ELIMINATING TROUBLESOME TUBING

Mike Sommerlot, Emerson Automation Solutions, says valve actuator instrument tubing can be subject to abuse, and damage from vibration and environmental extremes, which is why the company's 667 size i actuators now eliminate this problematic element

Valve actuator instrument tubing (Figure 1) can have a tough life. It can be damaged by rough handling during shipping or transport. Workers tend to lean ladders against it, stand on it, pick up valves by grabbing onto the tubing, overtighten connections and hang onto it for support.

Excessive vibration can damage a control valve's actuator tubing by causing fatigue damage at or near the nut/ferrule location, resulting in leakage. Leakage causes pressure to be lost, and without pressure in the tubing, the actuator cannot be controlled. Leakage also requires increased supply pressure, adding to operational costs.

Valve actuator tubing that is exposed to the elements can freeze in cold temperatures at low spots that collect condensation, thus blocking pressure signals. Freezing can also cause cracks and leaks.

As you may know, the valve actuator controls the position of a valve plug. Valve actuators can be powered by hydraulics, pneumatics or electric motors. In a spring and diaphragm pneumatic actuator, compressed air acting upon a rubber diaphragm moves the valve plug/stem assembly. A pneumatic actuator can be spring-closed or spring-opened, with air pressure overcoming the spring to provide movement. A "double acting" actuator uses air applied to different actuator ports to move the valve in the opening or closing direction. A central compressed air system is usually the source of the clean, dry, compressed air needed for pneumatic actuators.

The actuator is usually paired with a positioner. The positioner is connected to a control system, which sends the actuator commands to open, close or adjust the position of the valve plug via a 4-20mA signal, fieldbus signal or wireless signal.

For example, a digital positioner takes a control command from a 4-20mA HART connection and adjusts the pneumatic signal to the actuator diaphragm from 0 to 60 psig. The pneumatic signal travels from the positioner to the actuator diaphragm via tubing.

Emerson conducted market research, including a customer analysis along with surveys to our sales offices and service sector, in order to identify what issues customers bring up most often with respect to spring and diaphragm actuation. Along with these activities, we reviewed our Quality Assurance archive for a three-year period to understand the root-causes and frequency of actuation-related warranty claims.

We determined that the two biggest problems for customers were tubing/fitting issues and actuators being assembled incorrectly, often directly related to tubing and fittings. We also identified that end users had two priorities with respect to valve actuation: increased reliability and robustness, and reduced assembly complexity.

A solution to both of these top-two identified issues was eliminating external tubing. Several valve manufacturers have done so through various solutions. Emerson, for example, created an internal air passage in the actuator yoke to eliminate external tubing.

Figure 1: External instrument tubing on a control valve can be easily damaged by improper use – such as picking up the valve by the tubing line

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Figure 2: A standard 667 pneumatic actuator (left) has external actuator tubing running from the positioner to the diaphragm. Emerson's Fisher Model 667 size i actuator (right) replaces this tubing with an internal air passage

Emerson cast an internal air passage into the yoke of a Model 667 size i pneumatic actuator (Figure 2). This eliminates the need for external tubing from Emerson's Fisher FIELDVUE digital positioner to the actuator diaphragm casing. This configuration eliminates potential leak paths that can develop at tubing and fitting connections, as well as reduces the possibility of damage to tubing through improper use.

Now that the positioner is mounted integrally to the cast iron yoke boss – instead of the former approach of bolting to a mounting bracket, then to the yoke boss – this configuration is much more robust and the total assembly becomes more resistant to vibration.

The internal air passage also simplifies installation. The Model 667 size i allows the FIELDVUE positioner to mount using 50% fewer mounting parts, reducing installation time and expense. Also, there is no tubing to bend or cut, no ferrules or nuts to attach, and no chance of losing or mismatching those parts.

Eliminating external tubing is a significant improvement in actuator technology. By eliminating tubing, valve actuators become more reliable, less prone to vibration problems, and immune to damage from misuse and inclement weather.

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