100DHP™ CCI DRAG® Control Valve For High Pressure Turbine Bypass

What is a HP Turbine Bypass Valve?

It routes high pressure, high temperature steam around the HP Turbine, from the main steam line typically to the cold reheat line. In doing so, the HP turbine bypass valve must perform both pressure reduction as well as temperature control.

Pressure reduction is accomplished with the multi-stage trim (DRAG®) within the valve body. The inlet pressure is controlled by an upstream pressure controller, signalling the valve to modulate to maintain the pressure at the required set point. Alternatively the valve can be sent a digital signal to quick open or close to control pressure.

Temperature control is accomplished through the addition of water to the steam to reduce the specific enthalpy of the steam (a process called desuperheating). A separate water valve supplies the correct amount of water to the desuperheating mechanism (typically spray nozzles) within the steam conditioning valve. A downstream temperature transmitter typically operated in conjunction with a feed-forward algorithm within DCS to dictate the amount of water injected into the steam.

Combined Pressure Reduction and Desuperheating Ensure Maximum Performance and Reliability

The CCI DRAG® 100DHP range of valves are primarily used in utility power plants for Steam Turbine Bypass to Cold Reheat but potentially can be utilized in similar applications.

As reliability and performance are paramount to the operation of the plant, the selection of the DRAG® 100DHP in the turbine bypass application is critical. By utilizing the energy of the steam in the high velocity region, to desuperheat, steam at required condition can be assured.

Requirements for a reliable and high performance Turbine Bypass System

Resistance to thermal shock and fatigue

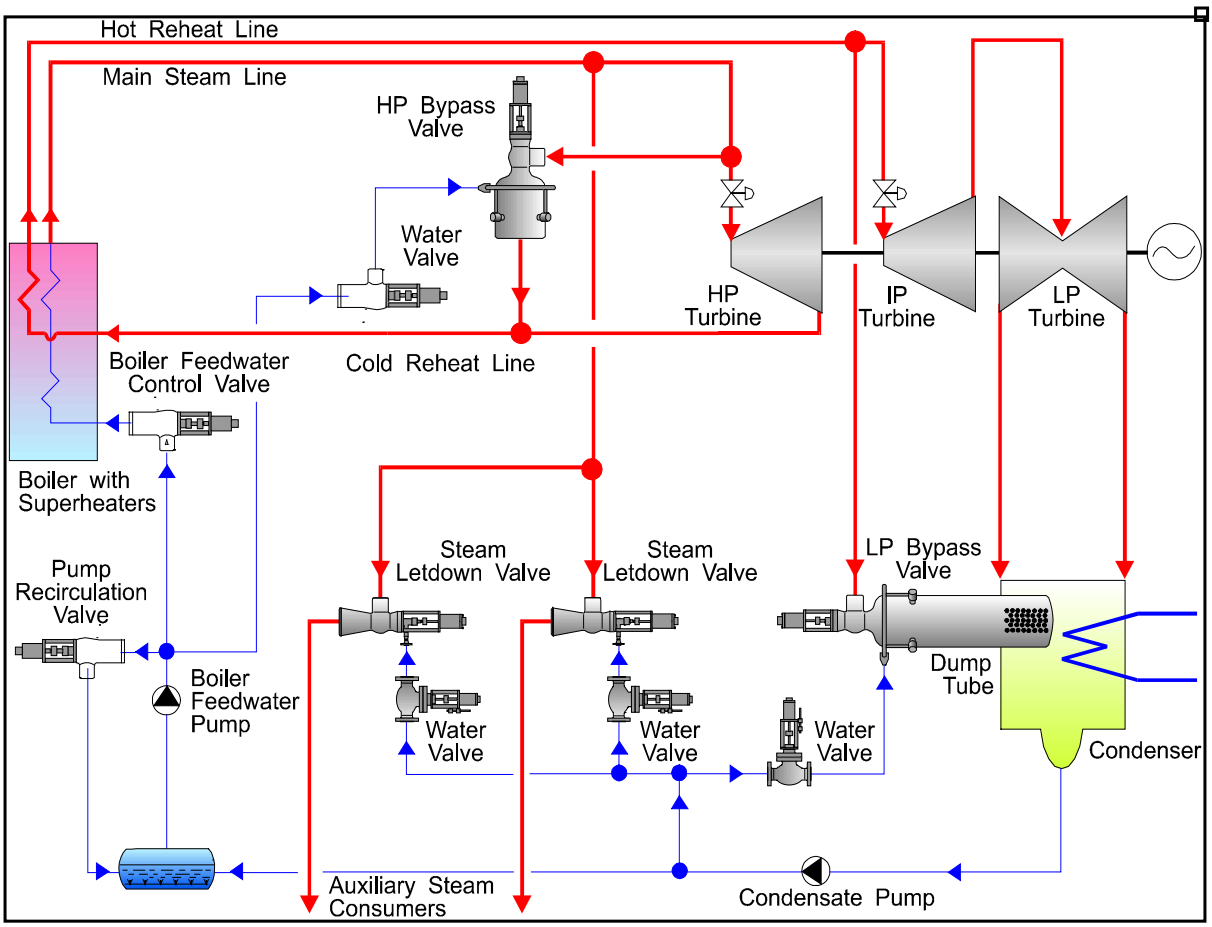
The Bypass Valve will be subject to severe thermal shock {200° C (360 °F)}. Valve body and trim must be designed to assure reliable operation

Maximising Power Output and reduced Maintenance

Repeatable seat tightness is required to prevent steam leakage that can otherwise be used to generate electricity ad therefore revenue. Excessive seat leakage also results in excessive maintenance and plant shutdown.

Must handle severe pressure drops.

The Bypass Valve will have to throttle or control pressure drops of greater than 100 bar (2500psi). The valve trim should have sufficient Pressure reducing stages and control trim exit velocity to prevent premature erosive wear, excessive damaging vibration and noise.



TYPICAL CONVENTIONAL REHEAT POWER PLANT

Figure 1: OP sytle nozzles provide superior primary atomization.

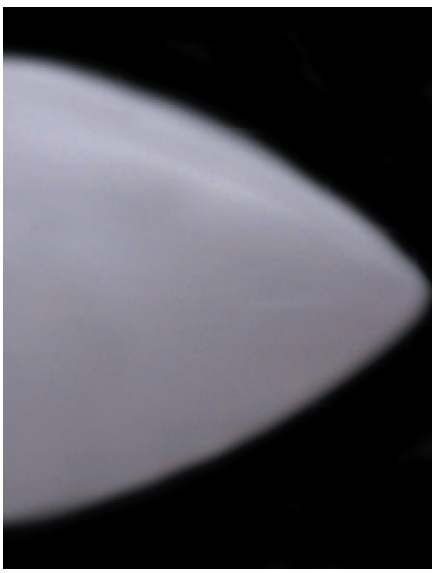


Figure 2: Good atomization at a wide range of flow rates.

Valve should have inlet/outlet connections to suit application.

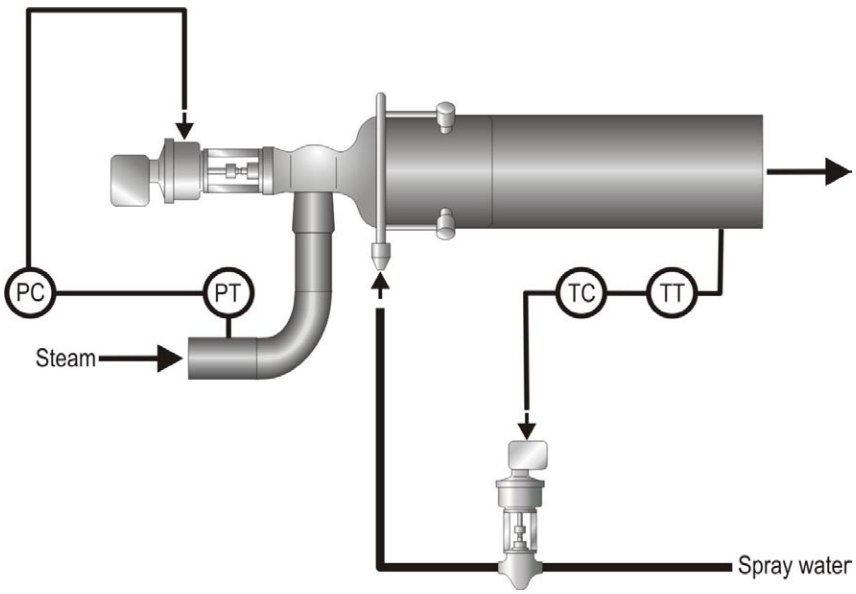
Valve inlet and outlet connections should be provided to suit customers piping and to maintain inlet and exit steam velocities to reasonable levels (<80m/s –250ft/s)

Control of final temperature

The Bypass valve should have desuperheating system capable of excellent atomization to provide rapid evaporation of high quantities of spraywater required for final temperature control. Failure to do so can lead to thermal stress of valve and piping leading to cracking as well as potential flooding or Cold Re-heat.

Maintenance

Valve should be in-line repairable for ease of inspection and maintenance.



HP BYPASS LAYOUT SHOWING INSTRUMENTATION AND WATER VALVE

The DRAG, High Pressure Steam Conditioning Solution

100DHP™ by CCI is the optimum high pressure turbine bypass valve for combined cycle plants, drum boilers and process steam plants. With a compact, robust design that fits into most existing piping arrangements, it can be installed in any orientation. All components, including the flow distributor, are removable through the top of the valve, making maintenance and inspection quick and easy. The spherical body shape has been designed to avoid material

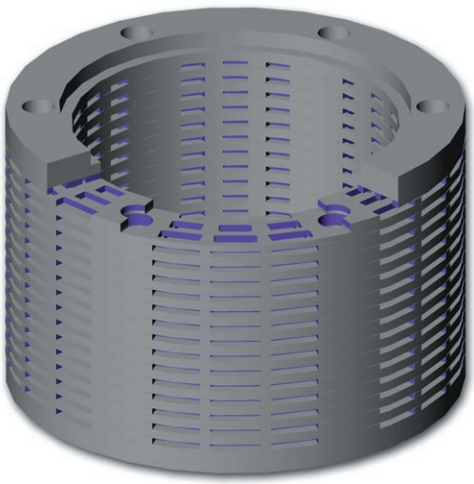


Figure 3: DRAG® disk stack's multi-stage pressure reduction eliminates noise, vibration and erosion.

Figure 4:

concentrations and abrupt changes in wall thickness, minimizing thermal stress in the valve. Featuring an integrated spring-loaded spraywater nozzle desuperheater manifold at the outlet, the 100DHP™ minimizes the downstream desuperheating distance making it extremely compact for high pressure turbine bypass applications.

Spring-Loaded Nozzle Desuperheater

100DHP™ desuperheating features integral spring-loaded water-injection nozzles that optimize water injection over a wide range of flow rates at low pressures. With a rangability limited only by the spraywater control valve, the spring-loaded water-injection nozzles vary the water flow rate as required to achieve the fine water droplet size needed for atomization.

The spring-loaded water-injection nozzle design provides the smallest droplet size possible without steam assist.

Low-Noise DRAG® Trim Technology – Designed with Multi-Stage Pressure Reduction

Velocity control is recognized throughout the industry as the only reliable long-term solution for the elimination of noise, vibration, and erosion. CCI DRAG® is the leading velocity control technology; the preferred low-noise valve solution for pressure reduction. 100DHP™ features a multi-path, multi-stage design that has been used successfully for over 40 years. The DRAG® disk stack forces steam through a tortuous path of right angle turns to control the pressure letdown and limit the fluid velocity, thereby limiting noise, and eliminating vibration and erosion. To deliver superior performance, the DRAG® disk stack configuration can be custom designed to the requirements of each application.

Accurate Control

CCI's long history of advanced technology valves and actuation systems for severe service has led to the development of the most reliable actuation systems available today. CCI has supplied pneumatic and hydraulic actuation systems for over 30 years and has an extensive installed base. Our pneumatic actuation systems can delivery stroke speeds of less than one second while maintaining accurate resolution and control.

The selection of pneumatic or hydraulic actuation is primarily a function of valve design for the particular application as well as customer preference. A comparison of the factors influencing actuator selection is given in Table 1.

Highly reliable, fast, accurate pneumatic and hydraulic actuators provide superior system control.

Improve Plant Efficiency – Eliminate Lost Steam

During normal operation, any leakage past the turbine bypass valve means lost revenue.

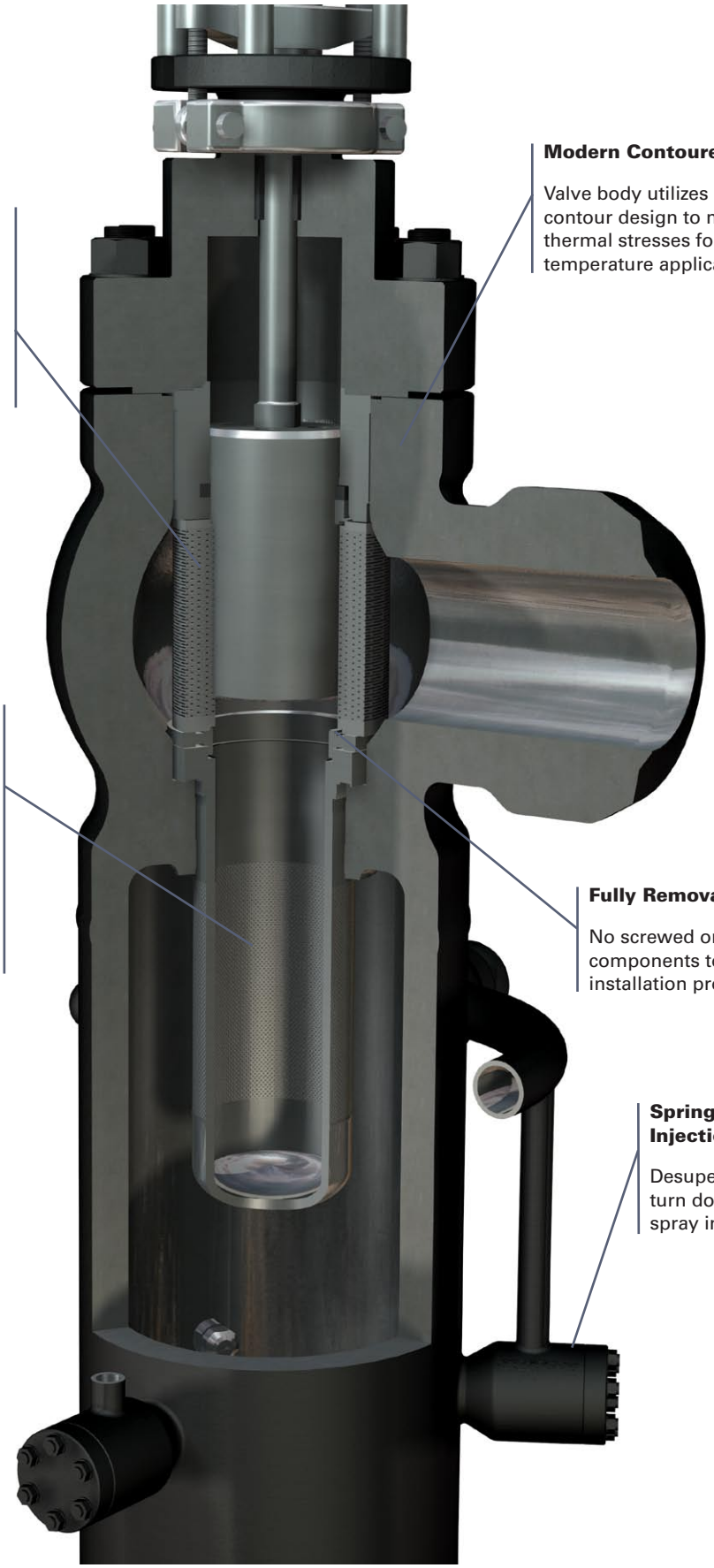
- Steam that does not go through the turbine does not generate electricty or revenue for the plant.
- Money spent generating the steam is lost.
- Steam leaking past a valve seat could erode the seat and cause an increase in the leakage rate and maintenance downtime.

The CCI 100DHP™ valve can be supplied with a Pressurized Seat Trim™, which provides dependable, repeatable, Class V Shutoff. The special CCI seat configuration ensures that the valve seat is not exposed to high velocity steam flow, thus protecting the seat and assuring tight shutoff the first time and everytime.

Table 1: Factors Influencing Actuator Selection

Performance Attribute	CCI Pneumatic Actuator	CCI Pneumatic Actuator with QuickTrak® [1]	CCI Hydraulic Actuator
Speed	1-2 second through accessory components tree	Less than 1 second with standard pneumatic servo	Very fast, less than 1 second
Accuracy	Good with overshoot, less than 1%	Excellent with no overshoot	Excellent with no overshoot
Hysteresis, Linearity and Deadband	Less than 1-3%	Less than 0.5%	Less than 0.3%
Dead Time on Seat	Less than 300-600 ms	Less than 100-200 ms	Less than 100 ms
Calibration/Tuning	1-4 hours	Less than 10 minutes[3]	2-4 hours

1. More information on CCI QuickTrak® intelligent digital valve controller is available upon request and at www.ccivalve.com
2. Optional optimized CCI QuickTrak® performance package including remote mounting is recommended for most applications
3. The CCI QuickTrak® system allows for fast, accurate and repeatable calibration without an expert technician.



DRAG® Trim Technology

Valve design utilizes multi-stage DRAG® technology to eliminate high enegry generated noise, vibration and erosion.

Modern Contoured Body

Valve body utilizes special contour design to minimize thermal stresses for high temperature applications.

Removable Flow Distributor

Outlet flow distributor to prevent outlet expansion noise and provide uniform flow profile for spray injection.

Device is removable to accomodate line flushing shut-off.

Fully Removable Trim

No screwed or welded components to simplify installation process.

Spring Loaded Spray Injection

Desuperheating with high turn down spring loaded spray injection nozzles.

Use check list to evaluate the benefits of CCI's 100DHP design

	Benefits	100DHP™	Competition
1	Multi-stage velocity control with up to 10 stages of pressure letdown reduces noise levels to below 85 dBA and eliminates noise-induced vibration which can cause fatigue failure of piping components.	✓	
2	High performance, high thrust, fast stroking pneumatic or hydraulic actuation with many years of documented service. Accurate control and resolution to less than 1 second stroke time for pneumatics (optional).	✓	
3	Repeatable Class V Shutoff in service and improved plant efficiency through elimination of lost steam.	✓	
4	High rangeability of steam flow achievable. Up to 100:1 with pneumatic actuation (1% resolution) and over 100:1 with hydraulics. Rangeability of desuperheating is limited by water valve selection.	✓	
5	Spraywater manifold system allows for multiple attemperation injection points while requiring only one water supply connection.	✓	
6	Removable flow distributor outlet cage for quick and easy maintenance. Outlet distributor utilizes Small-Drilled-Hole-Case design which reduces noise levels to below 85dBA.	✓	
7	Compact and flexible in design – easily fits into most existing piping arrangements. Can be installed in any orientation without additional support for the upper structure.	✓	
8	Contoured valve body designed for frequent start-ups and cyclic operation.	✓	
9	Low maintenance costs with quick change trim. No parts are welded or screwed into the valve body.	✓	
10	Extended trim life through the reduction of flow velocity and use of properly selected materials.	✓	
11	Optional condensate drain or pre-warming connection available if required.	✓	

Special needs can be accommodated. Please consult the factory.

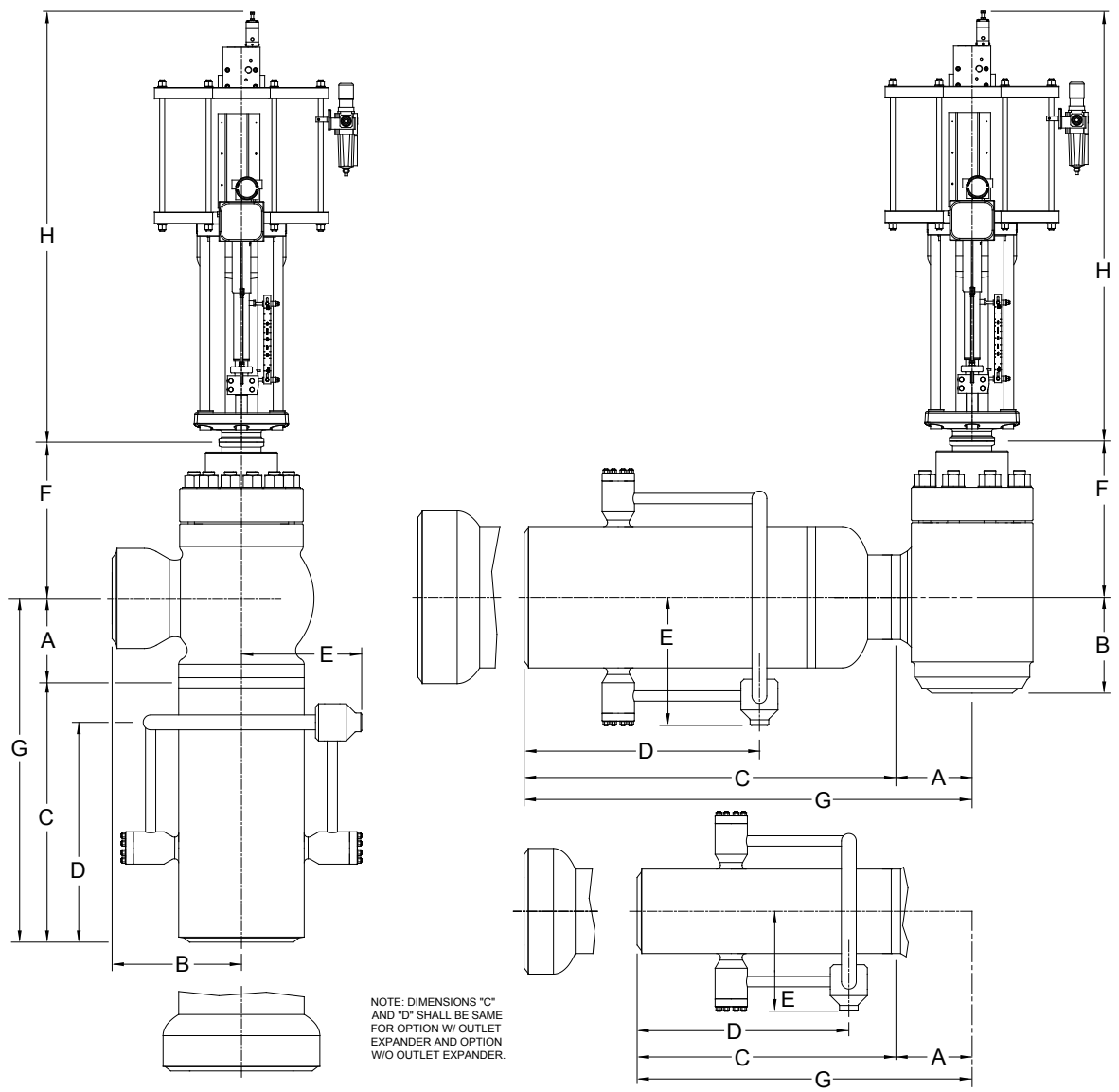


Table 2:Appromixate Flow to Close Dimensions (in inches)

Plug	Rating	Std. Connections[1]	A	B	C	D	E	F	G	H
4	1900	6,8 x 12,14,16	9.25	12.50	29.00	25.00	14.38[2]	15.62	38.25	53.0
	2450	6,8 x 12,14,16	9.25	13.25	29.00	25.00	14.38[2]	15.62	38.25	53.0
5	1850	8,10 x 14,16,18	10.50	14.25	30.75	25.50	15.00[2]	16.00	41.25	55.0
	2500	8,10 x 14,16,18	10.50	15.25	30.75	25.50	15.00[2]	16.00	41.25	55.0
6	1850	10,12 x 16,18,20	11.75	16.25	32.00	26.00	16.00[2]	19.88	43.75	55.0
	2420	10,12 x 16,18,20	11.75	17.25	32.00	26.00	16.00[2]	19.88	43.75	55.0

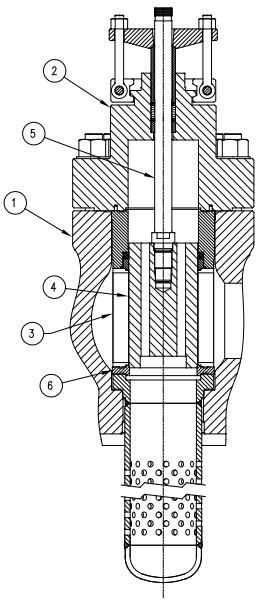
1. The 100DHP body is designed to accomodate a range of inlet and outlet connection sizes. The outlet connection can accomodate various sizes through DAM-E style expanders.

2. Dimension listed assumes buttweld or socketweld connection. Dimensions will increase for flanged connections.

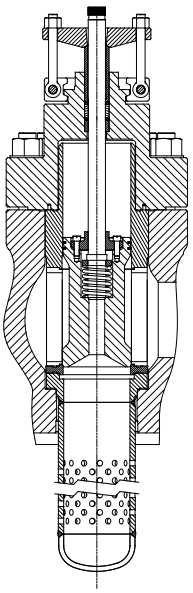
Table 3: Approximate Flow to Open Dimensions (in inches)

Plug	Rating	Std. Connections[1]	A	B	C	D	E	F	G	H
4	1900 x 900	6,8,10 x 8,10,12[2]	8.25	11.75	31.00	25.00	11.88[5]	15.62	39.25	53.0
		6,8,10 x 14[3]	8.25	11.75	6	6	6	15.62	6	53.0
		6,8,10 x 16,18,20[4]	8.25	11.75	42.75	26.00	15.50[5]	15.62	51.00	53.0
	2450 x 900	6,8,10 x 8,10,12[2]	8.50	11.75	31.00	25.00	11.88[5]	15.62	39.50	53.0
		6,8,10 x 14[3]	8.50	11.75	6	6	6	15.62	6	53.0
		6,8,10 x 16,18,20[4]	8.50	11.75	42.75	26.00	15.50[5]	15.62	51.25	53.0
5	1850 x 900	8,10,12 x 10,12,14[2]	10.00	13.50	31.00	25.00	12.88[5]	16.00	41.00	55.0
		8,10,12 x 16[3]	10.00	13.50	6	6	6	16.00	6	55.0
		8,10,12 x 18,20,22[4]	10.00	13.50	46.50	26.50	16.50[5]	16.00	56.50	55.0
	2500 x 900	8,10,12 x 10,12,14[2]	10.00	13.50	31.00	25.00	12.88[5]	16.00	41.00	55.0
		8,10,12 x 16[3]	10.00	13.50	6	6	6	16.00	6	55.0
		8,10,12 x 18,20,22[4]	10.00	13.50	46.50	26.50	16.50[5]	16.00	56.50	55.0
6	1850 x 900	10,12,14 x 10,12,14[2]	10.75	14.00	31.00	25.00	12.88[5]	19.88	41.75	55.0
		10,12,14 x 16[3]	10.75	14.00	6	6	6	19.88	6	55.0
		10,12,14 x 18,20,22[4]	10.75	14.00	46.50	26.50	16.50[5]	19.88	57.25	55.0
	2420 x 900	10,12,14 x 10,12,14[2]	10.75	14.00	31.00	25.00	12.88[5]	19.88	41.75	55.0
		10,12,14 x 16[3]	10.75	14.00	6	6	6	19.88	6	55.0
		10,12,14 x 18,20,22[4]	10.75	14.00	46.50	26.50	16.50[5]	19.88	57.25	55.0

1. The 100DHP body is designed to accomodate a range of inlet and outlet connection sizes.
2. For this size outlet, desuperheater shall be DAM or DAM-E style.
3. For this outlet, desuperheater shall be DAM-D or DAM-DE style.
5. Dimension listed assumes buttweld or socketweld connection. Dimensions will increase for flanged connections.
6. Final dimension shall be based on desuperheater design, which shall be dependent on operating conditions. Consult factory.



BALANCED PLUG
OPTION



PRESSURIZED
SEAT OPTION

Table 4: Capacity and Performance

Trim Size	4	5	6
Max Capacity (Cv) (Flow to Open)	320	500	700
Max Capacity (Cv) (Flow to Close)	215	310	450
Valve Characterization (% Cv vs % Opening)	Linear (Standard)Equal% or Modified Equal %		
Shuttoff Class	Class V		
Actuator Type	Double-Acting Low Volume Pneumatic Piston Actuator[1]		
Model Number	320 SC/V	400 SC/V	400 SC/V
Valve Position on Loss of Actuator Motive Power	Open, Closed, Or In-Place as specified		
Opening/Closing Stroke Time	2 Second Standard < 1 second optional		
Inlet Design Rating	1900 or 2450	1850 or 2500	1850 or 2420
Outlet Design Rating (Flow to Close)	900	900	900
Outlet Design Rating (Flow to Close)	1900 or 2450	1850 or 2500	1850 or 2420

1. Hydraulic Actuator available upon request.

Table 5: Materials

Component	Item No.	Materials of Construction
Body	1	A182-F91 or A182-F22
Bonnet	2	A182-F91 or A182-F22
Disk Stack	3	Inconel 718
Plug	4	A182-F22 with Stellite
Stem	5	Inconel 718
Seat Ring	6	A182-F22 with Stellite

Contact us at: info@ccivalve.com

For sales and service locations worldwide, visit us online at: www.ccivalve.com

Throughout the world, customers rely on CCI companies to solve their severe service control valve problems. CCI has provided custom solutions for these and other industry applications for more than 80 years.

We Solve Control Valve Problems®