Condition-based maintenance – new approaches to extend the life of HVAC equipment

By Neil Cameron, Johnson Controls Area General Manager, Building Efficiency – Africa

17 January 2017

HVAC is a long-term investment: chillers are big-ticket items that are meant to last the lifetime of a building – about 25-30 years – in fact a recent demolition of one of the first four star hotels in Dubai led to the retirement of three YORK® YT Chillers after nearly 34 years of service. These chillers were one of the first centrifugal chiller installations in the region. While scheduled maintenance may keep the equipment ticking over, condition-based maintenance ensures promised performance and energy efficiencies are achieved. With eco- and cost-conscious mindsets steering buyers' decisions, HVAC companies are increasingly aligned to sustainable maintenance practices. They offer a number of attractive condition-based maintenance approaches to suit the risk and investment stance of companies and property owners.

The reality is that chillers can and do last a lot longer. There are chillers that are over 50 years old that are still pulling a full shift in industrial and commercial environments. The machines that make it to this age are in various states of repair but the best have had a dedicated team attending to maintenance. These chillers are often only retired when replacement parts become difficult to source, or advancing technologies begin to make strides in efficiency that they cannot hope to emulate. With longevity now a key factor in HVAC vendors' roadmaps, the sophisticated, digitally-enhanced machines being built today can reach four decades and more.

What is condition-based maintenance?
Quite simply it is the ability to continuously monitor, assess and refine the performance of plant equipment. Monitoring may include vibration analysis, use of real-time performance data from sensors on and within the machine, and analysis of the chiller's alignment or deviation from its published operating 'signature' – the frequency and rate at which the machine functions at designed conditions.

The major vendors have all released such signatures to support equipment maintenance and care. Specialised service providers can make use of published signatures to provide condition-based maintenance services for a broad array of HVAC equipment.

The value of a 24x7 monitoring is significant:

- It enables early detection of out-of-sync operation and identifies precursors to failure. These are errors that can be corrected with a tweak if caught in time. The alternative is that the machine may run to fail, resulting in expensive replacement of parts and downtime. Compressors and impellers will, for example, last the lifetime of chiller if well maintained.
- Monitoring and analysis also enables efficient servicing of equipment. Service providers arrive onsite fully equipped to deal with the challenge – with pre-knowledge of potential problems, they can bring along the right spares and equipment needed to fine-tune or repair the machine.
- Energy and operational savings can be optimised with condition-based maintenance based on optimising levels of performance to meet budgets.

Condition-based maintenance approaches
For equipment at different life stages, and for owners with different HVAC priority levels, there are different condition-based maintenance models that can be applied.

- For owners of newer machines, built-in features such as performance monitoring, an

always-on connection to the cloud or Internet of Things (IoT), as well as self-identification of potential operating issues, offer a big advantage. It allows the machine to be remotely monitored, its performance to be benchmarked against a vendor database and a global peer set, standard reports to be issued and in-house maintenance teams or outsourced solution providers to be alerted immediately to errors or potential issues. This augments scheduled maintenance, adding significant value.

- For owners of older machines, specialised HVAC condition-based maintenance teams can conduct scheduled analysis, providing basic reports (e.g., regarding consistency, levels or potential contamination of oil and gas; pressure and temperature; or even vibration analysis) and helping plant owners to create maintenance schedules and strategies that improve on scheduled maintenance and break-fix efforts, and are aligned to operating requirements and budgetary constraints. For example, providing suitable planning for downtime or part replacement, or ensuring regular checks in periods of high performance.

- For owners considering making use of generic condition-based maintenance service providers – don't. HVAC equipment is complex, it requires more than a generic review.

· The future of condition-based maintenance?

Condition-based maintenance has been around for about 10 years but the reality of what can be achieved with the performance data that is being collected is only just becoming apparent. I believe that within five years' condition-based maintenance will become the norm. The functionality will be built into HVAC equipment and plant equipment will 'talk' to the building, automatically finding optimal solutions to performance issues in conjunction with other connected systems, and automatically scheduling needed maintenance.

Do you have a long-term plan to maximise your HVAC investment? The IoT, the improved ability to use available data intelligently and proven condition-based maintenance approaches make it easy to do, no matter the age or sophistication of your equipment