want to start with some small changes, for example eliminating paperwork and organizing your farm tools and equipment within a next-gen CMMS. Once your efficiency increases, you can try adding sensors to your equipment to see how the digitally transmitted signals can reflect the state of production equipment.

This technology can detect changes and faults that are invisible to the human eye. Through the use of sensors, your manufacturing process will become lean and transparent.

References

1. Farming maintenance and industry 4.0 [Electronic resource]. – Mode of access: https://www.mobility-work.com/blog/farming-maintenance-industry-40/. – Date of access: 08.04.2020.

2. Smart Farming. Automated Agriculture [Electronic resource]. – Mode of access: https://www.engineering.com/DesignerEdge/DesignerEdgeArticles/ArticleID/16653/Smart-FarmingAutomated-and-Connected-Agriculture. – Date of access: 08.04.2020.

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MAINTENANCE PRACTICES FOR DIESEL ENGINE FILTRATION

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Abstract. The article describes the typical maintenance practices for diesel engine filtration. It highlights oil, fuel and air filters maintenance operations.

Keywords: maintenance, fuel filter, oil filter, air filter, contamination, proper filtration.

Dirt is the deadly enemy of a diesel engine, and it comes in many forms. Abrasive contaminants are literally everywhere in the environment. Some like small metal particles, grinding swarf and paint residues may be introduced or left in the engine when it's assembled. Fuel and lubricants are another often overlooked source of contamination. Water, either dissolved or in solution, is a serious concern with stored diesel fuel. Dirt and other particulates from many sources, including airborne dirt and dust that enter tanks through vents and breathers, are almost certainly present in any stored fuels and lubricants.

Of course, the air itself is far from clean in most of the places a diesel engine works. Dust and dirt are a commonplace on construction jobsites, farms, and even stationary engine locations.

Even the engine itself is a source of contaminants. Bearings, crankshafts, pistons and other moving parts release microscopic metal particles as part of normal operating wear. Dust enters through worn seals and broken breathers. And, even maintenance parts like new filters can introduce contaminants if they aren't left in the original protective packaging until installed.

Oil, fuel and air filters are all that stand between you and costly engine wear, and each one has a specific range of requirements.

Oil Filters

Engine oil provides critical lubrication to moving parts, but also removes heat, enhances fuel efficiency and prevents formation of deposits and sludge. It can be an important contributor to engine emissions because oxidation and heating the oil can contribute to unwanted emissions.

The job of an oil filter is to keep the engine oil clean by extracting particulates such as soot caused by oil breakdown, from the burning fuel and metal contaminants. Without efficient filters and regular oil changes, contaminants build up on engine parts and oil passages causing restricted flow, reduced oil pressure and hot-spots. This can lead to abnormal wear of major components such as bearings, crank and camshaft.

All of the lubricating oil in an engine typically passes through the oil filter every 12 to 15 seconds, so an oil filter needs to balance capturing the soot and deposits whilst not starving the lubrications system of its valuable oil which could cause serious wear.

Fuel Filters

Diesel fuel pumps, injectors and nozzles all are manufactured to extremely close tolerances, often measured in just a few microns. Abrasive particles in the fuel can easily damage these components and others leading to poor starting, increased fuel consumption, reduced engine power and ultimately component failure.

The fuel filter's main role is to clean the fuel to prevent this damage, but its secondary role as a water separator is almost as important. Water contamination in diesel fuel causes poor fuel burn, reduced power, and cold spots as well as corrosion of sensitive components including injectors and fuel pumps that also impact engine performance. Abrasive wear of fuel injectors is the number one reason for premature replacement; effective filtration is the best way to prevent wear.

A typical fuel system returns unused fuel back to the tank, so a fuel filter is constantly having fuel cycled through it, and a fuel filter passes around 1.5 litres of fuel per minute, circulating 45,000 litres of fuel every 500 hours of service life.

Air Filters

A typical diesel engine uses about $500m^3$ of air every hour, but one spoonful of dust can cause irreversible damage to critical components. The air filter has to allow all of that air into the engine with minimal restriction while keeping at least 99.99 percent of the dust out.

Restricted airflow caused by a blocked filter reduces engine power output and increases fuel consumption, leading to a build-up of carbon deposits on overhaul components. Particles entering the combustion chamber through inefficient fil-

tering can cause wear of valves and valve seats, leading to poor performance and potential damage to sensitive components such as turbochargers, piston rings and valves, all of which are expensive to repair

All filters are not created equal. Nobody knows more about their engines than the people who design and build them. That's why virtually all original equipment manufacturers (OEMs) recommend original equipment filters, and why it's a good idea to follow that recommendation.

Chances are a non-genuine filter is not developed and tested to meet OEM specifications. Engines OEMs are continuously testing new and existing engines, so filters are tested on real engines, with many thousands of hours testing experience.

It is true that Perkins OEM filters tend to cost slightly more than aftermarket "will-fits", but there are good reasons.

Spiral roving is used to hold the pleats in an even shape. Without spiral roving the flow of fuel can move the pleats to and fro, weakening the structure, breaking down the integrity of the media and allowing more particles through

Acrylic beading prevents bunching. Fuel flow can distort the filter shape, moving some pleats closer and others wider apart. The pleats will try to move apart as the filter starts to load up with particles. As a result the heavily loaded areas open, and less loaded areas close up, reducing filter effectiveness

Non-metallic centre tube is actually stronger than metal. It helps retain the shape of the filter, and being plastic is cleaner during production. Metal centre tubes can carry the risk of small metal particles on the "clean" side of the filter being washed into the engine and causing wear.

Molded urethane end caps eliminate filter failures caused failure of the adhesive holding the end of the filter media. This produces a leak path that allows unfiltered fuel to enter the engine. The risk of failure is greatly reduced by molding the media into the end cap.

Filtration is one of the best ways to minimize the lifecycle operating cost of your diesel-powered equipment. It's really not all that complicated.

To sum it up it's necessary to observe the three rules: use the correct filters, change the filters regularly, and change filters carefully.

Proper filtration is certainly an area in which "An ounce of prevention is worth a pound of cure." The world outside your engine may be dirty, but the right filtration strategy and the right filters will keep the world inside your engine clean, efficient and productive.

References

1. Importance of good diesel engine filtration [Electronic resource]. – Mode of access: https:// www.perkins.com/en_GB/resources/meet-our-experts/julian-wood/diesel-engine-filtration.html – Date of access: 12.04.2020.

2. Dust Control: Know how your air filters work and how to change them to avoid big repair bills [Electronic resource]. – Mode of access: https://www.equipmentworld.com/dust-control-know-how-your-air-filters-work-and-how-to-change-them-to-avoid-big-repair-bills/ – Date of access: 12.04.2020.