

Testing, Testing?

Maintaining Improved Process Safety and Plant Availability

Reduced Inspections – A Partial Stroke Test (PST) at defined intervals can effectively prevent malfunctions. A successful test indicates that the valve performance is OK and that any corrosion or encrustation has been removed. The valve seat and plug is free again and it is ready for action in an emergency. The solenoid valves, which exhaust the air from the valve in an emergency, can get stuck too, as they are also held in the open position nearly all of the time. This means that the solenoid valves themselves also require testing in order to ensure that they can provide proper operation and safety in an emergency situation.

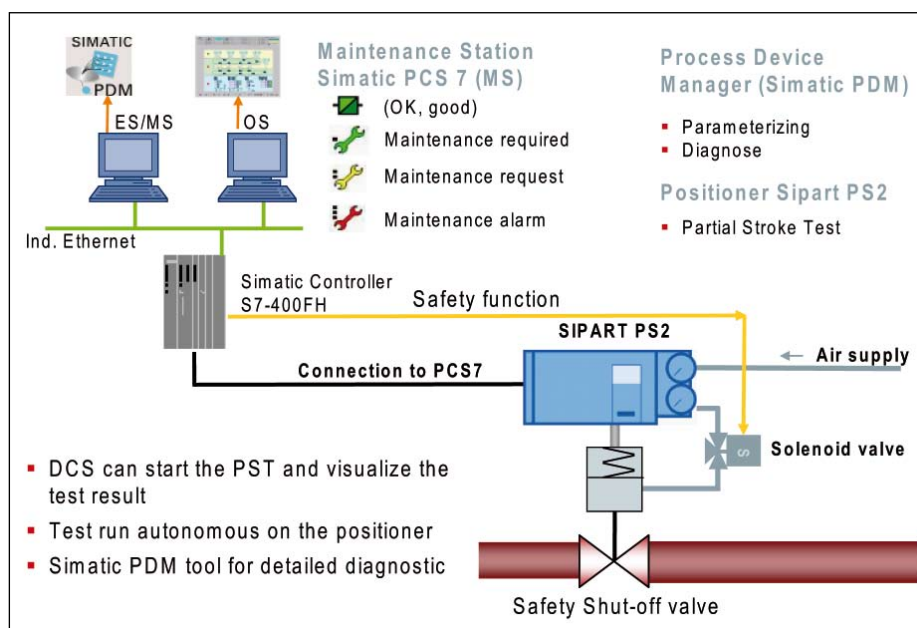
The importance of automated functional safety in process plants has grown over the past few years. Requirements for reliability of safety equipment result from risk analyses during the plant planning phase and are subdivided into the three Safety Integrity Levels (SIL 1 to SIL 3). The levels are assigned on the basis of the requirements with regard to Hardware Fault Tolerance (HFT) and Probability of Failure on Demand (PFD). The PFD calculations are based on the failure rate of devices and their test intervals. Sensors and valves are subjected to special stress due to their contact with process fluids. To maintain their PFD value, they must be checked at regular intervals, usually once annually. Otherwise, the PFD value rises and it is no longer possible to achieve the specified safety level. In safety chains, valves

are the components with the worst PFD values because, as simple shut-off devices, they remain, during normal operation, in the same position and are subject to constant contact with the fluid that is flowing through them. Many of these safety shutdown valves will never be operated during normal plant operation, so in the course of time the stiction will increase as a result of corrosion or a build-up of deposits on the shaft and the internal fittings. The breakaway torque for rotary valves and the breakaway force for linear valves can be multiplied. This increases the risk that the safety shutdown valve fails to operate, when required to do so in an emergency situation. Until now, checking and verification of the functionality of these valves was costly: The safety shut-off valves had to be subjected to an

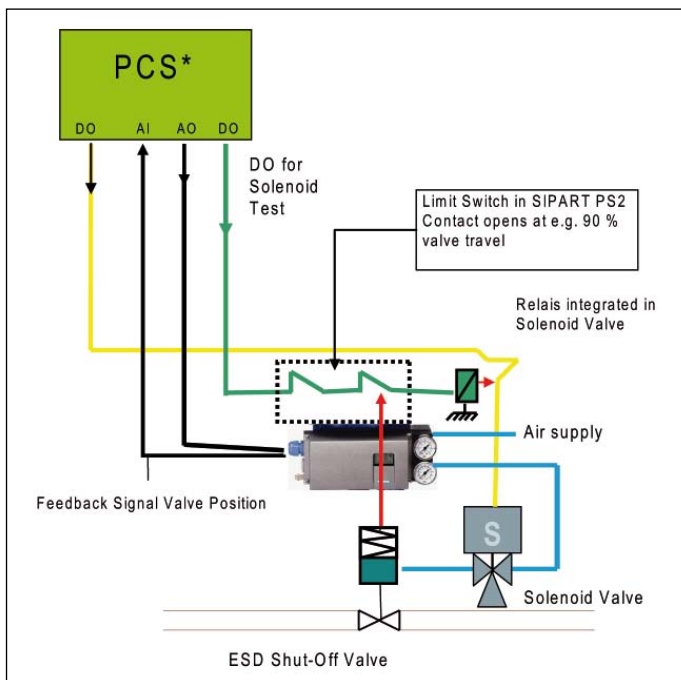
annual inspection on site; this often meant that the valve had to be removed from the plant for inspection.

Simplifying Inspection

To avoid removing valves and testing them in a workshop, an online testing method was required for checking the valves without a plant shut down: A very useful valve test procedure that can be performed online during normal operation is the PST. It supports functional testing of valves without the need to remove them from the plant. With the PST process, the respective valve is moved from 5 to 15% of valve stroke with the process operational. The procedure supports online diagnosis of the actuators and reduces the probability of PFD. This allows the interval between



Safety shut-off valve with positioner Sipart PS2



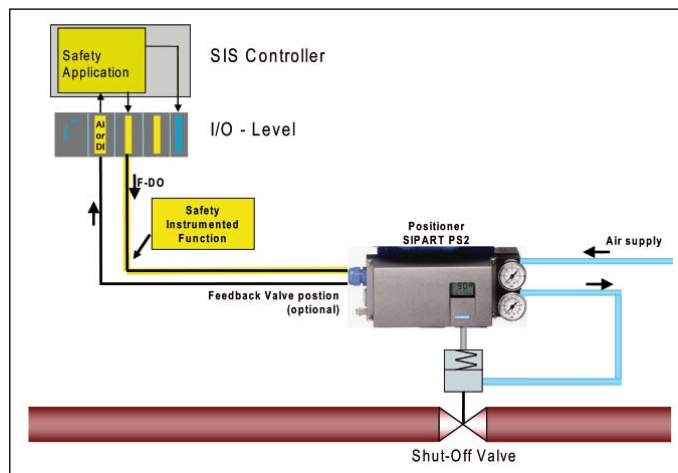
Stroke limiting with Solenoid Valve Test by means of positioner and special solenoid valve (with switch device)

testing to be extended and the outlay and costs to be reduced due to the reduction in maintenance work and downtime. This procedure does not affect normal operation because the disturbance to the process is so small that it is negligible, but it does prove that the valve can move and there is another positive effect: Any deposit build-up is removed. The valve is then “free” again and the PFD value will reduce towards its original level. The intelligent positioner Sipart PS2 already provides comprehensive valve diagnostics. It reliably detects sluggishness, pneumatic leakages, wear of valve cones or seats, stick slip friction, etc. The PST function is also integrated into the positioner. It can be triggered locally, using a discrete signal, or remotely via the Simatic Process Device Manager (PDM) or also cyclically. The saved reference response time for the valve is compared to the current response time. A maintenance requirement is signalled in a 3-level alarm concept, in accordance with Namur recommendation NE107, clearly and understandably on the local display or in the process control system. Thanks to extended diagnostic capabilities, the positioner supplies a

high-resolution PST response curve which can be visualized using Simatic PDM and compared with a reference curve, stored earlier.

Solid Solenoid Functioning Ensured

Normally the action of venting or exhausting of the safety shut-off valves is controlled using solenoid valves in the same manner as many other Open/Close block valves. Since these solenoid valves, like the valves themselves, are only used in an emergency, they tend to “stick”, i.e. their ability to function can fail following a sufficient time in a static state. They must therefore also be subjected to a function test. This can, however, be problematic because the solenoid valves do not have feedback functionality. The response of the safety shutdown valve, whose function was verified beforehand by a PST, is therefore used and its movement is signalled to the control system via the feedback function of the positioner. Due to delays, such as the cycle time of the safety and control system, the re-opening command for the solenoid valve frequently arrives too late, that is when the safety shut-off valve has already closed too far and a



The compact solution: The “Intelligent Solenoid Valve” performs both in one device – Partial Stroke Test and Safety Shut-Off Function

process shutdown occurs. To prevent this situation from occurring, three possible solutions with the Sipart PS2 positioner from Siemens can be provided:

1. Solenoid Valve Testing with Circuit Breaking Facility: A discrete command signal induces a switching device (e.g. relay) in the solenoid valve circuit to switch and thus interrupts the current flow. (This special solenoid valve will be available soon). The actuator is depressurized and the safety shut-off valve moves in the direction required during a safety shutdown. It only travels until a contact in the positioner interrupts the activation circuit and then switches the relay in the solenoid valve circuit, again without delay, so that the solenoid valve opens again and the actuator re-pressurizes. Immediate interruption is possible due to the fact that the contact is mechanically linked directly to the position feedback shaft of the positioner. The safety shut-off valve permanently swings to and fro to the adjusted test stroke value. This ensures that the control or safety system has sufficient time to detect this procedure.
2. Low cost electromechanical test version without electronics.
3. The compact Intelligent Solenoid Valve: One device instead of two. The intelli-

gent positioner Sipart PS2 is certified in accordance with IEC 61511 to SIL 2 for reliably depressurizing. It can therefore replace the solenoid valve with a supply voltage of 24 V. Since it is equipped with all the available diagnostic functions, it can also perform a partial stroke test at regular intervals. An additional device does not have to be mounted on the actuator, because Sipart PS2 functions both as solenoid valve and PST execution device.

Summary

The test interval of safety shut down valves and their controlling solenoid valves can be extended, if reasonable combinations of PSTs and solenoid valve tests are carried out. Thus, the reliability of the whole emergency shutdown assembly can be significantly increased. The Sipart PS2 positioners from Siemens offer solutions that can be implemented with a special solenoid valve with an integrated switch device (available soon) as well as by using the positioner as an “intelligent solenoid valve”.

► Contact:
Karin Kaljumäe
Re : IA&DT CC 149/09
Siemens AG
Fürth, Germany
Fax: +49 (0) 911 978 3321
karin.kaljumae@siemens.com
www.siemens.com