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acoustic innovation

Acoustic Emission Valve Monitoring in the Power Generation Industry

- Detect high pressure vavle leakage even under insulation, liquid or gas.
- Instantly check full valve closure & seating.
- Detect expensive leaks in compressed air and other gasses.

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As a matter of course, valve seats become worn and need to be refurbished. The frequency with which this needs to be done on a particular valve depends upon its operating conditions and its usage. In the case of high pressure water valves there are strong financial incentives to schedule for refurbishment those valves which are starting to leak. In order to identify such worn valve seats at the earliest opportunity, Nuclear Electric staff at Hartlepool Power Station started investigating the use of Acoustic Emission (AE) in the Spring of 1997.

It is well known that the turbulent flow of pressurised fluids escaping past a worn valve seat generates acoustic noise at both audible and ultrasonic frequencies. In high pressure systems the escaping fluid past a worn seal promotes accelerated wear and this provides a greater impetus for its early detection.

To further improve the maintenance of high pressure needle control valves the Condition Monitoring team at Hartlepool Power Station wanted a valve monitoring technique which was easy and quick to use but would give them meaningful numbers that could be logged and trended over time (as opposed to a 'listening-stick' type of instrument with a subjective headphones output). AE techniques which detect the high frequency structure borne component of acoustic noise looked promising but had not been adequately proven in this application.

To investigate the use of AE in this application, the Condition Monitoring team took spot measurements of the AE levels on eight valves over a 6 month period. To do this they used a portable Holroyd Instruments MHC instrument which provides a direct indication of the dB Level. It was soon found that some valves continued to operate at steady AE levels whilst some others rose progressively over several months as shown in Fig 1.

Naturally it was felt that those valves with a steady AE level had a stable seal and those with a rising AE level had progressive wear occurring in the valve seat. To see if this was in fact the case, AE measurements were used as the basis for selecting specific valves on which to carry out detailed testing and inspections. In general it was confirmed that those valves with increasing AE levels had valve seats which were visibly worn when stripped down. Invasive measurements showed that the valve with the degraded seat in Fig 1 for example was passing 2.5 kg per second of water when fully closed at 200 bar. Not surprisingly when a valve seat is replaced the AE level reduces as shown for a valve in Fig 2. Interestingly the AE level in Fig 2 soon starts to rise again, presumably indicating a rapid recurrence of the problem.

On some valves however there was a slight complication in that the progressive wear in the seat of a valve (which was not being monitored as part of the research) was detected and mis-ascribed to a nearby valve which was being monitored. This experience brought home the importance of monitoring the whole of this part of the plant in order to get an AE fingerprint of all the valves.

FIG 1 - AE from stable and degrading valve seals

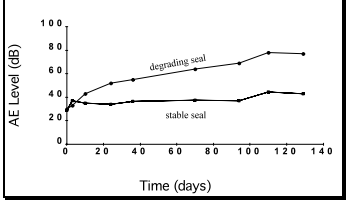
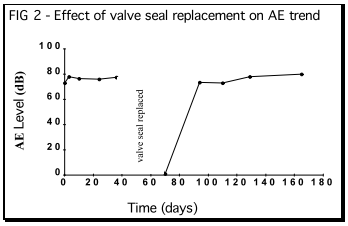


FIG 2 - Effect of valve seal replacement on AE trend



The time had come to start applying the AE method in a systematic way on a broader front. To do this consideration had to be given to how the measurements would be logged and analysed routinely in the quickest and lowest cost way. Two approaches were identified :

- Use the MHC-Memo which has a built in route mode data logger and is supplied complete with Win 3.1 trending and analysis software.
- Use Holroyd sensors to provide dB Level characterisations, feed these directly into their existing vibration data logger and analyse them using their existing analysis software.

Since trained inspectors with vibration data logging equipment already existed at Hartlepool Power Station, it was clear that Option 2 provided the lowest cost approach. (Option 1 would be best for those companies who do not already have such specialised equipment available). Now they are starting to reap the rewards of their efforts. AE measurements are giving them a new insight into the condition of the seals on their high pressure valves. This knowledge combined with prompt refurbishment enables energy losses and manpower to be minimised and hence real financial savings to be made.

DATA COURTESY OF NUCLEAR ELECTRIC, HARTLEPOOL POWER STATION

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To find out more about the Holroyd Instruments range of industrial AE products can provide an easier, lower cost, solution to your shop floor monitoring phone contact us at :

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