

Transducers help guarantee performance

Transducers from **Sensor Technology** are playing a vital role in the testing of valve actuators which operate in some of the world's most demanding and critical applications

Rotork is a world leading manufacturer of electric, pneumatic and hydraulic valve actuators and associated control systems, valve gearboxes and valve accessories.

Its capabilities encompass actuators and control systems for new plants, plant extensions and upgrades, together with life-of-plant support.

"If you look at something like an oil line, then any failure of the valve actuator could potentially be costing millions of dollars a day," explains chief development engineer Geoff Beeho. "We have to be able to guarantee the performance of the actuators in the most demanding conditions, so testing is vital. TorqSense torque transducers from Sensor Technology are a key element of our test rigs."

Businesses around the world rely on Rotork actuators in applications as diverse as power generation, water and sewage, industrial processes, subsea, marine, HVAC, incinerators and cement plants. Common features in many of these applications are challenging environmental conditions, extremes of temperatures and high costs associated with any downtime. Because of this, absolute reliability of the valve actuators is vital.

Rotork Controls designs custom actuator designs built around motorised gearboxes, using non-standard open frame motors. "We use a variety of motors depending on the particular application, including DC motors, single-phase motors and three-phase motors, but we don't rely on off-the-shelf products. Instead, we use open frame motors that we integrate directly into our own systems."

Demanding applications

"Performance testing is very important," continues Beeho. "The duty cycle is atypical - our motors are not in continuous use, only running intermittently and for short period. What is important to us is the short term ratings and this data isn't always readily available. We must have performance data that will tell us exactly what we need to know about the motors in these most demanding applications."

Rotork Controls designed its own rig to test the motors with Sensor Technology TorqSense transducers at its heart. "We needed non-contact



torque sensors in the rig. The early design used magnetically coupled torque sensors but we were never completely happy with these. So when we upgraded the rig to be able to perform a wider range of tests, we took the opportunity to look around the market and found TorqSense transducers."

SAW principles

These non-contact devices operate using surface acoustic wave (SAW) principles. Surface waves are produced by passing an alternating voltage across the terminals of two interleaved comb-shaped arrays laid onto one end of a piezoelectric substrate. A receiving array at the other end of the transducer converts the wave into an electric signal.

The frequency is dependent upon the spacing of the teeth in the array and as the direction of wave propagation is at right angles to the teeth, any change in its length alters the spacing of the teeth and hence the operating frequency. Tension in the transducer reduces the operating frequency while compression increases it.

To measure the torque in a rotating shaft, two saw sensors are bonded to a shaft at 45 degrees to the axis of rotation. When the shaft is subjected to torque, a signal is produced which is transmitted to a stationary pick up via a capacitive couple comprising two discs, one of which rotates with the shaft, the other being static.

"The TorqSense transducers imme-

diately struck us as being a much more robust solution, better suited to handling the torques we were subjecting them to," comments Beeho.

The common practices of over-specifying a motor that guarantee reliable operation in standard applications simply don't apply in valve actuation.

"Motor sizing is critical," says Beeho. "If we put in a motor that is too big, then we can risk damaging the valve. We can use motors that appear to be under-rated but because our duty cycle is so short we can get better performance from the motor. But the performance data to support this sort of motor use isn't always available or reliable, so we need to perform our own tests. We also need to know how our motors will handle extremes of temperature in given applications so that reliability is never compromised. TorqSense transducers allow us to make all the required tests."

An advantage of the TorqSense transducers in the Rotork test rig is that they provide both analogue and digital outputs.

Analogue and digital outputs

"This has proved to be a real bonus," says Beeho. "Not only can we use one output to check the calibration of the other, but it also means we have the flexibility to use both outputs performing different tests. For example, we might use the analogue output to feed torque and speed data into the power analyser during a performance test and then use the digital output for a temperature test. Here, we run the motor for 15 minutes at constant torque and see how hot it gets. The output from the TorqSense transducer allows us to close the loop so that we can keep the torque constant."

In any application, the fundamental considerations are the actuator's ability to overcome the resistive forces of the valve and the dynamic performance requirements to enable the valve to adequately meet the process demands. With its comprehensive testing procedures built around TorqSense transducers, Rotork Controls has the confidence that its electrically operated valve actuators will always meet the application requirements.

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