual

In addition to scheduling manufacturer-recommended routine maintenance checks, Drescher suggests daily visual

inspections. "The daily walk-around inspection is important. Think of it like you're an airplane pilot doing an inspection before the flight. Sometimes equipment is parked in a public place; you don't know what's happened to it or who used it last."

Miller concurs, adding, "Successful contractors train their equipment operators to perform routine fluid and filter checks at the start of every shift. For tracked equipment, the daily routine should include an inspection of the undercarriage and tracks." It's important to check track adjustment because mud and loose soil can damage seals if it freezes.

Alternatively, the track could be too loose or too tight. If the track is too tight, Drescher says, it accelerates undercarriage wear and causes a crawler to burn more fuel. If too loose, it will accelerate wear in a manner called "scalping," which Drescher describes as "rails slapping on the rollers and idlers, resulting in chipped parts and uneven wear on components."

Tightening is caused by material packing inside the rail. Loosening is caused by not retightening properly after changing the tension for different types of soil conditions, typically for mud and materials that pack. To avoid costly downtime, Drescher suggests checking track sag daily. John Deere conveniently positions a decal demonstrating how to measure track sag on the side of each machine to assist inspections.

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Search to detect the unexpected between maintenance intervals, Bergman urges: "Walk around, crawl all over, peer into every nook and cranny." Kamp believes a good visual inspection should be sufficient—not just a "wandering inspection without a form. You need a form that lists the components to be checked. You have to have a purpose."

Conducting a thorough PM is just as important as a good inspection. "There's a lot more to a PM than changing fluids and filters," Kamp says. He recommends testing the service and parking brakes, adjusting the track to extend undercarriage life, looking for hoses and wiring harnesses that might be rubbing, and numerous other checks. The job is so important, Kamp says, that Cat offers a complete training course for technicians to teach them how to perform proper maintenance and inspection.

Komatsu distributors hold PM clinics—typically for equipment at 2,500 hours or annually. “It provides an opportunity for inspections and diagnostic tests of the equipment,” Moore explains. “Is it performing to spec? Does it have the correct rpm? We perform functional checks of the operation of the machine so we can identify issues to follow up on. We look at hydraulic pressure, check seals for leakage.”

Leakage signals potential for contamination, which, as Kamp says, “is one of the biggest contributors to component failure.” For example, in common rail fuel systems where tolerances get as tight as 2 to 30 microns, cleaning the filter base with a shop rag that leaves behind lint or stray threads could “cause havoc to a fuel system.” Instead, Kamp recommends a disposable lint-free shop towel.

Another common mistake involves pre-filling fuel system filters prior to installation in an attempt to make starting the engine easier after changing the fuel filter. “A lot of customers, when pre-filling filters, pour the fuel in the large center hole of the filter,” Kamp explains. The fuel poured into this section won’t be filtered before entering the fuel system. Any dirt that may have been in the fuel can will be pumped directly into the fuel system and could damage the fuel system.

Cat knows “the importance of having a good tech conducting a good PM: reduced risk of contamination.” In fact, Kamp adds, to further decrease that risk, they filter oil before filling the PM truck and then filter it again before filling machinery. Even the 55-gallon drums of oil stored outside are covered to keep contamination out, and when taking oil samples in the field—where 75%–80% of PMs are done, he claims—techs are taught to perform them without removing the bottles from their plastic bags as a precaution against contamination.

Done properly, oil sampling of major components can play a critical role in preventive maintenance and even extend maintenance intervals. “When you take advantage of an oil sampling program, look for indicators for power train component issues,” Moore advises. “Metals in oil indicate wear on internal components that could signal the need for reman [remanufactured components] or repair.”

Whether done by the distributor or an independent company, testing engine, hydraulics, and transmission oil, as well as coolant from the radiator, is an important predictive step. In order to avoid mix-ups, Drescher says John Deere provides color-coded sample valves to easily identify sample ports.

Playing It Cool

Engine coolants protect the motor, extend its life and improve performance for every type of vehicle. Evans Cooling Systems in Sharon, CT, developed a waterless engine coolant for racing before expanding into the heavy-duty truck industry. “Our product can be used in any liquid-cooled internal combustion engine,” says Mike Tourville, marketing director.

According to industry sources, Evans reports, 40% of all engine breakdowns can be attributed to the cooling system. “In a truck,” Tourville elaborates, “a lot of energy is used to keep from overheating. But with our coolant, you won’t get to the boiling point, so there’s no worry about overheating.”

Unlike traditional water-glycol-based coolants that have a low boiling point, which limits the engine’s efficiency and reliability, Evans’ patented blend of glycols—propylene and ethylene—can safely handle higher temperatures. “Every other coolant has water,” Tourville says. Water-based coolants have a narrow operating range; above 212°F it is necessary to apply ever-increasing pressures to prevent boilover. “Pressure isn’t safe; it adds stress on the system and the hoses.” When boiling occurs, pitting from cavitation frequently follows. “Cylinder liner cavitation erosion is a big maintenance issue. Pitting from boiling eats away the cylinder lining.”



Water is also the root cause of corrosion in engine cooling systems. Because Evans's product has no water, there is no corrosion. "It lasts the life of the engine," Tourville points out. "This is a maintenance-free coolant that doesn't evaporate and doesn't contain additives. Not only is that more cost-effective, it also has environmental benefits because there's no disposal needed." Another environmental benefit is its reduced toxicity, making it safe around animals.

The maintenance benefits are evident: improved efficiency, reliability, and potential fuel savings. Because the operating temperature of an engine can be safely elevated, it's possible to reduce fan-on time. "That's a heavy draw of energy of up to 50%," Tourville estimates. In addition to preserving the life of the fan, fuel economy is improved and efficiency increased due to more available reserve capacity.

Photo: Case
Cylinder liner cavitation erosion

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Currently being tested in diverse applications, the waterless coolant is already solving the corrosion issues of the City of New York, increasing fuel economy by 3% for a large parcel delivery company and saving UCLA medical center \$100,000 a year on coolant changeouts in its generators.

Factoring the Variables

Saving money is always important. By being able to reduce or even eliminate fluid changes, companies can reduce expenses.

It's no secret that site conditions and environment make a difference on component life. Hydraulic oil doesn't break down; it just gets dirty. Engine oil is also adversely affected by harsh conditions, requiring more frequent changes.

"Every equipment manufacturer, including Case, defines standard maintenance intervals for its machines," Miller notes, "but many variables can alter those intervals, including climate, applications and job site conditions."

Ongoing maintenance schedules are usually based on hourly intervals, Moore elaborates, but adverse operating environments, whether dusty or coastal (salt), force additional steps. Drescher expands: "In dusty conditions, a lot more maintenance is required. You need to check air-cleaning systems and change filters more often. The undercarriage wears more quickly in abrasive conditions, so this area should be inspected more often if you operate in this environment."

"Sandy working conditions can accelerate scheduled maintenance requirements," Miller says. "One grain of sand can cause a lot of damage. You have to be very diligent in checking all of the machine's filters—air, fuel, oil, hydraulics—when you're working in a sandy environment. The same goes for working in high-dust conditions: Frequent cleaning and changing of air filters is crucial."

This is where the operator plays an important role, Miller believes. The operator knows the machine better than anyone and will be attuned to any changes or problems that come up. "An operator who is diligent about daily routine maintenance can add years of productive service to a machine and save a lot of unexpected costs, just by paying attention to the little things like daily fluid and filter checks."

Drescher agrees about the operator's impact on wear. "Most machines have protection to prevent abuse, but some operators are easier on equipment than others and can get production without pushing machines to the breaking point." The more often a machine operates in reverse, the more undercarriage wear there is. Turning in the same direction all the time also causes uneven wear, as does high-speed operation—a "cowboy" on the tractor who goes full speed when it's not necessary, for example. "A crawler is built to take abuse from the environment, but fleet managers and owner/operators appreciate a conscientious operator."

The major causes of damage to vulnerable cylinder rods on excavators and backhoe loaders are operator abuse and site conditions, Kamp indicates. "If you're digging a trench with rock and the rod gets scratched, when it retracts, it

risks cutting the seal on the hydraulic system, which means leaking oil and allowing dirt to get in. It could damage the pumps.”

In order to make a difference in difficult work environments, operators need training. John Deere’s current focus is on training the operator to run the machine only as needed, turning the engine off rather than idling it while they’re waiting. New John Deere K Series dozers are equipped with an auto shutdown feature that turns the engine off after idling for a set period of time. “When you’re idling, you’re using the engine and burning fuel,” Drescher explains. “That impacts the service life of the engine. If 20% to 30% of that life is at idle, it’s not productive or cost-effective because [service] intervals still come at hours, whether the machine is productive or not.” Turning off the engine saves a tangible amount in fuel costs.

Field Service

When units of major equipment, such as dozers and excavators, are in the field or in mines for extended periods of time on big jobs, returning to the shop for routine maintenance can prevent a project from moving forward on schedule.

Some of the bigger contractors may use a mechanic’s truck to provide service in the field or make use of one provided by an OEM as part of a maintenance contract for leased equipment, explains Phil Halt with Auto Crane. “The big contractors do maintenance at night, when the equipment isn’t working.” A mechanic’s truck typically carries a crane, welder, air compressor, and an assortment of fluids. Although expensive, Halt says, it makes a lot of sense for a large contractor with a lot of equipment on a big project.

But what about the smaller contractors and the smaller projects? Auto Crane offers a convenient option for them with its Lube Skid. “You don’t have to purchase a big truck,” Halt says. “You can maintain smaller equipment at one-fifth the cost.”

Designed to fit inside the bed of a truck, the Lube Skid features lifting hooks as well as front- and side-fork truck pockets for easy mobility. With a 60-gallon capacity and multi-configuration possibilities, it runs on compressed air. “It’s a great option offering flexibility for a niche market,” Halt summarizes.

Training Operation

Because the operator is a big factor in maintaining the equipment and can inflict a lot of damage if he or she is not taking care of it, Bergman says many companies involve the operator in maintenance and repair. Some municipalities are very specialized and don’t use the operator in maintenance, he says, but he believes it “sets the stage for missing details on maintenance because they have the greatest potential to see a problem.”

One challenge is moving a machine frequently to jobs with different conditions and different operators. “You need a good process to check in the machine,” Drescher advises. “An operator should even check little things like loose hardware on wear parts and sheet metal. Over time, this will add to maintenance time and cost.”

Operators should also check for leaks and an increasing number of things. “For machines using cooled exhaust gas recirculation technology, operators will have to check and maintain diesel particulate filters as part of their maintenance routines,” Miller indicates, adding that as Tier 4 Interim-certified equipment becomes more prevalent, operators should check diesel exhaust fluid gauges and warning indicators in machines using selective catalytic reduction technology.

Under the right operating conditions with trained operators, heavy machinery will provide maximum performance, Drescher states. John Deere distributors work closely with their customers, guiding them through maintenance issues and scheduling effectively because they understand the customer, working conditions and the machine.

It all begins with the correct machine for the job. “Matching the machine to the operating conditions is key,” Drescher points out. “Don’t overload a machine; size it correctly to the work being done.” In addition to load factor, he calculates a 24%–30% variance based on the operator. “Do they run into things, do they keep a machine maxed out all day, versus alternating light duty cycles?”

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To help monitor worksite conditions and operator actions, Caterpillar incorporates sensors to provide electronic data on a number of components. “If a wheel loader coasts downhill in neutral,” Kamp says, “that’s tracked. Sensors can

determine if a truck isn't loaded evenly or if the haul road is too rough." Making changes based on the electronic data provided can extend the life of components.

Komatsu equipment also features technology to track hours and what happens on a machine, Moore says. Fuel and idle time are issues that are frequently tracked, with reports going directly to Komatsu. "We know about issues before the customer does." In addition, most machinery features sophisticated panels with multiple indicators (dummy lights) for onboard monitoring and service reminders. "The machine alerts you when action is needed."

Monitoring the Situation

Electronic monitoring can significantly increase the efficiency of a company on many levels. Brad Mathews, vice president of marketing for Dexter + Chaney in Seattle, WA, says the firm's Spectrum Construction Software streamlines paperwork by tracking hours, usage, and maintenance of machinery, project management, accounting and even human resources.

Attachable almost anywhere on the outside of a machine, the 6- to 7-inch-long device is wired into the ignition system to monitor engine rpm. It builds daily logs, recording hours accurately and sending information to the company laptop—the "field master," as Mathews calls it—that transmits information to Spectrum without the need for additional cellular equipment. "It collects information from 20 to 30 pieces of equipment," he exclaims, "with no extra cell phone. That saves money." It can also be mounted on fuel trucks, alerting the fueler to perform maintenance tasks on site (such as an oil change) as it updates maintenance schedules. "It's great for remote sites."

The software automates the process of gathering hours. Because Dexter + Chaney built a maintenance schedule function into the platform, it's possible to set maintenance schedules based on working conditions. "You can individualize each piece of machinery," Mathews says, "and you can group maintenance items so you catch everything coming due." In other words, by looking at where equipment is in its cycle, more efficient scheduling can be planned ahead to further reduce downtime.

One of Spectrum's proprietary functions is its ability to track hours of operating and idling. Recording operating hours assists when costing out expenses to each job. "It changes the way customers manage their business," Mathews believes. "They record differently now that they have a place to store information. Previously, they didn't expense to jobs; they just listed costs under general expense. This helps with bidding and lets them know if they're making money."

It also helps contractors determine if their equipment is being used properly or frequently enough to justify the expense of rental or ownership—or perhaps the need for an additional unit. And, of course, it provides a complete repair history: documents such as oil analysis, notes, invoices for parts and repair. "If you're already tracking hours, why not add maintenance?" Mathews asks. "Maintenance was part of the design, because we knew it was important. Our software makes it easier. Tracking hours is very important, but manual recording is often inaccurate. Fleet managers like equipment, not paperwork."

Tips for the Trade

Noticing a trend in increased reliance on the dealer for scheduled maintenance, Miller believes contractors consider maintenance agreements cost-effective and convenient. To further assist customers, Case dealers offer onsite maintenance services to limit equipment downtime and minimize the need to take machines off the job site.

Moore says Komatsu likes to consider itself a business partner with its customers, so its distributors are happy to collaborate and pass along valuable tips for cost-effective ownership and efficiency. "We want the customer to get the best of out the machine."

Random maintenance tips Moore lists include adjusting the horizontal and vertical pins in the hitch on an articulated truck. "It can be expensive if it's not done." Drain the water out of the separator on a fuel system approximately every 10 hours or weekly, depending on the application and quality of the fuel, in order to preserve the life of the filter. Drain water and sediment out of fuel tanks. Visually inspect seals for leakage, particularly around the axle and shaft. Check the seals on hydraulics.

"Heat is the enemy," Moore states. "It deteriorates the life of a component." However, he admits, improved lubricants help reduce wear, which both extends parts life and helps fuel quality. Nevertheless, Kamp cautions, under- or overgreasing a machine is not effective. Overgreasing a linkage pin allows dirt to be mixed with the grease. This

could then leach inside and cause bearing failure. Likewise, undergreasing a pin can also lead to bearing failure, this time due to friction.

Bearings have defined maintenance intervals, Bergman says, adding that it's particularly important to maintain fluids and perform filter changes on hydraulics because contaminated oil damages pumps and valves.

To extend routine service intervals, John Deere offers upgraded filters, components designed to handle oil longer and improved oil service life. "It's less fluids and filter changes, less downtime, less cost for the customer," says Drescher. He indicates that they now have common filters for transmissions and hydraulic systems, which allows customers to stock less inventory but have the proper filter in stock.

Other upgrades are available from Deere, such as extended-life undercarriage systems. Heavier wear components, proprietary hardened bushing technology and seals designed to keep oil in the chain joint to higher hour levels help lower costs over time by extending system life. Drescher mentions extreme-duty cutting edges, but says it's important to consider site conditions because, while they last longer in rocky conditions, they cost and weigh more. Therefore, they aren't beneficial to all applications.

One universal rule is to monitor tire pressure; it impacts fuel economy as well as tire wear. In fact, many routine maintenance items will lower owning and operating costs—and that's what the customer wants, Kamp states.

"Machines only make money when they're running," says Drescher. The consequence of neglecting routine maintenance is increased unscheduled downtime. Since it often takes more downtime to repair an issue than to perform routine preventive maintenance, overall operating costs increase. There may be no immediate failure, Kamp explains, but you run the risk of reducing parts life and machine efficiency—and that can be costly to the customer in the long run. As if that's not bad enough, neglected wear parts could be causing unseen damage to other, more expensive components that will eventually lead to an expensive repair or even replacement.

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Without routine maintenance, you risk crisis, Moore interjects. "You end up being reactive, not proactive. Avoid catastrophic failure; the more scheduling you do, the better."

The benefits of good maintenance are both immediate and long-term, Miller believes. An aggressive preventive maintenance program can immediately lower operating costs and improve productivity. "In fact," he says, "you can gain an immediate competitive advantage compared with other contractors who don't give maintenance the attention it requires. One important long-term benefit of a good maintenance program is increased resale value when it's time to trade your machines." Keeping good records that document regularly scheduled maintenance will help bring a good price on the resale.

On "Grading and Excavation Contractor"

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