

The humble **sub form** is the **linchpin of oil analysis** (Part Two)

by *John S. Evans, B.Sc.*

This is the second part of the article on how to submit a submission form and what can go wrong if any information is missing or incorrect.

This is vitally important considering that 20% of all samples are submitted to Wearcheck with incorrect or insufficient details, causing costly delays and hampering accurate diagnosis. An example of a submission form appears on page 3.



John Evans

SAMPLE INFORMATION

The middle section of the form deals with the sample details and contains some of the most crucial information required for an accurate and meaningful diagnosis to be given. The first piece of information is what component the sample has come from. Everything that pertains to the naming of the equipment also applies to the naming of the component. In the example given above, if the component were named left planetary gear instead of left final drive, then once again the recorded information will not tie up.

It may seem obvious that a final drive and a planetary gear are the same thing to the mechanic filling in the sub form but Wearcheck's data capture clerks are not engineers. So, once again, if you've given something a name, don't change it!

The next piece of information required is the sample date; this

is as much for the customer's housekeeping as it is for Wearcheck's. It allows for samples to be sorted in their correct order and identifies when a sample was taken.

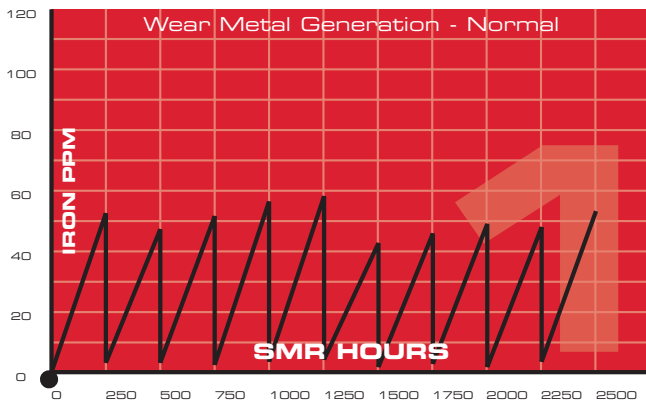
HOW LONG HAS THE OIL BEEN IN USE?

Now come two absolutely vital pieces of information: the service meter reading (SMR) and how long the oil has been in use. Once the origin of the sample has been correctly identified, the period oil in use (POIU) is the most critical piece of information required for an accurate diagnosis and this will now be discussed in detail. The SMR is also important as it shows the age of the machine. New machines may exhibit higher than normal wear readings as they bed

in. If the SMR is not known then these elevated readings may be misinterpreted as abnormal wear instead of a bedding in situation.

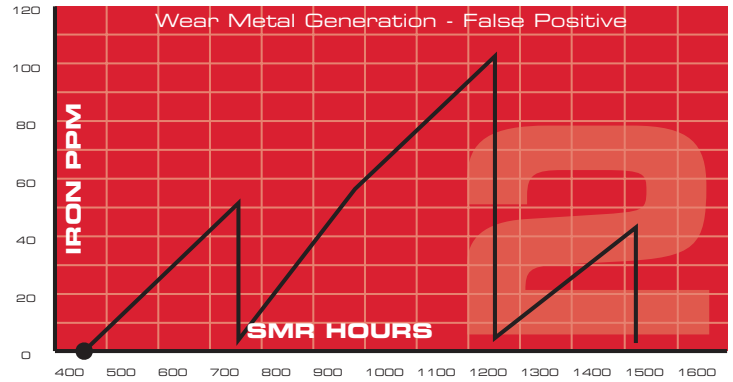
It is also important to supply the SMR and POIU in hours or kilometers. Saying the truck is four years old and the oil has been in use for three months is not that helpful. The truck may have been parked in the workshop for three months or it might travel between Durban and Cape Town every week. In the first situation that represents zero kilometers of usage, in the second nearly 40 000 kilometers.

The reason that the POIU is so critical is that the amount of wear, contamination and oil degradation that takes place will be totally dependant on how long the oil has been in use. If the oil has been in use for twice as long then it should be obvious that there will be approximately twice as much wear debris generated.

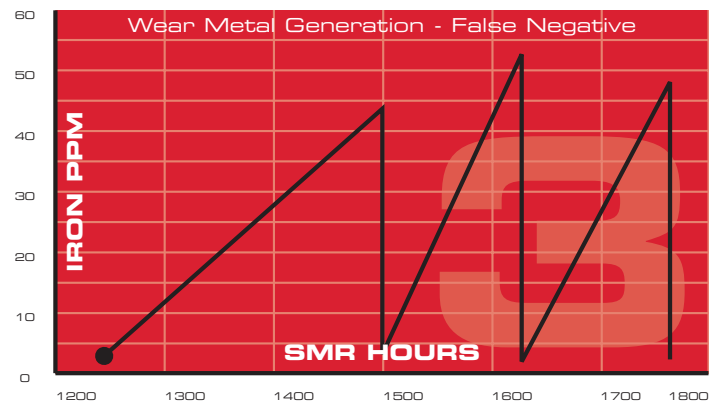


The first graph above shows normal wear metal generation in an engine. It can be seen over a period of 2 500 hours that, at a typical 250-hour oil drain interval, this engine would be expected to generate about 50 PPM iron.

The second graph shows that the service at 1 000 hours was not carried out and the oil was not changed. When the service was eventually carried out at 1253 hours, the oil had actually been in use for 493 hours, which means that an iron level of 103 PPM is quite normal for the period the oil has been in use. If the POIU had not been



given then, viewed against the normal trend of this engine, an iron level of 103 PPM actually looks quite high. This would have resulted in an actionable diagnosis where, in fact, no abnormal wear is taking place - in other words, a false positive.



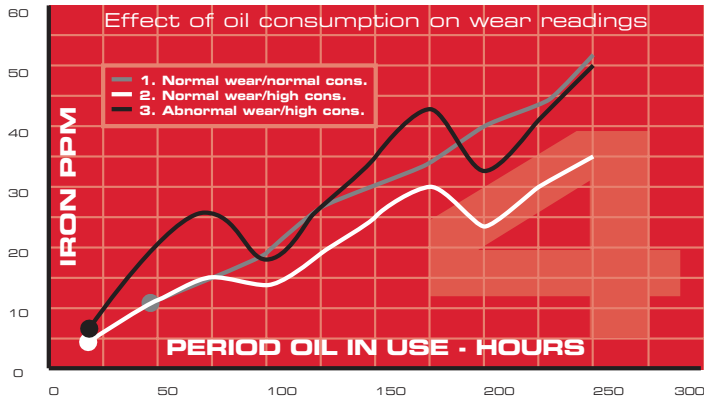
The third graph is an example of a false negative. In this case a sample was drawn at 1625 hours or only 123 hours since the last drain and 55 PPM iron looks quite normal when viewed against the previous history. However, this wear metal has been generated in half the normal time expected and is a clear indication of an abnormal wear situation developing. If the POIU had not been specified then this sample would have been diagnosed as being normal.

The sub form then asks if the oil and/or filters were changed at the time of sampling. This provides a service record for both the customer and Wearcheck and can be used to calculate how long the oil has been in use. Whether the oil has been changed or not will also influence the terminology used in the diagnosis.

If there are grounds for condemning the oil and the oil was not changed when the sample was taken, then the diagnosis will read, in part, '...XYZ **makes** the oil unfit for further use. Change the oil...' If the oil had been changed then this would read '...XYZ **made** the oil unfit for further use...'

OIL CONSUMPTION

Oil consumption can be quite a critical piece of information that is not always recorded and can have a dramatic effect on the diagnosis. The main reason for this is that with high oil consumption the component is continually being topped up with fresh oil and this causes all the readings to be diluted so that an abnormal situation may appear normal. The graph below illustrates what can happen:



Graph 1 shows normal wear taking place with normal oil consumption and again shows an expected iron reading of about 50 PPM after 250 hours of operation. Samples are taken approximately every 50 hours and show a smooth increase in iron over time. Graph 2 shows normal wear but with high oil consumption. There have been substantial top-ups of fresh oil at 100 and 200 hours and can be seen as a dip in the wear readings. The end result is the apparent iron level being about 15 PPM lower than expected. Graph 3 shows accelerated wear combined with high oil

EXAMPLE OF A SUBMISSION FORM

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MOBILE EQUIPMENT OIL SAMPLE SUBMISSION FORM

SAMPLE NUMBER	1234567-89
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Customer Name / Phone No.	JOHN EVANS
Your WEARCHECK Computer code	7JPHWD
Fleet or plant no.	1409-1
Registration or serial number	50H01234
Site	WESTMEAD

SAMPLE DETAILS

Component type (e.g. Engine)	ENGINE	
Date of sample	7 th SEPT 2004	
Service meter reading	4654	Hours
		Kms
Period oil in use	247	
Has this oil been drained? (Mark the appropriate box)	YES <input checked="" type="checkbox"/>	NO
Have the oil filters been changed (if applicable)?	YES <input checked="" type="checkbox"/>	NO
Oil consumption	<input type="checkbox"/> Ltrs	<input checked="" type="checkbox"/> Normal High Excessive
Comments or special circumstances:	RISING SUMP LEVEL	
Job Number	JP001	
Service meter reading when component	7407	Overhauled Kms / Hrs
		Replaced Kms / Hrs

SHADED AREAS - IF NEW OR CHANGED DETAILS

Chassis make & model (e.g. Mercedes Benz 2632, Caterpillar D9H)	CATERPILLAR 1409
Component make & model (e.g. A.D.E. 407T, Fuller RT 12509)	CATERPILLAR 3306
Oil brand, type & grade (e.g. Castrol Turbomax)	SHAL RIMULA SUPER 15W40
Oil capacity	28 Litres
Oil additive? (state brand)	NO
Radiator additive? (state brand)	SHAL TRIQUARD

NOTE:
IF ALL THE RELEVANT INFORMATION IS NOT SUPPLIED WITH THE SAMPLE AN ANALYSIS WILL BE CARRIED OUT BUT NO RELIABLE DIAGNOSIS CAN BE GIVEN

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consumption, and again there were large top-ups at 100 and 200 hours. The result here is an iron reading of 50 PPM at 250 hours that looks normal but is, in fact, abnormal because the true iron reading has been diluted by the addition of fresh oil. Without knowing the oil consumption this is potentially a dangerous situation that appears normal.

Often oil consumption is not measured and OEMs tend to quote consumption figures as litres of oil per 100 litres of fuel burned. What may be termed abnormal is also heavily dependent on duty cycles, making it very difficult to know whether a particular figure is normal or not. If the exact figure is not known or cannot be calculated, an indication of normal, high or excessive is still a big help to the diagnostics department.

It should be noted that if the oil consumption is high then that is already an indication of a problem that requires attention and an oil sample will probably not give any further information.

If there is high oil consumption and the wear readings appear normal it cannot be assumed that there might be a problem. Sampling under these conditions may provide diagnostics that are misleading. The problem should be corrected and then normal sampling and diagnosis can be resumed.

John Evans is diagnostic manager: mobile equipment for Wearthcheck Africa.

EXTRA INFORMATION

The next section on the sub form allows the customer to add brief comments or mention any special circumstances that might have relevance to the analysis carried out or have a bearing on the diagnosis. The more information provided, the more meaningful the diagnosis that can be made. There is also room to record when the component was replaced or overhauled.

This is useful information, as new or recently repaired equipment will usually exhibit a bedding in wear profile. Without this information elevated readings will be mistaken as abnormal wear as opposed to bedding in. Again, the more information Wearthcheck has in its possession the better the service that can be provided.

Finally, in this section of the sub form, there is room to record a job number. This has no impact on what Wearthcheck does but it allows the customer to reference a works order to a particular service or action and this number will be recorded on the report.

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