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On Board Kidney Loop Filtration

Question:

We have one shovel operating with a better ISO code than the others. How do we determine what is causing the high ISO codes of the others? To avoid conflict with the OEM regarding warranties etc it is not practical to modify or upgrade the existing return line filters. How do we size a kidney loop system to be installed in addition to the existing system?

Answer:

a. If you have one machine operating at an acceptable ISO Code (or be it better than the others) you at least know a certain ISO Code can be achieved with what contaminate removal system (filtration) is in place.

Time to get your RCA hat out and work out why!

Use your Patch Kit (Black and White Kit) as an investigative tool.

Are the particles externally ingressed (eg: dust, silica etc) or are they predominantly bright metal (internally generated wear debris)? Bring all your analysis together in an attempt to extract as much information as you can to determine what is happening.

Is it a high level of benign wear debris? Is it a high level of larger catastrophic wear debris? Is the high ISO code due to an underlying wear chain reaction not being controlled or is a catastrophic failure in progress?

How often are the existing filter elements blocking? If they are not blocking and you have a high particle count (ISO code) then they are not functioning. They are either inferior in quality or have an ineffective removal rate or they are damaged in some way.

If they are blocking more often than they do regularly, then what is the main material being captured? Wear metals, or externally ingressed material (dust, silica etc).

A good filter is a good condition-monitoring friend. If you listen to him, he can tell you a lot of information. He is working on the job all the time. If all is well his job is regular and he is able to cope with the situation. If there is a problem and his workload increases then he cannot cope, he tires early with the additional burden and requires frequent replacement.

Listen to him.

Have a look at him and see what he can tell you. He is a good friend who is trying to look after your system and can often tell you when things aren't well. Consider connecting him into your machine PLC monitoring system so he can speak up and be heard when he encounters an unusually high workload.

b. If it is not practical to address the inadequacies of the existing return line system, then as far as sizing a recirculation filtration system for the shovel goes you need to think a bit laterally.....

1. Leave the existing return filtration as it is, but check it is fully serviceable (eg: bypass valves and other sealing areas are in a good condition). This will provide a primary level of removal. (depending on its removal efficiency)

2. Have a look at the schematic and pick one of the many other circuits you have on board which will provide around 200 or 300 lpm continuous flow (reservoir size dependent) and will not be affected by the increased differential caused by a blocked filter (eg: indication at 2.5 bar Delta P and 3.5 bar Delta P for bypass).

An excellent place to look would be the cooler circuit. Install the filter assembly prior to the cooler.

A flow that will provide between 10 to 20 turns of the reservoir capacity (10,000 ltrs) in around 4 to 5 hours. (eg: 10,000 litres x 10 turns = 100,000 litres / 300 mins (5 hours) = 333 lpm) is ideal in a demanding application. If it is found the application is not as demanding then relax the flow rate. These calculations really are trial and error no matter what some people say. There are no fixed and hard rules.

Given you already have an existing level of pre-filtration via a full flow system in the return-line, a flow rate of the 200 to 300 lpm will be adequate and more practical.

Unfortunately, this is more an art than an exact science!! An understanding of what can be achieved and experience with other systems in similar applications is needed. Older machines with worn wiper seals on hydraulic rams will require higher flow rates. Newer machines with more effective external ingression components (better seals etc) may be happy with a much lower flow rate.

If the existing filtration in the return line is maintaining the wear level at an average ISO code, a decreased flow rate in the kidney loop may be acceptable. All these factors need to be assessed and taken into consideration when deciding on the final flow rate.

3. Alternatively, make a stand-alone unit complete with electric/air/hydraulic motor, pump and filter assembly to kidney loop the reservoir to avoid altering any of the OEM configuration.

4. Depending on how degraded the lubricant is in the first instance, (ie: oxidised etc – check the filterability) it may be best to discard it and start with new lube.

Clean up the system quickly using a "Beta7(c)=1000" to break the wear chain reaction. (or even a "Beta5(c)=1000" depending on the lubricant viscosity)

Don't be alarmed if you use 2 or 3 elements or more (depending on the starting cleanliness) to stabilise the system.

Once the system is stabilised you may be able to relax the efficiency to say "Beta12(c)=1000" and still maintain your targeted ISO cleanliness. (I'm guessing you should really be striving for ISO -/15/12 or better for the type of valves etc on the shovel.)

Once your system has stabilised, the service life of your filter element will be extended and a reasonable regular element service life pattern will develop. *Remember to regularly monitor the system ISO code.*