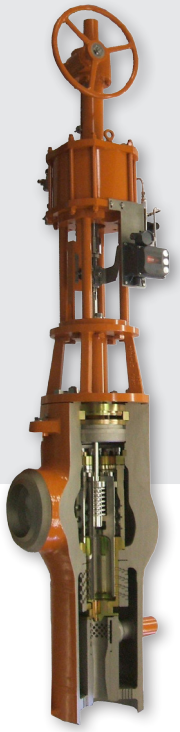
SPX®



COPES-VULCAN

DSCV-SA Valve

A Modern Solution to Steam Conditioning

Finding innovative ways to help the world meet its ever growing demand for power is a key focus for SPX. As a multi-industry Fortune 500 manufacturer, we provide creative solutions that serve global energy markets in a myriad of ways. Our ideas are helping to build more efficient new power plants and renovate older existing facilities. And, at thousands of power stations in more than 60 countries across continents, our evaporative and dry cooling solutions are hard at work. We also supply a wide range of components — from air preheaters to filter systems for nuclear, coal-fired, combined cycle, solar, thermal and geothermal power plants.

Copes-Vulcan has been providing control valves and desuperheaters for the power, process and nuclear industries since 1903. SPX provides a wide range of valves for the control of pressure, temperature and flow-induced noise in all types of power plants. Products include severe service and general service control valves, variable orifice desuperheaters, Raven™ trim and steam-conditioning valves and nuclear control valves, as well as custom designed speciality valves. Copes-Vulcan is recognized worldwide as a leader in valves for severe and critical service applications. Our strength lies in our ability to provide innovative valve solutions for our customers' application needs.

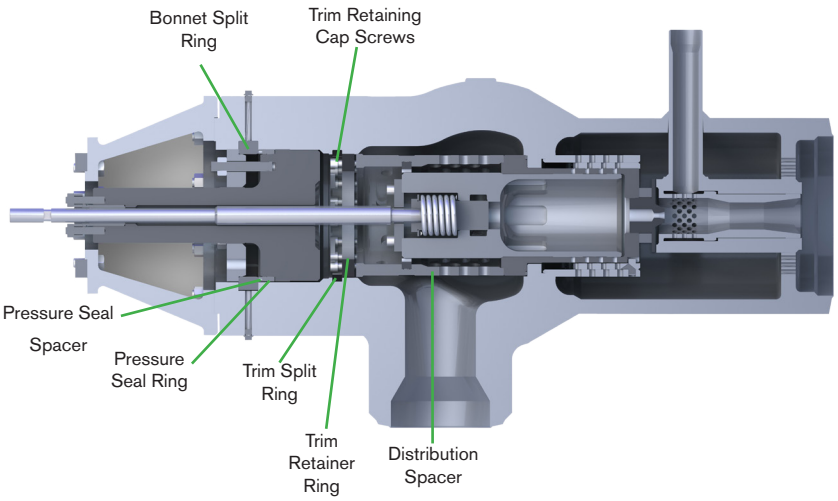
The DSCV-SA valve: a modern solution to steam conditioning

Mark Wheat, Business Unit Manager for SPX, outlines how technical innovation and leading edge design produced the world's leading steam turbine bypass valve

The DSCV-SA (Direct Steam Converting Valve - Steam Atomization) from SPX is designed for unprecedented operational reliability and eliminates potential risks associated with substandard designs during plant start-up, shutdown and turbine trips. As a result, the DSCV-SA is at the forefront of modern thermodynamic engineering in steam conditioning.

Key to the DSCV-SA's performance are a number of unique technical innovations developed by SPX following extensive consultation with customers in the power generation sector.

The first of these unique innovations is high-pressure trim balancing. Unlike conventional turbine by-pass valves, the DSCV-SA is designed to use high-pressure balance rather than low-pressure balance. This eliminates risk of wear, damage or breakage relating to piston rings and balancing systems, which are a major problem with traditional valves.



The DSCV-SA turbine bypass valve has evolved over many years to be at the fore-front of today's thermodynamic engineering in steam conditioning.

When an open command signal is received, the DSCV-SA actuator retracts and the pilot plug is the first to open. This allows P1 steam to flood through the large pilot plug port to the underside of the main plug which in turn balances it and reduces the actuation thrusts required.

In traditional low-pressure or P2 balancing designs, auxiliary balancing seals such as piston rings and close tolerance sealing surfaces are needed to prevent the high-pressure steam unbalancing the trim. In operation, if these seals or surfaces become worn or damaged, it can unbalance the trim and stem loads can fluctuate dramatically causing the valve to oscillate violently or not open on command.

When the DSCV-SA pilot plug is open, high-pressure inlet steam floods the underside of the main plug and the steam atomizing unit (see the following information on Steam Atomization) operates in preparation of the incoming cooling water from the water control valve. The pilot plug shoulder engages with the underside of the tandem cap of the main plug which then starts to lift and the main seat opens.

As the main plug opens, steam first enters the valve via a heavy duty distribution spacer. The steam passes through the spacer by means of numerous holes evenly positioned around the circumference. This heavy duty distribution spacer is specifically designed to negate any upstream pipework-induced flow disturbance being communicated to the main plug. This is important because long radius bends or isolation valves can be fitted directly to the valve inlet to minimize installation space. The main plug is fully guided by the cage and the E-A Ring contained within the spacer to ensure complete plug stability through full travel.

After the inlet steam has passed through the distribution spacer, it then travels through the main seat area to the underside of the main plug via large feed ports. With the main plug lifted, the pressure reducing ports of the cage now open to allow the steam to be pressure reduced in a controlled manner through the cage. As the main plug opens further, more pressure reducing ports are exposed and the steam flow rate increases.

Another unique innovation associated with the DSCV-SA is steam atomization combined with a converging/diverging venturi section for heat transfer. Steam atomization is a technology that has significant benefits over mechanically spraying the cooling water via nozzles.

Traditional mechanical spray nozzles - even spring-loaded types - are limited in their turndown. This is because the water atomization and spray pattern degrade as the water flow rate and available pressure differential reduces. As the water demand reduces, the spray water control valve closes and the spray valve trim absorbs the water pressure differential leaving little pressure differential for the spray nozzles. This lack of pressure differential at the spray nozzles does not allow atomization of the spray water, which results in the water pouring into the steam rather than producing a fine atomizing mist.

Mechanical spray nozzles rely on the surrounding steam velocity to provide adequate mixing. When the steam load reduces, so too does the steam velocity and the ability of the mechanical spray nozzles. This effect manifests itself with poor downstream steam temperature control and water 'drop-out' which can be very damaging as cold water can track along the bottom of the inside wall of the downstream pipe whilst un-cooled superheated steam travels along the top and sides. This produces high thermal shocks which can lead to steam header fracture.

With steam atomization however, cooling water is pre-heated, significantly accelerating the evaporation and desuperheating process. Equally important is the finely atomized incoming cooling water. Very fine atomization produces extremely small water droplet sizes with a vastly increased surface area to promote rapid heat transfer. The cooling water

Typical Product Applications

Combined Cycle Power

Boiler Main Feedwater Control Valves

Boiler Feed Pump Minimum Flow Recirculation

HP & LP Heater Drain Control Valves

Combined Cycle Power

Drum Level Control

Interstage Attemperators

Steam Pegging Valve

Nuclear Power

Primary and Secondary Circuit Control Valves

Boiler Main Feedwater Control Valves

Turbine Bypass

LNG

Gas Compressor Anti-Surge Valves

Emergency Depressurising Valves

Gas Coolers (Desuperheaters)

Oil and Gas

Steam Letdown Stations

Hot Gas Bypass Valves

Expander Bypass

is introduced via a combining tube where it is atomized and then passed through a converging – diverging venturi throat section. The hot atomized water exits the atomising head in the centre of the downstream header and is rapidly evaporated, cooling the main steam flow. The main steam flow, which has been pressure reduced, passes around the atomising head in a 360 degree annulus producing a natural thermal barrier between the atomised and preheated cooling water and the pipe wall. Because this method of water introduction does not rely on surrounding steam velocity or turbulence for effective mixing, it gives very high turndowns - generally in excess of 100:1.

In terms of design, the DSCV-SA has a standard body-to-bonnet joint, up to ANSI 900#, which is bolted and incorporates a fully-enclosed spiral wound gasket made from 300 stainless steel with graphite filler. For pressure ratings above ANSI 900# a pressure seal bonnet closure is employed, which utilizes a graphite sealing ring. The DSCV-SA is available in an almost infinite range of sizes, materials and pressure ratings as each valve is tailored to suit particular customer requests and requirements.

The valve can be fully rated or split rated design and available in standard, special or intermediate classes. Standard classes are available up to and including ANSI 4500# and intermediate and special class designs can be accommodated where required. As the DSCV-SA is usually supplied as a split rated design, this provides the customer with a convenient point for pipe transition for size, rating and material. The DSCV-SA is of a two-part construction and therefore virtually any configuration can be met to satisfy client requirements.

Importantly, the DSCV-SA is not a high maintenance valve. However, the complete trim is a 'Quick-Change' style with no welded in components or large internal threaded parts. The whole trim assembly is held in compression by either a compression ring or the bonnet. By simply removing the compression ring or bonnet, the whole trim merely slides out the top of the valve. Therefore in-situ maintenance, if required, should be both expeditious and uncomplicated with no need for specialised tooling or training.

Modern steam turbine bypass systems must be able to react and modulate very quickly under emergency conditions such as a turbine trip. Stroking speeds of less than one second may be required and as a result, the DSCV-SA can be supplied with either pneumatic or hydraulic actuation to meet this critical requirement.

Due to its unique innovations and fundamental attention to design and usability, hundreds of DSCV-SA valves are already in use worldwide in oil, gas, biomass and coal-fired power plants, refineries, paper mills and many other industrial activities which rely on steam generation for their processes.

About SPX

The SPX Flow Technology segment designs, manufactures and installs highly engineered solutions used to process, blend, meter and transport fluids, in addition to solutions for air and gas filtration and dehydration. The segment supports global food and beverage, dairy, pharmaceutical, oil and gas, energy, and industrial markets. SPX (NYSE: SPW) is a global Fortune 500 multi-industry manufacturing company. With headquarters in Charlotte, N.C., SPX has 15,500 employees in more than 35 countries worldwide. Visit www.spx.com.

Global Locations:

SPX Flow Technology
5620 West Road
McKean, PA 16426
USA
Phone: (814) 476-5800
Fax: (814) 476-5848

SPX Flow Technology
Road Two, Industrial Estate
Winsford, Cheshire CW7 3QL
England
Phone: +44 1606 552041
Fax: +44 1606 558275

SPX Flow Technology
25 International Business Park
#03-03/12 German Centre
Singapore 609916
Phone: + 65 6264 4366
Fax: + 65 6265 9133

SPX Flow Technology
E-mail: copesvulcan@spx.com
www.copesvulcan.com
www.spxft.com

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