Instant guide to plant maintenance

Reducing your Carbon Footprint

ABB Instrumentation

Adding Value to your Operation through Maintenance Management

Maintenance has long been considered a necessary evil in operating plant instrumentation. With the right consideration however, maintenance, including verification, calibration and routine checks, can add real value through improved reliability, uptime and optimisation of plant applications. Neil Ritchie and Mark Allinson of ABB stress that a good operations strategy can only work if the frontline instruments are properly applied and maintained.

Managing an instrument to ensure consistent levels of efficiency and performance throughout its lifetime can be a complex task that requires consideration of a multitude of different factors. For this reason, it is imperative to have an effective maintenance plan drawn up from the outset that will allow you to quickly identify and address any deviations or deterioration in performance.

Maintenance plans need to tackle three key issues:

1. **Maintenance Activities;** what specific actions are needed? What monitoring techniques are used?
2. **Expertise;** Do I have the right skills? How do I manage the knowledge and learning? How do I develop people to meet modern standards?
3. **Time;** when do I carry out each activity? How do I plan and organise for future needs. How do I avoid over maintaining equipment?

Maintenance engineers used to have a lot in common with fire fighters. When something, somewhere on a plant failed they would spring into action to sort out the problem and get production back on track. But these days, maintenance is increasingly about heading off trouble before it starts and this predictive approach is possible thanks largely to the advent of more intelligent control systems and instrumentation coupled with a good lifecycle management programme.

Predictive maintenance is not just about preventing catastrophic failures. Across the entire range of process industries, where product specifications are extremely tight and the pressure to minimise operating costs is enormous, being able to spot the early signs of deteriorating performance and planning and initiating maintenance activities at the right time can make the difference between profit and loss.

Take energy consumption for example. Industry as a whole saw gas and electricity prices rise by 47% and 34% respectively in 2005, according to the Engineering Employer's Federation. Using the right instrumentation to spot wastage such as leaking steam lines or over-temperature vessels saves energy and helps to mitigate the extra cost. Correct flow monitoring can allow boiler operators to control production to match demand, rather than waste steam through overproduction. Keeping instruments optimised, accurate and reliable will ensure that savings through wastage control and process control are realised on the bottom line.

Modern instrumentation developed by ABB provides technological advances that can be an aid to predictive maintenance practices. An example is ***fieldbus*** technology, a generic term for single cable networks transporting data, allowing many devices such as ***flow***, ***pressure***, ***analysers***, ***switchgear***, I/O Stations, ***motors***, ***drives*** and process controllers to be connected together down a single transmission line or fieldbus. Access to information can make decision making quicker, with instant alarm access, and can help with development of knowledge in plant performance.

Top Tips for operating a good Lifecycle Management Programme

1. Selection

The starting point for reliable and accurate instrumentation is choosing the right device for the job. Although this seems an obvious statement there are many instruments installed that are either not up to the task or do not offer the specification to offer real benefits to the business.

ABB's TF202 field mounted temperature transmitter has a robust design for hazardous areas

In particular, be on the lookout for low-maintenance options. Some types of equipment are specifically designed with built-in protection against arduous environments. For example, it may be worth opting for a type of ***temperature transmitter*** which is 'fully-potted', which makes the transmitter much less vulnerable to vibration, contamination ingress and changes in ambient temperature that can cause drift in other models.

When selecting the construction materials for an instrument, remember to consider all possible operational scenarios. Clearly the main process should be the primary consideration, but other factors are also important. For example, think about any cleaning chemicals that could be used. Ask questions such as can the installation be subjected to pressures or temperatures outside the rating of the instrument? Can a vacuum be created under fault conditions? Thinking outside the box at the instrument specification stage can, in some cases, significantly increase the working life of an instrument, and provide a much safer installation.

Selection however goes beyond just the product itself. The selection process should also consider the service back up and technical support offered by the supplier. Are there local service engineers available to help when needed? Can the supplier help manage or contribute to your lifecycle programme? Unfortunately, these considerations are often overlooked, only coming to the fore when a crisis occurs or a high penalty is incurred for an error.

2. Installation and Commissioning

It is important for any device to be installed and commissioned correctly. This requires not just following the manufacturer's operational specifications, but also considering post installation maintenance requirements. Instruments that are difficult to access are typically ignored or bypassed when performing maintenance activities. Devices should therefore be installed and commissioned to meet the precise design specifications and be easy to access.

Consider the operating environment when specifying instruments to increase suitability as well as considering appropriate maintenance needs

Another key consideration is the operating environment. Factors such as high ambient temperatures and excessive humidity, for example, can dramatically shorten an instrument's working life. Check the instruction manual or installation guide for practical ideas on how to avoid operational problems. Better still, utilise the expertise of the instrument manufacturer's service and applications engineers, who will have a wealth of practical knowledge and experience to assist with commissioning. Optimising the set up of an instrument at the outset can help to maximise its operational lifetime by reducing the risk of subsequent problems during operation.

3. Recording and Tracking Activities

Pressure on resources and the proliferation of instruments throughout a plant means the recording of service histories is often neglected or is implemented late in a product's lifecycle.

Paying attention to these areas from the outset can, however, offer real benefits and cost savings throughout the lifecycle of a product. For example, noting down the original set-up parameters of an instrument can improve recovery time if a crisis occurs. Many instruments now have memory 'scratchpads' to allow these parameters to be saved independently of the normal instrument working memory. Look for instruments offering this feature.

Subsequent service actions should also be recorded and planned, not only to meet the instrument's needs but also to meet regulatory requirements and avoid over maintaining a device. By recording and tracking activities in 'real-time', the need for regular and costly audits to establish current lifecycle status and condition of instruments is reduced. Getting the paperwork right is not only important for managing a good maintenance programme with direct advantages to plant, but in meeting regulatory, safety and environmental standards.

4. Planning and co-ordination

Although planning maintenance is not a new activity for most maintenance managers, the inherently longer service life of more reliable and robust equipment calls for a different approach. Many products can offer reliable service over 15 to 20 years with a good maintenance routine, but the additional features and benefits offered by newer technology must also be taken into account.

In simple terms, the maintenance programme needs to be designed to make the correct decisions to maintain, support and upgrade at exactly the right time.

Lifecycle planning meets this need by offering a plan based on manufacturer's research, experience and knowledge overlaid with the skill set and service product. For example, calibration may take place annually to ensure optimum performance, but various wearable components such as fans require replacement before they can introduce measurement or control inefficiencies.

ABB can work with you to formulate and implement the best maintenance plan for your plant

Good planning eliminates overburdening the plant with unnecessary intervention, cost and attention caused by over-maintaining products. Reputable manufacturers such as ABB offer complete lifecycle management programmes that include planned programmes of activity either for the customer to perform or which can be delivered by certified engineers.

5. Resources and Capabilities

Managing staffing to meet the needs of a varied and complex application of instruments and equipment can be difficult. Not only in recruiting the right calibre of person, but the continuous development of staff to keep up with current best practices plus an expanding array of environmental, technical and performance needs.

A continuous improvement programme using personal development programmes and training is only one element. Staying in touch with the technology also needs staff to have operational exposure to develop experience and enable learning.

Sometimes outsourcing specialist areas is the only solution. However, this can still deliver significant benefits in terms of reduced training costs, staff retention and maintaining a large headcount.

Alternatively, many manufacturers, including ABB, offer training programmes and workshops to keep their customers in touch with changing practices and technologies.

6. Do the job right

Cutting corners and avoiding steps in a maintenance routine are common sources of process error and additional costs. Doing the right job at the right time with the right skills is a sure-fire way to avoid higher costs and reduce downtime, whilst extending the life of the instrument and maximising efficiency. Calibration is a good example. Many ***pressure transmitter*** vendors claim their products require recalibration only every five years, but the figures quoted are based on a specific set of conditions that may have little to do with conditions on site. In many cases, the user will only know the correct calibration frequency for sure if he calculates it himself.

ABB's new 364 pressure transmitter offers long-term stability of 0.15% over 10 years

Calibration frequency depends on three things: the application, the performance required and the operating conditions.

The application is important because it affects the accuracy needed. Some applications have a direct bearing on safety or plant efficiency and call for a high performance figure, in the order of 0.5% of reading or better. Other applications may not demand a very high performance. If all that is needed is to indicate that the water level in a tank is approximately in the centre, for example, around 10% of span may be good enough.

Operating conditions are another vital factor. In the case of our pressure transmitter example for instance, static pressure, ambient temperature and product density stability will each have an associated error figure or an effect on the reading. Other parameters may be similarly important for other types of instrument.

Next, calculate the Total Probable Error. This is determined by a formula that incorporates terms for the quoted base accuracy of the device and the likely effects of static pressure and temperature errors on performance accuracy.

Determine the stability per month. The necessary data should be provided by the vendor for a particular instrument. Normally the stability will be expressed for a given time period, such as 36 months.

The calibration frequency is then given by the required performance minus the Total Probable Error, divided by the stability per month. This determines the frequency with which the calibration needs to be checked in order to maintain the desired accuracy.

7. Assess and Reassess

A good lifecycle programme needs continuous assessment. A properly designed programme will have such assessment built into tracking and recording, rather than handled as a separate and more frequent, high cost activity. Initial audits can focus activities into the right business-critical areas. The actual lifecycle programme in place should also be assessed periodically, challenging the methods and practices employed rather than just focussing on the needs of the discrete instrument. This 'double loop' learning approach will ensure that modern techniques and the benefits of new technology are accounted for in the whole plan.

For example, many ***pH meters*** benefit from regular cleaning, so in certain circumstances it may be best to install one with an automatic self-cleaning function. This type of sensor uses a jet wash system and would require a change in the maintenance applied.

pH meters with a self cleaning function significantly reduce the requirement for manual cleaning

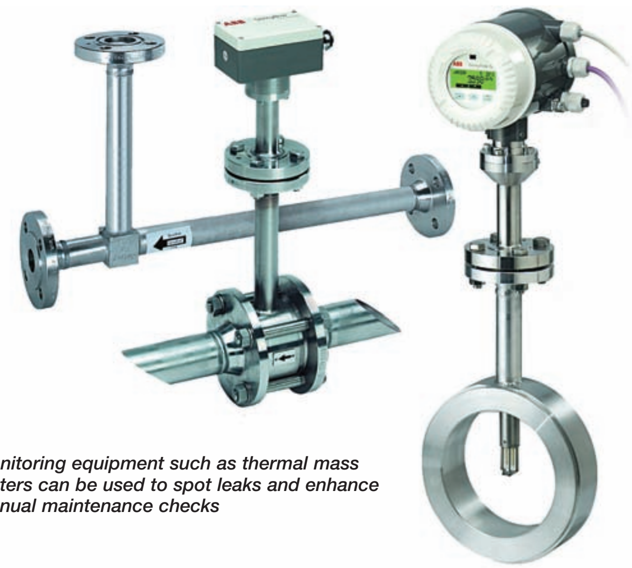
In addition, root cause analysis should be part of the correct maintenance activities. This is a well documented approach to analysing failures and looking for ways to improve or engineer out potential for a reoccurrence. This could be within product design, access or maintenance needs. This same approach can be applied to the practices undertaken. For example, keeping a spares inventory or a complete 'hot spare' instrument on standby for emergencies may be a valuable undertaking to avoid long periods of downtime of measurement error.

Walking the site can act as a simple way to find opportunities where good maintenance can improve plant operation and can often act as a surrogate for a carefully planned programme. An example is ***checking the performance of compressed air plant***, where leaks have been estimated to cost UK companies 30% of their energy costs.

Of course, there are traditional ways of detecting leaks, such as listening for hissing sounds or coating joints with soap solution and checking for bubbles. It's helpful when looking for leaks to realise that there are some components of a compressed air system that are especially vulnerable, such as pneumatic cylinders, flanges, filters, tools, presses and drop hammers. But even if you know where to start looking, site surveys are laborious, time consuming and must be repeated regularly.

This sort of survey can be expensive and will also only detect leaks that are big and accessible enough for a human operator to spot. As a rule of thumb, this approach leaves 10% of leaks un-repaired at any given time, which is worrying if you consider that a single five-millimetre hole in an air line costs around £1,400 per year.

One solution is to use ***thermal mass meters*** to measure compressed air consumption. In comparison to human operators, thermal mass meters can detect tiny leaks. They also operate continuously, so they can indicate a potential problem as it develops, rather than waiting for the next survey. Once in place, they can help with other aspects of good housekeeping, such as monitoring the amount of compressed air used by each consumer.



Monitoring equipment such as thermal mass meters can be used to spot leaks and enhance manual maintenance checks

8. Health and Safety
While this subject is last on our list of tips, it should certainly be prominent in everyone's thinking when approaching any maintenance activity. Following the right processes and recommendations and embedding health and safety into plant culture and any associated activities can significantly reduce risk.

Enjoy the benefits of investment

Investing in this technology and support makes sense if you consider the potential cost of unplanned downtime if things go wrong and the waste in energy, materials and resources caused by poorly controlled processes, not to mention the environmental impact. More and more companies are choosing instrumentation with good predictive and diagnostic capabilities, but it is also vital to protect your investment with an expert lifecycle management programme that considers the handling of maintenance and unplanned actions needed for your plant.

What ABB can offer

ABB can provide a complete range of customised or 'off the shelf' services from full lifecycle management programmes to simple calibration services packaged within our Advantage, Active and Active+ Portfolios. Our instrumentation products and support can help you achieve top levels of plant performance. Specialist sales and application engineers can guide you through the vast array of options to ensure you get the best instrumentation and the best support for the job first time, every time.

Call our Customer Support Centre on **01480 488080** for more information or email ***moreinstrumentation@gb.abb.com*** ref. 'Maintenance'.

Recommended reading:

'How thermal mass meters can help put the squeeze on compressed air costs'

'Fieldbus into the future'

'The easy guide to pH measurement'

'Is it time you checked your pressure transmitters?'

Guides:

FOUNDATION fieldbus solutions

PROFIBUS fieldbus solutions

Wallcharts:

Thermal mass flow management wallchart

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