

# 10 tips for Diagnosing control valve problems

To maximize the utility of diagnostic equipment used in chemical processing, technicians must stretch their knowledge of control valves and related diagnostic equipment that keeps tabs on valve health and safety. Too often, maintenance data isn't used as effectively as it could be, and institutionalized half-measures result in lost money, time, safety and efficiency. To make the most of valve diagnostic data, technicians must understand the ways that data can be lost, ignored or misused.

The advanced technology represented by online diagnostics has been around for 15 to 20 years, and is only recently moving out of its infancy into a mature role as an industry standard. In the past, plants were forced to use manual tests to identify a valve's performance complications. Diagnostics were developed as a way to cut expenses by eliminating the need to halt production to extract each valve for testing.

The type of valve diagnostics to be performed determines cost savings. Plants might be unaware of the

diagnostics equipment for testing a variety of valves. It's possible to diagnose problems in control valves and rotary valves (with or without instrumentation) and any valve having an air-operated actuator (spring return or double acting) using either transducers for different pressure ranges or preload with additional supplies. These techniques can be performed on valves that lack instrumentation. Using them allows you to examine spring ranges, valve performance, friction, seat load and actuator leaks.

Never make the mistake of assuming a valve is functional just because it's new. When a valve first arrives, test it before installing it. This way, deficient valves can be returned without setup effort or wasting time installing them. Also, making certain that valves placed in service are completely healthy is important. Once they're set up and tested, document their properly installed functionality.

But, the first step in achieving effective valve diagnostics is to train personnel in control valves anatomy function.

Technicians who don't understand a valve's function can't be expected to make the valve operate consistently at peak performance. Then follow the 10 tips for diagnosing control valve problems.

1. Keep good records  
This basic truth is vital to every aspect of your valve wellness program. Record every change and repair as well as details about the valve's history and current performance. During a turnaround, provide copies of these valve records and performance standards to your repair vendors. This ensures that everyone works from the same page without reams of unnecessary paperwork. When repairs are completed, test the valve for satisfactory performance and document the results before reinstalling the unit. Update the maintenance history and make sure the repair shop provides its test data to the plant for archiving.

2. Make obvious repairs up front  
Before doing anything else, repair the obvious problems such as leaky tubing and gauges. Then, run diagnostics to measure three pressure readings: transducer pressures, actuator pressures and supply pressures. Cylinder actuators (consider these “double acting” actuators) are a different configuration, comprised of upper and lower cylinder pressures.

3. Test initial controlling devices  
This is the device that receives the first indication of change or problems in the process flow. Examples include transducers, temperature controllers, pressure controllers and level controllers. Locating and testing these first may save you time, money and unnecessary plant shutdowns.

If you simply bypass the transducer, you risk overlooking the true problem with the control valve. If the transducer is remotely mounted, extend test leads to reach them.

4. Check positioner points  
Positioners change the pneumatic pressure to operate an actuator and to overcome friction and pressure imbalance. Positioners put distance between controllers and control valves and increase the speed of a control valve’s response to changes. It’s imperative that positioners

function correctly, especially at high pressures or for complicated chemical processes.

Accessing all positioner points is critical when measuring transducer, actuator and overall valve performance. To troubleshoot a valve, put the valve in its fail position, disconnect the positioner and verify that the valve’s handwheel is fully backed out. Next, check the positioner and controller for physical damage. Regularly testing properly calibrated diagnostic equipment against functional valves is essential for all of these procedures.

5. Take accurate travel measurements  
Ensure that travel measuring centers are properly set and positioned. Diagnostics measure the travel of a control valve with a travel transducer. On globe valves, it’s important to use the right scale. It’s also important that the correct travel variables are used in determining the length of travel. Ensuring that the correct configuration is vertical will have a major effect on the testing results. There are to be no angles or slacks, which can result in false measurements. The travel transducer must be placed directly on the valve stem, not on the positioner, linkage or actuator. Direct placement on the stem effectively determines how

far the valve has traveled. The ultimate objective is to find out what the valve is doing.

6. Use correct inputs  
Ensure that the proper control valve parameters are input into diagnostic machinery. Diagnostics look at valve performance while keeping in mind manufacturer guidelines and specifications. Diagnostics equipment can’t tell if a fluid is flowing through the valve, but it can determine if a valve has the wrong spring or settings, if the diaphragm settings are correct, if the seals are bad, and if the positioner is producing problems arising from wrong settings or improper maintenance.

In most cases, valves don’t need to be pulled offline and replaced. The problem may instead be with a transducer and positioner. Diagnostics identify specific problems and evaluate control valve parameters, including transducer performance, positioner performance and actuator performance. Additionally, diagnostics can assess spring rates and bench sets, allowing for intelligent calibration.

Diagnostics also can evaluate the valve body, ascertaining stem friction, packing friction and the seat load. While many plant employees aren’t trained to

interpret this data, those who know how to tweak control valve performance to conform to manufacturer guidelines, industry standards and specific process requirements are as valuable as having an in-house repair team.

The diagnostics equipment makes its evaluation based on the variables you input. For example, effective actuator area, the action of a valve (air to open, or air to close), stem diameter, packing configuration and type, seat diameter, instrumentation action and characteristics are key in obtaining a correct evaluation. The last variable needed is the travel distance or rotation.

- Do an as-found test  
This diagnostic test determines how well the valve is performing in its current condition. It correlates the transducer's input and output signals. It evaluates the positioner's input versus the actuator's applied air pressures. Taking all this into consideration helps determine overall valve performance. Evaluating the data based on manufacturers' standards determines what repairs are needed.
- Make control valve repairs  
Performing diagnostics enables you to make necessary replacements and repairs in the field, rather than on the bench. This includes work on instrumentation (positioner,

transducer, controller or replacement), actuator (diaphragm, seals), body subassembly (packing, trim components), and adjusting bench set, as well as making necessary implementation repairs.

- Perform final diagnostics  
After you make the repairs, always perform final calibration testing on the valve based on OEM standards and process conditions. Baseline diagnostic testing evaluates control valves inline, and dynamic testing such as sensitivity and deadband testing further uncovers what's going on inside a dysfunctional, or less than optimal valve.
- Analyze trends  
Take proactive steps toward efficiency by correcting problems early. Put your diagnostic history of valve repair into a database or diagnostic package for future use. This ensures that valves aren't repaired unnecessarily and it permits spotting future problems more easily. If the same problems crop up consistently, such records are the only way to spot patterns and diagnose illness.

If vendors and repair shops receive valves with as-found test results, detailed technical notes and plant performance standards, the expectations for repairs are clearly defined and efforts can focus on a targeted, cost-effective solution to a documented performance program. Providing detailed records minimizes the chance of making mistakes.

### Cash in on efficiency

Ideally, the objective for your valve wellness program should be efficiency. Correcting problems early and using diagnostics at every opportunity not only saves money and catches a greater percentage of malfunctions, it also saves time by eliminating the need to shut down an entire plant to search blindly for one faulty valve.

The skills of maintenance technicians are maximized when they have a consistent, coherent plan of regular diagnostic maintenance instead of waiting to fix something after it goes bad. As many as 60% of air-operated control valves have serious performance problems most are discoverable only through diagnostics. Many defects can be repaired without removing the valve from the line. Carefully maintained, tuned and calibrated valves produce more uptime and product. Good documentation and records ensure that valve problems can be isolated faster.

Taken all together, effective valve maintenance can be achieved by strategically applying intelligent, regular diagnostic procedures and keeping good records of trials, successes and failures. While contingencies should always be in place, using benchmarks and diagnostics can save countless hours and minimize stress, while maximizing efficiency and profits.

*Author Mr David W. Douglas is the president of Paradigm Services LP , Texas,USA*



