



SWING CHECK VALVES 旋启式止回阀

I、Rational structure, reliable seal, good performance and nice modeling.

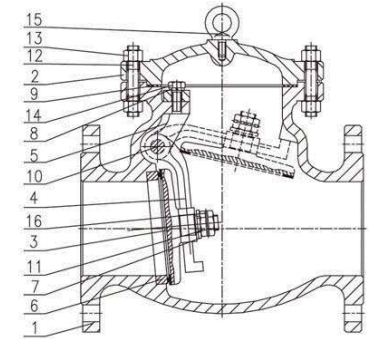
II、Disc in swing type, can be installed both in horizontal and vertical position.

III、The variety of body materials are optional. Gasket can be chosen according to customer's requirement and be used in different pressure, temperature and working condition.

IV、Inside shaft structure reduces leakage and is reliable to use.

Features 结构特点

- 1、产品结构合理、密封可靠、性能优良、造型美观。
- 2、阀瓣为旋启式，流道直通，水平管道和垂直管道均可安装。
- 3、阀体材料的品种齐全。垫片根据用户要求合理选配，能适用各种压力、温度和工况。
- 4、内式的销轴结构，减小外泄漏点，使用可靠。



Technical Data 技术参数



Size 公称尺寸: NPS 2~36、DN 50~900
 Pressure Rating 压力等级: Class 150~Class 1500, PN 16~PN 100
 Temperature 适用温度: -196~550°C
 Design Standard 设计标准: ASME B 16.34、API6D、DIN3356、BS1868
 Face to Face 结构长度: ASME B 16.10、DIN EN558
 Flanged Ends 法兰端: ASME B16.5、DIN EN1092
 Butt-welding Ends 对焊端: ASME B16.25
 Test and Inspection 试验和检验: API6D、ISO5208 EN12266.1、API598

Notes: The sizes of serial valve flange and butt-welding dimensions can be designed according to customer's requirement.
 注: 系列阀门法兰端和对焊端尺寸可根据用户要求设计制造

General Application 一般用途

They are used in industries including oil, chemistry, pharmaceutical, fertilizer and power generation to prevent the backward flow of the media.

旋启式止回阀适用于石油、化工、制药、化肥、电力行业等各种工况的管路上，防止介质的倒流。适用介质为：水、油品、蒸汽、酸性介质等。

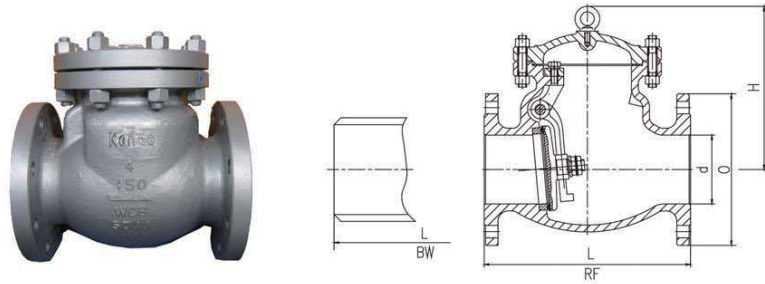
Material Specifications 材料规范

NO. 序号	Parts 零件名称	Materials 材料				
		Standard 标准	Sour(NACE) 抗硫(NACE)	Low Temperature 低温	High Temperature 高温	SS 不锈钢
1	Body 阀体	A216 WCB	A216 WCB	A352 LCC	A217 C5	A351CF8M
2	Cover 阀盖	A216 WCB	A216 WCB	A352 LCC	A217 C5	A351CF8M
3	Disc 阀瓣	A216 WCB	A351 CF8	A352 LCC	A217 C5	A351CF8M
4	Hinge 摇臂	A216 WCB	A216 WCB	A352 LCC	A217 C5	A351CF8M
5	Yoke 叉形架	A216 WCB	A216 WCB	A352 LCC	A217 C5	A351CF8M
6	Seat 阀座	A105	A182 F304	A350 LF3	A182 F5a	
7	Disc Washer 阀瓣垫圈	CS 碳钢	316	316	316	316
8	Bolt Washer 弹性垫圈	CS 碳钢	316	316	316	316
9	Gasket 垫片	Graphite+316 柔性石墨+316	Graphite+316 柔性石墨+316	Graphite+316 柔性石墨+316	Graphite+316 柔性石墨+316	Graphite+316 柔性石墨+316
10	Hinge Pin 圆柱销	A276 410	A182 F316	A182 F316	A276 410	A182 F316
11	Disc Nut 六角螺母	A182 F304	A182 F304	A182 F304	A182 F304	A182 F316
12	Bonnet Bolt 螺栓	A193 B7	A193 B7M	A320 L7M	A193 B16	A193 B8M
13	Bonnet Nut 螺母	A194 2H	A194 2HM	A194 7M	A194 4	A194 8M
14	Bolt 六角螺栓	A276 304	A276 304	A276 304	A276 304	A276 316
15	Eyebolt 吊环	CS 碳钢	CS 碳钢	CS 碳钢	CS 碳钢	SS 不锈钢
16	Disc Pin 开口销	A276 304	A276 304	A276 304	A276 304	A276 316

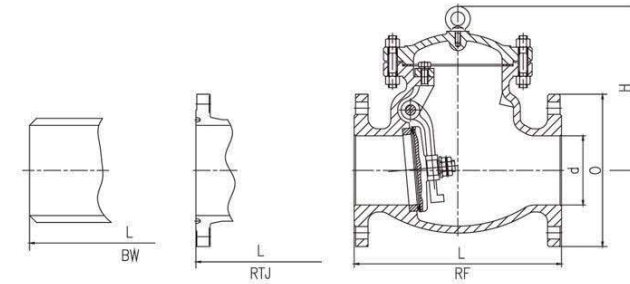
Notes: The materials can be selected according to customer's requirement. 注: 材料可根据用户要求合理选用。



ANSI SWING CHECK VALVES 美标旋启式止回阀



ANSI SWING CHECK VALVES 美标旋启式止回阀



Dimensions and Weights 尺寸及重量 (Class150 ~ Class300)

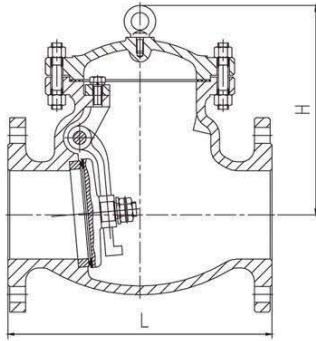
Class 压力级	NPS(in) 公称尺寸	Dimensions 尺寸 / mm				Weight 重量 / kg	
		d	L RF/BW	O	H	RF	BW
Class 150	2	51	203	150	150	15	12
	2½	64	216	180	170	26	17
	3	76	241	190	180	27	18
	4	102	292	230	237	42	32
	6	152	356	280	305	75	60
	8	203	495	345	370	124	106
	10	254	622	405	420	200	174
	12	305	698	485	440	310	258
	14	337	787	535	470	428	368
	16	387	864	595	520	555	483
	18	438	978	635	580	775	685
	20	489	978	700	630	835	720
	24	591	1295	815	870	1100	970
26	641	1295	870	901	1370	1120	
28	692	1448	927	920	1720	1550	
30	743	1524	984	970	1980	1780	
Class 300	2	51	267	165	170	21	15
	2½	64	292	190	185	30	22
	3	76	318	210	215	39	30
	4	102	356	255	235	70	44
	6	152	444	320	300	125	98
	8	203	533	380	340	190	150
	10	254	622	445	350	290	230
	12	305	711	520	420	450	375
	14	337	838	585	480	700	555
	16	387	864	650	520	840	766
	18	432	978	710	600	1000	915
	20	483	1016	775	670	1273	1100
	24	584	1346	915	750	1700	1500
26	635	1346	972	880	2175	1995	
28	686	1499	1035	1010	2565	2260	
30	737	1594	1092	1410	2989	2680	

Dimensions and Weights 尺寸及重量 (Class600 ~ Class1500)

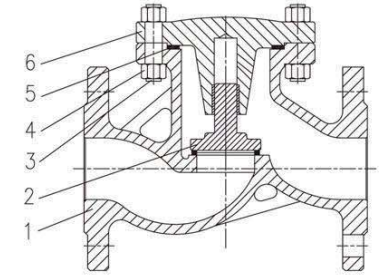
Class 压力级	NPS(in) 公称尺寸	Dimensions 尺寸 / mm					Weight 重量 / kg	
		d	L RF/BW RTJ		O	H	RF/RTJ	BW
Class 600	2	51	292	295	165	175	28	20
	2½	64	330	333	190	200	38	30
	3	76	356	359	210	230	52	40
	4	102	432	435	275	295	87	65
	6	152	559	562	355	360	224	155
	8	200	660	663	420	400	354	280
	10	248	787	790	510	460	555	395
	12	298	838	841	560	520	790	630
	14	327	889	892	605	590	892	710
	16	375	991	994	685	670	1200	1020
Class 900	2	47	368	371	215	300	70	50
	2½	57	419	422	245	310	100	77
	3	73	381	384	240	310	91	68
	4	98	457	460	290	335	150	113
	6	146	610	613	380	420	305	230
	8	191	737	740	470	503	510	387
	10	238	838	841	545	637	810	632
	12	282	965	968	610	757	1120	901
	14	311	1029	1039	640	810	1380	1139
	16	356	1130	1140	705	820	1900	1613
Class 1500	2	47	368	371	215	300	70	50
	2½	57	419	422	245	300	100	77
	3	70	470	473	265	340	150	115
	4	92	546	549	310	411	285	190
	6	136	705	711	395	511	550	452
	8	178	832	842	485	681	1010	845
	10	222	991	1001	585	757	1550	1280
	12	263	1130	1146	675	856	2280	1780



DIN SWING CHECK VALVES 德标旋启式止回阀



LIFT CHECK VALVES 升降式止回阀



Dimensions and Weights 尺寸及重量 (PN16 ~ PN100)

公称尺寸DN / mm		50	65	80	100	125	150	200	250	300	350	400	500	600
PN16	L / mm	200	240	260	300	350	400	500	600	700	800	900	1100	1300
	H / mm	150	170	180	237	270	305	369	424	440	470	520	630	870
	WT / kg	16	25	29	44	68	85	115	180	270	380	509	967	1507
PN25	L / mm	230	290	310	350	400	480	600	730	850	980	1100	1250	1450
	H / mm	150	170	180	237	270	305	369	424	440	470	520	630	870
	WT / kg	17	30	34	48	105	118	160	230	420	535	585	1025	1650
PN40	L / mm	230	290	310	350	400	480	600	730	850	980	1100	1250	1450
	H / mm	150	170	180	237	270	305	369	424	440	470	520	630	870
	WT / kg	17	30	34	48	105	118	220	320	450	600	800	1269	1669
PN63	L / mm	300	340	380	430	500	550	650	775	900	1025	1150	1400	—
	H / mm	180	200	220	245	300	335	385	445	520	565	635	750	—
	WT / kg	37	45	55	59	145	160	255	360	600	780	1100	1656	—
PN100	L / mm	300	340	380	430	500	550	650	775	900	1025	1150	1400	—
	H / mm	180	200	220	245	300	335	385	445	520	585	635	950	—
	WT / kg	80	95	110	125	190	260	400	560	800	1000	1250	1925	—

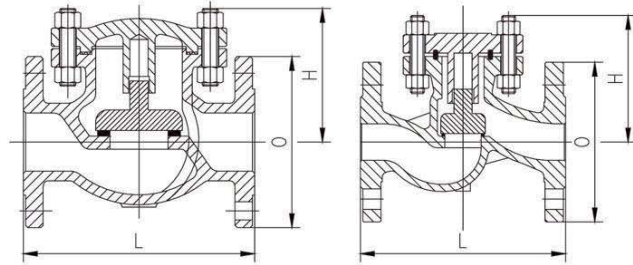
Material Specifications 材料规范

NO. 序号	Parts 零件名称	Materials 材料				
		Standard 标准	Sour(NACE) 抗硫(NACE)	Low Temperature 低温	High Temperature 高温	SS 不锈钢
1	Body 阀体	A216 WCB	A216 WCB	A352 LCC	A217 C5	A351CF8M
2	Disc 阀瓣	A105	A182 F316	A350 LF3	A182 F5a	A182 F316
3	Bolt 螺栓	A193 B7	A193 B7M	A320 L7M	A193 B16	A193 B8M
4	Nut 螺母	A194 2H	A194 2HM	A194 7M	A194 4	A194 8M
5	Gasket 垫片	Graphite+304 柔性石墨+304	Graphite+304 柔性石墨+304	Graphite+304 柔性石墨+304	Graphite+304 柔性石墨+304	Graphite+316 柔性石墨+316
6	Cover 阀盖	A216 WCB	A216 WCB	A352 LCC	A217 C5	A351CF8M

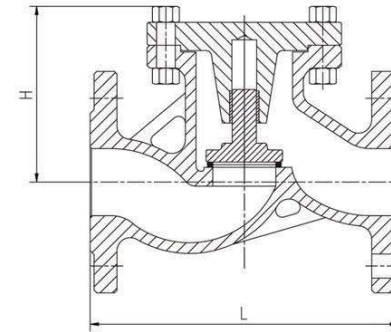
Notes: The materials can be selected according to customer's requirement. 注: 材料可根据用户要求合理选用。



ANSI LIFT CHECK VALVES 美标升降式止回阀



DIN LIFT CHECK VALVES 德标升降式止回阀



Dimensions and Weights 尺寸及重量 (Class150 ~ Class900)

Class 压力级		Class 150									
NPS(in) 公称尺寸		2	2½	3	4	6	8	10	12	14	16
Dimensions 尺寸 / mm	L	203	216	241	292	406	495	622	698	787	914
	O	150	180	190	230	280	345	405	485	535	595
	H	165	175	190	215	265	320	365	415	460	510
Weight重量 / kg		17	25	29	50	85	150	240	350	460	580
Class 压力级		Class 300									
NPS(in) 公称尺寸		2	2½	3	4	6	8	10	12	—	—
Dimensions 尺寸 / mm	L	267	292	318	356	444	559	622	711	—	—
	O	165	190	210	255	320	380	445	520	—	—
	H	190	205	220	245	295	330	420	480	—	—
Weight重量 / kg		28	33	45	70	150	230	390	520	—	—
Class 压力级		Class 600									
NPS(in) 公称尺寸		2	2½	3	4	6	8	10	12	—	—
Dimensions 尺寸 / mm	L	292	330	356	432	559	660	787	838	—	—
	O	165	190	210	275	355	420	510	560	—	—
	H	210	230	255	295	365	420	505	545	—	—
Weight重量 / kg		33	43	62	113	222	390	630	871	—	—
Class 压力级		Class 900									
NPS(in) 公称尺寸		2	2½	3	4	6	—	—	—	—	—
Dimensions 尺寸 / mm	L	368	419	381	457	610	—	—	—	—	—
	O	215	245	240	290	380	—	—	—	—	—
	H	235	270	302	342	425	—	—	—	—	—
Weight重量 / kg		120	166	176	182	403	—	—	—	—	—

Dimensions and Weights 尺寸及重量 (PN16 ~ PN100)

公称尺寸DN / mm		50	65	80	100	125	150	200	250	300	350	400
PN16	L / mm	200	240	260	300	350	400	500	600	700	800	900
	H / mm	165	175	190	215	230	265	320	365	415	460	510
	WT / kg	17	25	29	50	70	85	150	240	350	460	580
PN25	L / mm	230	290	310	350	400	480	600	730	850	980	1100
	H / mm	172	180	195	220	250	270	330	380	430	480	530
	WT / kg	18	27	32	55	80	90	155	250	360	290	620
PN40	L / mm	230	290	310	350	400	480	600	730	850	—	—
	H / mm	190	205	220	245	265	295	330	420	480	—	—
	WT / kg	28	33	45	70	100	150	230	390	520	—	—
PN63	L / mm	300	340	380	430	500	550	650	775	900	—	—
	H / mm	200	215	238	270	300	330	375	460	510	—	—
	WT / kg	30	38	54	91	124	186	310	500	690	—	—
PN100	L / mm	300	340	380	430	500	550	650	775	900	—	—
	H / mm	210	230	255	295	330	365	420	505	545	—	—
	WT / kg	33	43	62	113	150	222	390	630	871	—	—



WAFER DUO CHECK VALVES 对夹连接旋启式止回阀

- I、Short pattern, small volume and light weight.
 II、Both soft and metallic seats can be chosen according to different working conditions, all with perfect sealing effect.
 III、With a small starting pressure, discs can be fully opened under a very small pressure difference.
 IV、Quick close and small water hammer effect.
 V、Can be installed both in horizontal and vertical position.
 VI、The variety of body materials are optional. Gasket can be chosen according to customer's requirement and be used in different pressure, temperature and working condition.

Features 结构特点

- 1、产品结构长度短、体积小、重量轻。
- 2、密封面可根据不同的工况条件选用软密封或硬密封材质、密封性能好。
- 3、开启压力小，阀瓣在很小的压差下就能完全打开。
- 4、阀瓣关闭快速，水锤压力小。
- 5、水平或垂直管道均可使用，安装方便。
- 6、零件材质、阀门端面的尺寸及形状可根据实际工况或用户要求合理选配。

Technical Data 技术参数

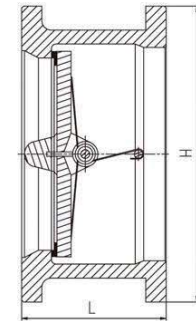


Sizes 公称尺寸：NPS 2 ~ 24
 Pressure Ratings 压力等级：Class150 ~ Class900
 Temperature 适用温度：-196°C ~ 540°C
 Face to Face 结构长度：API 594, API 6D
 Test and Inspection 试验和检验：API 598, API 6D

Material Specifications 材料规范

Name 名称	Materials (ASTM) 材料 (ASTM)
Body Materials 阀体材质	WCB, A105; WC6, F11; WC9, F22; LCB, LF1; CF8, 304; CF3, 304L; CF3M, 316L; Titanium & Titanium Alloy; Copper & Copper Alloy WCB, A105; WC6, F11; WC9, F22; LCB, LF1; CF8, 304; CF3, 304L; CF3M, 316L; 钛&钛合金; 铜&铜合金
Sealing Surface Materials 密封面材质	Body Material; 13Cr/13Cr; SS/Hard Alloy; Monel Metal; Hard Alloy/Hard Alloy; No.20 Alloy; Copper Alloy; NBR; PTFE; FPM; EPDM; SR 阀体材料; 13Cr/13Cr; SS/硬质合金; 蒙乃尔金属; 硬质合金/硬质合金; No.20合金; 铜合金; NBR; PTFE; FPM; EPDM; SR
Internal Parts Materials 内件材质	304; 304L; 316; 316L; Monel; No.20 Alloy; Copper Alloy; Titanium & Titanium Alloy 304; 304L; 316; 316L; 蒙乃尔; No.20 合金; 铜合金; 钛&钛合金
Spring Materials 弹簧材质	304; 304L; 316; 316L; Inconel X-600; Inconel X-750 304; 304L; 316; 316L; Inconel X-600; Inconel X-750

WAFER DUO CHECK VALVES 美标对夹连接旋启式止回阀



Dimensions and Weights 尺寸及重量 (Class150 ~ Class900)

公称尺寸 NPS / in	in	2	2½	3	4	6	8	10	12	14	16	18	20	24	28	30	32	36
	mm	50	65	80	100	150	200	250	300	350	400	450	500	600	700	750	800	900
Class 压力级		Class 150																
L / mm		60	67	73	73	98	127	146	181	184	191	203	219	222	—	305	—	368
H / mm		103	122	135	173	220	277	337	407	448	512	547	604	715	773	824	878	983
WT / kg		2	3	4	6	13	25	39	54	80	117	138	163	331	380	425	560	640
Class 压力级		Class 300																
L / mm		60	67	73	73	98	127	146	181	222	232	264	292	318	—	368	—	483
H / mm		110	128	147	179	249	305	359	420	483	537	594	652	772	882	1044	1196	1365
WT / kg		3	4	6	8	18	31	51	77	117	190	200	265	410	660	1020	1540	2260
Class 压力级		Class 600										Class 900						
公称尺寸 NPS / in	in	2	2½	3	4	6	8	10	12	14	16	18	20	2	2½	3	4	6
	mm	50	65	80	100	150	200	250	300	350	400	450	500	50	65	80	100	150
L / mm		60	67	73	79	136	165	213	229	273	305	362	368	70	83	83	102	159
H / mm		110	128	147	191	264	318	398	455	490	562	610	680	140	162	165	204	286
WT / kg		4	5	8	11	26	55	95	140	223	360	395	518	8	11	14	20	42



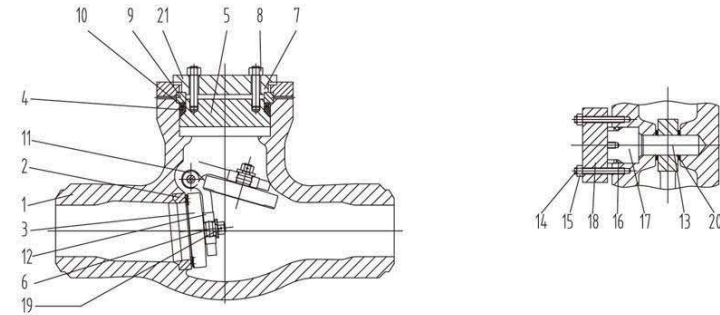
PRESSURE SEAL CAST STEEL CHECK VALVES 铸钢压力自密封止回阀

I、Pressure seal design and pure graphite gasket ring ensure high tightness and safety using.

II、Slam-free operation offered by tilting disc configuration.

Features 结构特点

- 1、采用压力密封结构设计的纯石墨密封环以便得到高的紧密性，保证了使用安全。
- 2、通过倾斜式阀瓣的旋转从而实现了阀门的开启和关闭。



Construction Configuration 结构形式

Swing check type, tilting disc type 旋启式形式、斜盘式形式

Sizes 公称尺寸

Swing check configuration 旋启式：NPS2 ~ 16

Tilting disc configuration 斜盘式：NPS2 ~ 24

Pressure Ratings 压力等级

Swing check configuration 旋启式：Class900 ~ Class1500

Tilting disc configuration 斜盘式：Class1500 ~ Class 2500

Temperature 适用温度：-196 ~ 593°C

Design- Standard 设计标准：ASME B16.34、API 6D、BS1868

Face to Face 结构长度：ASME B16.10

Butt-welding Ends 对焊端：ASME B16.25

Test and Inspection 试验和检验：API 6D、API598

Notes: The sizes of serial valve butt-welding dimensions can be designed according to customer's requirement.

注：系列阀门对焊端尺寸可根据客户要求设计制造

Technical Data 技术参数

General Application 一般用途

Specifically design to satisfy the requirements of the waterpower station also can be used in all high temperature application (i.e. chemical, petrochemical, steam).

满足水力工业安全要求的特定地思考，高压铸钢止回阀同样也适用于高温化工、石油和蒸汽管路上。

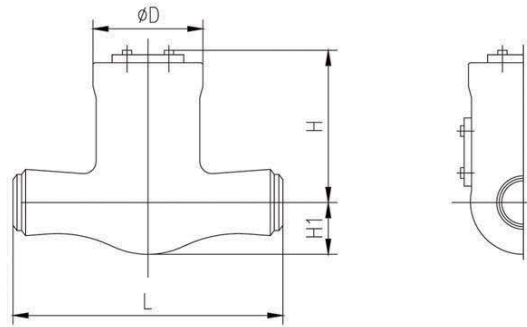
Material Specifications 材料规范

NO. 序号	Parts 零件名称	Materials 材料		
1	Body 阀体	A216 WCB	A217 WC6	A217 WC9
2	Seat 阀座	A105	A182 F22	A182 F22
3	Disc 阀瓣	A216 WCB	A217 WC6	A217 WC9
4	Gasket 垫片	316 Reinforced Graphite 316 + 增强石墨	316 Reinforced Graphite 316 + 增强石墨	316 Reinforced Graphite 316 + 增强石墨
5	Cover 阀盖	A105	A182 F22	A182 F22
6	Washer 垫圈	A182 F316	A182 F316	A182 F316
7	Cover Bolt 螺栓	A193 B7	A193 B16	A193 B16
8	Cover Nut 螺母	A194 2H	A194 4	A194 4
9	Segment Ring 四开环	A276 410	A276 410	A276 410
10	Intermediate Thrust Ring 止推环	A276 410	A276 410	A276 410
11	Hinge 摇臂	A216 WCB	A217 WC6	A217 WC9
12	Disc Nut 螺母	A194 2H	A194 4	A194 4
13	Hinge Pin 圆柱销	A182 F6a	A182 F6a	A182 F6a
14	Plug Bolt 螺栓	A193 B7	A193 B16	A193 B16
15	Plug Nut 螺母	A194 2H	A194 4	A194 4
16	Pin Gasket 垫片	316 Reinforced Graphite 316 + 增强石墨	316 Reinforced Graphite 316 + 增强石墨	316 Reinforced Graphite 316 + 增强石墨
17	Pressure Seal Plug 压力密封塞	A105	A182 F22	A182 F22
18	Flange 压板	A105	A182 F22	A182 F22
19	Pin 开口销	F316	F316	F316
20	Spacer 调节垫片	A182 F316	A182 F316	A182 F316
21	Retaining Ring 压紧盖	A105	A105	A105

Notes: The materials can be selected according to customer's requirement. 注：材料可根据用户要求合理选用。



ANSI PRESSURE SEAL CAST STEEL SWING CHECK VALVES 美标铸钢压力自密封旋启式止回阀

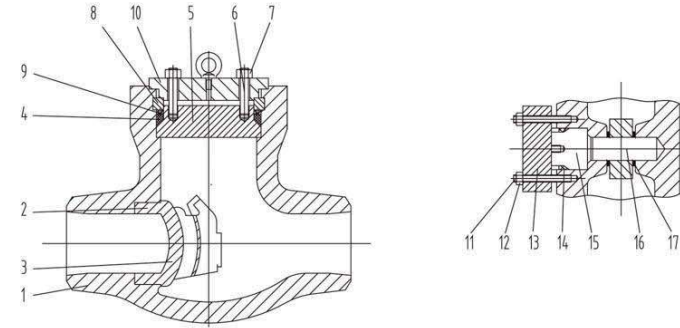


Dimensions and Weights 尺寸及重量 (Class900 ~ Class1500)

公称尺寸 NPS / in		2	2½	3	4	6	8	10	12	14	16
Class 900	L / mm	*	254	305	356	508	660	787	914	991	1092
	D / mm	160	160	170	192	270	340	396	420	516	580
	H / mm	230	230	240	265	310	405	455	475	540	620
	H1 / mm	65	65	70	85	115	145	170	200	225	250
	WT / mm	35	35	45	52	115	280	380	560	665	950
Class 1500	L / mm	216	254	305	406	559	711	864	991	1067	1194
	D / mm	160	160	170	230	285	380	430	500	540	620
	H / mm	230	230	235	260	350	440	490	535	595	700
	H1 / mm	65	65	75	95	125	170	190	225	245	275
	WT / mm	35	35	53	60	140	360	465	790	1040	1490

Notes: * Dimensions can be designed according to customer's requirement. 注: 带*的尺寸可根据客户要求设计制造。

PRESSURE SEAL CAST STEEL TILTING DISC CHECK VALVES 铸钢压力自密封斜盘式止回阀



Material Specifications 材料规范

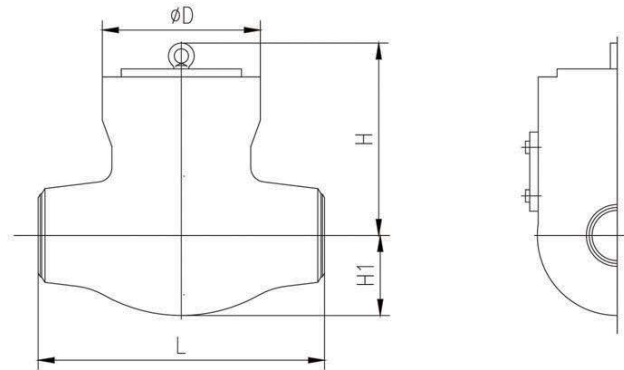
NO. 序号	Parts 零件名称	Materials 材料		
1	Body 阀体	A216 WCB	A217 WC6	A217 WC9
2	Seat 阀座	A105	A182 F22	A182 F22
3	Disc 阀瓣	A216 WCB	A217 WC6	A217 WC9
4	Gasket 垫片	316 Reinforced Graphite 316 + 增强石墨	316 Reinforced Graphite 316 + 增强石墨	316 Reinforced Graphite 316 + 增强石墨
5	Cover 阀盖	A105	A182 F22	A182 F22
6	Cover Bolt 螺栓	A193 B7	A193 B16	A193 B16
7	Cover Nut 螺母	A194 2H	A194 4	A194 4
8	Segment Ring 四开环	A276 410	A276 410	A276 410
9	Intermediate Thrust Ring 止推环	A276 410	A276 410	A276 410
10	Retaining Ring 压紧盖	A105	A105	A105
11	Bolt 螺栓	A193 B7	A193 B16	A193 B16
12	Nut 螺母	A194 2H	A194 4	A194 4
13	Flange 压板	A105	A182 F22	A182 F22
14	Gasket 垫片	316 Reinforced Graphite 316 + 增强石墨	316 Reinforced Graphite 316 + 增强石墨	316 Reinforced Graphite 316 + 增强石墨
15	Pressure Seal Plug 压力密封塞	A105	A182 F22	A182 F22
16	Pin 圆柱销	A182 F6a	A182 F6a	A182 F6a
17	Spacer 调节垫片	A182 F316	A182 F316	A182 F316

Notes: The materials can be selected according to customer's requirement. 注: 材料可根据用户要求合理选用。



ANSI PRESSURE SEAL CAST STEEL TILTING DISC CHECK VALVES

美标铸钢压力自密封斜盘式阀瓣止回阀



Dimensions and Weights 尺寸及重量 (Class1500 ~ Class2500)

NPS / in 公称尺寸		2	3	4	6	8	10	12	14	16	18	20	24
Class 1500	L / mm	216	305	405	559	711	864	991	1067	1194	1537	1664	1743
	D / mm	170	185	215	260	365	455	480	510	665	745	860	990
	H / mm	185	185	295	380	460	610	700	730	790	840	900	980
	H1 / mm	80	110	120	145	180	230	260	280	335	380	445	565
	WT / kg	60	65	110	270	530	780	1210	1490	2170	2825	4150	5200
Class 2500	L / mm	279	368	457	610	762	914	1041	1118	1245	1397	1547	1727
	D / mm	170	170	185	285	365	420	465	520	560	650	710	815
	H / mm	160	160	185	360	360	450	580	620	775	855	890	970
	H1 / mm	80	80	120	165	180	210	250	275	335	345	385	465
	WT / kg	60	65	105	245	520	860	1250	1750	2350	3200	4540	5700

Notes: * Dimensions can be designed according to customer's requirement. 注: 带*尺寸可根据客户要求设计制造。