

Self Testing Safety System STSS

For safety-related Valve Systems

Technical Information

RE 08121

Edition: 2013-02



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STSS, an intelligent Monitoring System – functional Safety on the highest Level

Introduction

Many processes in the chemical engineering take place under high temperatures and pressures. That includes the generation of electricity in power plants, processes in the chemical industry, including the media transport of oil, gas and others. To secure the necessary technical processes and avoid all negative effects for people, the environment and technology due to external interference and accidents in the plant; shut-off-, control- and safety valves are installed. These valves must operate reliably in a consistent manner. This reliability is primarily endangered because during long times of non-actuation of safety valves, no oil exchange takes place in the pipes and components. Possible outcomes of this “Non-Actuation” is that the oil can gum by a chemical conversion into a sticky or solid substance, or the silting effect (seizing of the valve spool by the deposition of dirt particles between the valve spool and the housing) can occur and potentially prevent the safety function of the hydraulic components in the event of an accident. As an additional consequence, the execution the expected function cannot be activated. The Self-Testing Safety System STSS - an intelligent monitoring system for safety related applications – is new developed to achieve the goal of a continuous operational reliability. It is independent of the vendor diversity in plant use, can run any operating cylinder, test the system and prevent the resin from forming and the silting effect by regular exchange of oil without interruption or interference of the plant operation.

System Description (see diagram)

As the main components, two active switching logic elements with associated pilot valve are placed on a logic block. When a control valve block is not installed, the logic block is connected directly to P and T. The system also includes a high-resolution measuring system, which is integrated in the fitting-actuating cylinder, and a programmable controller, which triggers the entire test cycle, controls, monitors, records and archives, without operation interference of the application.

Applications

- ▶ Power plant technology
- ▶ Chemical and petrochemical plants
- ▶ Gas transfer stations

Self-test Functions according to Operation Mode

The self-test procedure (see table) of the STSS is selected by the operation mode that applies for the actuating cylinder. You will find, for example, the valve in the “closed loop mode” which is by far the most common mode of operation. At the beginning of the test routine, the hydraulic lines leading to the control valve are shut off by a seat valve.

The actuating piston of the cylinder is fixed in its position hydraulically. The next step records the status of all the switching valves, including the position of the piston rod. By alternately switching the logic elements, it is registered whether the output of the switching control signals trigger a shift in the process valves.

As a consequence of decompression in the hydraulic lines and cylinder chambers, changes in the position of the piston rod occur within the inherent elasticity of the system in the micrometer range. Thus, no real movements are performed: the system is loaded less, but not opened. The analysis of monitoring signals of the logic elements provide, in combination with the changes in position of the piston rod, unambiguous evidence for the correct functioning of the STSS in its combination with the actuating cylinder.

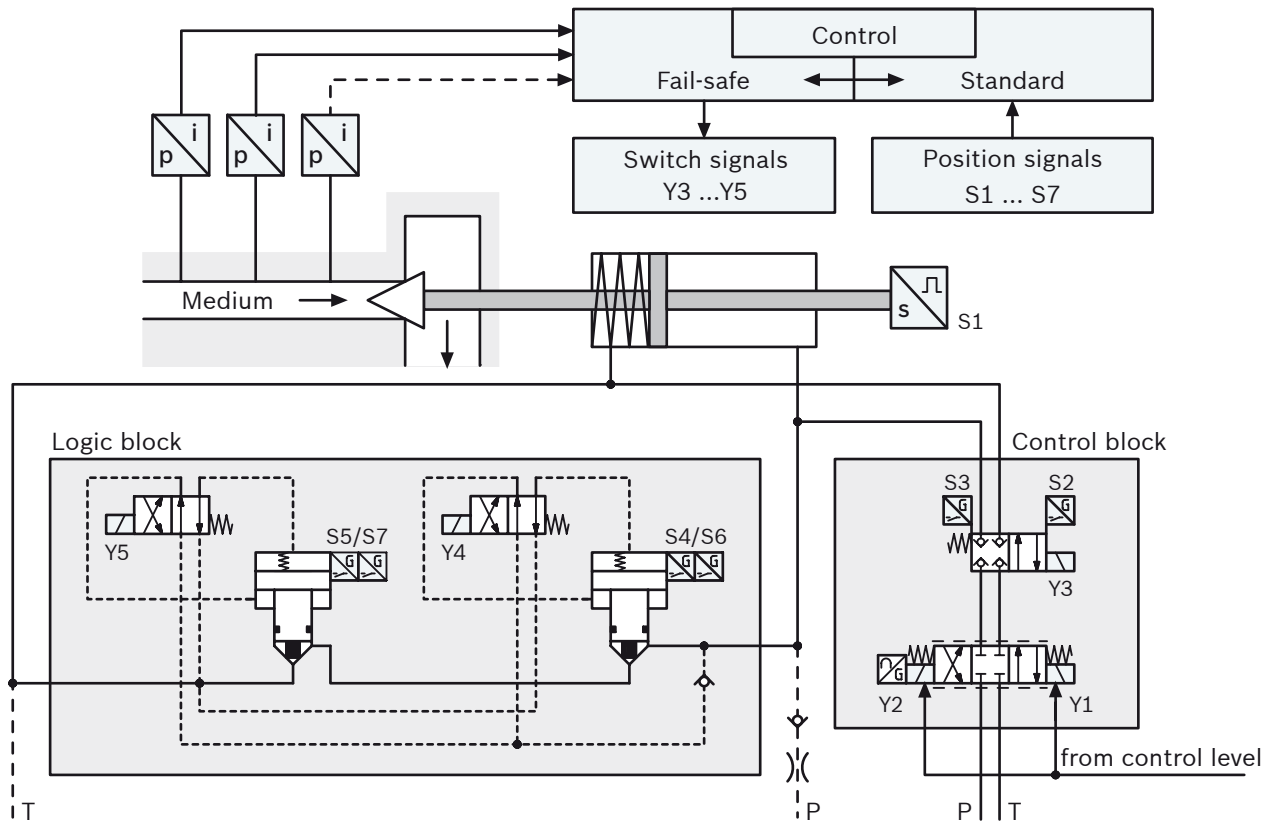
Features

- ▶ Using standard components
- ▶ Continuous seat valve technology
- ▶ Fail-safe electronics
- ▶ SIL2/3 designs (depending on number of logic blocks)
- ▶ Highest availability
(depending on number of logic blocks/electronics)

Advantages

- ▶ STSS unit can also be mounted on the drive directly
- ▶ Plant neutral used
- ▶ Optional components exchange during operation
- ▶ Test processes without plant stop possible
- ▶ Regular oil exchange prevents resinification and silting
- ▶ Deposition of suspended substances is conditioned by design and functionality largely avoided by self-purification
- ▶ 100% online status diagnosis with status message
- ▶ Details/signals via service, operation and maintenance as text display

Diagram: Safety Valve



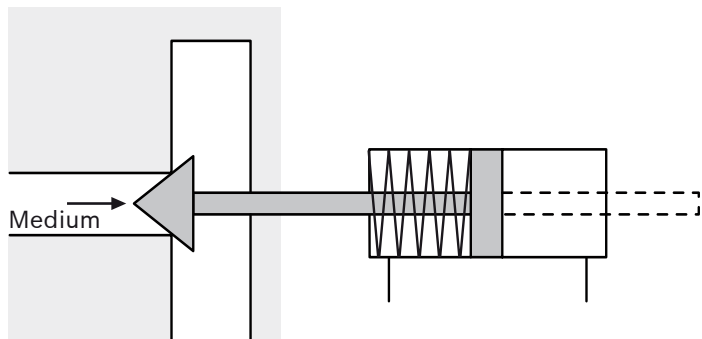
Self-test Functions according to Operation Mode

System status	Closed operation					Controlled operation					Safety function					Service												
	Switch signals					Position signals		Switch signals					Position signals		Switch signals					Position signals								
	Y1	Y2	Y3	Y4	Y5	S1	S2...S7	Y1	Y2	Y3	Y4	Y5	S1	S2...S7	Y1	Y2	Y3	Y4	Y5	S1	S2...S7	Y1	Y2	Y3	Y4	Y5	S1	S2...S7
Armature closed	X	-	X	X	X	-	-	X	-	X	X	X	-	-	X	-	X	X	X	-	-	X	-	X	X	X	-	-
Armature open																						-	X	X	X	X	-	-
Armature close																						X	-	X	X	X	-	-
Armature in control								X	X	X	X	X																
Cylinder lines shut off	X	-	-	X	X	-	-								-	-	-	X	X	-	-							
Status recording	X	-	-	X	X	X	X	X	X	X	X	X	-	X														
Left logic valve open	X	-	-	X	-	-	-	X	X	X	X	-	-	-														
Status recording	X	-	-	X	-	X	X	X	X	X	X	-	-	X														
Left logic valve close	X	-	-	X	X	-	-	X	X	X	X	X	-	-														
Status recording	X	-	-	X	X	-	X	X	X	X	X	X	-	X														
Right logic valve open	X	-	-	-	X	-	-	X	X	X	-	X	-	-														
Status recording	X	-	-	-	X	-	X	X	X	X	-	X	-	X														
Right logic valve close	X	-	-	X	X	-	-	X	X	X	X	X	-	-														
Status recording	X	-	-	X	X	X	X	X	X	X	X	X	-	X														
Both logic valves open															-	-	-	-	-	-	-							
Both logic valves close															-	-	-	X	X	-	-							
Cylinder lines open	X	-	X	X	X	-	-								X	-	X	X	X	-	-							
Armature closed	X	-	X	X	X	-	-	X	-	X	X	X	-	-	X	-	X	X	X	-	-	X	-	X	X	X	-	-

X ... Signal active - ... Signal inactive □ ... non-existent

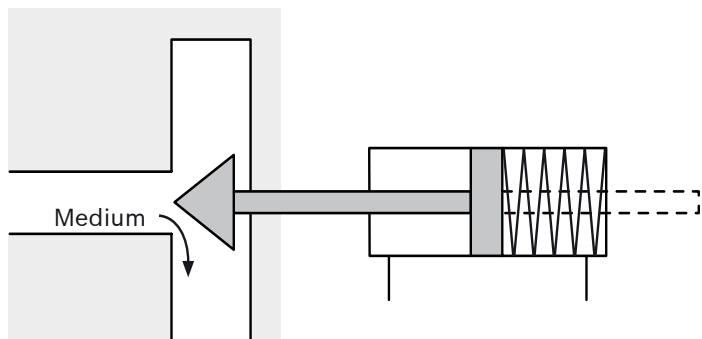
Safety-related Applications (examples)

Safety Valve – closed in normal Operation



- ▶ Double or single rod cylinder with (and without) spring return
- ▶ Close: hydraulically against spring force
- ▶ Open: with medium pressure, spring-supported
- ▶ Control or switching function superimposed

Trip Valve – open in normal Operation



- ▶ Double or single rod cylinder with (and without) spring return
- ▶ Close: against medium pressure, spring-supported
- ▶ Open: hydraulically against spring force
- ▶ Control or switching function superimposed

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