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MONITORING SERVICES Ltd.

EXPLODING THE MYTH

OF

CONDITION MONITORING

AND

PREVENTATIVE MAINTENANCE

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THE MYTH AND THE REALITY

Routine condition monitoring and predictive maintenance have in recent times become the "in thing" phrases to be dropped into conversation wherever, and whenever, we wish to impress and generally demonstrate our progressive approach to the problems of maintaining all manner of equipment. In this context "preventative maintenance" and the associated condition monitoring techniques are seen to represent the ultimate answer to the problems of the maintenance engineer.

Undoubtedly some equipment suppliers and service providers have emphasised the advantages of utilising "this equipment" or "that service" without mention of any of the limiting factors or circumstances, the resulting impression is that the equipment is all important and infallible, and the data analysis is done by the computer software. Thus maintenance and reliability problems can be solved by purchasing a certain package of "infallible equipment and software" or by employing the ultimate service, which utilizes the said equipment and software — *this is the myth.*

We have come to accept that computer errors are usually errors of the operator or program rather than the machine. We must also recognise that a failure of a condition monitoring system is likely to be due to operator or analyst error, compromises made in the choice and application of technique and equipment, or simply that the expected results are beyond the system capability.

The quality of the data is not guaranteed by the choice of equipment.

The monitoring engineer must identify the parameters, which are likely to give good indications of the various faults, and then select a technique and a sample point on the machine that will give the best result. For each data sample the selected method must collect the required information, while rejecting as much as possible of the background interference, which might otherwise mask the useful data.

The efficiency of the analysis is not guaranteed by the choice of software.

The monitoring engineer must select and set the alarm types and levels and be able to recognise when parameters, such as varying load, render the alarms ineffective. He must also set the monitoring intervals to minimise the probability of a fault progressing from initiation to failure between surveys, while not wasting the resources by over-monitoring.

Good equipment and software must be supported by good practice.

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Variations in the data sampling and analysis methods will affect the test results. To reduce this potential error to a minimum, the methods must be well defined with the emphasis on repeatability, and the personnel employed on these duties must be diligent as well as competent.

The results must be presented in a format which will suit, and complement the management organisation. This will enable job priorities to be established and give better targeting of the maintenance effort.

The predictive maintenance system is a continuous chain. The quality of data collected cannot exceed the capability of the equipment, nor can good results be achieved from the analysis of inadequate data. In fact all the components of the system must be of the same high standard to get the best result.

As with any chain the weakest link is the limiting factor, providing stronger components elsewhere in the chain is a waste of resource — *this is the reality.*

IMPLEMENTING CONDITION MONITORING

Often the decision to implement condition monitoring is a strategic decision, primarily because it is the upper levels of management who are in a position to fully evaluate the potential savings, and subsequently, to authorise the required investment of time and money.

If the decision results in the purchase of a package, still wrapped in myth, it falls to the maintenance department to reveal the reality. Condition monitoring is a tool and not a substitute for good engineering practice or skilled craftsmen.

The subsequent confrontation between senior management (who believe that they have supplied a conclusive answer) and maintenance staff (who are under pressure to produce the miracle) can only detract from the true worth. In extreme cases where, for whatever reason, no significant part of the miracle was achieved, it has tended to be the condition monitoring equipment and techniques, which are blamed for falling short of the promised capabilities. Further, a failure of one technique is often transferred and attributed to the other techniques as well and the whole system is condemned as useless.

We are left with a polarisation of opinion where the believers believe strongly and the disbelievers are totally dismissive. Very few tread the middle road.

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This polarisation is clearly demonstrated when comparing the results and attitudes of several different units; employing similar equipment and using the same instrumentation and software, the results tend to be highly variable with the main difference being the personnel. Does commitment spring from success or success from commitment? Whichever, the successful are committed, and the unsuccessful are dismissive. The basic fact remains that if some teams can make the systems work, so can the others.

The requirements for condition monitoring are:

1 To define a measurable parameter that will change as a fault develops. Preferably that change should be progressive, so that the deterioration can be trended and a subsequent failure time can be estimated, remedial action can then be taken to avoid mid-run downtime, while still achieving maximum unit life
2 To establish an adequate system of control to ensure:
   A That the data is collected, stored and analysed in a correct manner.
   B That alarms are acted upon and the results reported back into the system and recorded.
3 To monitor the performance and identify loopholes, where required modify the system to eliminate such shortfalls and ensure efficient use of manpower and instrumentation

This is a simple statement of the requirements, but the implementation is often far from simple. There is a wide range of parameters which can be measured to yield good condition monitoring data; each parameter may be measured by different techniques often with a range of instruments for each technique. The result is a vast multiple choice, a mix and match of methods and instrumentation, each decision leading to a further multiple choice.

Financial and logistical restrictions often influence the choice of equipment or the number of techniques to be employed within the system, this almost always means that some functions are monitored with second or even third best options, which may reduce the sensitivity to the developing fault and compromise the ability to reliably predict the failure.

For example having got as far as the choice of the Diagnostic Instruments PL31 data collector with an accelerometer and Entek software, the engineer is presented with 480 permutations of filters and processes during instrument set-up.

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The vast majority can be eliminated as not likely to give useful information, but the engineer will be left with a number of viable options from which he will select one or more targeting specific potential faults. The more critical the application, then the higher the level of monitoring. But, on every application there is a grey area, a cut-off line has to be established between 'worth doing' and 'probable waste of resource'.

Typical of this is 'balance and coupling alignment'. 'Out of balance' will be apparent as a vibration at 1 X shaft speed and predominantly radial; axial misalignment at 1 X shaft speed axial and radial; offset misalignment at 2X shaft speed axial and radial. A radial measurement cannot differentiate between balance and axial misalignment but can give good access to other data, such as gearmesh frequency, which the axial measurement rarely does.

If we require a definitive answer, then both measurements have to be collected. If we only require an indication of a developing fault to initiate further investigation, the radial measurement is usually the best as it indicates both faults.

CONCLUSIONS

When properly and skilfully applied, condition monitoring is a powerful diagnostic aid which can be utilised to best effect as the basis for a predictive maintenance programme.

Just as the computer became common place and accepted as a useful reliable tool, so must condition monitoring and predictive maintenance become accepted for what they are. Only then will the techniques become respected and the perception altered from its mythical status to that of an engineering science. As the competence of computer programmers has advanced, the resulting programs are becoming as easy to use as the original computer myths once portrayed. Condition monitoring and predictive maintenance will also continue to progress and become easier to apply with better, more reliable, more consistent results. The fact remains that at this time there are no all embracing, foolproof 'expert' diagnostic programs available.

Existing expert diagnostic systems do have a very real part to play, primarily in reducing the huge amounts of collected data down to something manageable and, for the less complicated and well catalogued applications, they can often accurately diagnose the problem. This will make the expert engineer available for the more exacting applications.

Such systems will always be limited by the engineers selection of monitoring points, his evaluation of probable faults and his knowledge of the machines.

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The data within a condition monitoring database quickly builds up into a valuable asset and should be treated as such, replacing or starting again will be an expensive project. When selecting a data management system, consideration should be given to future needs and aims of the company with regard to the ongoing development of both software and hardware. If there is a possibility that an extension of the system will be required, to take advantage of new methods of data collection or analysis, then the options should be left open to allow the system to be developed and updated.

The following PDF documents available from www.insightmonitoring.co.uk illustrate just some of the ways in which condition monitoring can be used to good advantage.

Example1.pdf
Example2.pdf

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