

自控回流阀

AUTOMATIC RECIRCULATION VALVES

——用于泵的最小流量保护
——For Centrifugal Pump
Minimum Flow Protection



北京航天石化技术装备工程公司

BEIJING AEROSPACE PETROCHEMICAL TECHNOLOGY
AND EQUIPMENT ENGINEERING CORPORATION



ARC1000系列 ARC1000 Series

弹簧阻尼器

Dampening valve

减少波动，防止“水锤”
protects system from
waterhammer if sudden
changes in flow demand
occur.

止回阀

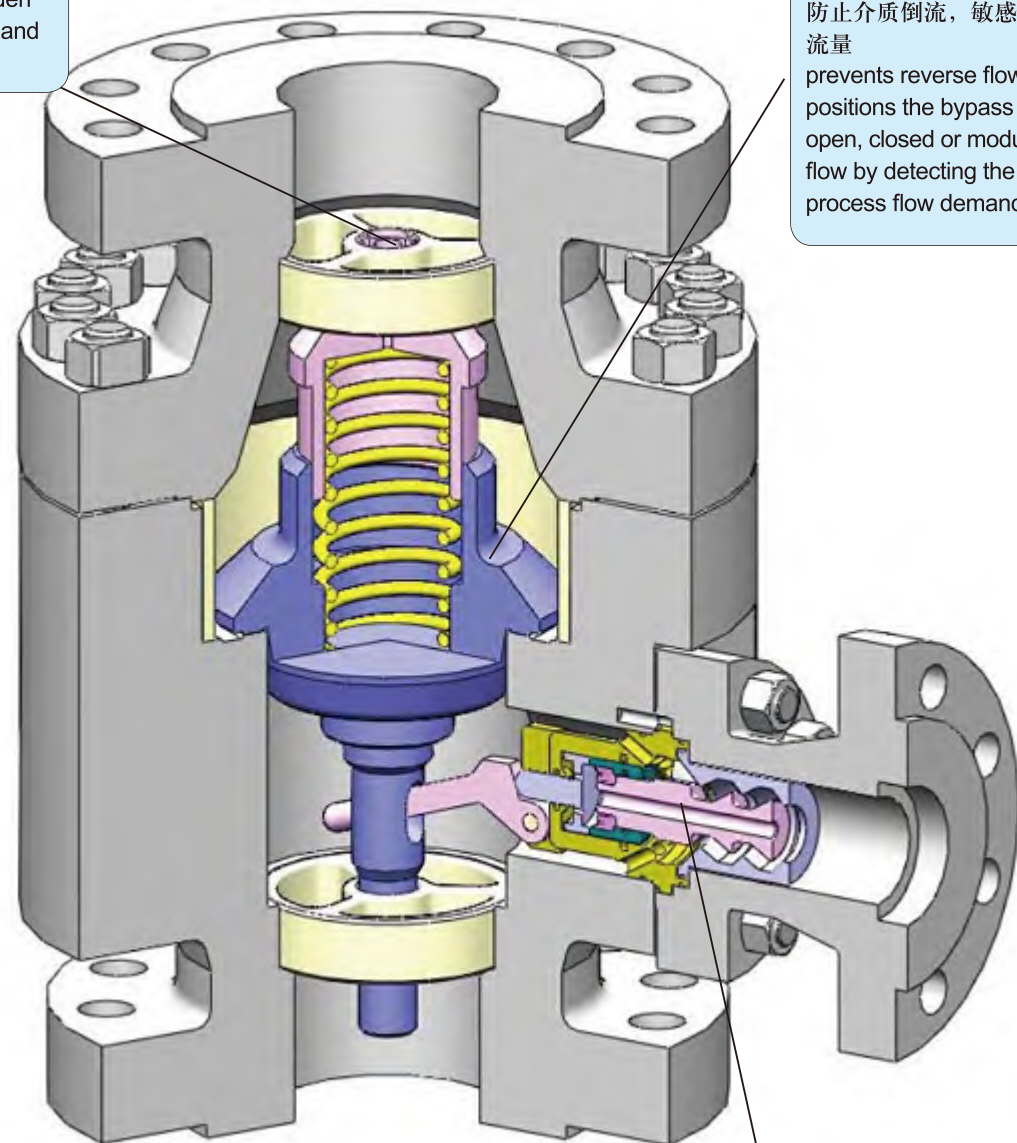
Check Valve Disc

防止介质倒流，敏感工艺
流量
prevents reverse flow and
positions the bypass for
open, closed or modulating
flow by detecting the
process flow demand.

旁通阀多级减压

Multiple stage pressure reduction

防止汽蚀同时起到旁路止回的作用
Prevents from flashing/cavitation
with integral check valve in bypass.



ARC2000系列 ARC2000 Series

弹簧阻尼器

Dampening valve

减少波动，防止“水锤”
protects system from
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changes in flow demand
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止回阀

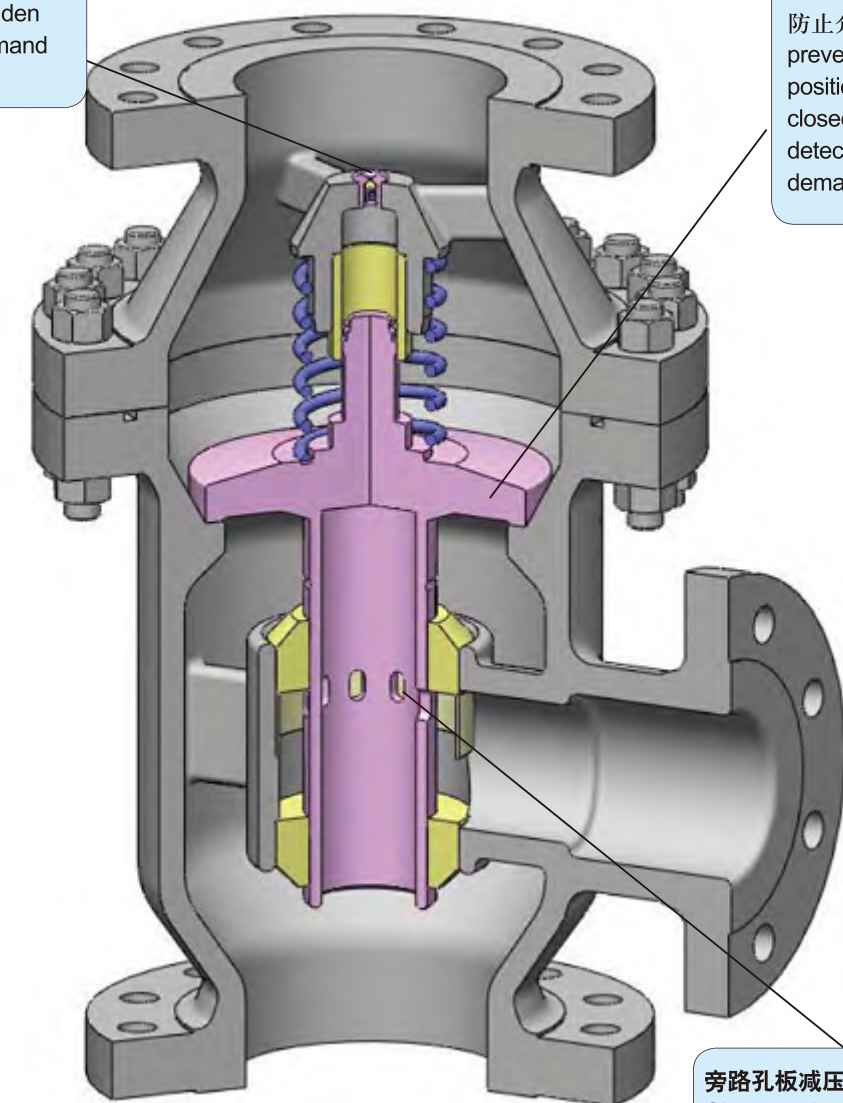
Check Valve Disc

防止介质倒流，敏感工艺流量
prevents reverse flow and
positions the bypass for open,
closed or modulating flow by
detecting the process flow
demand.

旁路孔板减压

Characterized orifices in the bypass

精准控制再循环流量
element provides accurate, modulated
recirculation flow

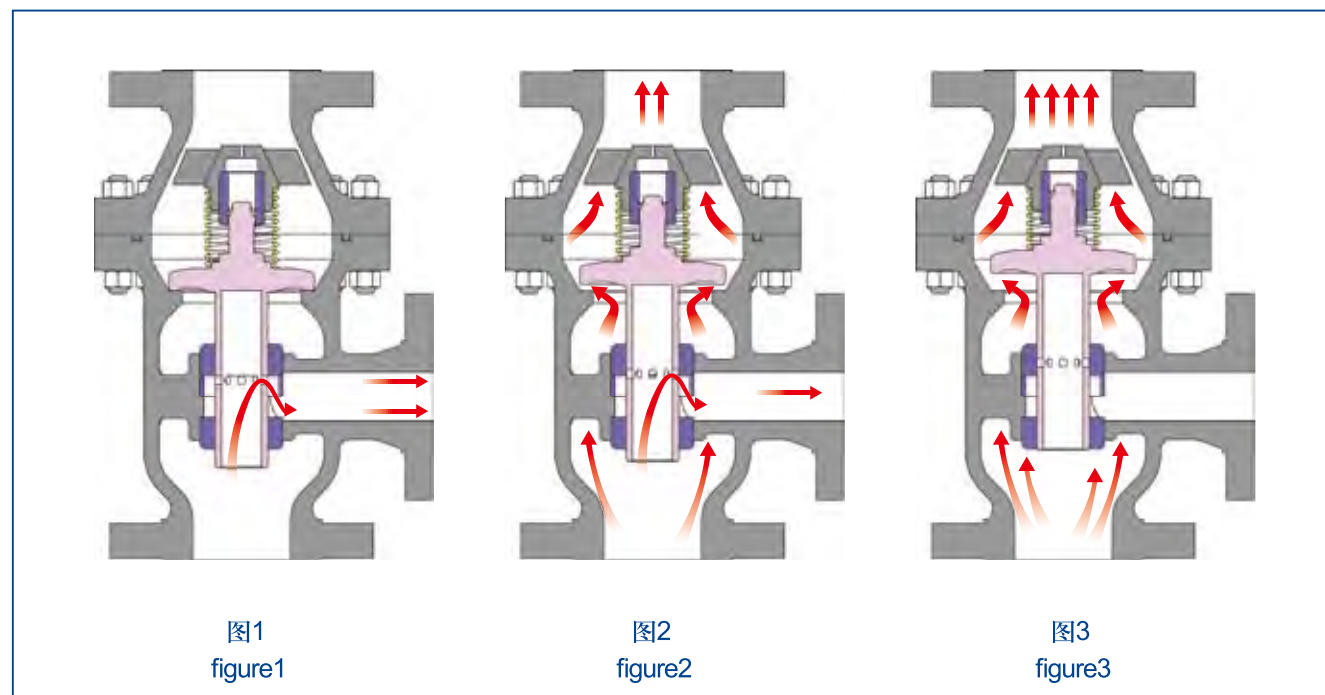


自控回流阀机理介绍

Automatic recirculation valve mechanism introduced

自控回流阀集止回、流量感知、旁通流量控制功能于一身，是一个独立的系统。它能动态感知主路流量变化，随主路流量调整旁通流量，其工作原理可用三种状态来描述：当主阀完全关闭（图1）、旁通处于完全打开位置时，此时泵处于最小需求流量工况，可有效保护泵不致发生“气蚀”；随着主路止回阀逐渐开启（图2），旁通逐渐关闭，工艺流量和再循环流量之和大于泵的最小需求流量；随着工艺流量增加，当主阀处于全开位置时（图3），旁通完全关闭。

The heart of the ARC valve is a main flow sensing check valve disc, which is flow sensitive but pressure sensitive. The disc modulates to the demand for process flow while 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 full open. The valve provides for single phase flow in the bypass eliminating the possibility of flashing or cavitation. 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 full open, as in Figure 3, the bypass is closed.



最小流量保护方式

Minumum Flow Protection Methods

连续循环系统 Continuous Recirculation System

最小需求流量与工艺流量的变化无关，回路经降压孔板直接回储罐。连续的最小流量循环虽然可以很好地保护泵，但是泵必须提供更大的输出功率，造成额外的能量浪费。见图4。

The desired minimum flow volume is recirculated regardless of the system demand for fluid. Fixed orifices reduce the pressure before discharging. Continuous recirculating provides reliable pump protection, however, it is very inefficient and costly. The pump and driver must be sized to allow for the additional flow that is recirculating even when the flow demand rate exceeds the required minimum flow. See Figure 4.

控制循环系统 Control Loop System

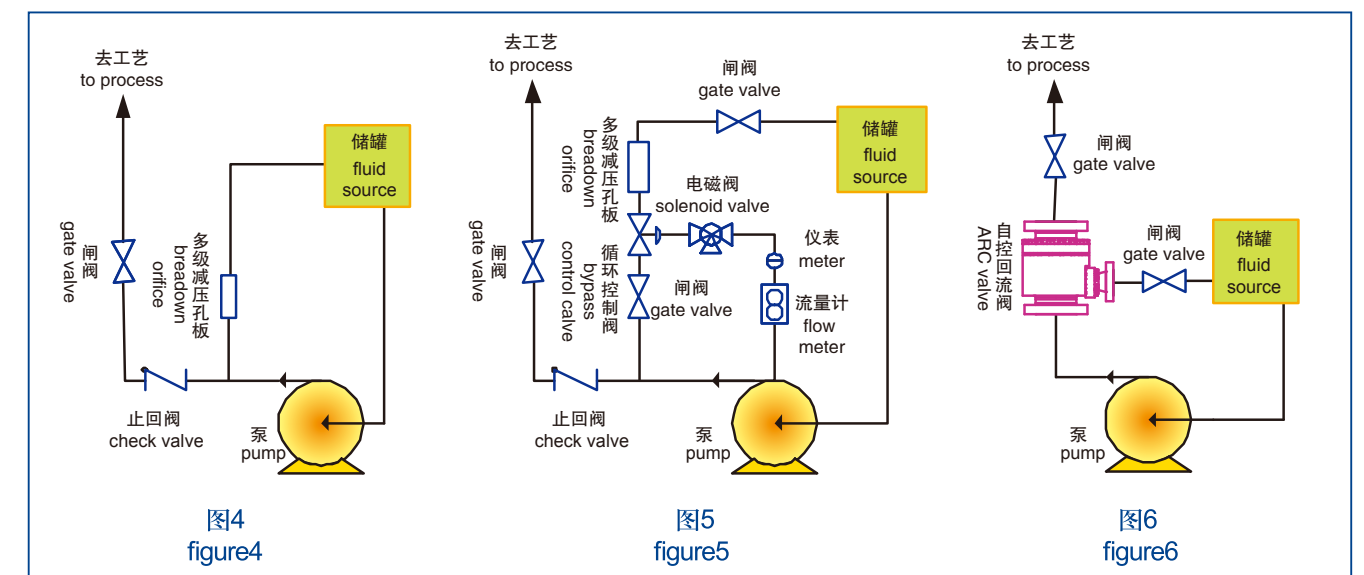
控制循环系统能够提供最小流量保护，当工艺流量大时，回路关闭，没有额外的能量损失。但控制循环系统由止回阀、流量计、降压孔板、回流控制阀、电磁阀组成，系统元件多，购买、安装、维护费用高。见图5。

Recirculating occurs only when the process flow demand drops below the required minimum flow rate. Instrument controlled systems eliminate the inefficient and costly to operate constant recirculating systems. However, the necessary system components; check valve, flow meter, pressure reducing valve and related piping result in a considerable expense to purchase, install and maintain. See Figure 5.

自控回流阀系统 Automatic Recirculation Valve System

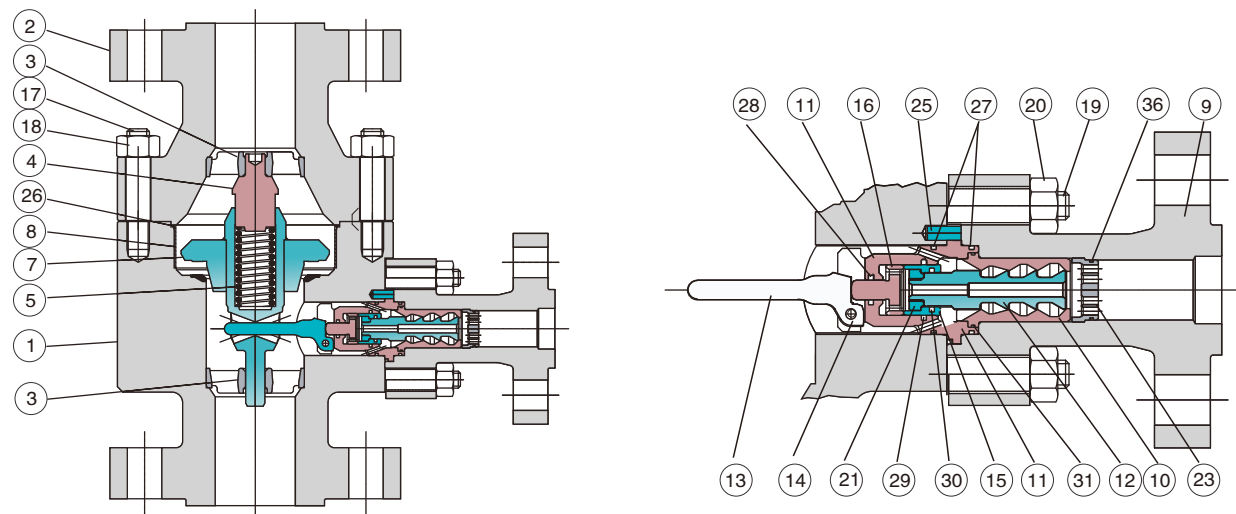
自控回流阀是集流量感知元件、多级降压、旁通控制阀和止回的功能于一体的三通阀。无需动力源和信号源，采用静密封，无外漏；完全的无电连接，属本质安全型；减少了连接的数量，安装、维护费用低。见图6。

The automatic recirculating valve performs all flow sensing, bypass pressure reduction, reverse flow protection and modulating recirculating flow in an integral three port valve. The valve performs the same function of an instrumented system without the multitude of components, piping connections and system design expense. The valve is flow operated and does not require any air or electricity to operate. See Figure 6.



ARC1000 结构与材质

ARC1000 main dimensions and materials

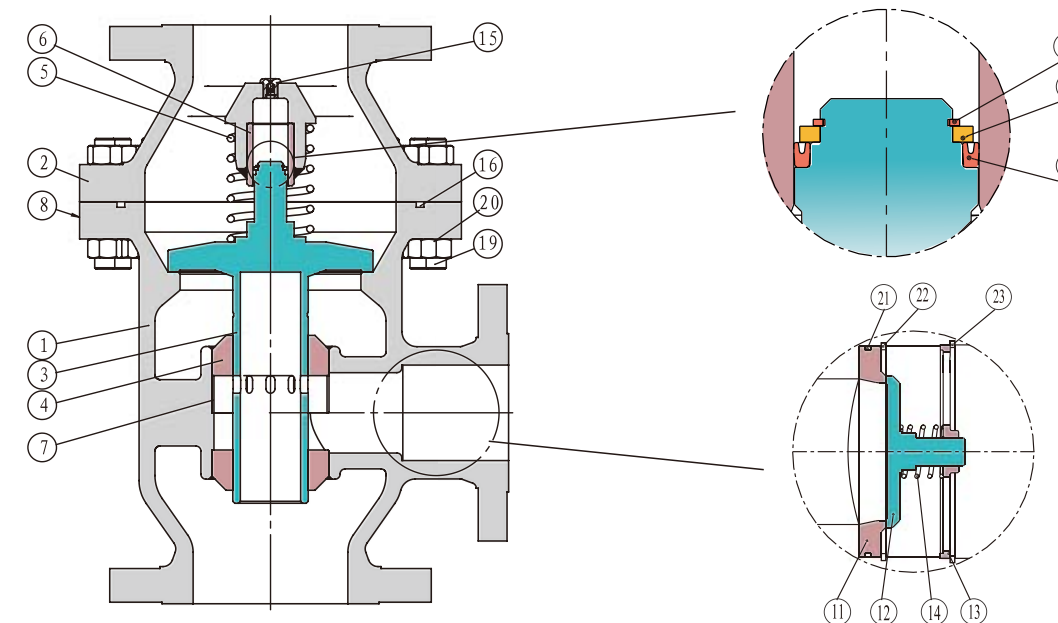


ARC 1000 材料 Materials

序号 Ref.No	零件名称 Part Name	材料代号Sign of Materials	
		01	02
1	阀体 Body	ASTM A105	ASTM A182 F304
2	阀盖 Bonnet	ASTM A105	ASTM A182 F304
3	支撑盘 Stem Guide	ASTM A276 304	ASTM A276 304
4	导杆螺套 Guide Bolt	ASTM A276 304	ASTM A276 304
5	弹簧 Spring	ASTM A276 304	ASTM A276 304
6	标牌 Nameplate	ASTM A276 304	ASTM A276 304
7	止回阀 Check Valve	ASTM A276 304	ASTM A276 304
8	衬里 Liner	ASTM A276 304	ASTM A276 304
9	旁路阀体 Bypass Branch	ASTM A105	ASTM A182 F304
10	涡旋衬套 Vortex Housing	ASTM A564 630	ASTM A564 630
11	控制器盖 Control Head	ASTM A564 630	ASTM A564 630
12	涡旋塞 Vortex Plug	ASTM A564 630	ASTM A564 630
13	操纵杆 Lever	ASTM A564 630	ASTM A564 630
14	转轴 Pivot Pin	ASTM A564 630	ASTM A564 630
15	减压衬套 Vortex Bushing	ASTM A564 630	ASTM A564 630
16	活塞 Piston	ASTM A564 630	ASTM A564 630
17	锁紧螺母 Vortex Plate	ASTM A564 630	ASTM A564 630
18	双头螺柱 Stud	ASTM A193 B7	ASTM A193 B8
19	六角螺母 Hex Nut	ASTM A194 2H	ASTM A194 8
20	双头螺柱 Stud	ASTM A193 B7	ASTM A193 B8
26	六角螺母 Hex Nut	ASTM A194 2H	ASTM A194 8
27	O形圈 O-Ring	Elastomer	Elastomer
28	O形圈 O-Ring	Elastomer	Elastomer
29	Glyd圈 Glyd Ring	Elastomer+PTFE	Elastomer+PTFE
30	Glyd圈 Glyd Ring	Elastomer+PTFE	Elastomer+PTFE
31	Glyd圈 Glyd Ring	Elastomer+PTFE	Elastomer+PTFE
32	O形圈 O-Ring	Elastomer	Elastomer

ARC2000 结构与材质

ARC2000 main dimensions and materials



ARC 2000 材料 Materials

主路 Mainpass

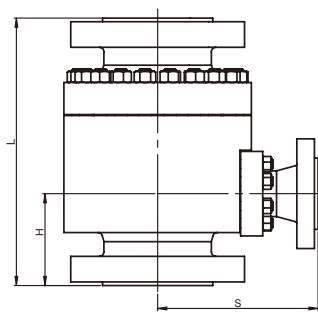
序号 Ref.No	零件名称 Part Name	材料代号 Sign of Materials	
		01	02
1	阀体 Body	ASTM A216 WCB	ASTM A351 GR.CF8M
2	阀盖 Bonnet	ASTM A216 WCB	ASTM A351 GR.CF8M
3	止回阀 Check Valve	ASTM A276 316	ASTM A276 316
4	套筒 Bypass Ring	ASTM A564 630	ASTM A564 630
5	主路弹簧 Main Spring	ASTM A276 316	ASTM A276 316
6	导向套 Slide Ring	ASTM A564 630	ASTM A564 630
7	衬里 Lower Sline Ring	ASTM A564 630	ASTM A564 630
8	标牌 Nameplate	ASTM A276 304	ASTM A276 304
9	挡板 Baffle	ASTM A276 316	ASTM A276 316
15	弹簧阻尼器 Dampening valve	ASTM A276 304	ASTM A276 316
16	O型圈 O-ring	Elastomer	Elastomer
17	范塞密封圈 Variseal ring	Elastomer	Elastomer
18	挡圈 Retaining Ring	ASTM A276 316	ASTM A276 316
19	螺柱 Bolt	ASTM A193 B7	ASTM A193 B8
20	螺母 Nut	ASTM A194 2H	ASTM A194 8

旁路 Bypass (可选 Optional)

11	阀座 Valve Seat	ASTM A276 316
12	阀瓣 Disc	ASTM A276 316
13	支撑盘 Stemguide	ASTM A276 316
14	旁路弹簧 Bypass Spring	ASTM A276 316
21	O型圈 O-Ring	Elastomer
22	挡圈 Retaining Ring	ASTM A276 316
23	挡圈 Retaining Ring	ASTM A276 316

ARC1000外型尺寸、重量和流量参数

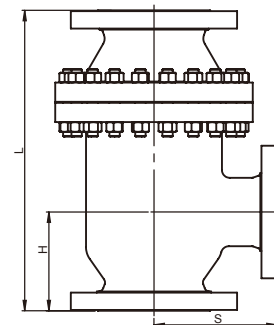
ARC1000 Dimensions, Weights and Flow Ratings



公称通径 Valve Size		法兰磅级	主路最大流量	旁路最大流量	旁路最大Cv	重量	结构尺寸 Dimensions(mm)		
主路 Main mm(In)	旁路 Bypass mm(In)	ANSI	Max. Main Flow (M³/h)	Max. Bypass Flow (M³/h)	Bypass Max. Cv	Weight (Kg)	L (mm)	H (mm)	S (mm)
40 (1.5)	25 (1)	600	34	14	1.3	32	260	90	190
		900			1.1	42	300	110	200
		1500			0.9	57	310	120	215
50 (2)	25 (1)	600	50	14	2.7	48	300	110	193
		900			1.7	76	340	130	203
		1500			1.6	95	350	130	233
65 (2.5)	40 (1.5)	600	75	34	3.5	68	340	125	220
		900			2.6	88	380	140	230
		1500			2.4	103	400	145	250
80 (3)	40 (1.5)	600	114	34	5.2	100	380	140	240
		900			4	113	410	150	250
		1500			3.5	140	450	165	275
100 (4)	50 (2)	600	204	57	8.5	149	430	155	266
		900			5.6	176	450	160	280
		1500			5.2	222	520	190	300
125 (5)	65 (2.5)	600	250	91	11	205	500	175	310
		900			9.5	272	525	185	310
		1500			6.5	278	650	235	341
150 (6)	80 (3)	600	454	125	14	375	550	190	335
		900			12	430	585	200	350
		1500			10	496	700	250	405
200 (8)	100 (4)	600	749	204	22	545	650	215	405
		900			20	640	675	225	405
		1500			16	786	850	295	475
250 (10)	150 (6)	600	999	279	35	822	800	270	520
		900			25	1155	800	270	520
		1500			22	1483	975	330	568
300 (12)	150 (6)	600	1498	431	55	1710	1051	360	649
		900			35	1978	1051	360	649
		1500			30	2665	1149	400	700

ARC2000外型尺寸、重量和流量参数

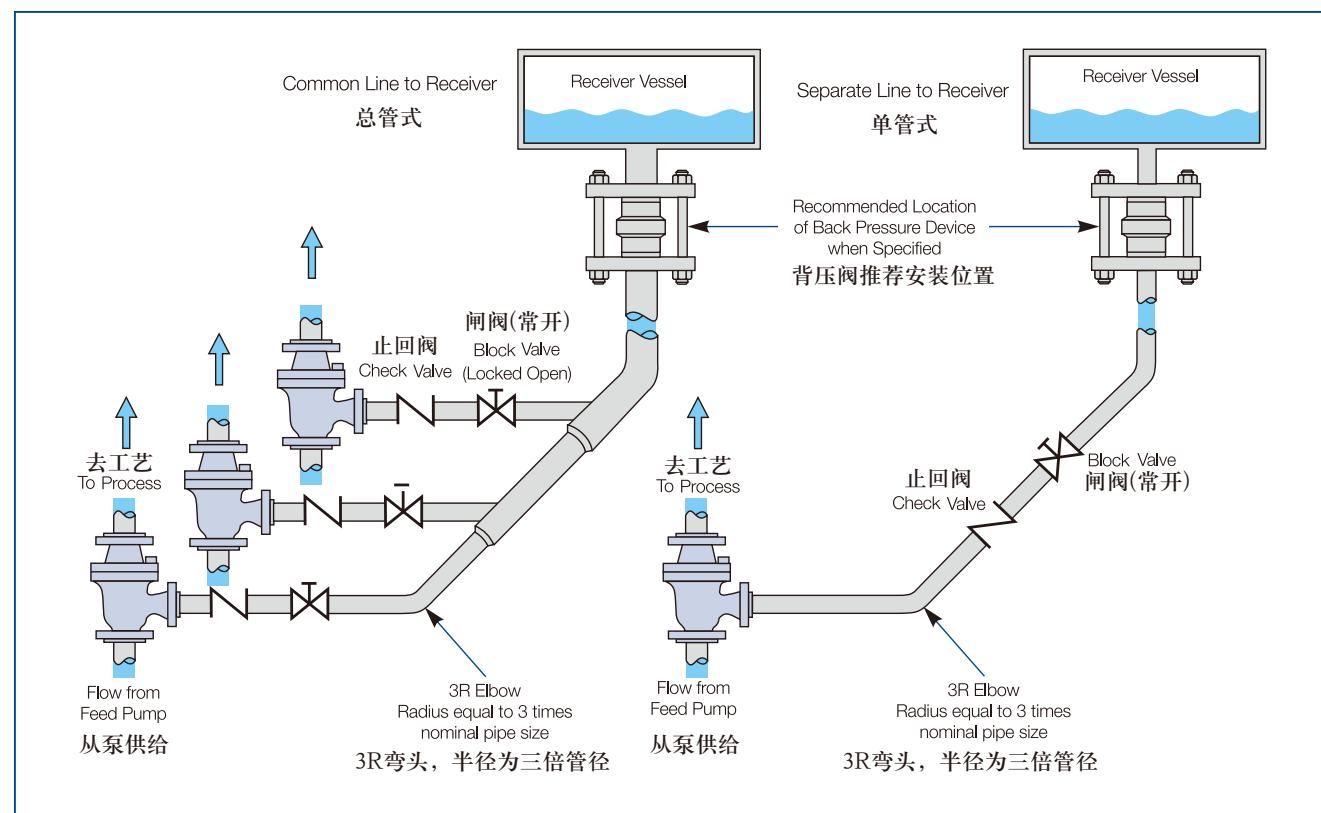
ARC2000 Dimensions, Weights and Flow Ratings



公称通径 Valve Size		法兰磅级	主路最大流量	旁路			重量	结构尺寸 Dimensions(mm)		
主路 Main mm(In)	旁路 Bypass mm(In)	ANSI	Max. Main Flow (M³/h)	最大流量 (m³/h)	最大Cv	最小Cv	Weight (Kg)	L (mm)	H (mm)	S (mm)
25 (1)	20 (3/4)	150	14	8	6.1	0.5	10	244	87	120
		300					15	244	87	120
		600					22	258	94	120
40 (1-12)	20 (3/4)	150	28	8	6.1	0.5	12	244	87	120
		300					17	244	87	120
		600					22	258	94	145
50 (2)	40 (1-1/2)	150	60	17	8.5	1.0	18	278	101	140
		300					22	278	101	450
		600					26	294	109	165
80 (3)	50 (2)	150	114	38	17	2.0	30	358	118	142
		300					42	393	130	153
		600					54	414	135	167
100 (4)	80 (3)	150	205	73	36.4	3.0	49	401	137	172
		300					72	462	158	185
		600					100	499	168	205
150 (6)	100 (4)	150	455	148	91	5.0	100	534	175	214
		300					143	578	190	237
		600					206	636	206	259
200 (8)	150 (6)	150	750	284	169.8	7.0	199	750	245	275
		300					272	796	258	295
		600					354	856	275	320
250 (10)	200 (8)	150	1250	545	425	25.0	430	900	300	340
		300					610	950	320	360
		600					875	1100	365	414
300 (12)	250 (10)	150	1650	950	830	42.0	520	920	305	370
		300					790	1015	340	400
		600					1300	1050	375	450
350 (14)	250 (10)	150	联系厂家 consult factory					1350	400	410
		300						1330	420	450
		600						1442	476	533
400 (16)	300 (12)	150	联系厂家 consult factory					1440	475	525
		300						1522	504	565
		600						1630	538	602
450 (18)	350 (14)	150	联系厂家 consult factory					1620	535	590
		300						1710	564	620
		600						1825	602	674
500 (20)	400 (16)	150	联系厂家 consult factory					1800	595	655
		300						1885	622	696
		600						2012	664	744

自控回流阀安装

ARC Valve installation



自控回流阀安装

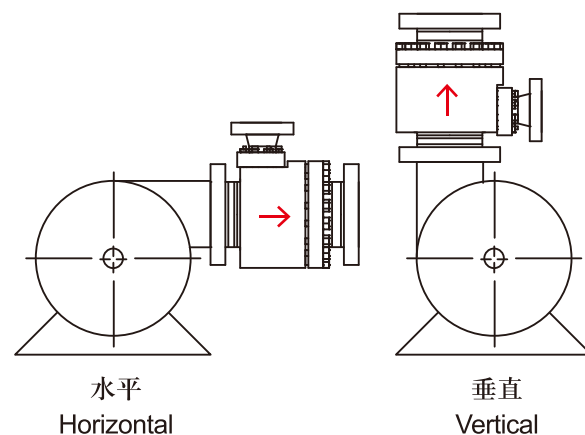
ARC Valve installation

自控回流阀是严格按照客户提供的参数设计的, 任何压力、温度、介质和流量参数变化都需要对阀内件进行修正, 如果上述参数有变请联系生产厂。

The valve and its components are selected according to specifications supplied by customers. Any change in pressure, temperature, type of fluid and flow condition, may require modification of valve internals. Please Consult with the factory if the aforementioned occurred.

自控回流阀既可垂直安装又可水平安装, 旁路安装方向任意, 但水平安装时旁路不能向下。自控回流阀一般安装在泵出口法兰, 介质流动方向必须和箭头方向一致。

The installation of the ARC valve can be both Vertical (preferred) and Horizontal. The by-pass flow direction may be any but down when installation is horizontal. ARC valve is normal installed near or on the discharge flange of the centrifugal pump. Flow direction must be as indicated by the arrow stamped into the body.



如何订货

How to Order

订货参数表 Required Application Data

1. 主路流量 Main Flow

最大 Maximum m^3/h
正常 Normal m^3/h
最小需求流量 Minimum Pump Flow m^3/h

2. 泵出口压力 Pump Discharge Pressure

正常流量时 Normal Flow MPa
旁路最小需求流量时 Bypass Flow MPa
关闭压力 Shut off Pressure MPa
旁路出口背压 Bypass Back Pressure MPa

3. 温度 Temperature

正常 Normal $^{\circ}\text{C}$
最高 Maximum $^{\circ}\text{C}$

4. 介质 Liquid

密度 Density Kg/m^3
饱和蒸汽压 Vapor Pressure MPa
动力粘度 Viscosity Cp

5. 安装方向 Install Direction

☐ 水平 Horizontal ☐ 垂直 Vertical

阀门型号 Valve Code

结构形式 Type	口径 Size	公称压力 Class	阀体材料 Material
ARC	1000 2000	01 - 150lb 03 - 300lb 06 - 600lb 09 - 900lb 15 - 1500lb 25 - 2500lb	01 - A105(1000) WCB(2000) 02 - 304(1000) CF8M(2000)

编制示例 For Example:

公称压力为300Lb, 公称通径3", 材质为CF8M, ARC2000自控回流阀的型号为ARC2000-03-03-02

Here is a valve with Pressure Class 300Lb, Valve DN 3", material CF8M, so its Valve Model is: ARC2000-03-03-02