Yarway 9200 Series ARC® Valve
For Centrifugal Pump Protection

PENTAIR

Self-contained valve functions as integral check valve, flow sensing element and bypass control valve.

Features
- Eliminates high cost of installation and maintenance of complex conventional flow control loops.
- Eliminates multiple vendors of components.
- Eliminates cavitation in the valving and piping.
- Only three pipe connections.
- Eliminates any power source or instrument signal.
- One piece body design. Bonnetless, packless design eliminates a potential leak path to atmosphere. Valve is intrinsically safe for a broad range of pumping applications in the hydrocarbon industry.
- Totally mechanical activation of the bypass with no levers, linkage, control signals or pilot valves to fail. Greatly reduced maintenance, improved reliability and confidence that the valve will operate when needed.
- Integral vortex inducing flow conditioner; controls the damaging effects of any cavitation resulting from the fluid pressure reduction by directing cavitation away from the pipeline walls.
- Balanced stem designed with characterized orifices provides a one-stage pressure reduction. Extends trim life and eliminates the creation of potentially destructive cavitation while insuring a more stable operation.
- Flow loop testing and performance curve evaluation certify each 9200 ARC® Valve order. Assures reliable performance from every valve.

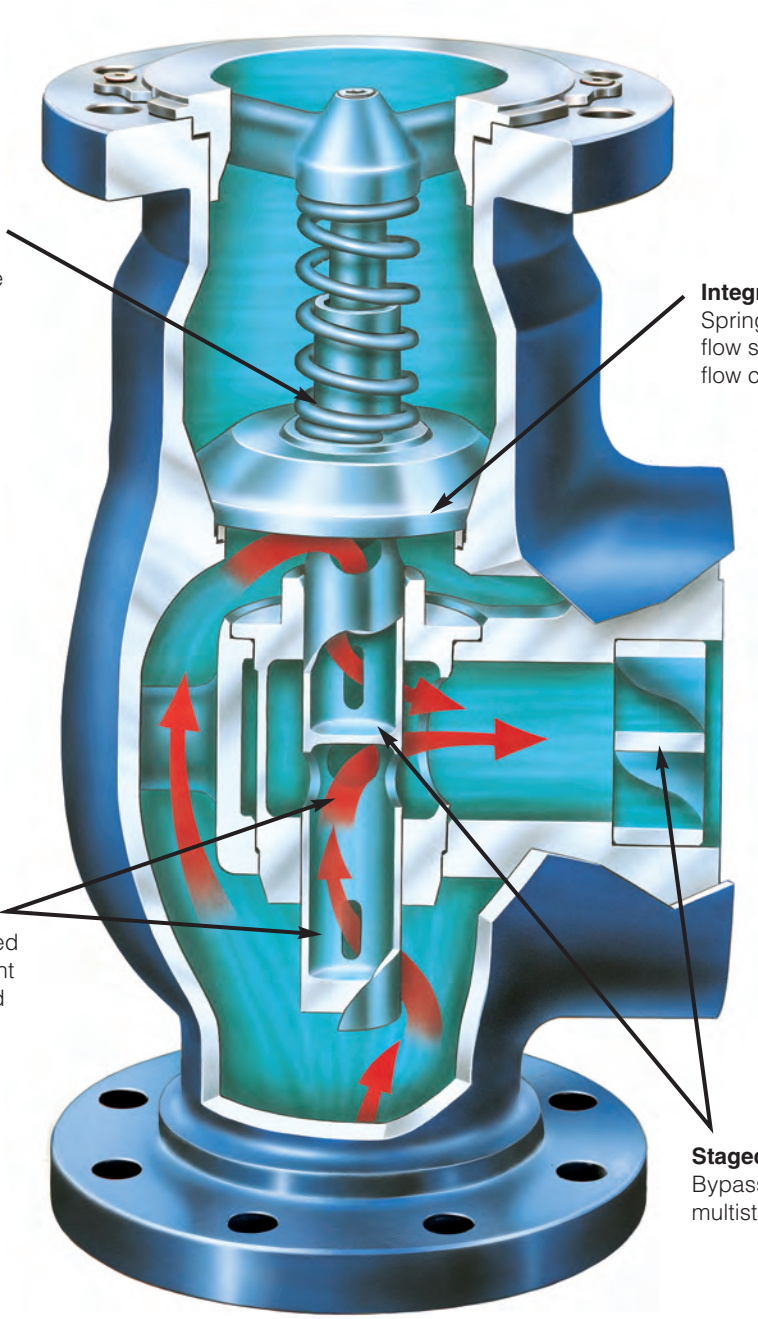
Sizes and Connections
- 2", 3", 4", 6", 8", 10", 12" and 14"
- 2" to 14" Class 150 - 300 ANSI RF flanged

Ratings
- ANSI Class: 150 - 300
- Temperature Range: -150°F to 550°F

Options
- NACE Valve conforming to MR0175 External Back Pressure Regulator (if required)
- DIN, BS, JIS, and RTJ flanges optional
- 6 Mo SS construction for sea water applications
- Super Duplex SS construction

Series 9200 ARC® Valve

Stable by Design – Large disc, spring and snubber design combined to achieve optimum operating stability at various process flow conditions.



Integral Check Valve – Spring-leaded against seat, the flow sensing disc acts as a main flow check valve.

Superior Recirculation Flow Control – Characterized orifices in the bypass element provide accurate, modulated recirculation flow.

Staged Pressure Letdown – Bypass trim design provides multistage pressure reduction.

The New Series 9200 ARC® Valve

The Series 9200 ARC® represents the latest concepts in valve design. It is truly a valve designed for today's market needs. Like its predecessors, it uses proven technology in providing economical, as well as effective, protection for centrifugal pumps against damage resulting from low flow instability or overheating. By providing recirculation flow to the suction source of the pump, the 9200 ARC® assures a minimum flow for stable pump operation.

Among the many improvements are a balanced bypass trim design offering improved efficiency in pressure letdown, improved flow capacity, and improved stability and performance at all service conditions. Externally a more compact and lighter weight one-piece design is used to ease valve installation, handling, maintenance and pipe support requirements and considerations. A new range of sizes through 14" is also offered. Internally, a flow conditioner is used to further improve pressure letdown in the bypass and reduce noise. For those special requirements,the 9200 ARC® offers a configurable trim design. In all cases the 9200 ARC® is flow tested prior to shipment to assure your performance requirements are met.

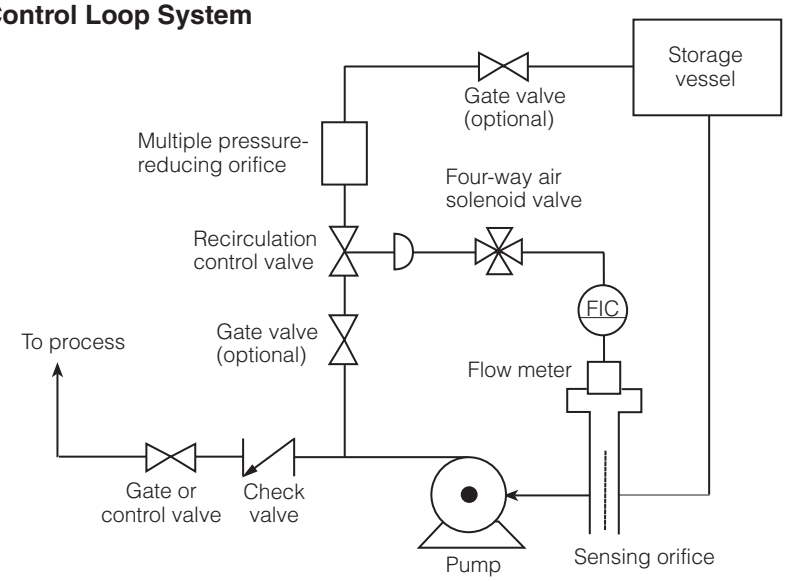
The modulating 9200 Series ARC® provides operating economies in several ways. The ARC® recirculates only the flow required to assure minimum flow through the pump at all times. Under full process flow, recirculation flow is not required. But as process flow demand decreases, recirculation flow becomes necessary. Unlike continuous recirculation, the ARC® responds directly to this need. This avoids the need to oversize the pump and prime mover which can add substantially to the capital, energy and operating costs of the system.

The ARC® also provides cost savings over an instrumented flow control loop. Instead of a multiple component system, the ARC® is a self-contained system; a flow sensing orifice; a check valve; a recirculation control valve and a pressure letdown device. Moreover, it requires no instrument signal or power source, and requires none of the maintenance associated with these systems.

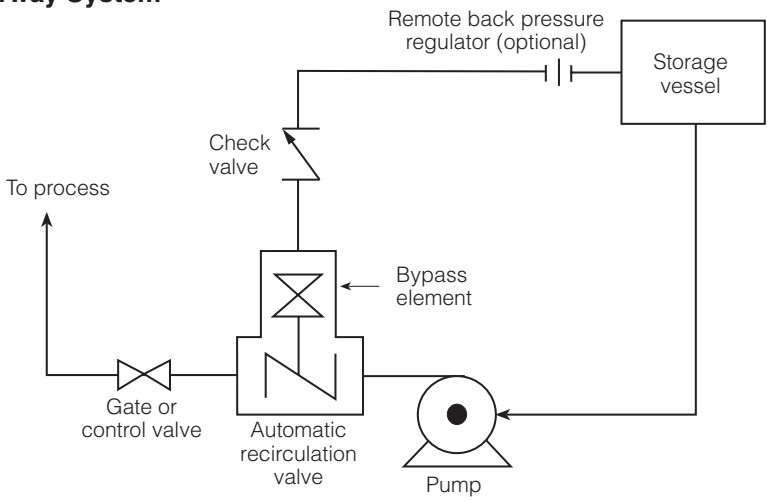
Manufactured and tested in the USA, the 9200 ARC® is one of an entire family of recirculation control valves manufactured by Yarway over the past 30 years.

ARC® valves have been installed in power plants, refineries and process plants worldwide, providing consistent and reliable service.

Control Loop System



Yarway System



How it Works: ARC® Operation and Pump/System Curve

The heart of the recirculation valve is a main flow sensing check valve disc, which is flow sensitive, not pressure sensitive. The disc modulates to the demand for process flow at the same time assuring a minimum flow through the pump. This modulating characteristic results in a consistent, stable, and repeatable performance over full pressure range.

The disc is shown in the closed position in Figure 1. In this position there is no process flow and the bypass is fully open. This protects the pump against planned or accidental “dead heading” which can result from a closed down stream pump isolation valve or process control valve.

As the disc lifts (Figure 2) in response to an increase in flow to the process, the bypass element, which is integral to the disc, closes the bypass flow orifices reducing recirculation flow. Recirculation flow is controlled with disc position. This modulation feature assures that the total of process flow and recirculation flow exceed the minimum flow through the pump as specified by the pump manufacturer.

When the disc is set at full lift position, as in Figure 3, the bypass is closed. As process flow decreases, the reverse action occurs and the recirculation flow again increases. Flow enters the bypass element at the bottom of the disc assembly and is controlled by characterized orifices inside the disc stem. Flow continues through an annulus in the bypass bushing and is directed to the outlet of the valve.

The valve provides for single phase flow in the bypass eliminating the possibility of flashing or cavitation. This is accomplished by the valve trim and flow conditioner design, and if necessary, an integral second stage pressure letdown device or external back pressure regulator.

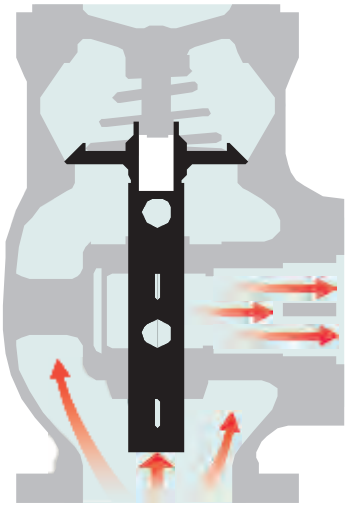


Figure 1
No Process Flow
Full Recirculation

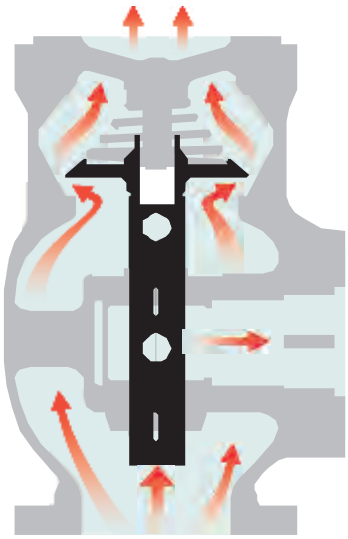


Figure 2
Changing Process Flow
Controlled Recirculation

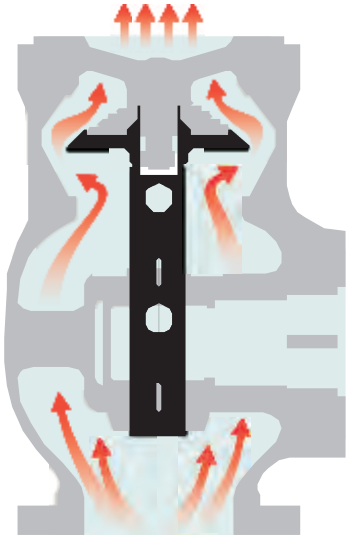


Figure 3
Increased Process Flow
No Recirculation

The cost of the electricity consumed in continuous recirculation cooling is significantly higher than usually realized. For example, the manufacturer of a 1200 gpm pump with a discharge head of 500 feet, may require 400 gpm recirculated flow to keep it cool (Figure 4).

Continuously pumping 400 gpm against a 500-foot head requires 65 horsepower. In a 5¢/kwh power cost area, total annual cost savings using an ARC® valve would be approximately $24,000 (Figure 5).

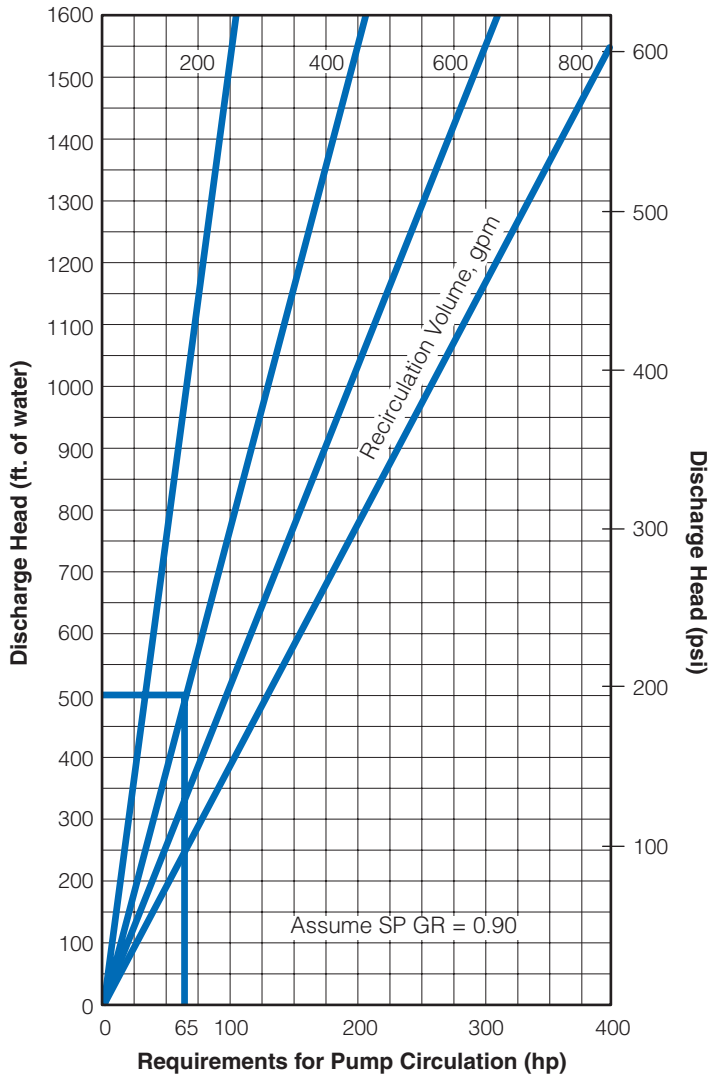


Figure 4

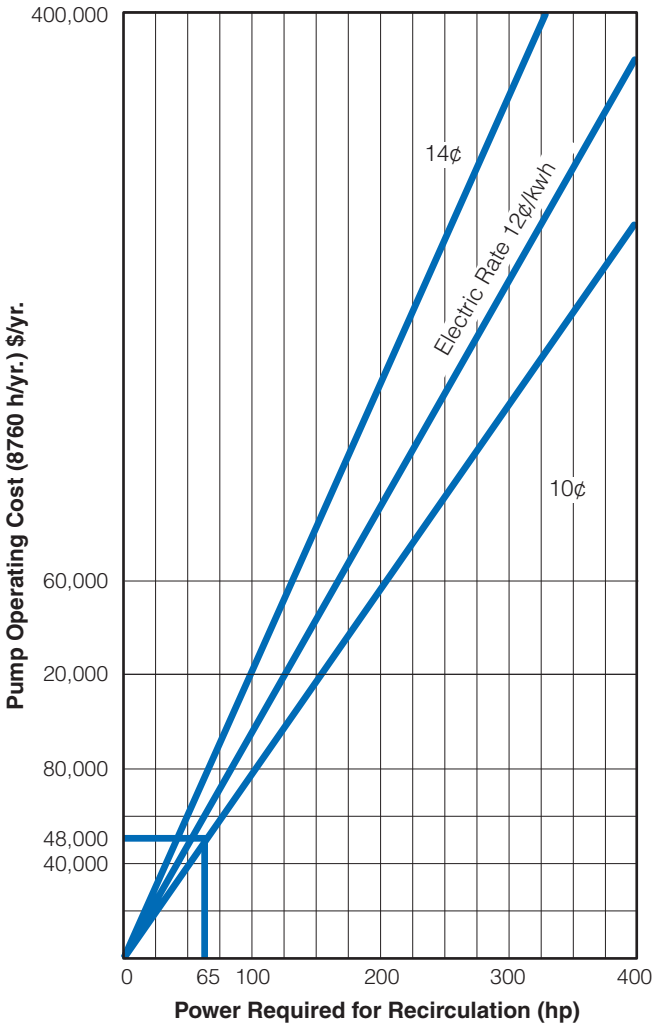
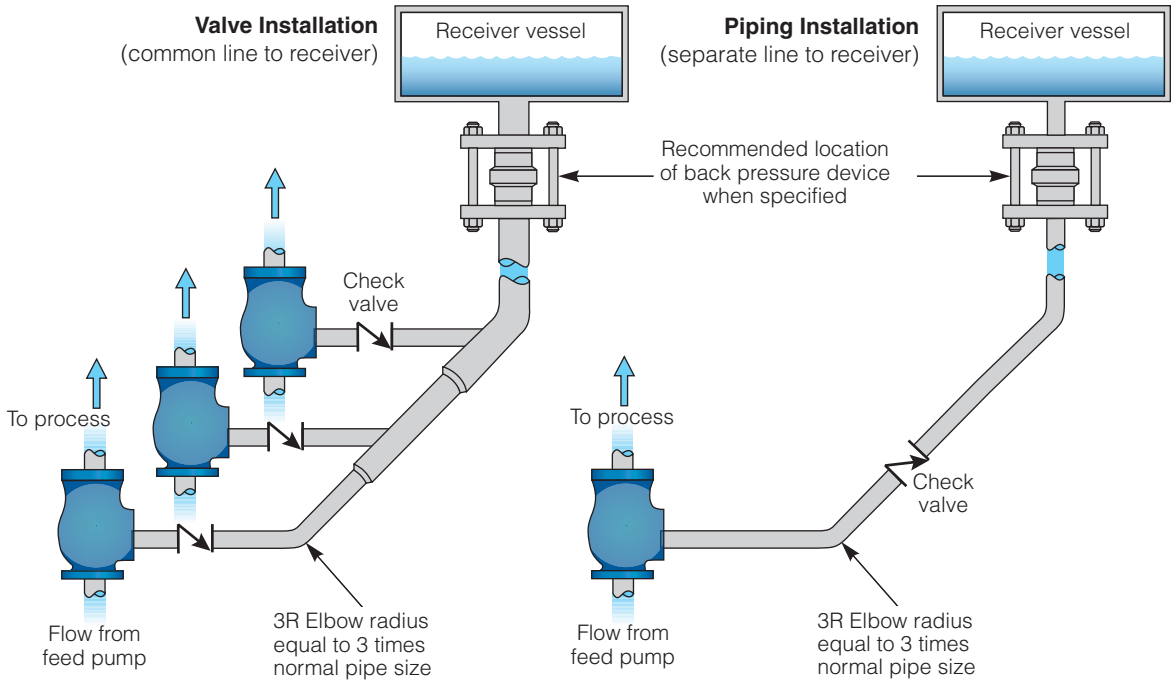


Figure 5

How it Works



Valve Installation

Two common installation approaches are pictured above. In the first, a common recirculation line is used to return bypass flow to the receiver vessel where multiple pumps are used to produce process flow. In these installations, each pump must be protected with a dedicated pump protection valve. The second diagram shows the more common one pump, one bypass system approach.

In each of these cases, treatment of the bypass line is very similar once flow requirements have been determined. A backpressure device with fixed or variable orifice is commonly mounted close to the receiver vessel where flashing liquid is safely discharged. Check valves are installed in the bypass line to prevent bypass back flow and block valves are installed with a lock open option to allow closure by authorized personnel only.

The 9200 ARC® can be installed in a vertical flow up or horizontal position. Other piping practices regarding velocity, geometry and location of valve and pipe members should be consistent with good industry practices and standards.

Back Pressure Regulator

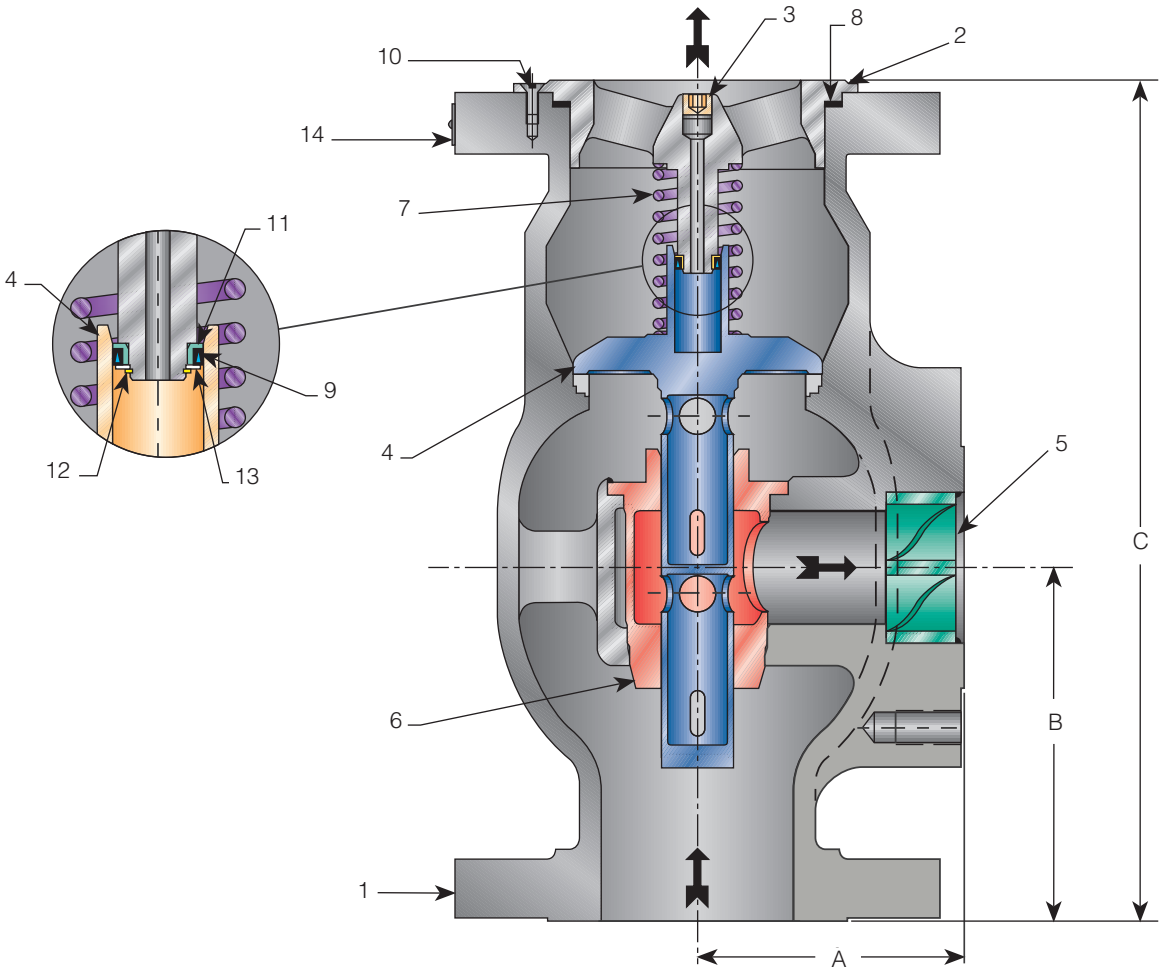
In high pressure pumping applications the system often does not provide adequate pressure in the bypass line to prevent cavitation or flashing. Either of these conditions is undesirable in that it can cause damage to both valves and the pipe system or cause a reduction in flow below the minimum desired, jeopardizing the pump protection system. All PRVs will experience a velocity induced recovery effect which will limit the amount of pressure drop a valve can take and cause a reduction in flow capacity.

The requirement of back pressure is generic to all pressure reducing applications. Pressure reduction even by multiple stage cascading can minimize the requirement, however no valve design will redefine a fluid's physical properties.

This becomes especially important in modulating systems. A fixed orifice will not provide the proper back pressure at all flow levels. As the flow in the bypass line is reduced, the orifice becomes less effective. Proper system design should be used to optimize valve pressure reduction and consider all fluid dynamic effects downstream or any pressure reducing device.

A responsible ARC® valve manufacturer will determine the need and supply a back pressure regulator when it is required.

9200 Series – Sizes 2", 3" and 4"



Parts and Materials

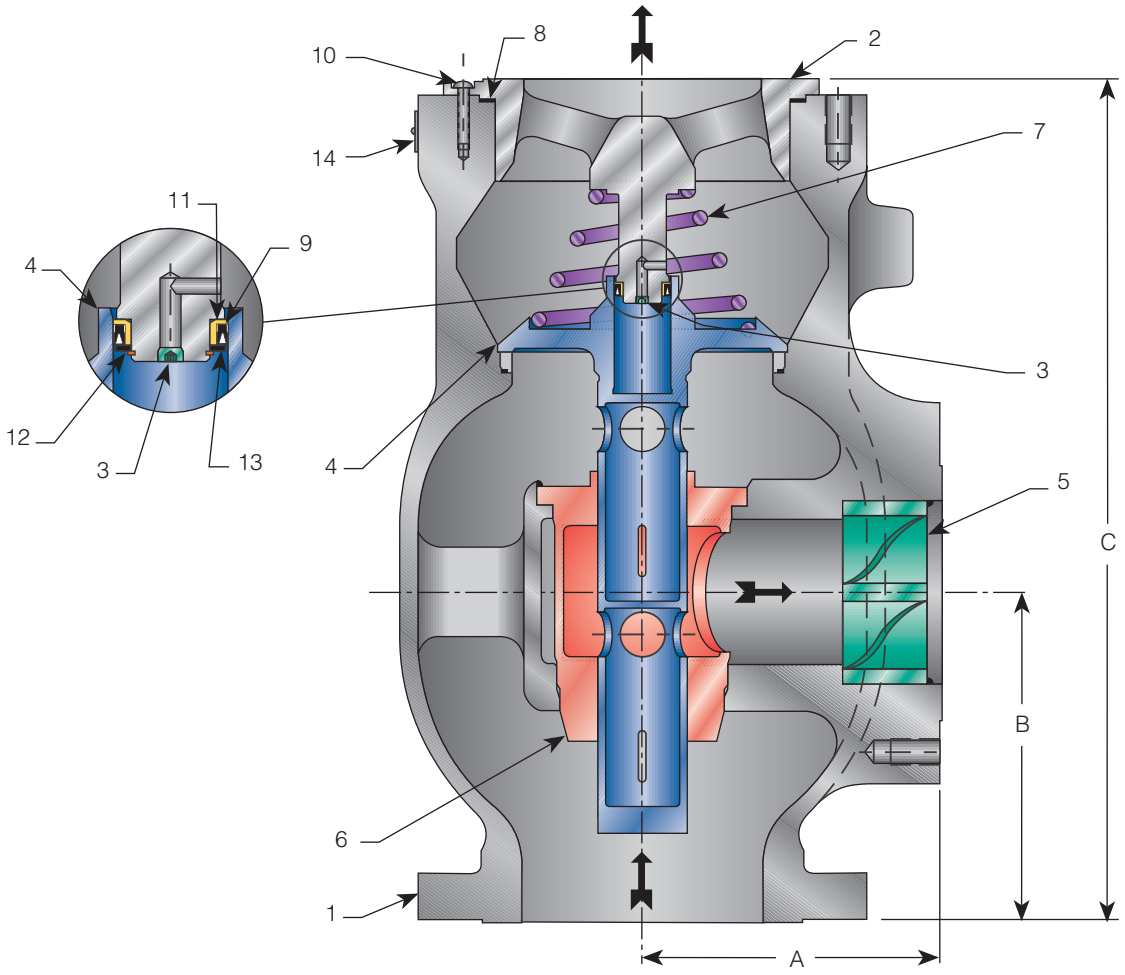
Item	Part	Material
1	Body	ASTM A-216 Grade WCB with ASTM A747 Grade CB7Cu-1 (17-4 PH Cast) Condition H900 (J92180) Seat Ring
2	Upper Stop	ASTM A216 WCB
3	Orifice	18-8
4	Disc Assembly	ASTM A351 Type CF8M
5	Flow Conditioner	ASTM A351 Type CF8M
6	Bypass Bushing	ASTM A747 Grade CB7Cu-1 (17-4 PH Cast) Condition H900 (J92180)

Item	Part	Material
7	Spring	AISI 316 Stainless Steel
8	Gasket	Sigraflex BP (Graphite)
9	Snubber Seal	Variseal – Carbon filled TFE
10	Screw	AISI 316 Stainless Steel
11	Snubber Ring	ASTM A276-S21800A (Nitronic 60 Bar)
12	Spiral Ring	PH15-7MO
13	Snubber Washer	AISI 316 Stainless Steel
14	Nameplate	AISI 300 Series Stainless Steel

Dimensions and Weights

Valve Size in. [DN]	Class ANSI	Dimensions, in. [mm] A	B	C	Bypass Flange Size in. [DN]	Weight lb. (kg)
2 [50]	150 300	4 1/4 [108.4]	4 3/4 [120.7]	11 [279.4]	1 1/2 [40]	42 (19.0) 46 (20.9)
3 [80]	150 300	4 3/4 [120.7]	5 3/4 [146.1]	13 3/4 [349.3]	2 [50]	73 (33.1) 81 (36.7)
4 [100]	150 300	5 1/2 [139.7]	7 3/4 [196.9]	17 3/4 [450.9]	3 [80]	126 (57.2) 147 (66.7)

9200 Series – Sizes 6" and 8"



Parts and Materials

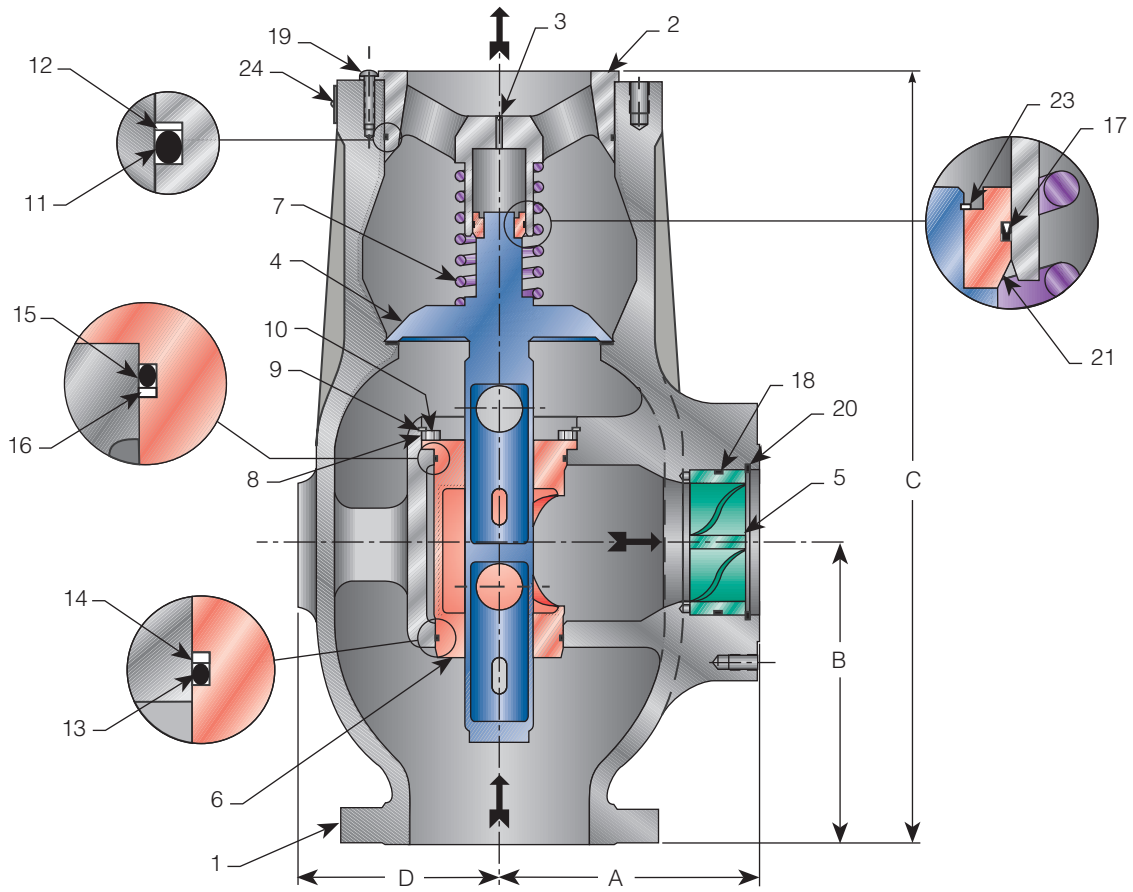
Item	Part	Material
1	Body	ASTM A-216 Grade WCB with ASTM A747 Grade CB7Cu-1 (17-4 PH Cast) Condition H900 (J92180) Seat Ring
2	Upper Stop	ASTM A216 WCB
3	Orifice	18-8
4	Disc Assembly	ASTM A351 Type CF8M
5	Flow Conditioner	ASTM A351 Type CF8M
6	Bypass Bushing	ASTM A747 Grade CB7Cu-1 (17-4 PH Cast) Condition H900 (J92180)

Item	Part	Material
7	Spring	AISI 316 Stainless Steel
8	Gasket	Sigraflex BP (Graphite)
9	Snubber Seal	Variseal – Carbon filled TFE
10	Screw	AISI 316 Stainless Steel
11	Snubber Ring	ASTM A276-S21800A (Nitronic 60 Bar)
12	Spiral Ring	PH15-7MO
13	Snubber Washer	AISI 316 Stainless Steel
14	Nameplate	AISI 300 Series Stainless Steel

Dimensions and Weights

Valve Size in. [DN]	Class ANSI	Dimensions, in. [mm] A	B	C	D	Bypass Flange Size in. [DN]	Weight lb. (kg)
6 [150]	150 300	7 1/2 [190]	8 1/2 [216]	21 1/2 [546]	N/A	4 [100]	296 (135) 344 (156)
8 [20]	150 300	10 [254]	11 [279.5]	28 [711]	8 3/4 [222]	6 [150]	559 (254) 613 (278)

9200 Series – Sizes 10", 12" and 14"



Parts and Materials

Item	Part	Material
1	Body	ASTM A-216 Grade WCB
2	Upper Stop	ASTM A-216 Grade WCB
3	Orifice	Stainless Steel 18-8
4	Disc Assembly	ASTM A351 Type CF8M Disc with ASTM A479 Type A21800A Stem
5	Flow Conditioner	ASTM A351 Type CF8M
6	Bypass Bushing	ASTM A747 Grade CB7Cu-1 (17-4 PH Cast) Condition H900 (J92180)
7	Spring	17-7 PH Condition CH-900
8	Bushing Retainer	ASTM A479 Type 410
9	Spiral Ring	ASTM A564 Type 631 (17-7 PH)
10	Set Screw	ASTM A286 UNS S66286
11	O-ring	EPDM

Item	Part	Material
12	Backup Ring	Carbon/Graphite Reinforced PTFE (Turcite 51)
13	O-ring	EPDM
14	Backup	Carbon/Graphite Reinforced PTFE (Turcite 51)
15	O-ring	EPDM
16	Backup Ring	Carbon/Graphite Reinforced PTFE (Turcite 51)
17	Snubber Seal	Variseal Turcon 10
18	O-ring	EPDM
19	Screw	Stainless Steel 316
20	Spiral Ring	ASTM A564 Type 631 (17-7 PH)
21	Snubber Ring	ASTM A479 Type S21800A (Nitronic 60 Bar)
20	Spiral Ring	ASTM A564 Type 631 (17-7 PH)
23	Spiral Ring	ASTM A564 Type 631 (17-7 PH)
24	Nameplate	300 Series Stainless Steel

Dimensions and Weights

Valve Size in. [DN]	Class ANSI	Dimensions, in. [mm] A	B	C	D	Bypass Flange Size in. [DN]	Weight lb. (kg)
10 [250]	150 300	13 [330]	16 [406]	41 1/2 [1054]	11 [279.4]	8 [200]	1600 (726)
12 [305]	150 300	15 [381]	19 [483]	50 [1270]	13 [330.2]	10 [250]	2650 (1200)
14 [355]	150 300	16 1/2 [419]	21 [533]	57 1/2 [1461]	15 [381]	10 [250]	3350 (1520)

Hydraulic Performance Test Lab

Performance – Profiled in Yarway's Hydraulic Performance Test Lab

In our hydraulic performance test laboratory, state-of-the-art data acquisition and computer graphics techniques are called upon for evaluation of the significant performance characteristics of Yarway recirculation control valves. The lab's equipment makes it possible to test a valve over its complete flow range for factors including:

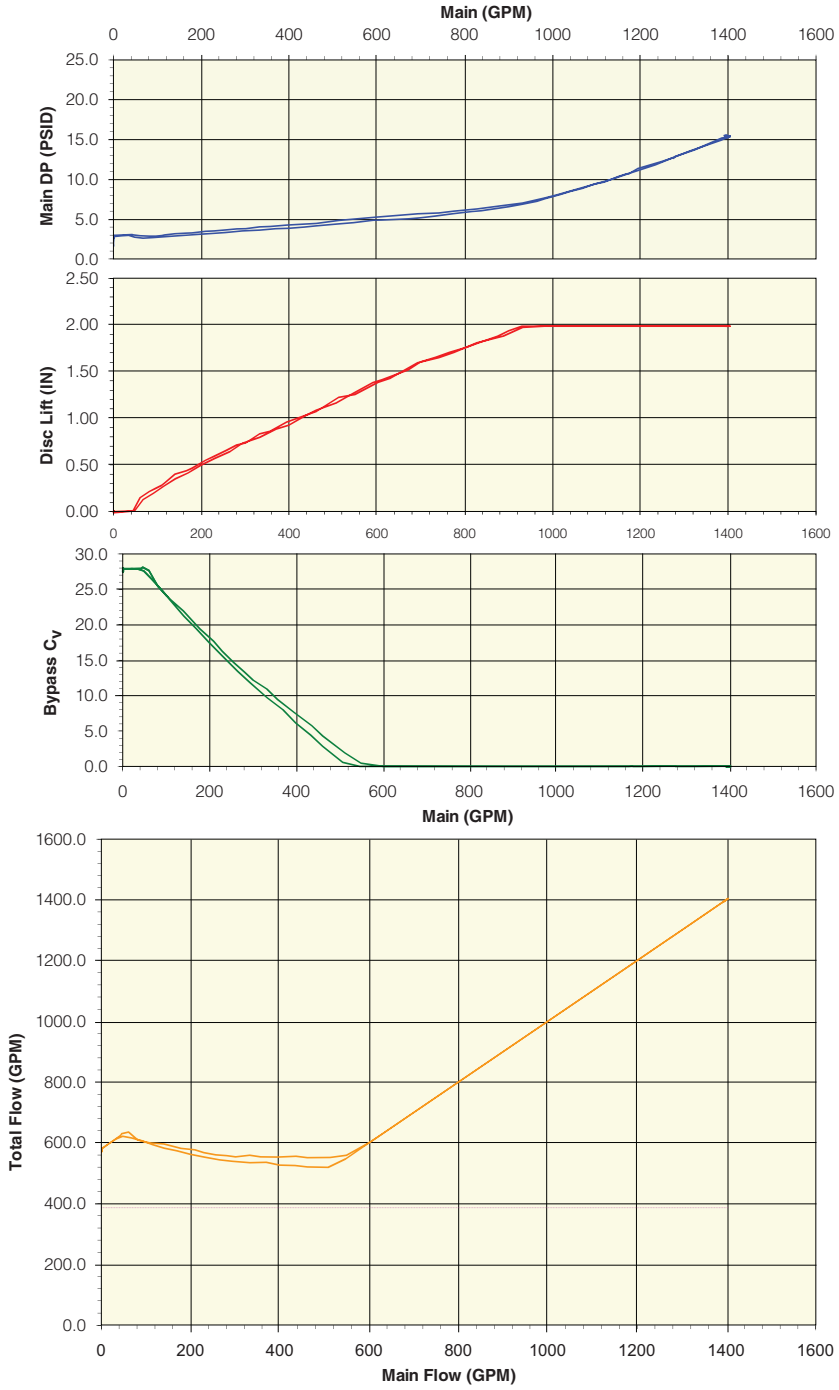
- Total flow through the pump
- Disc position
- Pressure drop across the main check
- Bypass C_v
- Bypass ΔP
- Valve response to sudden changes in flow
- Bypass piston pressure

These detailed analyses are the user's complete assurance that the valve meets performance requirements in all respects and can be supplied with the valve.

A certified test curve is shipped with each valve (see page 11 for example).

Insist on it, as you would for your pump!

Certified Test Curve



Maximum Main Flow (gpm [m³/hr] @ Specific Gravity = 1)								
Inch:	**2**	**3**	**4**	**6**	**8**	**10**	**12**	**14**
[DN]:	**[50]**	**[80]**	**[100]**	**[150]**	**[200]**	**[250]**	**[305]**	**[355]**
	190	430	765	1600	2800	4500	6500	8500
	[43]	[98]	[174]	[364]	[636]	[1023]	[1477]	[1932]

How to Order

Our sales representatives will help you select the correct valve for your application.
Please complete this form before contacting the sales office to help ensure all necessary information is provided.

Automatic Recirculating Control (ARC®) Valve Data Sheet

Customer:					
Company:					
Project:					
Location:					
Phone:		E-Mail:			
Qty Required:		Delivery Required:		Additional Info:	
Tag(s) ID:					

Pump Flow — Please Complete Flow Requirements

Normal -Process- flow:		GPM ☐ M³/H ☐ BPD ☐
Maximum -Process- flow:		
Minimum -Process- flow (optional):		(if Minimum Flow is to be considered in sizing)
Minimum pump protection flow:		(Minimum required "Recirculation Flow")

Pump Discharge Pressure — Please Complete Pressure Requirements

Pump pressure at Shut-off (zero flow):		psi ☐ bar ☐ KgF/cm² ☐ Kpa ☐
Pump pressure at Normal -Process- flow:		
Pump pressure at Minimum -Process- flow (optional):		(if Minimum Flow is to be considered in sizing)
Pump pressure at Minimum pump protection flow:		(at Minimum required "Recirculation Flow")
ARC Valve Bypass line pressure:		(Line pressure at ARC Valve bypass port)

Temperature — Please Enter Both Temperatures

Normal temperature at ARC Valve:		°F ☐ °C ☐
Maximum temperature at ARC Valve:		

Fluid

Liquid: ☐ Boiler Feed Water (In this case disregard S.G. and V.P.)
☐ Other (Please specify) _____

Specific Gravity:	
Vapor Pressure:	
Viscosity:	

Orientation of ARC Valve: Vertical ☐ Horizontal ☐

Desired End Connections:
- Raised Face Flange ☐
- Ring Type Joint (RTJ) ☐
- Flat Face Flange ☐
- Butt Weld Ends ☐
- Other - Specify in "Comments" ☐

Desired Pressure Class: 150 ☐ 300 ☐ 600 ☐ 900 ☐ 1500 ☐ 2500 ☐

Desired Body Material:
- A216 Gr. WCB ☐
- A351 Gr. CF8M ☐
- A351 Gr. CK3MCuN (6Mo) ☐
- A995 Gr. CD3MWCuN (Super Duplex) ☐

Desired Seal Material (except 2" to 8" 9200 and 9300):
- Ethylene Propylene (EPR or EPDM) ☐
- TFE Propylene (Aflas or Fluoraz) ☐
- Fluorocarbon Rubber (Viton®) ☐
- Other - Specify in "Comments" ☐

Pump Drive Type:
- Constant Speed - Motor Driven ☐
- Variable Speed (VFD) - Motor Driven ☐
- Variable Speed - Turbine Driven ☐
- Other - Specify in "Comments" ☐

Comments:

NACE Materials Required? ☐
Flow Test with Performance Certificate Required? ☐
Customer Inspection Required Prior to Shipment? ☐
Certificate of Compliance for Hydro Test Required? ☐
Magnetic Particle Test Required? ☐
Radiograph Inspection Required (specify scope)? ☐
Certified Material Test Report (Pressure Containing Components only)? ☐

Flow tests are generally conducted on all model 5300 and 7100 ARC® valves and one model 9100 or 9200 ARC® valve per sales order line item at no additional cost. Model 9300 ARC® valves and other flow test requirements are upon request and at additional cost. If flange drilling is other than ANSI, please specify in "Comments." Please include Pump Curve if available.