



Concentrated Solar Power Generation

Proven Valve and Actuation Solutions
for a Challenging Environment



Gemasolar Plant
Property of Torresol Energy®

Experience In Motion

Flowsolve – Solutions To Keep You Flowing

Flowsolve is one of the world's leading providers of fluid motion and control products and services. Globally, we produce engineered and industrial pumps, valves, seals, systems and automation equipment, and provide a range of related flow management services. Our solutions move even the most volatile and corrosive fluids safely and securely through some of the most extreme temperatures, terrain and challenging operating environments on the planet.

Flowsolve products and services are specified for use in a vast range of industries, including oil and gas, chemical, power generation, and various general industries.



Committed to Concentrated Solar Power Customers

Flowsolve valve, pump and seal divisions collaboratively work to develop and support optimally designed and fully integrated process equipment. Our combined experience with heat transfer fluids including thermal oil, molten salt, water, steam or air, and extreme weather conditions gives Flowsolve complete system knowledge, so concentrated solar power (CSP) generators can focus on their mission: harnessing the clean energy of the sun. Constructed on physically optimized global platforms, our product portfolio provides durable functionality and solid stability in challenging CSP applications such as parabolic trough, tower and molten salt thermal energy storage. Flowsolve works with customers to improve efficiency, maximize throughput and control process quality.

Supplier of Choice to the Concentrated Solar Power Industry

With global expertise in power generation, deep understanding of the flow control industry and customer-centric focus, Flowsolve is the trusted choice for the successful application of pre-engineered, engineered, and special purpose valve and automation solutions for CSP services.

- Valve solutions for molten salt applications
- Thermal oil valves
- Valves and desuperheaters for water steam power block applications
- Anti-corrosion solutions
- Electric heat systems
- Severe service solutions
- Actuation and instrumentation

In solar power since the dawn of the industry

Flowsolve products were instrumental in the first ever commercial-scale CSP project, and we have continued to be a leader in the industry in product innovation, performance and reliability. Flowsolve products are precisely engineered and constructed for flawless performance in concentrated solar power generation.



CONCENTRATED SOLAR POWER TECHNOLOGIES



Parabolic Trough

Parabolic trough CSP stations require a broad range of valve solutions to handle arduous applications involving high-temperature heat transfer fluids (HTF) such as synthetic oil, air, CO₂, water and molten salt. The most demanding of these valve applications are heat collection, fluid circulation and molten salt heat exchange storage. Synthetic (thermal) oil is one of the most frequently used fluids in parabolic trough CSP stations, presenting difficult sealing challenges with temperatures approaching 400°C (750°F). Flowserve has successfully and routinely surmounted these hurdles.

Products

- Gate, globe, check, ball, triple offset butterfly and control valves for high-temperature applications
- Severe service anti-cavitation and noise attenuation trims
- Actuation and positioning solutions

Product Brands of Distinction

Valtek® • Valbart™ • Edward® • Anchor/Darling® • Durco® • Argus™ • Kämmer® • Logix™ • Limitorque®



Power Tower Systems

Whether using air, molten salt or superheated water, power tower systems present intense operating temperature conditions which demand reliable valve solutions. Operating plants using water and molten salt as an HTF medium can reach temperatures up to 600°C (1110°F), whereas demonstration plants using air operate at 700°C (1300°F). Flowserve offers a comprehensive suite of unique product designs and custom engineered solutions capable of delivering unmatched performance and fit for CSP tower applications.

Products

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- Severe service anti-cavitation and noise attenuation trims
- Actuation and positioning solutions

MOLTEN SALT SOLUTIONS



A mixture of sodium nitrate (NaNO_3) and potassium nitrate (KNO_3), molten salt possesses high thermal conductivity, allowing temperatures to reach 600°C (1100°F). Its high thermal capacity makes it one of the most commonly used substances for heat transfer fluids as well as thermal storage. However, using molten salts presents specific challenges, such as crystallization of salt during normal operating conditions at temperatures below 221°C (430°F), which can damage equipment and lead to process downtime. Molten salt is a strong oxidizing fluid at high temperatures and can cause electrolytic corrosion if valve materials are not carefully selected. Galvanic corrosion is also a common phenomenon which occurs in valve equipment due

to the use of graphite in combination with carbon or alloy steel and an electrolyte such as molten salt.

As a leading provider of molten salt valves, Flowserve understands the detrimental effects of heat distortion and corrosion on valve equipment. That's why Flowserve utilizes advanced thermal validation techniques and engineered product designs to neutralize distortion and corrosion, increasing process yield and uptime. Flowserve molten salt solutions are constructed on physically optimized global platforms using standardized parts and components to ensure performance stability and longevity – under even the harshest conditions and for years to come.

Flowserve Molten Salt Severe Service Solutions

The use of molten salt as a heat transfer fluid is limited to 600°C (1112°F). At higher temperatures, the molten salt degrades and the resulting carbonates tend to plug valves and pumps. The industrial-grade salt contains impurities such as perchlorates and chlorides, which are known to cause metal corrosion.

Longer service life and lower maintenance costs are made possible through Flowserve custom engineered valve and trim options. Multiple advanced anti-corrosion, anti-cavitation selections neutralize the detrimental wear and tear that too often reduce valve life or lead to failures. Maximum flexibility is achieved through severe service products that incorporate a range of material, pressure and temperature options.



GLOBE CONTROL

Valtek Mark One™

SPECIFICATIONS

Sizes: to DN 300; to NPS 12
Pressures: PN 10 to 400; Class 150 to 2500
Materials: Carbon Steel; Stainless Steel;
Special Alloys
Temperatures: -196°C to 815°C
(-320°F to 1500°F)

SOLUTIONS

The industry's first choice for a reliable and tough globe control valve. The Mark One is flexible, servicing a wide range of applications from molten salt to heat transfer fluids as well as severe service applications required in a solar power plant. Available with a variety of options, including bellows seals to eliminate packing leakage and severe service options to eliminate cavitation and noise. The Mark One provides solid solutions to difficult applications.

For more information, see document VLENTB0001.



GLOBE CONTROL

Valtek FlowTop

SPECIFICATIONS

Sizes: DN 15 to 400; NPS 0.5 to 16
Pressures: PN 10 to 40; Class 150 to 300
Materials: Carbon Steel; Stainless Steel;
Special Alloys
Temperatures: -196°C to 538°C
(-320°F to 1000°F)

SOLUTIONS

The FlowTop general service control valve offers reliable and high-performing service and is available with a number of options, including bellows seals to eliminate packing leakage. It also offers superior performance in steam and water applications.

For more information, see document SAEEBRV740.



GLOBE CONTROL

Edward Univalve

SPECIFICATIONS

Sizes: DN 15 to 100; NPS ½ to 4
Pressure Class: PN 290, 460 and 760;
Class 1690, 2680 and 4500
Materials: A105, F22, F91, F316, F347
Temperatures: -29°C to 816°C
(-20°F to 1500°F)

SOLUTIONS

High-performance isolation valve designed for manual throttling of heat transfer fluids and molten salts.

For more information, see document EVENCT0001.



TRIPLE OFFSET BUTTERFLY

Durco TX3

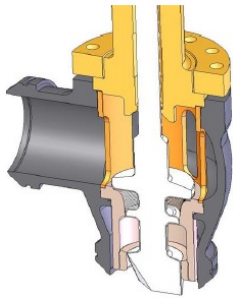
SPECIFICATIONS

Sizes: DN 80 to 600; NPS 3 to 24
Pressures: PN 20 to 260;
Class 150 to 1500
Materials: Carbon Steel; Stainless Steel;
Dual-phase Steel; Special Alloy
Temperatures: -196°C to 820°C
(-320°F to 1500°F)

SOLUTIONS

The Durco TX3 boasts reliable, long-lasting, zero-leakage shutoff — even in CSP applications. It has obtained numerous industry certifications, so it can be used around the world. Multiple valve body configurations available.

For more information, see document DVENBR0061.



MULTI-STEP TRIM

Multi-Step

SPECIFICATIONS

Design: Angle Type Valves F

SOLUTIONS

The multi-step trim features a contoured seat designed to facilitate draining of the pipe system. Optimized to guarantee good controllability at extremely low load below 10%, the design guarantees low seat leakage over a long operation period, as the sealing area is not exposed to a high flow velocity. The multi-step trim avoids critical operating conditions at high differential pressure.



ANTI-CAVITATION TRIM

Valtek CavControl

SPECIFICATIONS

Sizes: DN 25 to 600;
NPS 1 to 24
K_v (C_v) Range: 1.3 to 865
(1.5 to 1000)
Flow Direction: Over the Plug
Pressure Stages: 1

SOLUTIONS

A cost-effective trim that minimizes cavitation damage to valve components with a special seat retainer that controls the location and concentrates vapor bubble implosion away from metal parts.

For more information, see document FCENBR0068.



NON-INTRUSIVE, ELECTRONIC

Limitorque MX

SPECIFICATIONS

Sizes: From 73 to 2300 Nm;
55 to 1700 ft lb
Flanges: F/FA10 to F/FA25
Temperatures: -60°C to 70°C
(-140°F to 158°F)

SOLUTIONS

Limitorque MX motor-operated electric actuators are able to withstand significant temperature fluctuations while also controlling and monitoring solar power processes with unparalleled reliability.

For more information, see document LMENBR2302.



PISTON-TYPE Hydraulic Damper

SOLUTIONS

The hydraulic damper for piston-type actuators prevents valve oscillation and protects the actuator from pressure shocks and hammering by increasing the robustness of the construction. A hand pump is included for manual override.

Flowserve Electric Heating and Temperature Control

The melting point of molten nitrate salt is 221°C (430°F) at atmospheric pressure. To guarantee reliable valve sealing performance, the packing or bellow seal of the molten salt control valve needs to be maintained approximately 50°C (90°F) above the melting point of the fluid (~ 270°C [518°F]). The Flowserve electric heat system maintains proper temperature at the sealing areas to mitigate crystallization and ensure optimum leakage resistance. The compact and highly energy-efficient system automatically switches off upon reaching a defined temperature, protecting the sealing components and improving the useful service life of the valve.



Cast-In Heater With Integrated Thermocouple Type K

SPECIFICATIONS

Material: Brass Casting
Design: Two-part Design for Easy Assembly
Temperature: Max. 600°C (1112°F)
Power Cable With Metal Protection
Nominal Voltage: 230 V, IP65, CE

SOLUTIONS

Cast-in heater with the integrated thermocouple type K provides additional safety levels to protect from overheating.



Junction Box With Overheating Protection

SPECIFICATIONS

Material: Metal Casting (DIN 1725),
RAL7035/RAL7040, CE, IP65
Integrated Temperature Transmitter
4-20 mA Standard or HART on Demand

SOLUTIONS

Junction box regulates the temperature in the heat element with an integrated temperature sensor and protects against overheating. The set point default value is 590°C (1094°F); other values are possible.



Thermal Insulation

SPECIFICATIONS

Type: Fiber Blanket up to 1200°C (2192°F)
Material: Metal Sheet (Stainless Steel)

SOLUTIONS

Thermal insulation provides effective protection from rainwater (seal tape and silicone [high-temperature]).

HEAT TRANSFER FLUID SOLUTIONS



Irrespective of the heat transfer fluid, Flowserve valves can really take the heat — be it steam, water, air, thermal oil or molten salt.

Flowserve solutions for heat transfer fluid applications combine platform standardization, high performance and simplified maintenance to deliver a lower total cost of ownership. Flowserve engineers a broad range of valves and ultra-high precision positioners for CSP and HTF applications. These high-performance solutions offer greater reliability, precise operation

and significantly reduced packing leakage. Quality production ensures dramatic improvements in process uptime, reliability and yield. Because Flowserve valves for CSP and HTF service are constructed on global platforms using standardized parts and components, up-front engineering is held to a minimum. Simplified operation, maintenance and service further ensure lower total cost of ownership.

TRUNNION MOUNTED CONTROL BALL

Valbart TMCBV



SPECIFICATIONS

Sizes: DN 75 to 1400; NPS 3 to 56
Pressures: Class 150 to 2500; API 3000, 5000 and 10 000
Materials: Carbon Steel; Stainless Steel; Special Alloys
Temperatures: -196°C to 450°C (-320°F to 842°F)

SOLUTIONS

Cost-efficient, compact control ball valve that provides excellent flow capacity and high rangeability. The TMCBV is flexible, servicing a wide range of applications from heat transfer fluids to severe service applications required in a solar power plant. Available with a wide range of trim designs to eliminate cavitation and noise, this valve offers greater capacity than comparable globe valves, achieving the same flow with a smaller TMCBV which costs less, weighs less and requires less space.

For more information, see document VLENBR0067.

AXIAL FLOW VALVE TRIM

Kämmer Multi-Z



SPECIFICATIONS

Sizes: DN 25 to 250; NPS 1 to 10
Pressures: PN 40 to 400; Class 300 to 2500
Materials: Carbon Steel; Stainless Steel; Chrome-Moly; Special Alloys
Temperatures: -196°C to 538°C (-320°F to 1000°F)

SOLUTIONS

The Multi-Z provides milestone advancements in axial flow valve sizing. With balanced sigma distribution across the stages, cavitation is eliminated in the intermediate pressure drops extending the life of the trim. With the ability to pass large solids and control low Cv ranges, the Multi-Z is well suited for some of the most taxing CSP applications encountered.

For more information, see document KMEEBR1613.

DESUPERHEATER

Valtek VariCool



SPECIFICATIONS

Valve Type: Desuperheater
Steam Line: DN 150 to DN 1000; 6" to 40";
Cooling Water DN 25 and DN 40; 1" and 1.5"
Pressure: PN 40 to PN 160; Class 300 to 2500
Material: Carbon Steel; Stainless Steel
Temperature: -10°C to 530°C (14°F to 986°F)

SOLUTIONS

The VariCool desuperheater integrates the precision of a control valve into a desuperheater to attain maximum rangeability, responsiveness and control. The multi-stage design of the piston tube allows the VariCool to manage a wide spectrum of differential pressures as it directly injects atomized cooling liquid to cool process steam.

For more information, see document SAENBRV901.

POSITIONER

Logix 3200MD



SPECIFICATIONS

Air Cap: 20.4 Nm³/h @ 4 bar (12 SCFM @ 60 psi)
Air Con: 0.5 Nm³/h @ 4 bar (<0.3 SCFM @ 60 psi)
Repeatability: <0.05%
Temperatures: -40°C to 80°C (-40°F to 176°F)

SOLUTIONS

A digital HART® positioner with state-of-the-art piezo technology to provide superior performance and reliability. Easily configured using HART handheld or ValveSight software.

For more information, see document LGENBR3000.



POSITIONER
Logix 3400MD

SPECIFICATIONS

Air Cap: 20.4 Nm³/h @ 4 bar (12 SCFM @ 60 psi)
Air Con: 0.5 Nm³/h @ 4 bar (<0.3 SCFM @ 60 psi)
Repeatability: <0.05%
Temperatures: -40°C to 80°C (-40°F to 176°F)

SOLUTIONS

The Logix 3400 is an ITK 6.1 certified digital Foundation Fieldbus positioner with state-of-the-art piezo technology to provide superior performance and reliability.

For more information, see document LGENBR3404 or LGENBR3405.



POSITIONER
Logix 420

SPECIFICATIONS

Air Cap: 20.8 Nm³/h @ 4.1 bar
(12.2 SCFM @ 60 psi)
Air Con: 0.082 Nm³/h @ 4.1 bar
(0.048 SCFM @ 60 psi)
Repeatability: ≤ 0.25%
Temperatures: -52°C to 85°C
(-61.6°F to 185°F)

SOLUTIONS

The Logix 420 is a compact, cost-competitive solution for the single-acting, explosion-proof, intrinsically safe and non-incendive markets. Supports HART 6 and 7 protocols.

For more information, see document LGENBR0106.



SOFTWARE
**ValveSight DTMs for HART or
Fieldbus Communications**

SPECIFICATIONS

System Requirements: Windows XP,
Windows 7, Windows 8, Windows 10
Compatibility: Foundation Fieldbus;
HART 6 and 7; FDT 1.2 and 2.0
Equipment: Valves

SOLUTIONS

ValveSight software is designed to help engineers and maintenance personnel responsible for managing HART or Fieldbus positioners by simplifying setup, calibration, configuration and diagnostics.

For more information, see document LGENSF0014 or LSENBR0004.

SALES AND SERVICE



Unparalleled Service: Day or Night, Worldwide

Flowserve services precision quality pumps, control valves, seals and automation equipment for a diverse range of industries worldwide. Our Quick Response Centers (QRC) are equipped with thousands of parts, including OEM and Flowserve custom-built products. And each has the manpower and equipment to expedite time-sensitive repairs of any size.

Flowserve service technicians can restore all types of control, manual-operated or pressure relief valves to original quality.

Should any valve prove unrepairable, we can usually replace it with a new valve within the same time frame.

Service When and Where You Need It Most

Flowserve QRCs are strategically located around the world to ensure rapid response to your time-critical repair needs. They serve as a local, single point of contact for the full inventory of Flowserve products and services, including the machinery to manufacture custom-built units. We offer better than 95% on-time performance for all repairs and can turn around new and custom-built units within 72 hours.

Time-critical Repairs

Flowserve offers 24-hour emergency repair, free pick-up and delivery within QRC service areas, mobile and on-site repair. When a service technician is needed, we can have one on-site within 24 hours anywhere in North America, and 48 hours outside of North America.





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