Goodwin

Market leader in Dual Plate Check Valve quality and design
Retainerless design for fugitive emission control

DUAL PLATE CHECK VALVE TYPES

WAFER TYPE BR

ANSI B16.5
- Flange dimensions to ANSI B16.5
- Face to Face dimensions to API 594

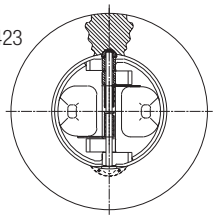
ANSI B16.47 SERIES A
ANSI B16.47 SERIES B
(For valve sizes 26" and larger)
- Flange dimensions to either Series A or Series B (Customer to specify)
- Face to Face dimensions to API 594

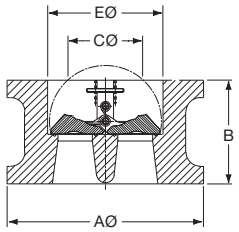
(Retainerless design supplied as standard†)

API 6A/ISO 10423
- Flange dimensions to API 6A/ISO 10423
- Face to Face dimensions to API 6A/ISO 10423

API 6D/ISO 14313
- Flange dimensions to ANSI B16.5
- Face to Face dimensions to API 6D/ISO 14313

EXTENDED BODY
- Flange dimensions to ANSI B16.5





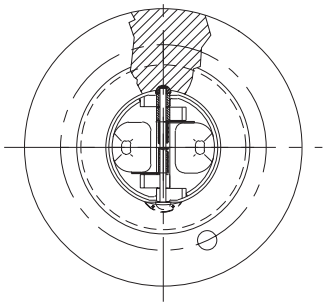
DOUBLE FLANGED TYPE BFR

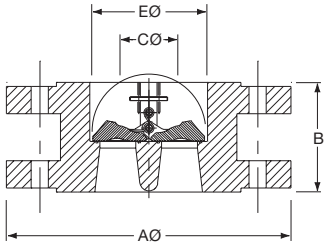
ANSI B16.5
- Flange dimensions to ANSI B16.5
- Face to Face dimensions to API 594

ANSI B16.47 SERIES A
ANSI B16.47 SERIES B
(For valve sizes 26" and larger)
- Flange dimensions to either Series A or Series B (Customer to specify)
- Face to Face dimensions to API 594

TYPE BFT
- Threaded Lug Type also available

(Retainerless design supplied as standard†)





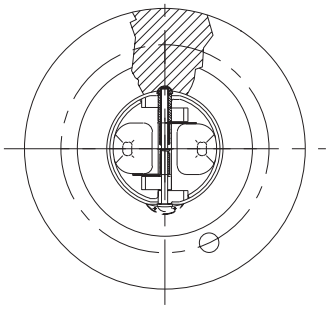
SOLID LUG TYPE BSR

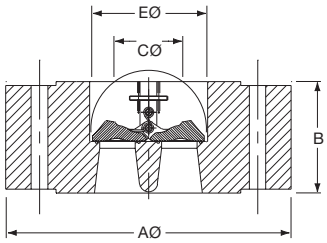
ANSI B16.5
- Flange dimensions to ANSI B16.5
- Face to Face dimensions to API 594

ANSI B16.47 SERIES A
ANSI B16.47 SERIES B
(For valve sizes 26" and larger)
- Flange dimensions to either Series A or Series B (Customer to specify)
- Face to Face dimensions to API 594

TYPE BTR
- Threaded Flanged Type also available

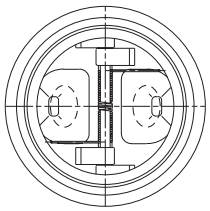
(Retainerless design supplied as standard†)

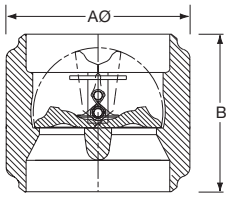




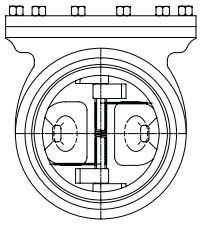
BUTTWELD END TYPE BWR & TYPE BWA

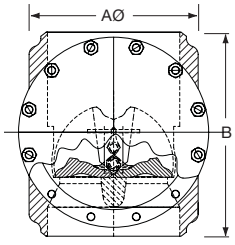
(Retainerless design supplied as standard†)





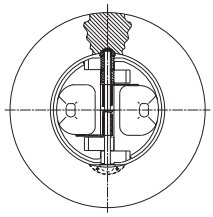
(Retainerless design supplied as standard†)

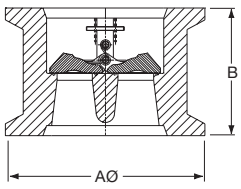




HUB ENDED TYPE BHR

(Available in reduced (R) and full (F) bore.)





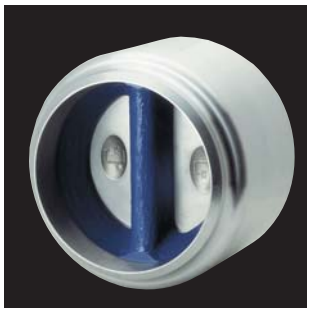
† On occasions, for technical reasons, Goodwin may offer valves with retainers. In such instances, this will be clearly indicated in the quotation. Outside profile of bodies may differ from those shown.

TYPE BR
Wafer Retainerless

TYPE BFR
Flanged Retainerless

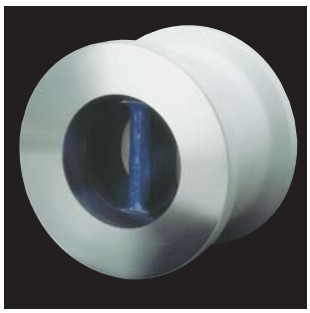
TYPE BSR
Solid Lug Retainerless

TYPE BWR
Buttweld End Retainerless



TYPE BWA
Buttweld End Retainerless with access

TYPE BHR
Hub-Ended Retainerless



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As part of our continuous product improvement policy we reserve the right to institute changes in any materials, designs and specifications within this catalog. E&OE

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TYPICAL CONSTRUCTIONS

CARBON STEEL BODY VALVES — API 600

Seal	Figure No	Body	Plates (1) (8)	Body Seat	Plate Seat	Wetted Parts (2)	Spring (3) (12)	TRIM No.
Metal to metal	CEPPR-YE	A216 WCB/A105	A217 CA15	AS BODY	AS PLATE	410 SS	INCONEL X750®	
Metal overlay	CEEPR-YE	A216 WCB/A105	A217 CA15	410 SS	AS PLATE	410 SS	INCONEL X750®	1
Metal overlay	CEUPR-YE	A216 WCB/A105	A217 CA15	STELLITE 6®	AS PLATE	410 SS	INCONEL X750®	8
Metal overlay	CEUUR-YE	A216 WCB/A105	A217 CA15	STELLITE 6®	STELLITE 6®	410 SS	INCONEL X750®	5
Resilient (4)	CEVPR-YE	A216 WCB/A105	A217 CA15	VITON A®	AS PLATE	410 SS	INCONEL X750®	
Lined (5)	CAXPR/MM	A216 WCB/A105	B148 C95800	CHLOROPRENE®	AS PLATE	MONEL 400®	MONEL K500®	
Metal to metal	OSPPR-YS	A352 LCC/A350 LF2	A351 CF8M	AS BODY	AS PLATE	316 SS	INCONEL X750®	
Metal overlay	OSSPR-YS	A352 LCC/A350 LF2	A351 CF8M	316 SS	AS PLATE	316 SS	INCONEL X750®	10
Metal overlay	OSUPR-YS	A352 LCC/A350 LF2	A351 CF8M	STELLITE 6®	AS PLATE	316 SS	INCONEL X750®	12
Metal overlay	OSUUR-YS	A352 LCC/A350 LF2	A351 CF8M	STELLITE 6®	STELLITE 6®	316 SS	INCONEL X750®	5
Resilient (4)	OSVPR-YS	A352 LCC/A350 LF2	A351 CF8M	VITON A®	AS PLATE	316 SS	INCONEL X750®	

STAINLESS STEEL BODY VALVES — API 600

Seal	Figure No	Body	Plates	Body Seat	Plate Seat	Wetted Parts (2)	Spring (3) (12)	TRIM No.
Metal to metal	SSPPR-YS	A351 CF8M/A182 F316	A351 CF8M	AS BODY	AS BODY	316 SS	INCONEL X750®	10
Metal overlay	SSUPR-YS	A351 CF8M/A182 F316	A351 CF8M	STELLITE 6®	AS PLATE	316 SS	INCONEL X750®	12
Metal overlay	SSUUR-YS	A351 CF8M/A182 F316	A351 CF8M	STELLITE 6®	STELLITE	316 SS	INCONEL X750®	5
Resilient (4)	SSVPR-YS	A351 CF8M/A182 F316	A351 CF8M	VITON A®	AS PLATE	316 SS	INCONEL X750®	

IRON BODY VALVES

Seal	Figure No	Body (6)	Plates (7) (8)	Body Seat	Plate Seat	Wetted Parts (7)	Spring (7)
Resilient (4)	XANPF-MM	A126 Cl. B	B148 C95800	BUNA N®	AS PLATE	MONEL 400®	MONEL K500®
Lined (5)	XAXPF-MM	A126 Cl. B	B148 C95800	CHLOROPRENE®	AS PLATE	MONEL 400®	MONEL K500®
Resilient (4)	9ANPF-MM	A395	B148 C95800	BUNA N®	AS PLATE	MONEL 400®	MONEL K500®
Resilient (4)	9ANPF-II	A395	B148 C95800	BUNA N®	AS PLATE	INCONEL 625®	INCONEL 625®
Lined (5)	9AXPF-MM	A395	B148 C95800	CHLOROPRENE®	AS PLATE	MONEL 400®	MONEL K500®
Metal to metal	88PPF-SS	A 439 D2	A 439 D2	AS BODY	AS PLATE	316 SS	316 SS
Metal to metal	88PPF-II	A 439 D2	A 439 D2	AS BODY	AS PLATE	INCONEL 625®	INCONEL 625®
Resilient (4)	88NPF-SS	A 439 D2	A 439 D2	BUNA N®	AS PLATE	316 SS	316 SS
Resilient (4)	88NPF-II	A 439 D2	A 439 D2	BUNA N®	AS PLATE	INCONEL 625®	INCONEL 625®
Resilient (4)	8ANPF-II	A 439 D2	B148 C95800	BUNA N®	AS PLATE	INCONEL 625®	INCONEL 625®

ALUMINIUM BRONZE BODY VALVES

Seal	Figure No	Body (8)	Plates (8)	Body Seat	Plate Seat	Wetted Parts (9)	Spring
Metal to metal	AAPPR-MM	B148 C95800	B148 C95800	AS BODY	AS PLATE	MONEL 400®	MONEL K500®
Resilient (4)	AANPR-MM	B148 C95800	B148 C95800	BUNA N®	AS PLATE	MONEL 400®	MONEL K500®

DUPLEX STAINLESS STEEL BODY VALVES

Seal	Figure No	Body	Plates	Body Seat	Plate Seat	Wetted Parts	Spring (12)
Metal to metal	QQPPR-YI	UNS J92205	UNS J92205	AS BODY	AS PLATE	INCONEL 625®	INCONEL X750®
Metal overlay	QQUPR-YI	UNS J92205	UNS J92205	STELLITE 6®	AS PLATE	INCONEL 625®	INCONEL X750®
Resilient (4)	QQWPR-YI	UNS J92205	UNS J92205	VITON B®	AS PLATE	INCONEL 625®	INCONEL X750®

INCONEL STEEL BODY VALVES

Seal	Figure No	Body	Plates	Body Seat	Plate Seat	Wetted Parts	Spring
Metal to metal	IIPPR-II	UNS N26625	UNS N26625	AS BODY	AS PLATE	INCONEL 625®	INCONEL 625®
Metal overlay	IIUPR-II	UNS N26625	UNS N26625	STELLITE 6®	AS PLATE	INCONEL 625®	INCONEL 625®
Inconel clad body (10)	OIIPR/II	A352 LCC	UNS N26625	INCONEL 625® CLAD	AS PLATE	INCONEL 625®	INCONEL 625®

TITANIUM BODY VALVES

Seal	Figure No	Body (11)	Plates (11)	Body Seat	Plate Seat	Wetted Parts	Spring
Metal to metal	TTPPR-TT	B348 Gr2/ B381 F2	B348 Gr2/ B381 F2	AS BODY	AS PLATES	B348 Gr2	TITANIUM Ti 6Al4V
Resilient (4)	TTVPT-TT	B348 Gr2/ B381 F2	B348 Gr2/ B381 F2	VITON A®	AS PLATES	B348 Gr2	TITANIUM Ti 6Al4V

See opposite page for applicable notes (1) to (12)

TYPICAL CONSTRUCTIONS

NOTES

(1) If required, CA15/410SS plate material could be substituted with CF8M/316SS
(2) In A216 WCB/A105 Carbon Steel valves, 316SS with 410SS hinge and stop pins is manufacturer's standard wetted parts material
(3) If required, spring material could be substituted with 316SS
(4) Subject to application different resilient materials are available, for example Buna N®, Viton A®, Viton B®, Viton GLT®, Neoprene®, Teflon® (PTFE), EPDM
(5) Subject to application different linings are available, for example Chloroprene®, Neoprene®, Chlorobutyl, Rilsan Nylon II®, EPDM, Glass Flake and Coal Tar Epoxy.
(6) Cast Iron for sizes 2" to 20" only; Ductile Iron and Ni-Resist Iron for all sizes to 144"
(7) Alternative plate, wetted parts and spring materials are available, for example 316SS, subject to application
(8) Alternative specifications of Aluminium Bronze available on request eg ASTM B148 C95500
(9) In Aluminium Bronze valves, Inconel 625® wetted parts with Monel 400® hinge and stop pins is manufacturer's standard wetted parts material
(10) Alternative base body materials for Inconel cladding could be used
(11) Alternative Titanium specifications available: B367 C2
(12) Inconel 718® springs can be supplied in lieu of Inconel X750® springs

STANDARDS DEFINITIONS

API 594 (Extract from Sixth Edition, 2004)

5.4 **Trim**
5.4.1 The trim includes the following:
a) Body seating surfaces
b) Plate Seating surfaces

5.5 **Internal Wetted Parts**
The term "wetted parts" shall include, but not be limited to, stem or shaft, hinges, pins, bolts, bearings, and any other part in contact with the fluid medium other than the body, cover, plates or disc, trim, springs and pipe plugs.

API 600 (Extract from Second Edition, 2004)/ ISO 10434

TABLE 3 - Nominal Seating Surface Materials

Name	Trim Number				
	1	5	8	10	12
Plate seating surface	13 Cr (410SS)	Stellite 6®	13 Cr (410SS)	18-8 Cr-Ni (316SS)	18-8 Cr-Ni (316SS)
Body seating surface	13 Cr (410SS)	Stellite 6®	Stellite 6®	18-8 Cr-Ni (316SS)	Stellite 6®

GOODWIN CHECK VALVE FEATURES:

RETAINERLESS
To meet FUGITIVE EMISSIONS control requirements valves are supplied RETAINERLESS as standard, i.e. no threaded plugs in the pressure boundary.This design eliminates the potential leakpath to atmosphere associated with competitors' valves with threaded retaining plugs. The Retainlerless design is ideal on applications where there is a risk of crevice/thread corrosion from either the contained fluid or the environment. Having no threaded retaining plugs in the pressure boundary the Retainlerless design eliminates the associated problems of crevice/thread corrosion.

PRESSURE CLASSES: ANSI 150 TO 2500 LB, API 2000 TO 10,000 LB.

NOMINAL SIZE RANGE

ANSI 150 lb.	**2" to 144"**	Larger diameter valves for the respective pressure classes can be designed and manufactured on request.
ANSI 300 lb.	**2" to 60"**	
ANSI 600 lb.	**2" to 54"**	
ANSI 900 lb.	**2" to 48"**	
ANSI 1500 lb.	**2" to 40"**	
ANSI 2500 lb.	**2" to 24"**	

FLANGE STANDARD
Unless otherwise specified in the order text, valves that are to fit between flanges, i.e. types BR, BFR and BSR, will be supplied to accommodate flanges to ANSI B16.5 for 2" through 24" and ANSI B16.47 Series A for valves 26" and larger. Customers requiring the valve to be compatible with ANSI B16.47 Series B or other flange standard must specify such in their inquiry and order.

SEAT LEAKAGE
A metal-to-metal leakage rate of 1cc/minute/inch diameter can be achieved if specified with customer enquiry/order.
(Note: API 598 specifies 3cc/minute/inch diameter with water.)

INDEPENDENT PLATE SUSPENSION
Valves above 24" ANSI 300lb are supplied with independent plate suspension.

PRESSURE EQUIPMENT DIRECTIVE 97/23/EC
Goodwin can manufacture its Dual Plate Check Valves in compliance with the European Pressure Equipment Directive (PED) 97/23/EC to meet customer requirements.

ATEX DIRECTIVE 94/9/EC
Goodwin can manufacture its Dual Plate Check Valves in compliance with the European Atmosphere Explosive Directive (ATEX) 94/9/EC to meet customer requirements.

ORDERING INSTRUCTIONS

EXAMPLE:

Type	Valve Size	Flange Standard	ANSI/API Pressure Rating		Body Material	Plate Material	Body Seat	Plate Seat	End Connection	Special Feature	Spring Material	Wetted Parts
BR	30	A	015	–	C	S	W	P	R	/	Y	S

* 'R' in the valve type code indicates Retainerless.

VALVE TYPE*	
BR	Wafer
BFR (BFT)	Flanged (BFT: Threaded)
BSR (BTR)	Solid Lug (BTR: Threaded)
BHR (R)	Hub Ended Reduced Bore (R)
BHR (F)	Hub Ended Full Bore (F)
BH (F)	Hub Ended Full Bore (F)
BWR (BWA)	Buttweld End
BL	Wafer-Lined
BFL	Flanged-Lined
BSL	Solid Lug-Lined
BC	Wafer - Clad (Retainerless)
BFC	Flanged - Clad (Retainerless)
BSC	Solid Lug - Clad (Retainerless)
BD	Wafer - Clad (Retaining Plugs)
BFD	Flanged - Clad (Retaining Plugs)
BSD	Solid Lug - Clad (Retaining Plugs)

VALVE SIZE
Inches: For ANSI, AWWA & API standards
Millimetres: For JIS standards and PN ratings

FLANGE STANDARD	
FIG	STANDARD
-	ANSI B16.5
-	ANSI B16.47 Series A (MSS SP 44)
A	ANSI B16.47 Series B (API 605)
D	AWWA C207 Class D
E	AWWA C207 Class E
F	Hub Ended - Full Bore Internals
R	Hub Ended - Reduced Bore Internals
J	JIS 2210
V	Compact Flange

ANSI / API PRESSURE RATINGS	
FIG	PRESSURE RATINGS
015	ANSI 150
030	ANSI 300
060	ANSI 600
090	ANSI 900
150	ANSI 1500
250	ANSI 2500
200	API 2000
300	API 3000
500	API 5000
100	API 10000

BODY AND/OR PLATE MATERIAL		
FIG	MATERIAL	SPECIFICATION
C	Carbon Steel	ASTM A216 WCB / A105
L	Low Temp Carbon Steel	ASTM A352 LCB
O	Low Temp Carbon Steel	ASTM A352 LCC / A350 LF2
D	High Temp Cr Mo Steel	ASTM A217 WC6
K	Low Alloy Steel	ASTM A487 GR 4C
E	410 Stainless Steel	ASTM A217 CA15
P	5% Cr Steel	ASTM A217 C5
W	9% Cr Steel	ASTM A217 C12
G	Low Temp 13% Cr 4% Ni	ASTM A352 CA6NM
S	316 Stainless Steel	ASTM A351 CF8M / A182 F316
F	316L Stainless Steel	ASTM A351 CF3M / A182 F316L
Y	347 Stainless Steel (High Temp)	ASTM A351 CF8C / A182 F321
Q	22% Chrome Duplex[1]	J92205 / ASTM A890 4A or A995 4A (WE[1])
B	25% Chrome Super Duplex[3]	J93372 / ASTM A995 CD4MCuN
R	Ferralium 255-3SC®[2]	(WE[2])
Z	25% Chrome Super Duplex[3]	J93380 / ASTM A890 6A or A995 6A (WE[3])
H	Alloy 825[4]	N08826 / ASTM A494 CU5MCuC (WE[4])
I	Alloy 625[5]	N26625 / ASTM A494 CW6MC (WE[5])
V	Avesta 254 SMO®[6]	J93254 / ASTM A351 CK3MCuN (WE[6])
U	Stellite®	Stellite 6®
T	Titanium	ASTM B367 C2 / B381 F2 / B348 GR2
J	Hastelloy C276®[7]	ASTM A494 CW12MW (WE[7])
M	Monel	ASTM A494-M35-2
A	Nickel Aluminium Bronze	† BS EN 1982 CC333G / ASTM B148 C95800
1	Chromium Molybdenum Steel	ASTM A217 GR WC9
2	3.5% Nickel Steel	ASTM A352 LC3
3	304 Stainless Steel	ASTM A351 CF8
4	304L Stainless Steel	ASTM A351 CF3
5	Alloy 20	ASTM A351 CN7M
6	317 Stainless Steel	ASTM A351 CG8M
7	Carbon Molybdenum Steel	ASTM A352 LC1
8	Ni-Resist ® Iron	ASTM A439 D2
9	Ductile Iron	ASTM A395
X	To Be Specified	TO BE SPECIFIED

BODY SEAT/PLATE OVERLAY MATERIAL			
FIG	MATERIAL	OPERATING TEMP RANGE * °F	°C
P	Same as Body / Plate	As Body / Plate	As Body / Plate
E	410 Stainless Steel	-20 to 1000	-29 to 538
S	316 Stainless Steel	-425 to 1500	-254 to 538
F	316L Stainless Steel	-425 to 850	-254 to 455
G	17-4 PH Stainless Steel	-40 to 800	-40 to 427
I	Inconel 625		
M	Monel 400	-321 to 900	-196 to 482
U	Stellite No 6 ®	-450 to 1500	-267 to 815
J	Viton GLT ®	-22 to 400	-30 to 204
V	Viton A®	-40 to 400	-40 to 204
W	Viton B® Anti Explosive Decompression FR58 90	-4 to 392	-20 to 200
N	Buna-N®	-22 to 250	-30 to 121
T	Neoprene® $	-40 to 250	-40 to 121
K	Teflon®	-200 to 450	-129 to 232
D	EPDM	-14 to 230	-10 to 110
L	Elast-O-Lion ® 985	-40 to 320	-40 to 160
X	To Be Specified		

END CONNECTION	
FIG	CONNECTION
Q	Raised Face 3.2 µm max. Spiral Groove
R	Raised Face 3.2-6.3 µm Spiral Groove
S	Raised Face 6.3-12.5 µm Spiral Groove
F	Flat Face 3.2-6.3 µm Spiral Groove
G	Flat Face 6.3-12.5 µm Spiral Groove
E	Raised Face 3.2 µm max Concentric Groove
D	Raised Face 3.2-6.3 µm Concentric Groove
C	Raised Face 6.3-12.5 µm Concentric Groove
A	Flat Face 3.2-6.3 µm Concentric Groove
Z	Flat Face 6.3-12.5 µm Concentric Groove
J	Ring Type Joint
H	Clamped End
W	Buttweld End
V	Compact Flange

SPECIAL FEATURES	
-	No Special Features
/	To be specified in order and inquiry text
S	Super Torque Spring
L	Low Torque Spring
M	Mini Torque Spring

SPRING MATERIAL			
FIG	MATERIAL	RECOMMENDED MAX TEMP °F	°C
S	316 Stainless Steel	250	121
Y	Inconel X750®	1000	537
I	Inconel 625®	1000	537
M	Monel K500®	400	204
L	Inconel 718	1022	550
T	Titanium Ti 6AL4V	662	350
X	To Be Specified		

WETTED PARTS*	
FIG	PINS/OTHER
S	316 SS
F	316L SS / 316 SS
E	410 SS / 316 SS
G	17-4 PH / 316 SS
I	Inconel 625®
A	Monel K500® / 625
M	Monel 400® / 625
3	304 SS / 316 SS
4	304L SS / 316 SS
W	347 SS / 625
Y	321 SS / 625
Q	F51 DSS / 625
Z	F55 SDSS / 625
H	Incoloy 825® / 625
T	Titanium

* Manufacturers standard materials for Wetted parts. Other combinations available on request.

LINED VALVES
Valves can be supplied with various linings, such as Neoprene®, Chloroprene®, Chlorobutyl, Rilsan Nylon II®, EPDM,Glass Flake and Coal Tar Epoxy (lined valves have retaining plugs).

CLAD VALVES
Valves can be supplied with various internal claddings such as Inconel 625 & 825.

† Previously BS 1400 AB2

WE - Wrought Equivalents
[1] UNS S31803
[2] UNS S32550
[3] UNS S32760
[4] UNS N08825
[5] UNS N06625
[6] UNS S31254
[7] UNS N10276

* Suitability will depend, in part, on operating temperature range of base material.

$ For ANSI 150lb & 300lb only

Goodwin.

MATERIALS AND APPLICATIONS SUITABILITY MATRIX

PLEASE OPEN HERE TO VIEW

PLEASE OPEN HERE TO VIEW

Materials and Applications Suitability Matrix

Oil & Gas Production & Transmission

	CARBON STEEL					LOW TEMP CARBON STEEL			STAINLESS STEEL				NON-FERROUS		DUPLEX			NICKEL ALLOYS			TITANIUM
Figure Number	CEPPR-YE	CEEPR-YE	CEVPR-YE	CEUPR-YE	CEUUR-YE	OSSPR-YS	OSVPR-YS	OSUUR-YS	SSPPR-YS	SSVPR-YS	SSUUR-YS	YYPPR-YS	AAPPR-YI	AANPR-YI	QQPPR-YI	QQUUR-YI	ZZPPR-YI	IIPPR-YI	IIUUR-YI	OIIPR-YI	TTPPR-TT
Body Material	WCB	WCB	WCB	WCB	WCB	LCC	LCC	LCC	CF8M	CF8M	CF8M	CF8C	AB2	AB2	S31803	S31803	S32760	INCONEL 625	INCONEL 625	LCC/625 CLAD	TITANIUM
API 600 Trim Number		1		8	5	10		5	10		5										
Temperature Range - Deg C	-29°C to 399°C	-29°C to 399°C	-29°C to 204°C	-29°C to 399°C	-29°C to 399°C	-46°C to 399°C	-40°C to 204°C	-46°C to 399°C	-200°C to 538°C	-40°C to 204°C	-200°C to 538°C	-200°C to 871°C	-198°C to 232°C	-57°C to 121°C	-46°C to 250°C	-46°C to 250°C	-46°C to 250°C	-198°C to 482°C	-198°C to 482°C	-46°C to 399°C	-46°C to 260°C
Temperature Range - Deg F	-20°F to 750°F	-20°F to 750°F	-20°F to 399°F	-20°F to 750°F	-20F to 750°F	-51°F to 750°F	-40°F to 399°F	-51°F to 750°F	-328°F to 1500°F	-40°F to 399°F	-328°F to 1500°F	-328°F to 1600°F	-325°F to 450°F	-76°F to 250°F	-51°F to 482°F	-51°F to 482°F	-51°F to 482°F	-324°F to 900°F	-324°F to 900°F	-51°F to 750°F	51°F to 500°F
Crude Oil - Sweet Non-Abrasive	2	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude Oil - Sweet & Abrasive	4	3	3	2	1	4	4	1	4	4	0	4	4	4	0	0	0	4	0	4	0
Crude Oil - Sour Non-Abrasive	2	1	1	0	0	2	2	0	0	0	0	0	4	4	1	0	1	1	10	1	0
Crude Oil - Sour & Abrasive	4	4	4	3	2	4	4	2	4	4	0	4	4	4	3	1	3	4	1	4	0
Gas, Hydrocarbon - Sweet Non-Abrasive	2	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas, Hydrocarbon - Sweet & Abrasive	4	3	3	2	1	4	4	1	4	4	0	4	4	4	0	0	0	4	0	4	0
Gas, Hydrocarbon - Sour Non-Abrasive	2	1	1	0	0	2	2	0	0	0	0	0	4	4	1	0	1	1	0	1	0
Gas, Hydrocarbon - Sour & Abrasive	4	4	4	3	2	4	4	2	4	4	0	4	4	4	3	1	3	4	1	4	0
Hydrocarbon Liquids - Sweet Non Abrasive	2	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrocaron Liquids - Sweet & Abrasive	4	3	3	2	1	4	4	1	4	4	0	4	4	4	0	0	0	4	0	4	0
Hydrocarbon Liquids - Sour Non Abrasive	2	1	1	0	0	2	2	0	0	0	0	0	4	4	1	0	1	1	0	1	0
Hydrocarbon Liquids - Sour & Abrasive	4	4	4	3	2	4	4	2	4	4	0	4	4	4	3	1	3	4	1	4	0
Compressed Air	2	2	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel - Diesel	2	2	2	0	0	2	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Fuel - Gas	2	2	2	0	0	2	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Instrument Air	3	3	3	3	3	3	3	3	2	1	0	0	0	0	0	0	0	0	0	0	0
Lube Oil	2	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen (or other inert gas)	2	2	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seawater Fire Service	4	4	4	4	4	4	4	4	4	4	4	4	2	2	4	4	4	0	0	0	1
Seawater Injection	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	1	1	1
Water (Effluent) - Foul	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	2	0	0	0	0
Water (Potable)	4	4	4	4	4	3	3	3	1	1	0	4	1	1	0	0	0	0	0	0	0
Water Injection (Sour)	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	1	1	1	0

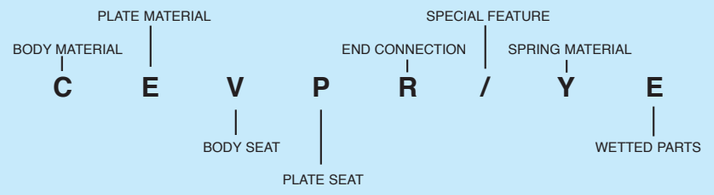
Refining, Transmission & Petrochemical

	CARBON STEEL					LOW TEMP CARBON STEEL			CHROME STEEL			STAINLESS STEEL			NON-FERROUS		NICKEL ALLOYS		
Figure Number	CEPPR-YE	CEEPR-YE	CEVPR-YE	CEUPR-YE	CEUUR-YE	OSSPR-YS	OSVPR-YS	OSUUR-YS	DEPPR-YE	PEPPR-TE	WEPPR-YE	SSPPR-YS	SSVPR-YS	SSUUR-YS	AAPPR-YI	AANPR-YI	IIPPR-YI	IIUUR-YI	OIIPR-YI
Body Material	WCB	WCB	WCB	WCB	WCB	LCC	LCC	LCC	WC6	C5	C12	CF8M	CF8M	CF8M	AB2	AB2	INCONEL 625	INCONEL 625	LCC-625 CLAD
API 600 Trim Number		1		8	5	10		5				10		5					
Temperature Range - Deg C	-29°C to 399°C	-29°C to 399°C	-29°C to 204°C	-29°C to 399°C	-29°C to 399°C	-46°C to 399°C	-40°C to 204°C	-46°C to 399°C	-29°C to 539°C	-29°C to 539°C	-29°C to 539°C	-200°C to 538°C	-40°C to 204°C	-200°C to 538°C	-198°C to 232°C	-57°C to 121°C	-198°C to 482°C	-198°C to 482°C	-46°C to 399°C
Temperature Range - Deg F	-20°F to 750°F	-20°F to 750°F	-20°F to 399°F	-20°F to 750°F	-20 to 750°F	-51°F to 750°F	-40°F to 399°F	-51°F to 750°F	-20°F to 1100°F	-20°F to 1100°F	-20°F to 1100°F	-328°F to 1500°F	-40°F to 399°F	-328°F to 1500°F	-325°F to 450°F	-76°F to 250°F	-324°F to 900°F	-324°F to 900°F	-51°F to 750°F
Crude Oil - Sweet Non-Abrasive	2	1	1	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0
Crude Oil - Sweet & Abrasive	4	3	3	2	1	4	4	1	4	4	4	4	4	0	4	4	4	0	4
Crude Oil - Sour Non-Abrasive	2	1	1	0	0	2	2	0	2	2	2	0	0	0	4	4	1	0	1
Crude Oil - Sour & Abrasive	4	4	4	3	2	4	4	2	4	4	4	4	4	0	4	4	4	1	4
Hydrocarbon Liquids - Sweet Non Abrasive	2	1	1	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0
Hydrocarbon Liquids - Sweet & Abrasive	4	3	3	2	1	4	4	1	4	4	4	4	4	0	4	4	4	0	4
Hydrocarbon Liquids - Sour Non Abrasive	2	1	1	0	0	2	2	0	2	2	2	0	0	0	4	4	1	0	1
Hydrocarbon Liquids - Sour & Abrasive	4	4	4	3	2	4	4	2	4	4	4	4	4	0	4	4	4	1	4
Instrument Air	3	3	3	3	3	3	3	3	0	0	0	2	1	0	0	0	0	0	0
Water Potable	4	4	4	4	4	3	3	3	4	4	4	1	1	0	1	1	0	0	0

Gas Liquefaction & LNG

	LOW TEMP CARBON STEEL				STAINLESS STEEL		NON-FERROUS		DUPLEX		NICKEL ALLOYS	
Figure Number	OSSPR-YS	OSUUR-YS	77PPR-YS	22PPR-YS	SSPPR-YS	YYPPR-YS	AAPPR-YI	MMPPR-MM	QQPPR-YI	ZZPPR-YI	IIPPR-YI	OIIPR-YI
Body Material	LCC	LCC	LC1	LC3	CF8M	CF8C	AB2	MONEL	S31803	S32760	INCONEL 625	LCC/625 CLAD
API 600Trim Number	10	5			10							
Temperature Range - Deg C	-46°C to 399°C	-46°C to 399°C	-59°C to 343°C	-101°C to 343°C	-200°C to 815°C	-200°C to 871°C	-198°C to 232°C	-198°C to 204°C	-46°C to 250°C	-46°C to 250°C	-198°C to 482°C	-46°C to 399°C
Temperature Range - Deg F	-51°F to 750°F	-51°F to 750°F	-75°F to 650°F	-150°F to 650°F	-328°F to 1500°F	-328°F to 1600°F	-325°F to 450°F	-325°F to 400°F	-51°F to 482°F	-51°F to 482°F	-324°F to 900°F	-51°F to 750°F
Liquid Argon	5	5	5	5	1	0	1	1	5	5	0	5
Liquid Hydrogen	5	5	5	5	1	0	1	1	5	5	0	5
Liquid Nitrogen	5	5	5	5	1	0	1	1	5	5	0	5
Liquid Oxygen	5	5	5	5	1	0	1	1	5	5	0	5
LNG at -161 Deg C	5	5	5	5	1	0	1	1	5	5	0	5
Butane	1	1	0	0	0	0	0	0	0	0	0	0
LPG	1	1	0	0	0	0	0	0	0	0	0	0
Propane	1	1	0	0	0	0	0	0	0	0	0	0

Understanding the Goodwin Figure Number



For full listing of materials available and codings please see opposite.

Desalination & Water Transmission

	CARBON STEEL		STAINLESS STEEL				CAST IRON		DUCTILE IRON		NI-RESIST				NON-FERROUS			
Figure Number	CAXPR-SS	CAXPR-II	SSPPR-SS	SSPPR-II	SSVPR-SS	SSVPR-II	XAXPF-MM	XAXPF-II	9ANPF-MM	9ANPF-II	88PPR-SS	88PPR-II	88NPR-SS	88NPR-II	AAPPR-MM	AAPPR-II	AANPR-MM	AANPR-II
Body Material	WCB / LINED	WCB / LINED	CF8M	CF8M	CF8M	CF8M	C IRON LINED	C IRON LINED	DUCTILE IRON	DUCTILE IRON	A439 D2	A439 D2	A439 D2	A439 D2	AB2	AB2	AB2	AB2
API 600 Trim Number			10	10														
Temperature Range - Deg C	-29°C to 121°C	-29°C to 121°C	-200°C to 815°C	-200°C to 538°C	-40°C to 204°C	-40°C to 204°C	-29°C to 121°C	-29°C to 121°C	-29°C to 121°C	-29°C to 121°C	-29°C to 399°C	-29°C to 399°C	-29°C to 121°C	-29°C to 121°C	-198°C to 232°C	-198°C to 232°C	-57°C to 121°C	-57°C to 121°C
Temperature Range - Deg F	-20°F to 250°F	-20°F to 250°F	-328°F to 1500°F	-328°F to 1500°F	-40°F to 399°F	-40°F to 399°F	-20°F to 250°F	-20°F to 250°F	-20°F to 250°F	-20°F to 250°F	-20°F to 750°F	-20°F to 750°F	-20°F to 250°F	-20°F to 250°F	-325°F to 450°F	-325°F to 450°F	-76°F to 250°F	-76°F to 250°F
Brine (De Oxygenated)	2	1	1	0	1	0	2	0	2	0	1	0	1	0	1	0	1	0
Brine (Oxygenated)	4	2	4	4	4	4	3	2	3	2	4	1	4	1	1	1	1	1
Distillate	1	0	1	0	1	0	1	0	1	0	0	0	0	0	1	0	1	0
Seawater, Flowing	2	0	2	0	2	0	2	0	2	0	1	0	1	0	1	0	1	0
Seawater, Stagnant	4	2	4	4	4	4	3	2	3	3	4	1	4	1	1	1	1	1
Water, Demineralised / Potable	2	0	1	0	1	0	2	2	2	2	2	0	2	0	1	0	1	0

Notes:-

- **The information in the above chart is intended as a general guide based on previous supply history over the last 25 years to the hydrocarbon, energy and process industries. Ultimate responsibility for material selection rests with the customer.**
- **Goodwin Check Valves are manufactured to meet requirements of NACE MR 01 75 when specified in customer enquiry/order.**
- **For sour service applications, Inconel 718 springs can be provided when specified in customer enquiry/order.**
- **For stagnant seawater and oxygenated brine applications, Inconel 625® springs should be used.**
- **If tight shut-off is a requirement, soft seats such as Viton® or Buna N® are available, subject to compatability with fluid and temperatures.**
- **All Goodwin Check Valves are supplied as Retainerless* construction ensuring the pressure boundary is not degraded by crevice corrosion in sour service applications as compared to the old fashioned retainer design that is prone to crevice corrosion down the retainer sealing threads in the valve body.**
- **Goodwin Check Valves are certifiable in compliance with the European Pressure Equipment Directive (PED) 97/23/EC when specified in customer enquiry/order.**
- **Goodwin does not recommend use of Dual Plate Check Valves in reciprocating machinery applications. It is the responsibility of the customer to ensure the valve is suitable for its intended application.**

* Lined valves are fitted with retainers but these are protected from the line fluid by resilient sealing compound.

Legend:-

- OVERSPECIFIED - 0
- EXCELLENT - 1
- GOOD - 2
- SATISFACTORY - 3
- NOT RECOMMENDED - 4 *
- DO NOT USE - 5 ‡

* Not Recommended - The use of this construction on the particular application is likely to lead to premature failure of the valve, which may lead to catastrophic failure or fatality.

‡ Do Not Use - You must avoid using this construction on the particular application to avoid catastrophic failure and possible fatality.

TECHNICAL ADVANTAGES OF SPECIFYING AND

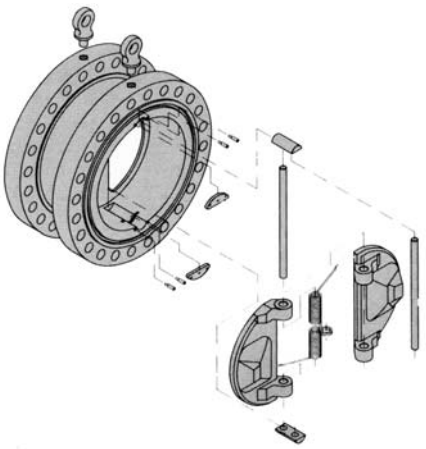
QUALITY ASSURED

The Goodwin Dual Plate Check Valve is designed, manufactured and tested in facilities in the UK audited to BS EN ISO 9001. Goodwin's valve shop and foundry have been registered by the British Standards Institute to ISO 9000 series for some twenty two years. Approval for both companies was first obtained in 1984. The steel foundry, Goodwin Steel Castings Ltd., was the first in Europe to receive such accreditation.

CERT No. FM 00343
ISO 9001

RETAINERLESS DESIGN (Pat)

Goodwin was one of the first dual plate check valve manufacturers to offer a retainerless design. This original patented design has now been superseded by a technically superior solution which is available in all types of Goodwin check valve - wafer, flanged, hub-ended and buttweld end. The engineer no longer needs to worry about whether spiral wound gaskets or ring joints are compatible as the Goodwin design accommodates both USA and European sealing elements.



Not only does the retainerless design provide a higher integrity pressure vessel - no screwed plugs, Goodwin's design enables the valve to be disassembled very quickly without the use of force or special tools other than an Allen wrench. The Goodwin retainerless check valve design concept is such that it is impossible for the valve to become disassembled in the line and does not utilise any springs or circlips.

With improved machining technology Goodwin are able to offer this superior design as standard at a price equal or less than competitors' valves with retaining plugs.

There is no intrusion into the gasket sealing element surface by the retaining mechanism on Goodwin check valves.

(Pat) = Patented Internationally

RETAINING PLUGS

On occasion, for technical reasons, e.g. compact flange and lined valves, Goodwin cannot supply its Retainerless design. In such instances, Goodwin will provide valves with retaining plugs. Retaining plugs have been successfully utilised on check valves for some 40 years.

Cv FACTORS

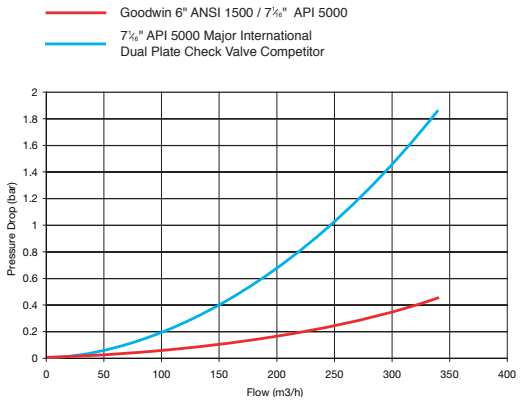


Diagram 1 (Feb. 1994)

From the adjacent graph it can be seen that the pressure drop in the Goodwin high pressure dual plate check valve is substantially less than that of other manufacturers.

This superior performance is achieved by the use of Goodwin's plates (Pat) which, through their slim design, offer less restriction to flow whilst in the fully open position. Also the plates by having a combination of rigidity in certain areas and flexibility in others make it possible to use larger throat areas in the body. This contributes to Goodwin's better flow efficiencies whilst maintaining seat sealing performance.

On conventional dual plate check valves there is typically a 50% reduction in valve throat area between a 150lb valve and a 1500lb valve, whereas there is only around 10% reduction on the Goodwin valve.

From the FLUENT® computer simulation (see page 41), it can be seen that the pressure drop is caused not only by a reduced flow area in the body but also by the plates constricting the flow path when in the open position. These constrictions are minimised in the Goodwin valve.

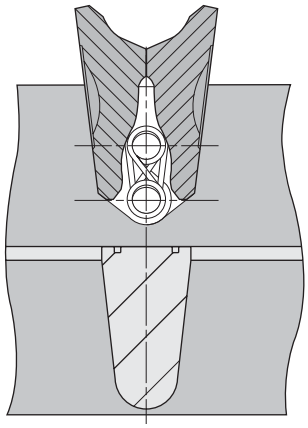
USING GOODWIN DUAL PLATE CHECK VALVES

PLATE SHOCK BUMPERS

For many years Goodwin produced dual plate check valves with plate shock bumpers located at the extreme edge of the curve of the plate. Goodwin's plate (Pat) now incorporates the plate bumper at the centre of mass of the plate approximately one-third the way in from the curved edge. With the plate bumper at the centre of mass, when the bumper of each plate collides, there is an equal and opposite force acting on the plates which prevents significant bending moments acting on the hinge pin of the plate. Plate bumpers are supplied as standard on all sizes, pressures and types of Goodwin Dual Plate Check Valves.

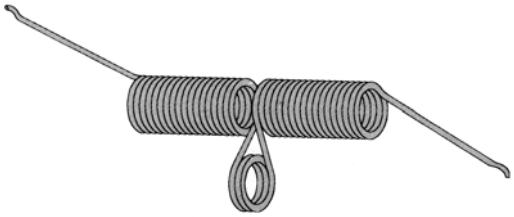
It is an accepted fact that there will be occasions when the plates do not arrive fully open at the same instance. Clearance on the bumper allow and ensure the plates to hit each other rather than the stop pin. This helps prevent large forces being exerted on the stop pin which could cause damage.

The stop pin has only one purpose, to stop a plate going over top dead centre when reverse flow occurs. If this did occur both plates would be on the same side of the valve leaving one port open, thereby stopping the valve performing its sole function of preventing reverse flow.



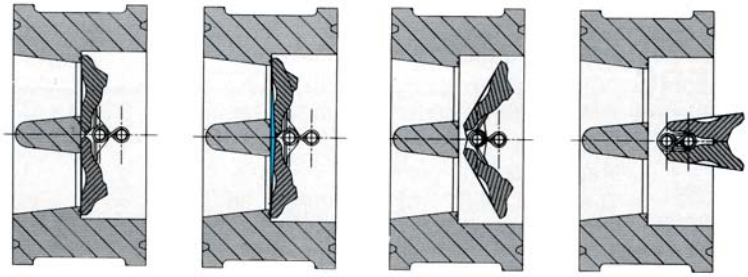
INDEPENDENT PLATE CLOSING ACTION

The independent spring action optimises the equal closing rates of each plate especially when friction coefficients are uneven due to one plate resting upon another. The springs have been designed to ensure stresses are kept to a level so that the spring should have a theoretical infinite life. Spring designs utilised in Goodwin valves have undergone accelerated laboratory testing and are proven to be capable of operating without failure over 2,000,000 cycles.



SEAT LIFE

Increased seat life is obtained by eliminating the problem of the plates dragging on the seat when opening.
Due to the clearance between the plate hinge and the hinge pin, the heel of the plate lifts with the initial flow as the foot of the spring acts beyond the centre of pressure of the plate. As the flow then increases through the valve the plates open without the heels of the plate scuffing the body seat.



SEAT LEAKAGE - METAL TO METAL SEATS

The dual plate check valve is tested to API 598 which has a metal to metal seat permitted seal leakage of 3 cc/inch of bore/min. This small but significant amount arises because it is more difficult to obtain a perfect seal on a D shaped seat compared to a circular seat. The Goodwin plates (Pat) have been specifically designed to overcome this problem and to be better at sealing than earlier designs, such that near zero leakage can be economically achieved on metal to metal seats. This is particularly useful on high temperature gas applications and cryogenic applications where it is not possible to use resilient seats.

In contrast to other dual plate check valves the seat sealing characteristics of the Goodwin valve are enhanced as line pressure increases unlike competitors valves which can significantly deteriorate in higher pressure classes. This characteristic enables Goodwin to provide dual plate check valves with substantially lower leakage rates than specified in API 598.

CUSTOMERS AND MARKETS

GOODWIN GROUP COMPANIES OVER THE YEARS HAVE SUPPLIED PRODUCTS TO THE FOLLOWING CUSTOMERS AND MARKETS:-

USERS

ADCO
ADMA OPCO
ADNOC
ADWEA
AGIP
AIOC
AIR LIQUIDE
ALSTOM
AMERADA HESS
ANADARKO
ARAMCO

BASF
BAPETCO
BHP BILLITON
BOC
BG
BP
BTC PIPELINE CO

CHEVRON
CNOOC
CNPC
CNRL
CNTIC
CON EDISON
CONOCOPHILLIPS
CTOC

DOLPHIN ENERGY
DOW CHEMICAL
DUKE POWER
DUPONT

EASTMAN CHEMICALS
ECOPETROL
EDISON
EG LNG
EGAT
EGPC
EMEPMI
ENAGAS
ENCANA
ENI
ESSO
EXXONMOBIL
EXXONEFTGAS

FORMOSA

GAIL
GASCO
GAZ DE FRANCE
GE
GENREF
GORO NICKEL
GULF

HUSKY OIL
INDIA OIL CORP
IPCL
IRVING OIL

JUPC

KNPC
KOC
KOGAS

LAGOVEN
LASMO
LYONDELL/CITGO

MAERSK
MARATHON
MARAVEN
METHANEX
MEW (OMAN)
MEW (KUWAIT)
MINERA ESCONDIDA
MURPHY OIL

NATCO
NLNG
NNPC
NODCO
NORSK HYDRO
NOVA CHEMICALS
OCCIDENTAL
OMV
ONGC
ORYX

PDO
PDVSA
PEMEX
PERTAMINA
PETROBRAS
PETROCHINA
PETROVIETNAM
PIDEC
POGC
POSCO
PTT
PTTEP

QAFAC
QAFCO
QAPCO
QATAR VINYL CO
QP
QLGC (QATARGAS)
QUANTUM

RAS LAFFAN LNG CO
RELIANCE
REPSOL
SABIC
SAKHALIN ENERGY
SANTOS
SASOL
SAUDI CHEVRON PHILLIPS
SAUDI METHANOL CO
SEGAS
SHELL
SINOPEC
SK CORP
SONAHESS
SONATRACH
STATOIL
SUNCOR

TAKREER
TALISMAN
TENGIZCHEVROIL
THAI OLEFINS
TOTALFINAELF
TRANS CANADA
TYUMEN OIL

UNOCAL

WOODSIDE

YPF

ZADCO

CONTRACTORS

ABB LUMMUS GLOBAL
ACERGY
AIR PRODUCTS
AIR LIQUIDE
AKER KVAERNER
ALLIANCE
AMEC
AMKC
ATLANTIA

BANTREL
BECHTEL
BLACK & VEATCH
BOC

CB & I
CB & I JOHN BROWN
CHIYODA
CLOUGH
COLT ENGINEERING
CONSOLIDATED CONTRACTORS
COSTAIN
CTCI

DAELIM
DAEWOO
DEGREMONT
DODSAL
DOOSAN
EDELEANU
EIL
ENPPI
ENTREPOSE

FLUOR DANIEL
FOSTER WHEELER

GEC ALSTOM
GROOTINT
GS ENGINEERING
GUSTO

HALLIBURTON
HAMWORTHY
HANWHA
HATCH
HITACHI ZOSEN
HYUNDAI

ICA FLUOR
IOEC
I V OIL & GAS

JACOBS
JGC
JP KENNY CALEDONIA
J. RAY McDERMOTT
KAWASAKI
KTI
KELLOGG BROWN & ROOT
KEPPEL FELS
KRUPP UHDE

LARSON & TOUBRO
LINDE
LITWIN
LURGI

MACCHI
MAN TURBO
M.W. KELLOGG
MHI
McDERMOTT
MES
MODEC
MUSTANG

NATCO
NIPPON STEEL
NPCC
NUOVO PIGNONE

OIEC
PARSONS
PARAGON
P.T. TRIPATRA
PENANG SHIPBUILDING
PETROFAC
PETROJET
PROMAN
PROSERNAT

RAYTHEON ENGINEERING
RANHILL WORLEY

SADRA
SAIBOS
SAIPEM
SALZGITTER
SAMSUNG
S&B
SBM
SBM-IMODCO
SEC
SEMBAWANG ENGINEERING
SENER
SHAW
SHEDDEN UHDE
SIME DARBY
SIME SEMBAWANG
SK ENGINEERING
SNAMPROGETTI
SNC LAVALIN
SOFRESID
SPIE CAPAG
STG INTERNATIONAL
STOLT OFFSHORE
STONE AND WESTER
STORK PROTECH
SWECOMEX

TECNICAS REUNIDAS
TECNIMONT
TECHNIP
TOYO ENGINEERING
TRANSFIELD WORLEY
TRI OCEAN

UHDE
UMA ENGINEERING

W S NELSON
WEIR WESTGARTH
WILBROS
WOOD GROUP
WORLEY PARSONS

VECO
VOSPER THORNEYCROFT

INDUSTRIES SERVED

On & Offshore Oil & Gas Production
Refinery
Petrochemical
Chemical
Fertilizer
Gas Plant
GTL
LNG
Liquid Gases
Terminals
Pipeline
Power
Desalination
Water

TYPICAL APPLICATIONS

Pump discharge
Compressor discharge
Compressor suction
Heat Exchangers
Reactors
Separators
Vessels
High / low pressure
High / low temperature
Cryogenic
Erosive
Corrosive
Toxic
Flammable
Chemicals
Petrochemicals
Hydrocarbons
Gases
Liquids
Steam
Seawater

DUAL PLATE vs SWING CHECK

ADVANTAGES OF GOODWIN WAFER CHECK VALVE vs SWING CHECK VALVE

The short face-to-face design inherently makes the Goodwin Check Valve lighter and more compact than a swing check valve, leading to ease of installation and lower costs. Typically, the Goodwin Wafer Check Valve (Type BR) is less than one quarter the weight and one quarter the face-to-face of a traditional full-bodied swing check valve.

The significant savings in space and weight that are achieved by specifying Goodwin Wafer Check Valves instead of swing check valves are accompanied by a substantially lower purchase price. The comparison table illustrates for a 24" 150# Carbon Steel body valve the relative price saving to be made. Should the valve body material be of Stainless Steel, Duplex Stainless Steel, high nickel alloy or some other high grade material, then the savings that can be made by specifying and using Goodwin Dual Plate Wafer Check Valves escalate.

Generally, with the Goodwin Check Valve:

- The larger the valve diameter
- The higher the pressure class
- The higher the grade of material

- **The greater the cost saving**

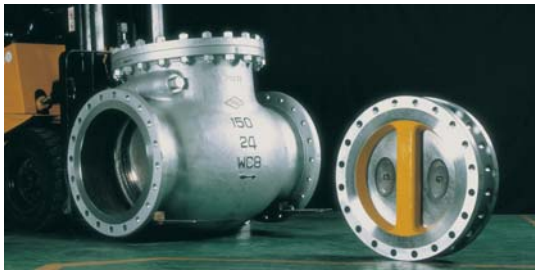
For new construction projects, check valve costs can be reduced by as much as 70% by utilizing Goodwin Wafer Check Valves instead of traditional flanged full-bodied swing check valves.

24" ANSI 150lb Carbon Steel			
Type	**Swing Check**	**Wafer Type BR**	**Flanged Type BFR**
Weight	1346 kg	337 kg	409 kg
Face to Face	51" / 1295 mm	8.75" / 222 mm	8.75" / 222 mm
Cv	20,800	26,511	26,511
Price in US$	US$8,240	US$2,267	US$3,252

8" ANSI 150# Swing Check = 128kg
8" ANSI 150# Goodwin Wafer Check = 36kg

FLANGED DUAL PLATE CHECK VALVE VS. SWING CHECK VALVE

Many client company specifications exclude wafer type valves. The Goodwin Flanged Dual Plate Check Valve allows installation in a piping system in a conventional double flanged manner, i.e. studs and nuts per flange connection. Although higher in price than wafer design the flanged style check valve still provides very significant weight, space and cost savings against ther traditional swing check valve.

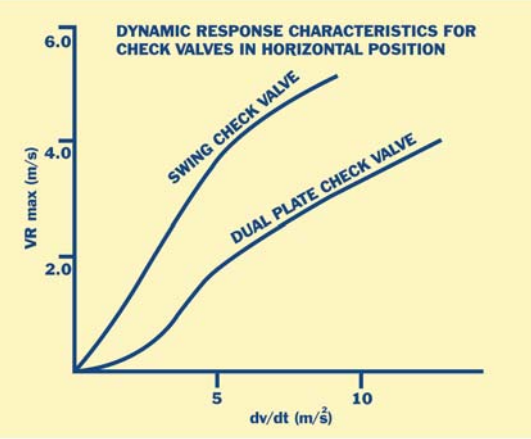


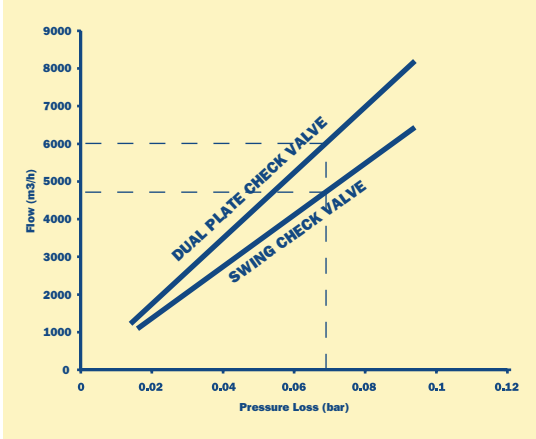
24" ANSI 150# Check Valves
Swing Check: 1346kg Goodwin Flanged Check: 409kg

TECHNICAL SUPERIORITY

Additional to the Dual Plate Check Valve offering commercial benefit in terms of its low relative purchase price and lower transportation and installation costs, it also offers improved technical performance providing long term economic benefit and lower life cycle costs.. Energy savings provided by superior valve design and performance in terms of reduced pressure drop can exceed the valve purchase price several times over. Goodwin Dual Plate Check Valves have higher CV values / lower pressure drop losses than swing check valves and are vastly superior in their dynamic response (substantially reducing the propensity for slam associated with swing check valves) as illustrated in the comparison table and graphs.

In summary, the Goodwin Dual Plate Check Valve is both commercially and technically superior to the swing check valve and is now considered the "check valve of choice" in all but the most demanding and critical of applications.



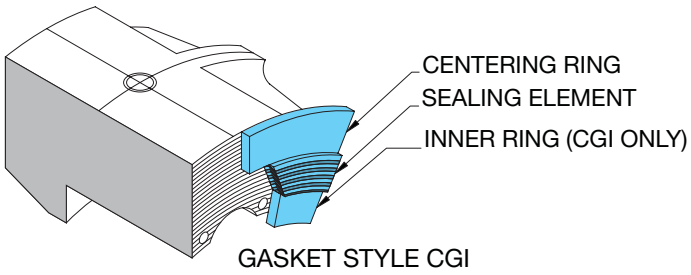


EXPLODED VIEWS AND SPARE PARTS

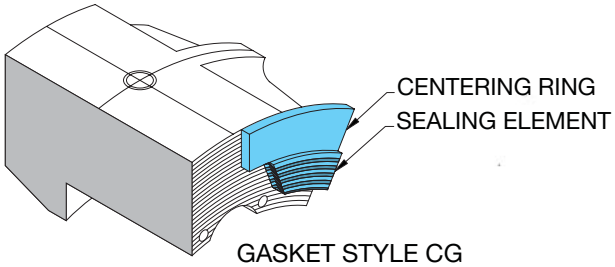
WAFER RETAINERLESS — TYPE BR

VALVE COMPONENTS

	BR01	-	BODY
*	B02	-	PLATE x 2
*	BR03	-	HINGE/STOP PIN x 2
*	B04	-	SPRING
*	BR06	-	CARRIER x 2
*	BR08	-	KEEPER PLATE x 2
*	BR10	-	DOWEL x 4
†	B11	-	EYEBOLT



GASKET STYLE CGI



GASKET STYLE CG

(Some BR TYPE bodies are forged - as depicted in the exploded view)

(Body outer profile may differ from that shown)

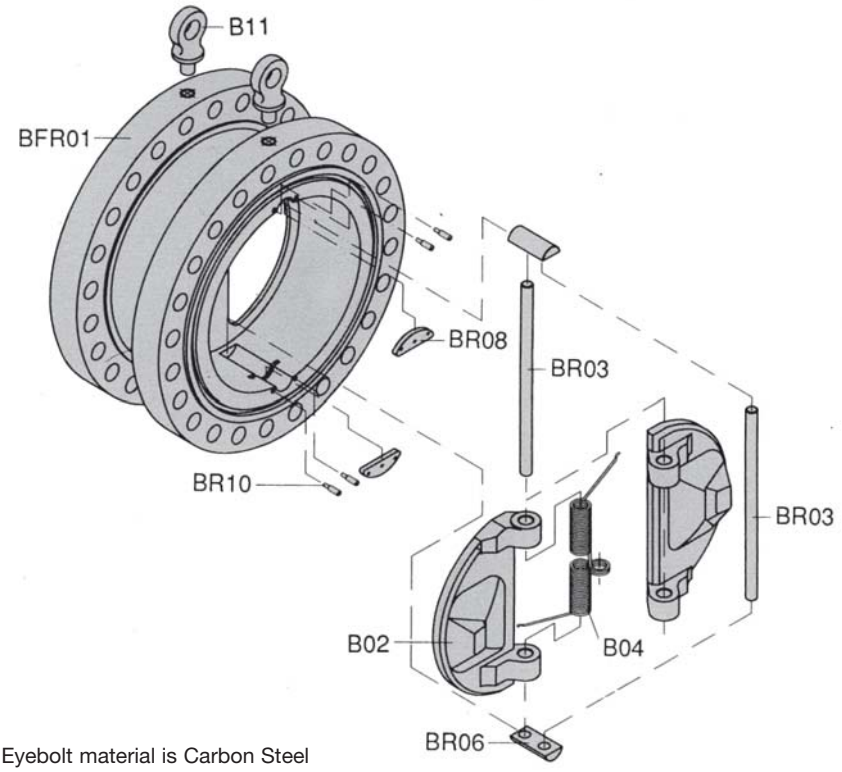
* Spares Available

† Eyebolt(s) supplied for valves over 20kg. Eyebolt material is Carbon Steel

FLANGED RETAINERLESS — TYPE BFR

VALVE COMPONENTS

	BFR01	-	BODY
*	B02	-	PLATE x 2
*	BR03	-	HINGE/STOP PIN x 2
*	B04	-	SPRING
*	BR06	-	CARRIER x 2
*	BR08	-	KEEPER PLATE x 2
*	BR10	-	DOWEL x 4
†	B11	-	EYEBOLT x 2



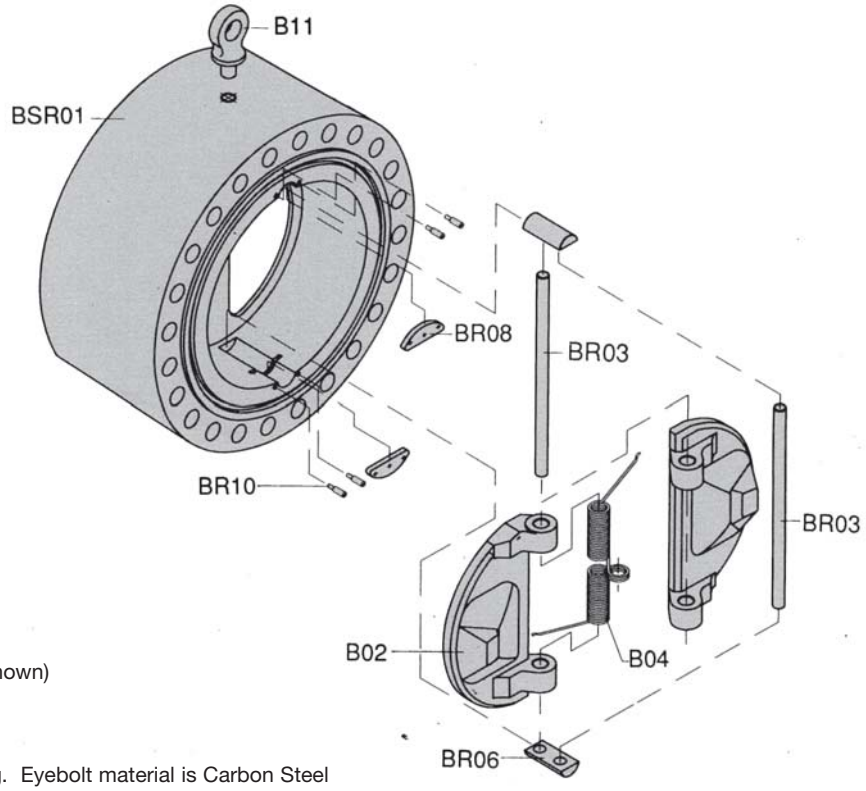
* Spares Available

† Eyebolt(s) supplied for valves over 20kg. Eyebolt material is Carbon Steel

SOLID LUG RETAINERLESS — TYPE BSR

VALVE COMPONENTS

	BSR01	-	BODY
*	B02	-	PLATE x 2
*	BR03	-	HINGE/STOP PIN x 2
*	B04	-	SPRING
*	BR06	-	CARRIER x 2
*	BR08	-	KEEPER PLATE x 2
*	BR10	-	DOWEL x 4
†	B11	-	EYEBOLT



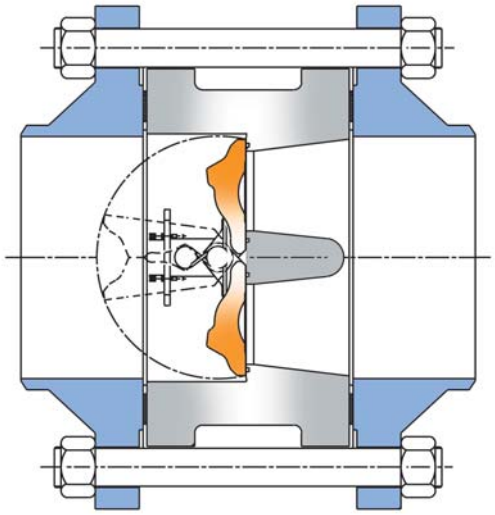
(Body outer profile may differ from that shown)

* Spares Available

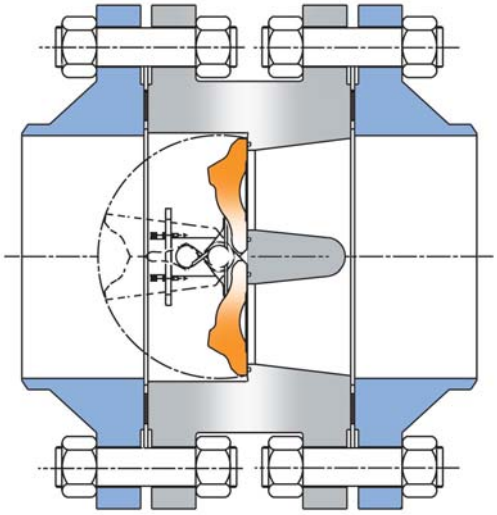
† Eyebolt(s) supplied for valves over 20kg. Eyebolt material is Carbon Steel

INSTALLATION BETWEEN END CONNECTIONS

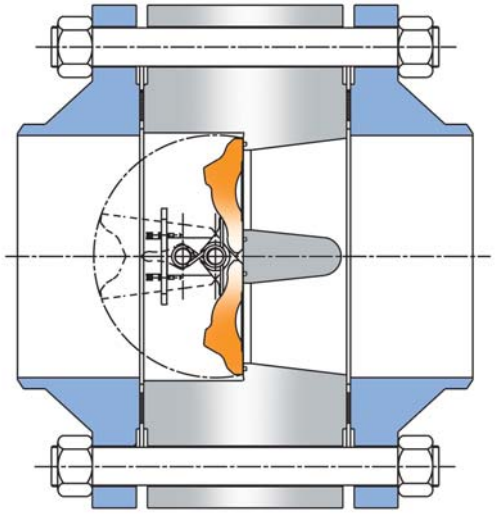
TYPE BR - Wafer



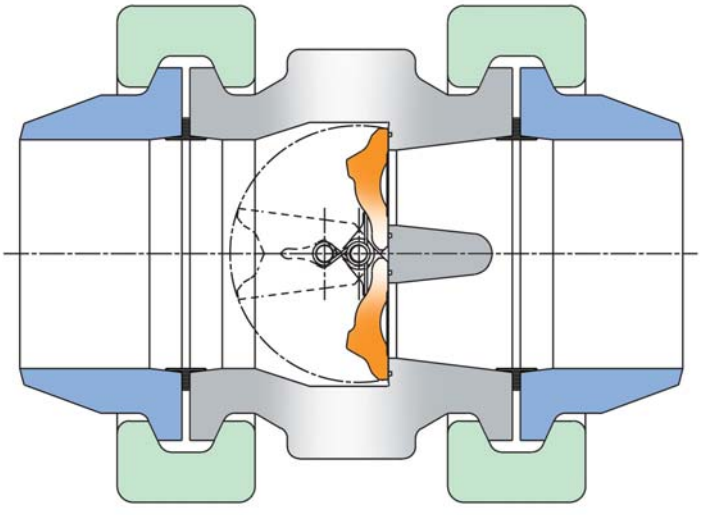
TYPE BFR - Flanged



TYPE BSR - Solid Lug



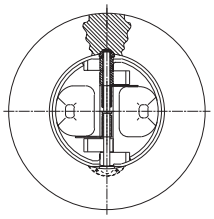
TYPE BHR - Hub Ended

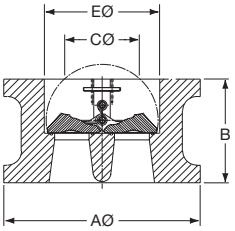


BR, BFR & BSR have face-to-face dimensions to API 594.
BH & BHR face-to-face dimensions to manufacturer's standard.

WAFER TYPE BR

INSTALLATION DIMENSIONS





ANSI B16.5

							FLANGE DETAIL					
Size	Pressure Rating	End Facing	A Ø	B	C Ø	E Ø	HOLE P.C.D.	HOLE DIA.	STUD SELECTION			Δ VALVE APPROX WEIGHT
									No.	Diameter	*Length	
inches	ANSI		mm	mm	mm	mm	mm	mm		inches	mm	kg
	150	RF	105	60	0	57	120.7	19.1	4	5/8	165	3
	300	RF	111	60	0	57	127.0	19.1	8	5/8	170	3
2	600	RF/RJ-23	111	60	0	57	127.0	19.1	8	5/8	195	3
(50mm)	900	RF/RJ-24	143	70	0	57	165.1	25.4	8	7/8	240	8
	1500	RF/RJ-24	143	70	0	57	165.1	25.4	8	7/8	240	8
	2500	RF/RJ-26	146	70	0	57	171.4	28.6	8	1	275	13
	150	RF	137	73	51	87	152.4	19.1	4	5/8	185	6
	300	RF	149	73	51	87	168.3	22.2	8	3/4	205	8
3	600	RF/RJ-31	149	73	51	87	168.3	22.2	8	3/4	230	8
(80mm)	900	RF/RJ-31	168	83	60	87	190.5	25.4	8	7/8	255	12
	1500	RF/RJ-35	175	83	60	87	203.2	31.8	8	1 1/8	285	13
	2500	RF/RJ-32	197	86	60	87	228.6	34.9	8	1 1/4	335	16
	150	RF	175	73	89	113	190.5	19.1	8	5/8	185	10
	300	RF	181	73	89	113	200.0	22.2	8	3/4	210	11
4	600	RF/RJ-37	194	79	89	113	215.9	25.4	8	7/8	255	13
(100mm)	900	RF/RJ-37	206	102	83	113	235.0	31.8	8	1 1/8	300	19
	1500	RF/RJ-39	210	102	83	113	241.3	34.9	8	1 1/4	325	21
	2500	RF/RJ-38	235	105	83	113	273.0	41.3	8	1 1/2	395	29
	150	RF	222	98	140	166	241.3	22.2	8	3/4	220	16
	300	RF	251	98	140	166	269.9	22.2	12	3/4	245	20
6	600	RF/RJ-45	267	137	89	166	292.1	28.6	12	1	340	36
(150mm)	900	RF/RJ-45	289	159	89	166	317.5	31.8	12	1 1/8	380	54
	1500	RF/RJ-46	283	159	89	166	317.5	38.1	12	1 3/8	455	52
	2500	RF/RJ-47	318	159	89	166	368.3	54.0	8	2	540	70
	150	RF	279	127	171	207	298.5	22.2	8	3/4	255	36
	300	RF	308	127	171	207	330.2	25.4	12	7/8	290	40
8	600	RF/RJ-49	321	165	168	207	349.2	31.8	12	1 1/8	385	72
(200mm)	900	RF/RJ-49	359	206	130	207	393.7	38.1	12	1 3/8	455	122
	1500	RF/RJ-50	352	206	130	207	393.7	44.5	12	1 5/8	530	116
	2500	RF/RJ-51	387	206	143	207	438.2	54.0	12	2	630	132
	150	RF	340	146	235	260	362.0	25.4	12	7/8	285	52
	300	RF	362	146	235	260	387.4	28.6	16	1	325	56
10	600	RF/RJ-53	400	213	200	260	431.8	34.9	16	1 1/4	460	118
(250mm)	900	RF/RJ-53	435	241	195	260	469.9	38.1	16	1 3/8	505	196
	1500	RF/RJ-54	435	248	184	260	482.6	50.8	12	1 7/8	620	203
	2500	RF/RJ-55	476	254	191	260	539.8	66.7	12	2 1/2	790	217
	150	RF	410	181	260	300	431.8	25.4	12	7/8	325	97
	300	RF	422	181	260	300	450.8	31.8	16	1 1/8	375	98
12	600	RF/RJ-57	457	229	232	300	489.0	34.9	20	1 1/4	480	164
(300mm)	900	RF/RJ-57	498	292	206	300	533.4	38.1	20	1 3/8	575	293
	1500	RF/RJ-58	521	305	210	300	571.5	54.0	16	2	720	373
	2500	RF/RJ-60	549	305	225	300	619.1	73.0	12	2 3/4	895	394

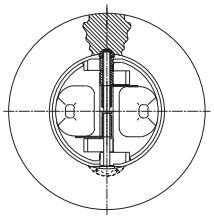
* Where Ring Joint Facing shown in End Facing, Stud lengths based on Ring Joint flange connection.

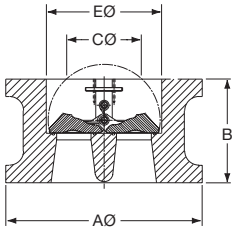
Δ Weights are for valve only and exclude mating flanges and bolting. Weight will vary according to corrosion allowance specification.

VALVE SIZE	2" to 24"	26" to 60"	66" to 144"
FLANGE STANDARD	ANSI B16.5	ANSI B16.47 SERIES A (MSS SP44)	AWWA C207 (CLASS E 275 PSI)

WAFER TYPE BR

INSTALLATION DIMENSIONS





ANSI B16.5 / ANSI B16.47 SERIES A

							FLANGE DETAIL					
Size	Pressure Rating	End Facing	A Ø	B	C Ø	E Ø	HOLE P.C.D	HOLE DIA.	STUD SELECTION			Δ VALVE APPROX WEIGHT
									No.	Diameter	*Length	
inches	ANSI		mm	mm	mm	mm	mm	mm		inches	mm	kg
14 (350mm)	150	RF	451	184	286	339	476.3	28.6	12	1	340	123
	300	RF	486	222	286	339	514.4	31.8	20	1 1/8	420	176
	600	RF/RJ-61	492	273	232	339	527.0	38.1	20	1 3/8	535	186
	900	RF/RJ-62	521	356	0	339	558.8	41.3	20	1 1/2	660	396
	1500	RF/RJ-63	578	356	0	339	635.0	60.3	16	2 1/4	810	484
16 (400mm)	150	RF	514	191	332	387	539.8	28.6	16	1	350	133
	300	RF	540	232	330	387	571.5	34.9	20	1 1/4	445	207
	600	RF/RJ-65	565	305	330	387	603.2	41.3	20	1 1/2	590	331
	900	RF/RJ-66	575	384	162	387	616.0	44.5	20	1 5/8	705	532
	1500	RF/RJ-67	641	384	162	387	704.8	66.7	16	2 1/2	885	587
18 (450mm)	150	RF	549	203	395	438	577.9	31.8	16	1 1/8	375	141
	300	RF	597	264	391	438	628.6	34.9	24	1 1/4	485	294
	600	RF/RJ-69	613	362	330	438	654.0	44.5	20	1 5/8	665	394
	900	RF/RJ-70	638	451	244	438	685.8	50.8	20	1 7/8	815	611
	1500	RF/RJ-71	705	468	184	438	774.7	73.0	16	2 3/4	1010	791
20 (500mm)	150	RF	606	219	438	487	635.0	31.8	20	1 1/8	400	215
	300	RF	654	292	438	487	685.8	34.9	24	1 1/4	520	363
	600	RF/RJ-73	683	368	432	487	723.9	44.5	24	1 5/8	685	544
	900	RF/RJ-74	699	451	406	487	749.3	54.0	20	2	835	637
	1500	RF/RJ-75	756	533	210	487	831.8	79.4	16	3	1125	1275
24 (600mm)	150	RF	718	222	537	579	749.3	34.9	20	1 1/4	420	337
	300	RF	775	318	524	579	812.8	41.3	24	1 1/2	570	521
	600	RF/RJ-77	791	438	510	579	838.2	50.8	24	1 7/8	800	819
	900	RF/RJ-78	838	495	445	579	901.7	66.7	20	2 1/2	975	1230
	1500	RF/RJ-79	902	559	391	579	990.6	92.1	16	3 1/2	1235	2713
26 (650mm)	150	RF	775	356	597	629	806.5	34.9	24	1 1/4	605	416
	300	RF	835	356	597	629	876.3	44.5	28	1 5/8	650	735
	600	RF/RJ-93	867	457	578	629	914.4	50.8	28	1 7/8	850	842
	900	RF/RJ-100	883	533	559	629	952.5	73.0	20	2 3/4	1045	1182
28 (700mm)	150	RF	832	381	648	680	863.6	34.9	28	1 1/4	635	544
	300	RF	899	381	648	680	939.8	44.5	28	1 5/8	685	733
	600	RF/RJ-94	914	483	629	680	965.2	54.0	28	2	890	871
	900	RF/RJ-101	946	572	610	680	1022.4	79.4	20	3	1100	1441
30 (750mm)	150	RF	883	305	641	735	914.4	34.9	28	1 1/4	565	662
	300	RF	953	368	641	735	997.0	47.6	28	1 3/4	685	952
	600	RF/RJ-95	972	505	584	735	1022.4	54.0	28	2	920	1578
	900	RF/RJ-102	1010	635	584	735	1085.9	79.4	20	3	1180	2132
32 (800mm)	150	RF	940	356	641	784	977.9	41.3	28	1 1/2	645	707
	300	RF	1006	406	641	784	1054.1	50.8	28	1 7/8	750	1635
	600	RF/RJ-96	1022	533	610	784	1079.5	60.3	28	2 1/4	970	1743
	900	RF/RJ-103	1073	660	610	784	1155.7	85.7	20	3 1/4	1235	2034
36 (900mm)	150	RF	1048	368	648	865	1085.9	41.3	32	1 1/2	675	682
	300	RF	1118	483	648	865	1168.4	54.0	32	2	845	1269
	600	RF/RJ-98	1130	635	527	865	1193.8	66.7	28	2 1/2	1095	2120
	900	RF/RJ-105	1200	718	356	865	1289.1	92.1	20	3 1/2	1335	3259

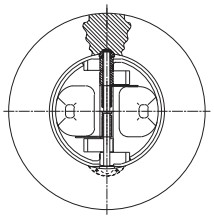
* Where Ring Joint Facing shown in End Facing, Stud lengths based on Ring Joint flange connection.

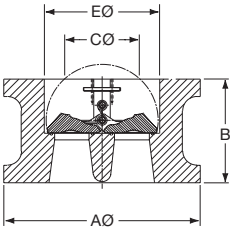
Δ Weights are for valve only and exclude mating flanges and bolting. Weight will vary according to corrosion allowance specification.

VALVE SIZE	2" to 24"	26" to 60"	66" to 144"
FLANGE STANDARD	ANSI B16.5	ANSI B16.47 SERIES A (MSS SP44)	AWWA C207 (CLASS E 275 PSI)

WAFER TYPE BR

INSTALLATION DIMENSIONS





ANSI B16.47 SERIES A / AWWA C207 CLASS E

							FLANGE DETAIL					
Size	Pressure Rating	End Facing	A Ø	B	C Ø	E Ø	HOLE P.C.D.	HOLE DIA.	STUD SELECTION			Δ VALVE APPROX WEIGHT
									No.	Diameter	Length	
inches	ANSI		mm	mm	mm	mm	mm	mm		inches	mm	kg
	150	RF	1162	432	882.7	987	1200.2	41.3	36	1 1/2	740	962
40	300	RF	1114	546	749.3	909	1155.7	44.5	32	1 5/8	910	1825
(1000mm)	600	RF	1156	660	743.0	909	1212.9	60.3	32	2 1/4	1155	3750
	900	RF	1251	762	736.6	909	1339.9	92.1	24	3 1/2	1395	3972
	150	RF	1219	432	935.1	1062	1257.3	41.3	36	1 1/2	755	1134
42	300	RF	1168	568	836.6	1015	1206.5	44.5	32	1 5/8	940	2630
(1050mm)	600	RF	1219	702	647.7	972	1282.7	66.7	28	2 1/2	1225	3135
	900	RF	1302	787	584.2	972	1390.7	92.1	24	3 1/2	1440	3670
48	150	RF	1384	524	1036.7	1193	1422.4	41.3	44	1 1/2	865	3007
(1200mm)	300	RF	1324	629	965.2	1136	1371.6	50.8	32	1 7/8	1040	4400
	600	RF	1391	787	889	1136	1460.5	73.0	32	2 3/4	1365	4416
54	150	RF	1549	591	1092.2	1281	1593.9	47.6	44	1 3/4	970	2680
(1350mm)	300	RF	1492	718	1092.2	1281	1549.4	60.3	28	2 1/4	1190	3878
60	150	RF	1715	660	1206.5	1422	1759.0	47.6	52	1 3/4	1065	4148
(1500mm)	300	RF	1645	838	1206.5	1422	1701.8	60.3	32	2 1/4	1330	5392
66 (1650mm)	150	RF	1886	787	1435.1	1663	1930.4	47.6	52	1 3/4	1090	7636
72 (1800mm)	150	RF	2051	851	1530.4	1818	2095.5	47.6	60	1 3/4	1160	8590
78 (1950mm)	150	RF	2210	927	1663.7	1974	2260.6	54.0	64	2	1265	10237
84 (2100mm)	150	RF	2375	1041	1752.6	2116	2425.7	54.0	64	2	1380	12777
90 (2250mm)	150	RF	**	**	**	**	**	**	**	**	**	**
96 (2400mm)	150	RF	**	**	**	**	**	**	**	**	**	**
102 (2550mm)	150	RF	**	**	**	**	**	**	**	**	**	**
108 (2700mm)	150	RF	**	**	**	**	**	**	**	**	**	**
114 (2850mm)	150	RF	**	**	**	**	**	**	**	**	**	**
120 (3000mm)	150	RF	**	**	**	**	**	**	**	**	**	**
126 (3150mm)	150	RF	**	**	**	**	**	**	**	**	**	**
132 (3300mm)	150	RF	**	**	**	**	**	**	**	**	**	**
138 (3450mm)	150	RF	**	**	**	**	**	**	**	**	**	**
144 (3600mm)	150	RF	**	**	**	**	**	**	**	**	**	**

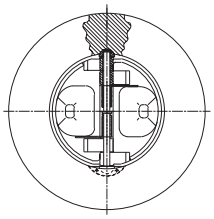
Δ Weights are for valve only and exclude mating flanges and bolting. Weight will vary according to corrosion allowance specification
** Apply to Goodwin for details

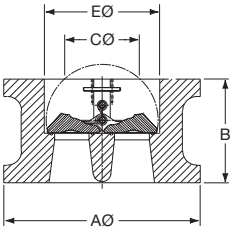
VALVE SIZE	26" to 60"	*** 66" to 144"
FLANGE STANDARD	ANSI B16.47 SERIES A (MSS SP44)	AWWA C207 (CLASS E 275 PSI)

*** Valves 66" to 144" can be supplied with dimensions to suit flange standards AWWA C207 Classes B, D. E or F and Taylor Forge

WAFER TYPE BR

INSTALLATION DIMENSIONS





ANSI B16.47 SERIES B

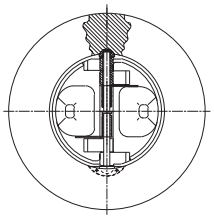
							FLANGE DETAIL					
Size	Pressure Rating	End Facing	A Ø	B	C Ø	E Ø	HOLE P.C.D.	HOLE DIA.	STUD SELECTION			Δ VALVE APPROX WEIGHT
									No.	Diameter	*Length	
inches	ANSI		mm	mm	mm	mm	mm	mm		inches	mm	kg
	150	RF	725	356	597	629	744.5	22.2	36	3/4	525	395
26	300	RF	771	356	597	629	803.3	34.9	32	1 1/4	650	698
(650mm)	600	RF/RJ-93	765	457	578	629	806.5	44.5	28	1 5/8	850	800
	900	RF/RJ-100	838	533	559	629	901.7	66.7	20	2 1/2	1025	1123
	150	RF	776	381	648	680	795.3	22.2	40	3/4	555	517
28	300	RF	826	381	648	680	857.3	34.9	36	1 1/4	675	696
(700mm)	600	RF/RJ-94	819	483	629	680	863.6	47.6	28	1 3/4	895	827
	900	RF/RJ-101	902	572	610	680	971.6	73.0	20	3	1110	1369
	150	RF	827	305	641	735	846.1	22.2	44	3/4	480	629
30	300	RF	886	368	641	735	920.8	38.1	36	1 3/8	675	904
(750mm)	600	RF/RJ-95	880	505	584	735	927.1	50.8	28	1 7/8	935	1499
	900	RF/RJ-102	959	635	584	735	1035.1	79.4	20	3	1185	2025
	150	RF	881	356	641	784	900.2	22.2	48	3/4	530	672
32	300	RF	940	406	641	784	977.9	41.3	32	1 1/2	740	1553
(800mm)	600	RF/RJ-96	933	533	610	784	984.3	54.0	28	2	985	1656
	900	RF/RJ-103	1016	660	610	784	1092.2	79.4	20	3 1/4	1230	1932
	150	RF	987	368	648	865	1009.7	25.4	44	7/8	565	648
36	300	RF	1048	483	648	865	1089.0	44.5	32	1 5/8	840	1206
(900mm)	600	RF/RJ-98	1048	635	527	865	1104.9	60.3	28	2 1/4	1135	2014
	900	RF/RJ-105	1124	718	356	865	1200.2	79.4	24	3	1310	3096
40	150	RF	1095	432	883	987	1120.6	28.6	44	1	640	1166
(1000mm)	300	RF	1150	546	749	909	1190.8	44.5	40	1 5/8	910	2007
42	150	RF	1146	432	935	1062	1171.4	28.6	48	1	645	1077
(1050mm)	300	RF	1200	568	837	1015	1244.6	47.6	36	1 3/4	945	2893
48	150	RF	1307	524	1037	1193	1335.0	31.8	44	1 1/8	760	2857
(1200mm)	300	RF	1368	629	965	1136	1416.1	50.8	40	1 7/8	1130	4840
54	150	RF	1464	591	1092	1281	1492.3	31.8	56	1 1/8	840	2546
(1350mm)	300	RF	1530	718	1092	1281	1577.8	50.8	48	1 7/8	1150	4266
60	150	RF	1630	660	1207	1422	1662.2	34.9	52	1 1/4	925	3941
(1500mm)	300	RF	1707	838	1207	1422	1763.8	60.3	40	2 1/4	1305	5931

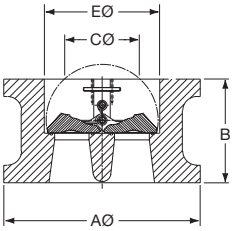
* Where Ring Joint Facing shown in End Facing, Stud lengths based on Ring Joint flange connection.
Δ Weights are for valve only and exclude mating flanges and bolting. Weight will vary according to corrosion allowance specification.

INTERMEDIATE SIZES ARE AVAILABLE TO SPECIAL ORDER
FACE TO FACE DIMENSIONS ARE TO API 594

WAFER TYPE BR

INSTALLATION DIMENSIONS





API 6A / ISO 10423

							FLANGE DETAIL					
Size	API Rating	End Facing	A Ø	B	C Ø	E Ø	HOLE P.C.D.	HOLE DIA.	STUD SELECTION			Δ VALVE APPROX WEIGHT
									No.	Diameter	*Length	
inches	PSI CWP		mm	mm	mm	mm	mm	mm		inches	mm	kg
2 1/16	2000	RJ-23	111	70	0	57	127.0	19.1	8	5/8	210	3
	3000	RJ-24	143	70	0	57	165.1	25.4	8	7/8	245	8
	5000	RJ-24	143	70	0	57	165.1	25.4	8	7/8	245	8
3 1/8	2000	RJ-31	149	83	51	87	168.1	22.2	8	3/4	240	7
	3000	RJ-31	168	83	60	87	190.5	25.4	8	7/8	260	13
	5000	RJ-35	175	86	60	87	203.2	31.8	8	1 1/8	295	14
4 1/16	2000	RJ-37	194	102	89	113	215.9	25.4	8	7/8	280	9
	3000	RJ-37	206	102	83	113	235.0	31.8	8	1 1/8	305	20
	5000	RJ-39	210	105	83	113	241.3	31.8	8	1 1/4	335	28
7 1/16	2000	RJ-45	267	159	89	166	292.1	28.6	12	1	360	32
	3000	RJ-45	289	159	89	166	317.5	31.8	12	1 1/8	385	54
	5000	RJ-45	283	159	89	166	317.5	38.1	12	1 3/8	455	53
9	2000	RJ-49	321	206	168	207	349.3	31.8	12	1 1/8	430	65
	3000	RJ-49	359	206	130	207	393.7	38.1	12	1 3/8	460	123
	5000	RJ-50	352	206	130	207	393.7	44.5	12	1 5/8	535	117
11	2000	RJ-53	400	241	200	260	431.8	34.9	16	1 1/4	490	113
	3000	RJ-53	435	248	195	260	469.9	38.1	16	1 3/8	515	197
	5000	RJ-54	435	254	184	260	482.6	50.8	12	1 7/8	630	204
13 5/8	2000	RJ-57	457	292	232	300	487.7	34.9	20	1 1/4	545	140
	3000	RJ-57	498	305	206	300	533.4	38.1	20	1 3/8	590	327

Δ Weights are for valve only and exclude mating flanges and bolting.
API 10000 Valves are available upon application. API 10000 Valves have retaining plugs, ie are not retainerless.
Testing procedure in accordance with API 6A / ISO 10423. Allowable leakage rate in accordance with API 598.

TYPE BR to API 6D / ISO 14313

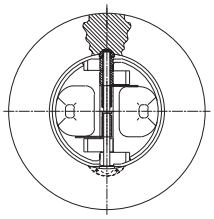
THE INSTALLATION DIMENSIONS
ARE THE SAME AS ANSI VALVES (WAFER TYPE BR)

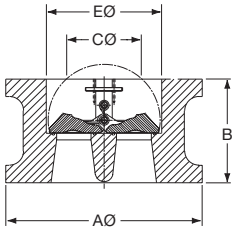
SIZE 2" - 12" 2500# 14" - 24" 1500#

TESTING PROCEDURE IN ACCORDANCE WITH API 6D / ISO 14313
ALLOWABLE LEAKAGE RATE IN ACCORDANCE WITH API 598.

WAFER TYPE BR

INSTALLATION DIMENSIONS





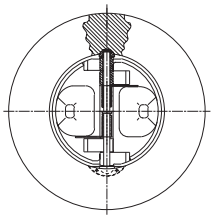
DIN 2501 / BS4504

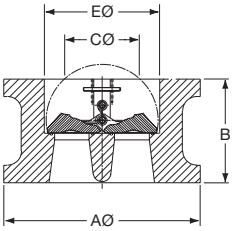
						FLANGE DETAIL					
Size	Pressure Rating	A Ø	B	C Ø	E Ø	HOLE P.C.D.	HOLE DIA.	STUD SELECTION			Δ VALVE APPROX WEIGHT
								No.	Diameter	Length	
mm	ANSI	mm	mm	mm	mm	mm	mm			mm	kg
	PN10	109	60	-	57	125	18	4	M16	165	3.2
50mm	PN16	109	60	-	57	125	18	4	M16	165	3.2
(2")	PN25	109	60	-	57	125	18	4	M16	170	3.2
	PN40	109	60	-	57	125	18	4	M16	170	3.2
	PN10	144	73	51	87	160	18	8	M16	185	7.7
80mm	PN16	144	73	51	87	160	18	8	M16	185	7.7
(3")	PN25	144	73	51	87	160	18	8	M16	205	7.7
	PN40	144	73	51	87	160	18	8	M16	205	7.7
	PN10	164	73	89	113	180	18	8	M16	185	9.0
100mm	PN16	164	73	89	113	180	18	8	M16	185	9.5
(4")	PN25	170	73	89	113	190	22	8	M20	210	10.0
	PN40	170	73	89	113	190	22	8	M20	210	10.5
	PN10	220	98	140	166	240	22	8	M20	220	15.5
150mm	PN16	220	98	140	166	240	22	8	M20	220	16.0
(6")	PN25	226	98	140	166	250	26	8	M24	245	19.4
	PN40	226	98	140	166	250	26	8	M24	245	20.0
	PN10	275	127	171	207	295	22	8	M20	255	35.0
200mm	PN16	275	127	171	207	295	22	12	M20	255	36.0
(8")	PN25	286	127	171	207	310	26	12	M24	290	38.0
	PN40	293	127	171	207	320	30	12	M27	290	40.0
	PN10	330	146	235	260	350	22	12	M20	285	51.0
250mm	PN16	331	146	235	260	355	26	12	M24	285	52.0
(10")	PN25	343	146	235	260	370	30	12	M27	325	54.0
	PN40	355	146	235	260	385	33	12	M30	325	56.0
	PN10	380	181	260	300	400	22	12	M20	325	94.0
300mm	PN16	386	181	260	300	410	26	12	M24	325	97.0
(12")	PN25	403	181	260	300	430	30	16	M27	375	98.0
	PN40	420	181	260	300	450	33	16	M30	375	99.0
	PN10	440	184	286	339	460	22	16	M20	340	122.0
350mm	PN16	446	184	286	339	470	26	16	M24	340	123.0
(14")	PN25	460	222	286	339	490	33	16	M30	420	174.0
	PN40	477	222	286	339	510	36	16	M33	420	176.0
	PN10	491	191	330	387	515	26	16	M24	350	131.0
400mm	PN16	498	191	330	387	525	30	16	M27	350	133.0
(16")	PN25	517	232	330	387	550	36	16	M33	445	204.0
	PN40	549	232	330	387	585	39	16	M36	445	207.0
	PN10	541	203	395	438	565	26	20	M24	375	141.0
450mm	PN16	558	264	391	438	585	30	20	M27	375	284.0
(18")	PN25	-	-	-	-	600	36	-	-	-	-
	PN40	574	264	391	438	610	39	20	M36	480	294.0
	PN10	596	219	438	487	620	26	20	M24	400	215.0
500mm	PN16	620	292	438	487	650	33	20	M30	400	354.0
(20")	PN25	627	292	438	487	660	36	20	M33	520	359.0
	PN40	631	292	438	487	670	42	20	M39	520	363.0
	PN10	698	222	537	579	725	26	20	M27	420	337.0
600mm	PN16	737	318	524	579	770	36	20	M33	420	518.0
(24")	PN25	734	318	524	579	770	39	20	M36	570	516.0
	PN40	750	318	524	579	795	48	20	M45	570	521.0

Δ Weights are for valve only and exclude mating flanges and bolting.

WAFER TYPE BR

INSTALLATION DIMENSIONS





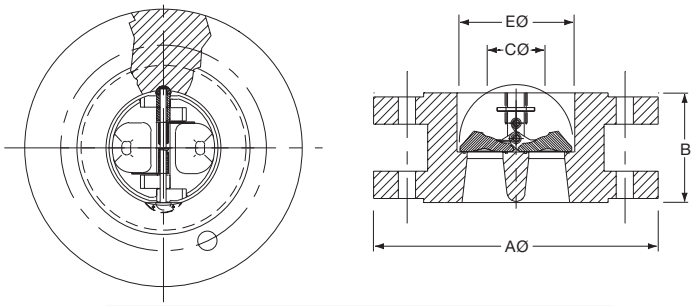
JIS 2210 & KS B1511

Size	Series	End Facing	A Ø	B	C Ø	E Ø	FLANGE DETAIL					Δ VALVE APPROX WEIGHT
							HOLE	HOLE	STUD SELECTION			
							P.C.D.	DIA.	No.	Diameter	Length	
inches			mm	mm	mm	mm	mm	mm			mm	kg
2	10K	RF	101	60	0	57	120	19	4	M16	150	2.5
(50mm)	20K	RF	101	60	0	57	120	19	8	M16	150	2.5
3	10K	RF	131	73	51	87	150	19	8	M16	168	6.5
(80mm)	20K	RF	137	73	51	87	160	23	8	M20	180	6.5
4	10K	RF	156	73	89	113	175	19	8	M16	165	8.1
(100mm)	20K	RF	162	73	89	113	185	23	8	M20	185	8.1
6	10K	RF	217	98	140	166	240	23	8	M20	205	16.0
(150mm)	20K	RF	235	98	140	166	260	25	12	M22	215	16.2
8	10K	RF	267	127	171	206	290	23	12	M20	235	29.0
(200mm)	20K	RF	280	127	171	206	305	25	12	M22	250	29.2
10	10K	RF	330	146	235	260	355	25	12	M22	265	48.5
(250mm)	20K	RF	353	146	235	260	380	27	12	M24	275	49.0
12	10K	RF	375	181	260	300	400	25	16	M22	300	91.0
(300mm)	20K	RF	403	181	260	300	430	27	16	M24	315	92.0
14	10K	RF	420	184	286	339	445	25	16	M22	305	90.0
(350mm)	20K	RF	447	222	286	339	480	33	16	M30	375	92.0
16	10K	RF	483	191	332	387	510	27	16	M24	320	125.0
(400mm)	20K	RF	507	232	332	387	540	33	16	M30	395	127.0
18	10K	RF	538	203	395	438	565	27	20	M24	335	132.0
(450mm)	20K	RF	572	264	395	438	605	33	20	M30	435	134.0
20	10K	RF	593	219	438	487	620	27	20	M24	350	185.0
(500mm)	20K	RF	627	292	438	487	660	33	20	M30	465	188.0
24	10K	RF	697	222	537	579	730	33	24	M30	370	285.0
(600mm)	20K	RF	731	318	537	579	770	39	24	M36	510	289.0
26	10K	RF	747	356	597	629	780	33	24	M30	510	567.0
(650mm)	20K	RF	802	356	597	629	850	48	24	M45	590	571.0
28	10K	RF	807	381	648	680	840	33	24	M30	535	576.0
(700mm)	20K	RF	852	381	648	680	900	48	24	M45	625	579.0
30	10K	RF	867	305	641	734	900	33	24	M30	465	442.0
(750mm)	20K	RF	914	368	641	734	970	56	24	M52	634	447.0
32	10K	RF	917	356	641	784	950	33	28	M30	515	1319.0
(800mm)	20K	RF	974	406	641	784	1030	56	24	M52	680	1325.0
36	10K	RF	1017	368	648	865	1050	33	28	M30	530	640.0
(900mm)	20K	RF	1084	483	648	865	1140	56	28	M52	765	647.0
40 (1000mm)	10K	RF	1121	432	883	909	1160	39	28	M36	585	855.0
48 (1200mm)	10K	RF	1341	524	1037	1193	1380	39	32	M36	710	1891.0
54 (1350mm)	10K	RF	1495	590	1092	1281	1540	45	36	M42	800	3063.0
60 (1500mm)	10K	RF	1655	660	1206	1421	1700	45	40	M42	870	3840.0

Δ Weights are for valve only and exclude mating flanges and bolting.

FLANGED TYPE BFR

INSTALLATION DIMENSIONS



ANSI B16.5 / ANSI B16.47 SERIES A

							FLANGE DETAIL					
Size	Pressure Rating	End Facing	A Ø	B	C Ø	E Ø	HOLE P.C.D.	HOLE DIA.	STUD SELECTION			Δ VALVE APPROX WEIGHT
									No. §	Diameter	*Length	
inches	ANSI		mm	mm	mm	mm	mm	mm		inches	mm	kg
8 (200mm)	150	RF	343	127	171	207	298.5	22.2	8	3/4	140	49
10 (250mm)	150	RF	406	146	235	260	362.0	25.4	12	7/8	150	82
	600	RF/RJ-53	508	213	200	260	431.8	34.9	16	1 1/4	245	183
	900	RF/RJ-53	546	241	195	260	469.9	38.1	16	1 3/8	265	203
12 (300mm)	150	RF	483	181	260	300	431.8	25.4	12	7/8	150	125
	300	RF	521	181	260	300	450.8	31.8	16	1 1/8	205	153
	600	RF/RJ-57	559	229	232	300	489.0	34.9	20	1 1/4	255	239
	900	RF/RJ-57	610	292	206	300	533.4	38.1	20	1 3/8	285	347
14 (350mm)	150	RF	533	184	286	339	476.3	28.6	12	1	165	144
	300	RF	584	222	286	339	514.4	31.8	20	1 1/8	210	207
	600	RF/RJ-61	603	273	232	339	527.0	38.1	20	1 3/8	265	378
	900	RF/RJ-62	641	356	0	339	558.8	41.3	20	1 1/2	310	470
16 (400mm)	150	RF	597	191	332	387	539.8	28.6	16	1	170	176
	300	RF	648	232	305	387	571.5	34.9	20	1 1/4	220	301
	600	RF/RJ-65	686	305	330	387	603.2	41.3	20	1 1/2	285	451
	900	RF/RJ-66	705	384	162	387	616.0	44.5	20	1 5/8	325	610
18 (450mm)	150	RF	635	203	395	438	577.9	31.8	16	1 1/8	180	210
	300	RF	711	264	391	438	628.6	34.9	24	1 1/4	230	392
	600	RF/RJ-69	743	362	330	438	654.0	44.5	20	1 5/8	305	560
	900	RF/RJ-70	787	451	244	438	685.8	50.8	20	1 7/8	365	843
20 (500mm)	150	RF	699	219	438	487	635.0	31.8	20	1 1/8	190	270
	300	RF	775	292	438	487	685.8	34.9	24	1 1/4	240	489
	600	RF/RJ-73	813	368	432	487	723.9	44.5	24	1 5/8	325	762
	900	RF/RJ-74	857	451	406	487	749.3	54.0	20	2	385	1782
24 (600mm)	150	RF	813	222	537	579	749.3	35.0	20	1 1/4	205	409
	300	RF	914	318	524	579	812.8	41.3	24	1 1/2	265	756
	600	RF/RJ-77	940	438	510	579	838.2	50.8	24	1 7/8	365	1143
	900	RF/RJ-78	1041	495	445	579	901.7	66.7	20	2 1/2	485	1750
26 (650mm)	150	RF	870	356	597	629	806.5	34.9	24	1 1/4	245	1007
	300	RF	972	356	597	629	876.3	44.5	28	1 5/8	290	1238
	600	RF/RJ-93	1016	457	578	629	914.4	50.8	28	1 7/8	390	1418
	900	RF/RJ-100	1086	533	559	629	952.5	73.0	20	2 3/4	510	1991
28 (700mm)	150	RF	927	381	648	680	863.6	35.0	28	1 1/4	255	1025
	300	RF	1035	381	648	680	939.8	44.5	28	1 5/8	305	1120
	600	RF/RJ-93	1073	483	629	680	965.2	54.0	28	2	405	1467
	900	RF/RJ-100	1168	572	610	680	1022.4	79.4	20	3	525	2426
30 (750mm)	150	RF	984	305	641	735	914.4	35.0	28	1 1/4	260	793
	300	RF	1092	368	641	735	997.0	47.6	28	1 3/4	325	1283
	600	RF/RJ-95	1130	505	584	735	1022.4	54.0	28	2	410	1575
	900	RF/RJ-102	1232	635	584	735	1085.9	79.4	20	3	540	3829
32 (800mm)	150	RF	1060	356	641	784	977.9	41.3	28	1 1/2	290	950
	300	RF	1149	406	641	784	1054.1	50.8	28	1 7/8	345	1354
	600	RF/RJ-96	1194	533	610	784	1079.5	60.3	28	2 1/4	430	1977
	900	RF/RJ-103	1314	660	610	784	1155.7	60.3	20	3 1/4	570	3425

* Where Ring Joint Facing shown in End Facing, Stud lengths based on Ring Joint flange connection.

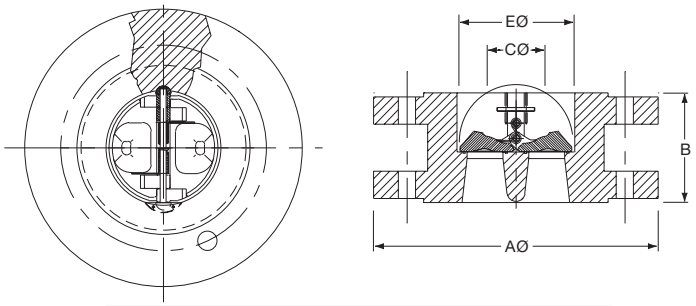
Δ Weights are for valve only and exclude mating flanges and bolting. Weight will vary according to corrosion allowance specification.

§ Number of studs is per flange, therefore, double the amount for valve installation purposes

VALVE SIZE	2" to 24"	26" to 60"	66" to 144"
FLANGE STANDARD	ANSI B16.5	ANSI B16.47 SERIES A (MSS SP44)	AWWA C207 (CLASS E 275 PSI)

FLANGED TYPE BFR

INSTALLATION DIMENSIONS



ANSI B16.47 SERIES A / AWWA C207 CLASS E

Size	Pressure Rating	End Facing	A Ø	B	C Ø	E Ø	FLANGE DETAIL					Δ VALVE APPROX WEIGHT
							HOLE P.C.D	HOLE DIA.	STUD SELECTION			
										Diameter	Length	
inches	ANSI		mm	mm	mm	mm	mm	mm	No. §	inches	mm	kg
	150	RF	1168	368	648	865	1085.9	41.3	32	1 1/2	305	1148
36	300	RF	1270	483	648	865	1168.4	54.0	32	2	360	1993
(900mm)	600	RF/RJ-98	1314	635	527	865	1193.8	60.3	28	2 1/2	455	2877
	900	RF/RJ-105	1461	718	356	865	1289.1	92.1	20	3 1/2	615	**
	150	RF	1289	432	883	987	1200.2	41.3	36	1 1/2	305	1515
40	300	RF	1238	546	749	909	1155.7	44.5	32	1 5/8	360	3073
(1000mm)	600	RF	1321	660	743	909	1212.9	60.3	32	2 1/4	490	6314
	900	RF	1511	762	737	909	1339.9	92.1	24	3 1/2	630	6688
	150	RF	1346	432	935	1062	1257.3	41.3	36	1 1/2	320	2170
42	300	RF	1289	568	837	1015	1206.5	44.5	32	1 5/8	370	4429
(1050mm)	600	RF	1403	702	648	972	1282.7	66.7	28	2 1/2	520	5278
	900	RF	1562	787	584	972	1390.7	92.1	24	3 1/2	650	**
	150	RF	1511	524	1037	1193	1422.4	41.3	44	1 1/2	340	2750
48	300	RF	1467	629	965	1136	1371.6	50.8	32	1 7/8	410	5010
(1200mm)	600	RF	1594	787	889	1136	1460.5	73.0	32	2 3/4	575	5043
54	150	RF	1683	591	1092	1281	1593.9	47.6	44	1 3/4	380	3267
(1350mm)	300	RF	1657	718	1092	1281	1549.4	60.3	28	2 1/4	470	**
60	150	RF	1854	660	1207	1422	1759.0	47.6	52	1 3/4	400	**
(1500mm)	300	RF	1810	838	1207	1422	1701.8	60.3	32	2 1/4	490	**
66 (1650mm)	150	RF	2032	787	1435	1663	1930.4	47.6	52	1 3/4	300	7000
72 (1800mm)	150	RF	2197	851	1530	1818	2095.5	47.6	60	1 3/4	305	**
78 (1950mm)	150	RF	2362	927	1664	1974	2260.6	54.0	64	2	340	**
84 (2100mm)	150	RF	2534	1041	1753	2116	2425.7	54.0	64	2	340	**
90 - 144 (2250mm-3600mm)	150	RF	**	**	**	**	**	**	**	**	**	**

* Where Ring Joint Facing shown in End Facing, Stud lengths based on Ring Joint flange connection.

Δ Weights are for valve only and exclude mating flanges and bolting. Weight will vary according to corrosion allowance specification.

§ Number of studs is per flange, therefore, double the amount for valve installation purposes

** Apply to Goodwin for details.

VALVE SIZE	2" to 24"	26" to 60"	66" to 144"
FLANGE STANDARD	ANSI B16.5	ANSI B16.47 SERIES A (MSS SP44)	***AWWA C207 (CLASS E 275 PSI)

***Valves 66" to 144" can be supplied with dimensions to suit flange standards AWWA C207 Classes B, D or F and Taylor Forge.

Valve 2", 3", 4", 6" cannot be supplied in Flanged Type due to insufficient space for the two nuts between the flanges whilst complying with API 594 face-to-face dimension. These valves would be supplied as Solid Lug unless otherwise specified by the customer. If flanged type is required in these sizes the valves have extended face-to-face as detailed in the below table. Higher pressure classes are available on request.

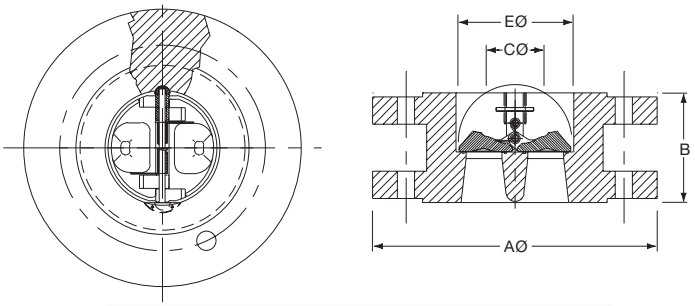
FLANGED TYPE BFR (Small Diameter - Extended Body - Non API 594)

ANSI B16.5

Size	Pressure Rating	End Facing	A Ø	B	C Ø	E Ø	FLANGE DETAIL					Δ VALVE APPROX WEIGHT
							HOLE P.C.D	HOLE DIA.	STUD SELECTION			
										Diameter	Length	
inches	ANSI		mm	mm	mm	mm	mm	mm	No. §	inches	mm	kg
2	150	RF	152	114	0	57	120.7	19.1	4	5/8	105	7
(50mm)	300	RF	165	114	0	57	127.0	19.1	8	5/8	110	9
3	150	RF	191	133	51	87	152.4	19.1	4	5/8	110	11
(80mm)	300	RF	210	133	51	87	168.3	22.2	8	3/4	130	15
4	150	RF	229	121	89	113	190.5	19.1	8	5/8	110	16
(100mm)	300	RF	254	121	89	113	200.0	22.2	8	3/4	135	18
6	150	RF	279	130	140	166	241.3	22.2	8	3/4	120	21
(150mm)	300	RF	318	130	140	166	269.9	22.2	12	3/4	145	27
8 (200mm)	300	RF	381	152	171	207	330.2	25.4	12	7/8	160	48
10 (250mm)	300	RF	445	178	235	260	387.4	28.6	16	1	175	68

FLANGED TYPE BFR

INSTALLATION DIMENSIONS



ANSI B16.47 SERIES B

Size	Pressure Rating	End Facing	A Ø	B	C Ø	E Ø	FLANGE DETAIL HOLE P.C.D.	HOLE DIA.	STUD SELECTION No. §	Diameter	*Length	Δ VALVE APPROX WEIGHT
inches	ANSI		mm	mm	mm	mm	mm	mm		inches	mm	kg
	150	RF	786	356	597	629	744.5	22.2	36	3/4	165	906
26	300	RF	867	356	597	629	803.3	34.9	32	1 1/4	290	1114
(650mm)	600	RF/RJ-93	889	457	578	629	806.5	44.5	28	1 5/8	380	1276
	900	RF/RJ-100	1022	533	559	629	901.7	66.7	20	2 1/2	480	1792
	150	RF	837	381	648	680	795.3	22.2	40	3/4	175	923
28	300	RF	921	381	648	680	857.3	34.9	36	1 1/4	290	1008
(700mm)	600	RF/RJ-94	953	483	629	680	863.6	47.6	28	1 3/4	395	1320
	900	RF/RJ-101	1105	572	610	680	971.6	73.0	20	2 3/4	515	2183
	150	RF	887	305	641	735	846.1	22.2	44	3/4	175	714
30	300	RF	991	368	641	735	920.8	38.1	36	1 3/8	305	1155
(750mm)	600	RF/RJ-95	1022	505	584	735	927.1	50.8	28	1 7/8	420	1418
	900	RF/RJ-102	1181	635	584	735	1035.1	79.4	20	3	545	3446
	150	RF	941	356	641	784	900.2	22.2	48	3/4	175	855
32	300	RF	1054	406	641	784	977.9	41.3	32	1 1/2	330	**
(800mm)	600	RF/RJ-96	1086	533	610	784	984.3	54.0	28	2	440	2642
	900	RF/RJ-103	1238	660	610	784	1092.2	79.4	20	3	555	2642
	150	RF	1057	368	648	865	1009.7	25.4	44	7/8	195	1033
36	300	RF	1172	483	648	865	1089.2	44.5	32	1 5/8	340	1794
(900mm)	600	RF/RJ-98	1213	635	527	865	1104.9	60.3	28	2 1/4	480	2589
	900	RF/RJ-105	1346	718	356	865	1200.2	79.4	24	3	585	**
40	150	RF	1175	432	883	987	1120.6	28.6	44	1	210	1364
(1000mm)	300	RF	1273	546	749	909	1190.6	44.5	40	1 5/8	365	3380
42	150	RF	1226	432	935	1062	1171.4	28.6	48	1	215	1953
(1050mm)	300	RF	1334	568	837	1015	1244.6	47.6	36	1 3/4	375	4872
48	150	RF	1392	524	1037	1193	1335.0	31.8	44	1 1/8	235	2475
(1200mm)	300	RF	1511	629	965	1136	1416.1	50.8	40	1 7/8	400	5511
54	150	RF	1549	591	1092	1281	1492.3	31.8	56	1 1/8	245	2940
(1350mm)	300	RF	1673	718	1092	1281	1577.8	50.8	48	1 7/8	415	**
60	150	RF	1726	660	1207	1422	1662.2	34.9	52	1 1/4	260	**
(1500mm)	300	RF	1878	838	1207	1422	1763.8	60.3	40	2 1/4	465	**

Δ Weights are for valve only and exclude mating flanges and bolting. Weight will vary according to corrosion allowance specification.

* Where Ring Joint Facing shown in End Facing, Stud lengths based on Ring Joint flange connection.

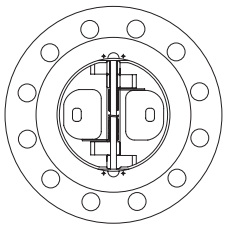
§ Number of studs is per Flange, therefore double the amount for valve installation requirements

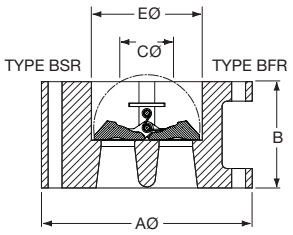
** Apply to Goodwin for details

INTERMEDIATE SIZES ARE AVAILABLE TO SPECIAL ORDER
FACE TO FACE DIMENSIONS ARE TO API 594

SOLID LUG TYPE BSR
FLANGED TYPE BFR

INSTALLATION DIMENSIONS





JIS 2210 & KS B1511

Size	Series	Type	A Ø	B	C Ø	E Ø	FLANGE DETAIL			Δ VALVE APPROX WEIGHT
							STUD SELECTION			
inches			mm	mm	mm	mm	No. §	Diameter	Length mm	kg
2	10K	BSR	155	60	0	57	4	M16	145	6
(50mm)	20K	BSR	155	60	0	57	8	M16	145	6
3	10K	BSR	185	73	51	87	8	M16	155	10
(80mm)	20K	BSR	200	73	51	87	8	M20	170	11
4	10K	BSR	210	73	89	113	8	M16	155	14
(100mm)	20K	BSR	225	73	89	113	8	M20	175	16
6	10K	BSR	280	98	140	166	8	M20	195	28
(150mm)	20K	BSR	305	98	140	166	12	M22	215	30
8	10K	BFR	330	127	171	206	12	M20	105	42
(200mm)	20K	BFR	350	127	171	206	12	M22	125	46
10	10K	BFR	400	146	235	260	12	M22	120	72
(250mm)	20K	BFR	430	146	235	260	12	M24	140	77
12	10K	BFR	445	181	260	300	16	M22	120	113
(300mm)	20K	BFR	480	181	260	300	16	M24	145	118
14	10K	BFR	490	184	285	339	16	M22	125	132
(350mm)	20K	BFR	540	222	285	339	16	M30	160	136
16	10K	BFR	560	191	332	387	16	M24	135	162
(400mm)	20K	BFR	605	232	332	387	16	M30	135	167
18	10K	BFR	620	203	395	438	20	M24	140	192
(450mm)	20K	BFR	675	264	391	438	20	M30	170	199
20	10K	BFR	675	219	438	487	20	M24	145	249
(500mm)	20K	BFR	730	292	438	487	20	M30	190	256
24	10K	BFR	795	222	524	579	24	M30	160	354
(600mm)	20K	BFR	845	318	537	579	24	M36	200	361
26	10K	BFR	845	356	597	629	24	M30	165	943
(650mm)	20K	BFR	945	356	597	629	24	M40	225	958
28	10K	BFR	905	381	648	680	24	M30	170	965
(700mm)	20K	BFR	995	381	648	680	24	M45	230	973
30	10K	BFR	970	305	641	734	24	M30	175	744
(750mm)	20K	BFR	1080	368	641	734	24	M52	255	753
32	10K	BFR	1020	356	641	784	28	M30	180	2221
(800mm)	20K	BFR	1140	406	641	784	28	M52	260	2231
36	10K	BFR	1120	368	648	685	28	M30	170	990
(900mm)	20K	BFR	1250	368	648	865	28	M52	270	1090
40 (1000mm)	10K	BFR	1235	432	883	987	28	M36	200	1439
48 (1200mm)	10K	BFR	1465	524	1037	1193	32	M36	220	3184
54 (1350mm)	10K	BFR	1630	590	1092	1281	36	M42	240	**
60 (1500mm)	10K	BFR	1795	660	1206	1421	40	M42	250	**

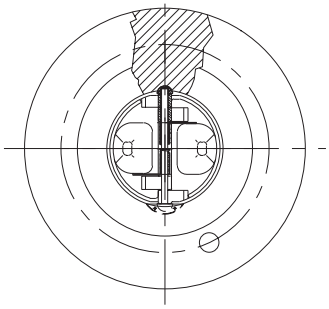
Flanged style standard from 8" (200mm) and larger.
Solid Lug available on request

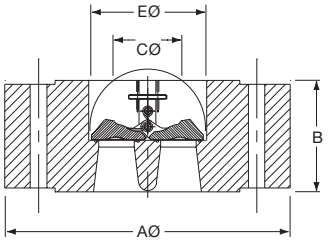
Δ Weights are for valve only and exclude mating flanges and bolting.
** Apply to Goodwin for details

§ For BFR Type number of studs is per Flange, therefore double the amount for valve installation requirements

SOLID LUG TYPE BSR

INSTALLATION DIMENSIONS





ANSI B16.5

							FLANGE DETAIL					
Size	Pressure Rating	End Facing	A Ø	B	C Ø	E Ø	HOLE P.C.D.	HOLE DIA.	STUD SELECTION			Δ VALVE APPROX WEIGHT
									No.	Diameter	*Length	
inches	ANSI		mm	mm	mm	mm	mm	mm		inches	mm	kg
	150	RF	152	60	0	57	120.7	19.1	4	5/8	165	7
	300	RF	165	60	0	57	127.0	19.1	8	5/8	170	8
2	600	RF/RJ-23	165	60	0	57	127.0	19.1	8	5/8	195	8
(50mm)	900	RF/RJ-24	216	70	0	57	165.1	25.4	8	7/8	240	16
	1500	RF/RJ-24	216	70	0	57	165.1	25.4	8	7/8	240	16
	2500	RF/RJ-26	235	70	0	57	171.4	28.6	8	1	275	19
	150	RF	191	73	51	87	152.4	19.1	4	5/8	185	12
	300	RF	210	73	51	87	168.3	22.2	8	3/4	205	14
3	600	RF	210	73	51	87	168.3	22.2	8	3/4	230	14
(80mm)	900	RF/RJ-31	241	83	60	87	190.5	25.4	8	7/8	255	25
	1500	RF/RJ-35	267	83	60	87	203.2	31.8	8	1 1/8	285	29
	2500	RF/RJ-32	305	86	60	87	228.6	34.9	8	1 1/8	335	38
	150	RF	229	73	89	113	190.5	19.1	8	5/8	185	19
	300	RF	254	73	89	113	200.0	22.2	8	3/4	210	23
4	600	RF/RJ-37	273	79	89	113	215.9	25.4	8	7/8	255	30
(100mm)	900	RF/RJ-37	292	102	83	113	235.0	31.8	8	1 1/8	300	45
	1500	RF/RJ-39	311	102	83	113	241.3	34.9	8	1 1/4	325	51
	2500	RF/RJ-38	356	105	83	113	273.0	41.3	8	1 1/2	395	69
	150	RF	279	98	140	166	241.3	22.2	8	3/4	220	32
	300	RF	318	98	140	166	269.9	22.2	12	3/4	245	45
6	600	RF/RJ-45	356	137	89	166	292.1	28.6	12	1	340	81
(150mm)	900	RF/RJ-45	381	159	89	166	317.5	31.8	12	1 1/8	380	115
	1500	RF/RJ-46	394	159	89	166	317.5	38.1	12	1 3/8	455	119
	2500	RF/RJ-47	483	159	89	166	368.3	54.0	8	2	540	184
	150	RF	343	127	171	207	298.5	22.2	8	3/4	255	63
	300	RF	381	127	171	207	330.2	25.4	12	7/8	290	78
8	600	RF/RJ-49	419	165	168	207	349.2	31.8	12	1 1/8	385	134
(200mm)	900	RF/RJ-49	470	206	130	207	393.7	38.1	12	1 3/8	455	217
	1500	RF/RJ-50	483	206	130	207	393.7	44.5	12	1 5/8	530	230
	2500	RF/RJ-51	552	206	143	207	438.2	54.0	12	2	630	300
	150	RF	406	146	235	260	362.0	25.4	12	7/8	285	93
	300	RF	445	146	235	260	387.4	28.6	16	1	325	115
10	600	RF/RJ-53	508	213	200	260	431.8	34.9	16	1 1/4	460	234
(250mm)	900	RF/RJ-53	546	241	195	260	469.9	38.1	16	1 3/8	505	330
	1500	RF/RJ-54	584	248	184	260	482.6	50.8	12	1 7/8	620	378
	2500	RF/RJ-55	673	254	191	260	539.8	66.7	12	2 1/2	790	489
	150	RF	483	181	260	300	431.8	25.4	12	7/8	325	170
	300	RF	521	181	260	300	450.8	31.8	16	1 1/8	375	242
12	600	RF/RJ-57	559	229	232	300	489.0	34.9	20	1 1/4	480	304
(300mm)	900	RF/RJ-57	610	292	206	300	533.4	38.1	20	1 3/8	575	509
	1500	RF/RJ-58	673	305	210	300	571.5	54.0	16	2	720	650
	2500	RF/RJ-60	762	305	225	300	619.1	73.0	12	2 3/4	895	747
	150	RF	533	184	286	339	476.3	28.6	12	1	340	199
	300	RF	584	222	286	339	514.4	31.8	20	1 1/8	420	313
14	600	RF/RJ-61	603	273	232	339	527.0	38.1	20	1 3/8	535	440
(350mm)	900	RF/RJ-62	641	356	0	339	558.8	41.3	20	1 1/2	660	775
	1500	RF/RJ-63	749	356	0	339	635.0	60.3	16	2 1/4	810	905
	150	RF	597	191	332	387	539.8	28.6	16	1	350	246
	300	RF	648	232	330	387	571.5	34.9	20	1 1/4	445	489
16	600	RF/RJ-65	686	305	330	387	603.2	41.3	20	1 1/2	590	660
(400mm)	900	RF/RJ-66	705	384	162	387	616.0	44.5	20	1 5/8	705	850
	1500	RF/RJ-67	826	384	162	387	704.8	66.7	16	2 1/2	885	1120

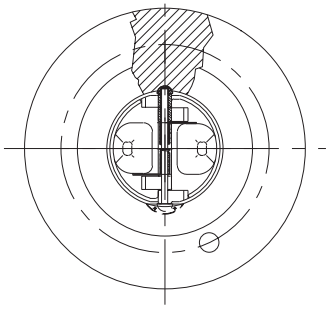
* Where Ring Joint Facing shown in End Facing, Stud lengths based on Ring Joint flange connection.

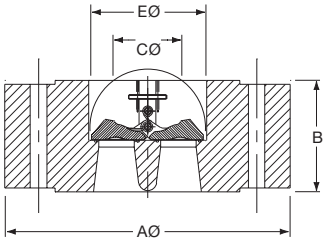
Δ Weights are for valve only and exclude mating flanges and bolting. Weight will vary according to corrosion allowance specification

VALVE SIZE	2" to 24"	26" to 60"	66" to 144"
FLANGE STANDARD	ANSI B16.5	ANSI B16.47 SERIES A (MSS SP44)	AWWA C207 (CLASS E 275 PSI)

SOLID LUG TYPE BSR

INSTALLATION DIMENSIONS





ANSI B16.5 / ANSI B16.47 SERIES A

							FLANGE DETAIL					
Size	Pressure Rating	End Facing	A Ø	B	C Ø	E Ø	HOLE P.C.D.	HOLE DIA.	STUD SELECTION			Δ VALVE APPROX WEIGHT
									No.	Diameter	*Length	
inches	ANSI		mm	mm	mm	mm	mm	mm		inches	mm	kg
18 (450mm)	150	RF	635	203	395	438	577.9	31.8	16	1 1/8	375	290
	300	RF	711	264	391	438	628.6	34.9	24	1 1/4	485	558
	600	RF/RJ-69	743	362	330	438	654.0	44.5	20	1 5/8	665	1078
	900	RF/RJ-70	787	451	244	438	685.8	50.8	20	1 7/8	815	1450
	1500	RF/RJ-71	914	468	184	438	774.7	73.0	16	2 3/4	1010	1775
20 (500mm)	150	RF	699	219	438	487	635.0	31.8	20	1 1/8	400	348
	300	RF	775	292	438	487	685.8	34.9	24	1 1/4	520	766
	600	RF/RJ-73	813	368	432	487	723.9	44.5	24	1 5/8	685	995
	900	RF/RJ-74	857	451	406	487	749.3	54.0	20	2	835	1960
	1500	RF/RJ-75	984	533	210	487	831.8	79.4	16	3	1125	2200
24 (600mm)	150	RF	813	222	537	579	749.3	34.9	20	1 1/4	420	396
	300	RF	914	318	524	579	812.8	41.3	24	1 1/2	570	1190
	600	RF/RJ-77	940	438	510	579	838.2	50.8	24	1 7/8	800	1554
	900	RF/RJ-78	1041	495	445	579	901.7	66.7	20	2 1/2	975	2351
	1500	RF/RJ-79	1168	559	391	579	990.6	92.1	16	3 1/2	1235	3325
26 (650mm)	150	RF	870	356	597	629	806.5	34.9	24	1 1/4	605	1254
	300	RF	972	356	597	629	876.3	44.5	28	1 5/8	650	1542
	600	RF/RJ-93	1016	457	578	629	914.4	50.8	28	1 7/8	850	1766
	900	RF/RJ-100	1086	533	559	629	952.5	73.0	20	2 3/4	1045	2479
28 (700mm)	150	RF	927	381	648	680	863.6	34.9	28	1 1/4	635	1276
	300	RF	1035	381	648	680	939.8	44.5	28	1 5/8	685	1395
	600	RF/RJ-94	1073	483	629	680	965.2	54.0	28	2	890	1827
	900	RF/RJ-101	1168	572	610	680	1022.4	79.4	20	3	1100	3021
30 (750mm)	150	RF	984	305	641	735	914.4	34.9	28	1 1/4	565	987
	300	RF	1092	368	641	735	997.0	47.6	28	1 3/4	685	1996
	600	RF/RJ-95	1130	505	584	735	1022.4	54.0	28	2	920	3045
	900	RF/RJ-102	1232	635	584	735	1085.9	79.4	20	3	1180	3835
32 (800mm)	150	RF	1060	356	641	784	977.9	41.3	28	1 1/2	645	2925
	300	RF	1149	406	641	784	1054.1	50.8	28	1 7/8	750	3428
	600	RF/RJ-96	1194	533	610	784	1079.5	60.3	28	2 1/4	970	3815
	900	RF/RJ-103	1314	660	610	784	1155.7	85.7	20	3 1/4	1235	4265
36 (900mm)	150	RF	1168	368	648	865	1085.9	41.3	32	1 1/2	675	1430
	300	RF	1270	483	648	865	1168.4	54.0	32	2	845	2661
	600	RF/RJ-98	1314	635	527	865	1193.8	66.7	28	2 1/2	1095	5896
	900	RF/RJ-105	1461	718	356	865	1289.1	92.1	20	3 1/2	1335	**
40 (1000mm)	150	RF	1289	432	883	987	1200.2	41.3	36	1 1/2	740	1386
	300	RF	1238	546	749	909	1155.7	44.5	32	1 5/8	910	3827
	600	RF	1321	660	743	909	1212.9	60.3	32	2 1/4	1155	7862
	900	RF	1511	762	737	909	1339.9	92.1	24	3 1/2	1395	8328
42 (1050mm)	150	RF	1346	432	935	1062	1257.3	41.3	36	1 1/2	755	2377
	300	RF	1289	568	837	1015	1206.5	44.5	32	1 5/8	940	5515
	600	RF	1403	702	648	972	1282.7	66.7	28	2 1/2	1225	6572
	900	RF	1562	787	584	972	1390.7	92.1	24	3 1/2	1440	**
48 (1200mm)	150	RF	1511	524	1037	1193	1422.4	41.3	44	1 1/2	865	4174
	300	RF	1467	629	965	1136	1371.6	50.8	32	1 7/8	1040	6239
	600	RF	1594	787	889	1136	1460.5	73.0	32	2 3/4	1365	**
54 (1350mm)	150	RF	1683	591	1092	1281	1593.9	47.8	44	1 3/4	970	**
	300	RF	1657	718	1092	1281	1549.4	60.3	28	2 1/4	1190	**
60 (1500mm)	150	RF	1854	660	1207	1422	1759.0	47.6	52	1 3/4	1065	**
	300	RF	1810	838	1207	1422	1701.8	60.3	32	2 1/4	1330	**

Δ Weights are for valve only and exclude mating flanges and bolting. Weight will vary according to corrosion allowance specification.

* Where Ring Joint Facing shown in End Facing, Stud lengths based on Ring Joint flange connection. ** Apply to Goodwin for details

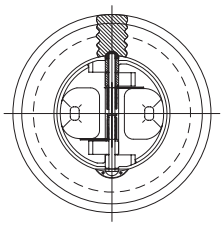
VALVE SIZE	2" to 24"	26" to 60"	66" to 144"
FLANGE STANDARD	ANSI B16.5	ANSI B16.47 SERIES A (MSS SP44)	AWWA C207 (CLASS E 275 PSI)

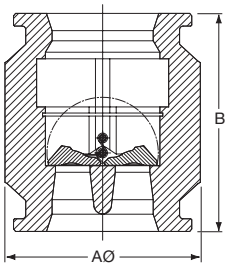
*** Valves 66" to 144" can be supplied with dimensions to suit flange standards AWWA C207 Classes B, D. E or F and Taylor Forge

HUB ENDED (Full bore)

INSTALLATION DIMENSIONS

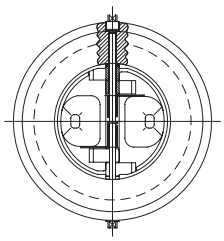
TYPE BHR(F)

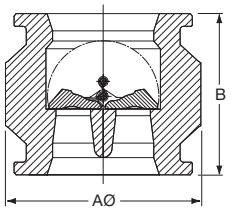




Size mm	Pressure Rating	Seal Ring Size	A Ø mm	B mm	Δ APPROX WEIGHT kg
4 (100mm)	900	34-40	229	279	101
	1500		229	279	101
	2500		229	279	101
6 (150mm)	900	46-62	327	358	230
	1500		327	358	230
	2500		327	358	230
8 (200mm)	900	62-82	409	418	408
	1500		409	418	408
	2500		409	418	408
10 (250mm)	900	84-97	464	485	500
	1500		464	485	500
	2500		464	485	500
12 (300mm)	900	102-112	590	602	573
	1500		590	602	573
	2500		590	602	573
14 (350mm)	900	97-120	590	602	800
	1500		590	602	800
	2500		590	602	800

TYPE BH(F)





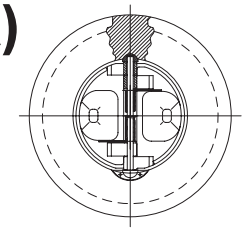
Size mm	Pressure Rating	Seal Ring Size	A Ø mm	B mm	Δ APPROX WEIGHT kg
2 (50mm)	900	13-20	117	136	14
	1500		117	136	14
	2500		117	136	14
3 (80mm)	900	23-27	162	158	29
	1500		162	158	29
	2500		162	158	29
4 (100mm)	900	31-40	191	220	46
	1500		191	220	46
	2500		191	220	46
6 (150mm)	900	40-62	274	279	135
	1500		274	279	135
	2500		274	279	135
8 (200mm)	900	56-82	368	311	243
	1500		368	311	243
	2500		368	311	243
10 (250mm)	900	72-97	409	381	320
	1500		409	381	320
	2500		409	381	320
12 (300mm)	900	92-112	482	431	440
	1500		482	431	440
	2500		482	431	440
14 (350mm)	900	110-120	511	482	646
	1500		511	482	646
16 (400mm)	900	112-120	651	628	770
	1500		651	628	770
16 (400mm)	900	130-137	552	533	770
	1500		552	533	770
18 (450mm)	900	160	660	584	1245
	1500		660	584	1245

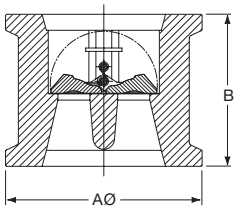
Δ Weights are for valve only. Weight will vary according to corrosion allowance specification.

1. Type BH(F) is supplied with external threaded retainers
2. Reduced Bore Retainerless, Type BHR(R), i.e. no external threaded components, can be supplied (see page 28)
3. Clamps, seal rings and companion hubs are not included with the valve
4. Particular make of Hub Ends, Seal Ring Size and Clamp Style must be specified by customer. Relevant technical information should be obtained from the chosen clamp supplier, e.g. Graylok®, Techlok®, Clamplok®.
5. Dimension B: These are typical only. Due to the large variety of Hub End sizes and Clamp Styles available the face-to- face dimensions for a given size and rating may vary to maintain ANSI and API design specifications. Please contact Goodwin for details prior to using above data as design criteria.
6. Valve sizes not listed above are available on application, together with customer specified end sizes and types. All valves are rated in accordance with ANSI B 16.34, API 594 and API 598 design and application specifications.
7. Internals designed to suit customer's specified hub-ended bore details.

HUB ENDED TYPE BHR(R)
(Reduced bore)

INSTALLATION DIMENSIONS





Size mm	Pressure Rating	Seal Ring Size	A Ø mm	B mm	Δ APPROX WEIGHT kg
3 (80mm)	900	23-27	127	114	15
	1500		127	114	15
	2500		127	114	15
4 (100mm)	900	31-40	152	127	17
	1500		152	127	17
	2500		152	127	17
6 (150mm)	900	46-62	235	159	54
	1500		235	159	54
	2500		235	159	54
8 (200mm)	900	52	292	159	95
	1500		292	159	95
	2500		292	159	95
8 (200mm)	900	64-82	292	206	95
	1500		292	206	95
	2500		292	206	95
10 (250mm)	900	67-97	346	248	120
	1500		346	248	120
	2500		346	248	120
12 (300mm)	900	91-112	406	317	321
	1500		406	317	321
	2500		406	317	321
14 (350mm)	900	97-120	470	356	490
	1500		470	356	490
	2500		470	356	490
16 (400mm)	900	114-120	533	406	642
	1500		533	406	642

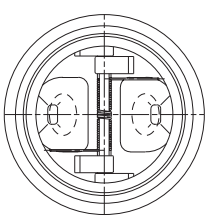
Size mm	Pressure Rating	Seal Ring Size	A Ø mm	B mm	Δ APPROX WEIGHT kg
16 (400mm)	900	130-140	533	381	642
	1500		533	381	642
18 (450mm)	900	134-144	559	394	335
	1500		559	394	339
18 (450mm)	900	S162	533	314	301
	1500		533	314	304
20 (500mm)	900	160	660	463	994
	1500		660	463	994
20 (500mm)	900	180	660	381	994
	1500		660	381	994
24 (600mm)	900	180	749	578	1750
	1500		749	578	1750
24 (600mm)	900	220	749	419	1750
	1500		749	419	1750
30 (750mm)	900	251	992	584	2950
	1500		992	584	2950

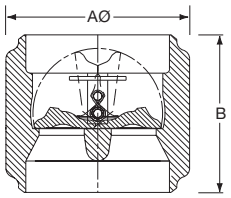
Δ Weights are for valve only. Weight will vary according to corrosion allowance specification.

1. Full Bore Retainerless, Type BHR(F), i.e. no external threaded components, can be supplied (see page 27)
2. Clamps, seal rings and companion hubs are not included with the valve
3. Particular make of Hub Ends, Seal Ring Size and Clamp Style must be specified by customer. Relevant technical information should be obtained from the chosen clamp supplier, e.g. Graylok®, Techlok®, Clamplok®.
4. Dimension B: These are typical only. Due to the large variety of Hub End sizes and Clamp Styles available the face-to- face dimensions for a given size and rating may vary to maintain ANSI and API design specifications. Please contact Goodwin for details prior to using above data as design criteria.
5. Valve sizes not listed above are available on application, together with customer specified end sizes and types. All valves are rated in accordance with ANSI B 16.34, API 594 and API 598 design and application specifications.
6. Internals designed to suit customer's specified hub-ended bore details.
7. BHR(R) valves have reduced bore internals, usually one size down. Refer to page 33 for Cv values.

BUTTWELD END TYPE BWR

INSTALLATION DIMENSIONS





Size inches	Pressure Rating	A Ø mm	B mm	Δ APPROX WEIGHT kg
3 (80mm)	150	98.0	136.0	6.5
	300	98.0	136.0	6.5
4 (100mm)	150	129.5	120.7	6.9
	300	129.5	120.7	7.4
	600	135.6	120.7	8.5
	900	146.7	165.1	14
	1500	155.1	165.1	16
	2500	169.8	165.1	19
6 (150mm)	150	168.3	136.5	13
	300	168.3	136.5	13
	600	171.9	136.5	15
	900	228.8	206.4	28
	1500	228.8	206.4	37
	2500	228.8	206.4	44
8 (200mm)	150	226.5	152.4	22
	300	226.5	152.4	25
	600	239.5	215.9	43
	900	252.2	292.1	69
	1500	284.2	292.1	92
	2500	312.6	292.1	113
10 (250mm)	150	270.6	187.3	43
	300	270.6	187.3	43
	600	289.4	262.0	78
	900	305.7	262.0	90
	1500	346.5	346.1	159
	2500	367.3	346.1	179
12 (300mm)	150	329.5	215.9	63
	300	329.5	215.9	69
	600	351.8	292.1	117
	900	372.6	317.5	159
	1500	419.2	349.3	234
	2500	367.3	412.8	344
14 (350mm)	150	380.0	260.4	102
	300	380.0	260.4	113
	600	381.8	355.6	199
	900	381.8	355.6	231
	1500	429.6	355.6	264
16 (400mm)	150	425.3	304.8	146
	300	425.3	304.8	164
	600	441.0	400.1	263
	900	469.5	400.1	315
	1500	493.8	438.2	434

Size inches	Pressure Rating	A Ø mm	B mm	Δ APPROX WEIGHT kg
18 (450mm)	150	475.4	330.2	190
	300	475.4	330.2	215
	600	487.5	409.6	306
	900	519.5	447.7	423
	1500	555.4	457.2	568
20 (500mm)	150	526.7	400.1	273
	300	526.7	400.1	213
	600	539.9	495.3	461
	900	578.0	546.1	637
	1500	621.7	546.1	855
24 (600mm)	150	609.6	342.9	361
	300	609.6	419.1	458
	600	635.4	546.1	722
	900	680.1	603.2	1020
	1500	738.5	660.4	1401
28 (700mm)	150	711.2	374.7	435
	300	727.1	419.1	572
	600	774.3	489.0	910
	900	822.1	584.2	1307
30 (750mm)	150	762.0	387.4	596
	300	768.4	431.8	715
	600	819.2	508.0	1098
	900	868.9	609.6	1568
32 (800mm)	150	812.8	368.3	572
	300	833.0	431.8	792
	600	887.3	533.4	1342
	900	940.2	635.0	1892
36 (900mm)	150	914.4	419.1	921
	300	914.4	482.6	1118
	600	944.8	552.5	1618
	900	1003.2	660.4	2292
40 (1000mm)	150	1016.0	469.9	1255
	300	1016.0	571.5	1607
	600	1057.8	660.4	2396
	900	1121.8	736.6	3256
42 (1050mm)	150	1066.8	508.0	1637
	300	1066.8	596.9	2013
	600	1109.6	673.1	2739
	900	1175.6	749.0	3767
48 (1200mm)	150	1219.2	520.7	1922
	300	1219.2	622.3	3180
	600	1219.2	698.5	3719
	900	1226.6	775.0	4174

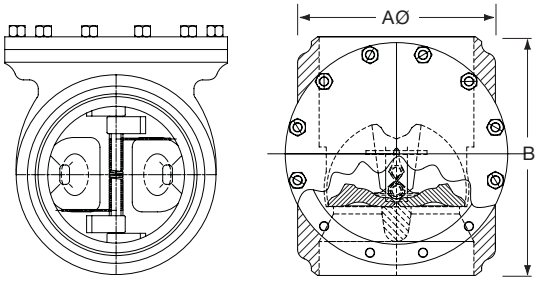
Δ Weights are for valve only and exclude pup or transition pieces. Weight will vary according to corrosion allowance specification.

PIPE SCHEDULE

Customer must state pipe schedule at time of enquiry as this may necessitate transition prices. The nominal bore of the valve will be determined by the pipe schedule selected by the customer and be in accordance with ASME/ANSI B16.25

BUTTWELD END TYPE BWA

INSTALLATION DIMENSIONS



Size inches	Pressure Rating	A Ø mm	B mm	Δ APPROX WEIGHT kg
4 (100mm)	150	129.5	305	23
	300	129.5	305	25
	600	135.6	356	28
	900	146.7	356	41
	1500	155.1	406	53
	2500	169.8	457	69
6 (150mm)	150	168.3	406	51
	300	168.3	406	51
	600	171.9	508	62
	900	228.8	508	91
	1500	228.8	559	130
	2500	228.8	610	166
8 (200mm)	150	226.5	457	79
	300	226.5	457	89
	600	239.5	610	153
	900	252.2	660	208
	1500	284.2	711	298
	2500	312.6	762	387
10 (250mm)	150	270.6	533	138
	300	270.6	533	138
	600	289.4	737	274
	900	305.7	787	347
	1500	346.5	864	525
	2500	367.3	914	619
12 (300mm)	150	329.5	610	195
	300	329.5	610	214
	600	351.8	813	421
	900	372.6	914	591
	1500	419.2	991	860
	2500	367.3	1041	1144
14 (350mm)	150	380.0	686	301
	300	380.0	686	334
	600	381.8	889	656
	900	381.8	991	834
	1500	429.6	1067	1016
16 (400mm)	150	425.3	737	401
	300	425.3	737	451
	600	441.0	991	861
	900	469.5	1092	1118
	1500	493.8	1194	1540

Size inches	Pressure Rating	A Ø mm	B mm	Δ APPROX WEIGHT kg
18 (450mm)	150	475.4	813	521
	300	475.4	813	591
	600	487.5	1092	1046
	900	519.5	1194	1474
	1500	555.4	1295	2081
20 (500mm)	150	526.7	864	684
	300	526.7	864	782
	600	539.9	1168	1423
	900	578.0	1321	1981
	1500	621.7	1372	2834
24 (600mm)	150	609.6	1067	1140
	300	609.6	1067	1228
	600	635.4	1295	2132
	900	680.1	1346	3065
	1500	738.5	1422	4089
28 (700mm)	150	711.2	1118	1382
	300	727.1	1118	1657
	600	774.3	1397	3152
	900	822.1	1448	4281
30 (750mm)	150	762.0	1168	1908
	300	768.4	1168	2093
	600	819.2	1448	3806
	900	868.9	1499	5103
32 (800mm)	150	812.8	1219	1997
	300	833.0	1219	2423
	600	887.3	1473	4604
	900	940.2	1524	6037
36 (900mm)	150	914.4	1372	3054
	300	914.4	1372	3301
	600	944.8	1499	5555
	900	1003.2	1549	7174
40 (1000mm)	150	1016.0	1422	4012
	300	1016.0	1422	4379
	600	1057.8	1524	7297
	900	1121.8	1575	9449
42 (1050mm)	150	1066.8	1422	5042
	300	1066.8	1422	5440
	600	1109.6	1524	8327
	900	1175.6	1600	10630
48 (1200mm)	150	1219.2	1524	6240
	300	1219.2	1524	8923
	600	1219.2	1626	11120
	900	1226.6	1700	12257

Δ Weights are for valve only and exclude pup or transition pieces. Weight will vary according to corrosion allowance specification.

PIPE SCHEDULE

Customer must state pipe schedule at time of enquiry as this may necessitate transition prices. The nominal bore of the valve will be determined by the pipe schedule selected by the customer and be in accordance with ASME/ANSI B16.25

CHECK VALVE APPLICATIONS

A check valve is a vital item, installed in support of automatic shutdown valves and safety devices. Its purpose is to prevent and protect against the consequences of unintended reverse flow.

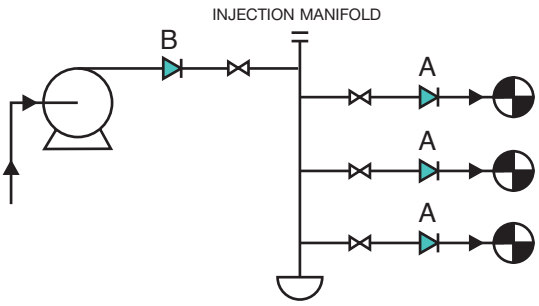
The Goodwin Check Valve provides high integrity first-line defence in the event of unwanted reverse flow and operates in advance of, or in conjunction with safety devices. It is immediately responsive and fast acting in its closure, thereby maximising protection to prevent or minimize the adverse effect of any backflow.

Correct use of the Goodwin Check Valve will give enhanced protection for the safety of personnel, the environment, mechanical equipment, process plant, and against loss of product or production. It is not an isolating valve and should not be used as such.

Investment in Goodwin Check Valves can protect against significant financial loss that might be caused by unintended reverse flow.

Typical installations where the Goodwin Check Valve might be used are shown below.

WELLHEAD INJECTION LINES



Fluid: Treated Sea Water, Gas, Condensate
Typical Sizes: (A) 4", 6", 8" (B) 12" to 16"
Rating: 900, 1500, 2500, API 5000, API 10000
Typical Materials: LCC, Duplex, SMO 254, 825, 625
Typical Style: Wafer, Flanged, Solid Lug, Hub Ended.

Purpose:

Valve A: Prevention of backflow into injection line. Valve placed as near as practical to well head to help protect entire line and injection manifold against possible over pressure.

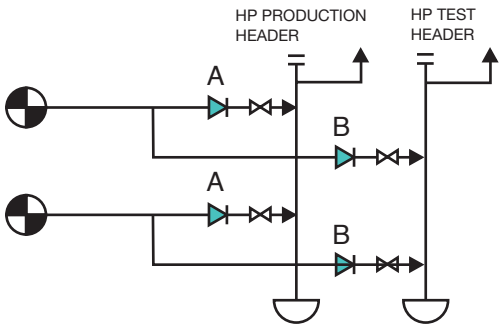
Valve B: Prevention of backflow into pump. Protection against reverse rotation and consequent mechanical damage.

PRODUCTION FLOWLINES

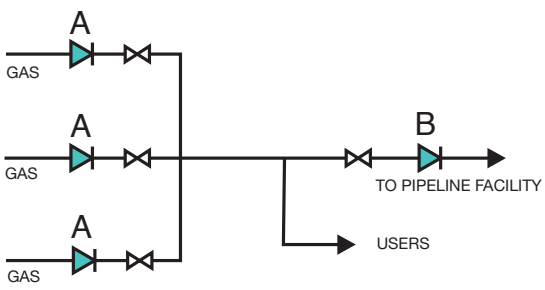
Fluid: Hydrocarbons (Gas, Oil & Condensates)
Typical Sizes: 4", 6", 8", 10"
Typical Pressures: ANSI 1500, 2500
Typical Materials: LCC, CF3MN, Duplex, 825, 625, CF8M
Typical Style: Hub Ended, Flanged, Solid Lug

Purpose:

Valve A: Prevention of backflow into flowline/reservoir.
Valve B: Prevention of backflow from test header to HP Production header.



SALES GAS EXPORT FACILITY



Fluid: Gas
Typical Sizes: (A) 10" to 16" (B) 16" to 36"
Typical Pressures: ANSI 600 and 900
Typical Materials: LCB, LCC, WCB, WCC
Typical Style: Wafer, Flanged

Purpose:

Valve A: Prevention of backflow into any one gas train from operating gas train(s) ensuring gas train separation.

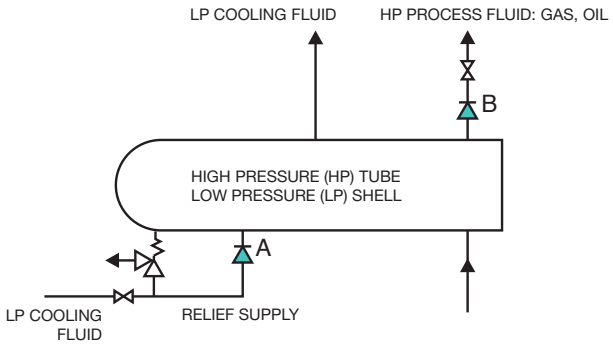
Valve B: Prevention of backflow in the event of process failure or pressure loss. Initial protection against loss of large pipeline inventory.

HEAT EXCHANGER

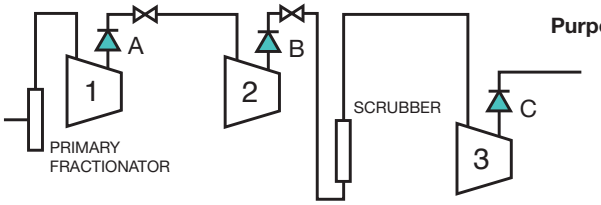
Fluid: Water, Sea Water
Typical Sizes: 6" to 24"
Typical Pressures: ANSI 150
Typical Materials: Al. Br, CS, Duplex, SMO254, 625
Typical Style: Wafer

Purpose:

Valve A: Prevention of backflow of HP process fluid in LP supply system in event of HP tube rupture. A key component in the protection of the LP system against over pressure and contamination.
Valve B: Prevention of backflow of HP process fluid in event of HP tube rupture. Protection against loss of inventory of HP process fluid.



REFINERY: PROCESS GAS CENTRIFUGAL COMPRESSOR TRAIN



Fluid: Process Gas
Typical Sizes: (A) up to 52" 150: (B) up to 30" 150: (C) up to 18" 300
Typical Materials: WCB
Typical Style: Wafer, Flanged

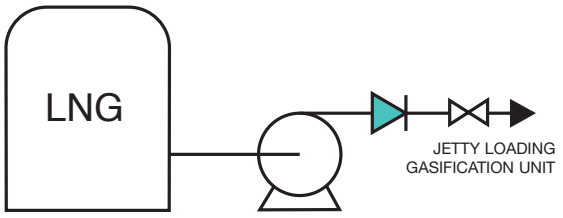
Purpose:

Valve A: Installed on discharge - prevention of backflow through 1st compressor.
Valve B: Installed on discharge - prevention of backflow through 2nd compressor.
Valve C: Installed on discharge - prevention of backflow through 3rd compressor.
Protection against reverse rotation of compressor and consequent mechanical damage and line depressurisation

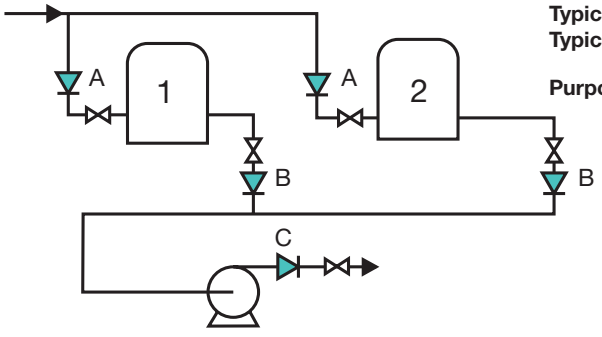
LNG STORAGE

Fluid: LNG @ - 162°C
Typical Sizes: Up to 24"
Typical Pressures: ANSI 150, 300
Typical Materials: Stainless Steel, CF8M, CF3M
Typical Style: Wafer, Flanged, Solid Lug

Purpose: Prevention of backflow into pump and LNG storage tank. Protection against reverse rotation of pump and over pressure of LNG storage tank.



PRODUCT TANK FARM WITH SHARED LOADING FACILITIES



Fluid: Diesel Oil, Gasoline, Kerosene
Typical Sizes: Up to 42"
Typical Pressures: ANSI 150
Typical Materials: WCB
Typical Style: Wafer, Flanged

Purpose:

Valve A: Prevention of backflow from tanks. Protection against loss of inventory in event of supply line rupture.
Valve A & B: Prevention of cross flow between tanks of different levels. A key component in the protection against over pressurisation, excessive vacuum and contamination.
Valve C: Prevention of backflow into pump. Protection against reverse rotation and consequent mechanical damage. Protection against loss of inventory in event of pump supply line rupture.

TECHNICAL DATA

C_V PRESSURE DROP FORMULA

Based on ISA-S75.01-1985
for turbulent flow

FOR LIQUIDS

$$Q = 0.865 C_V \sqrt{\frac{\triangle P}{G_f}}$$

Q max of ≏ 0.7 C_V vapourising liquid

$$\sqrt{\frac{P_1 - F_f P_v}{G_f}}$$

FOR GASES AND VAPOURS

$$Q = 417 \cdot C_V \cdot P_1 \cdot Y \sqrt{\frac{X}{G_g T_1 Z}}$$

$$W = 94.8 \cdot C_V \cdot P_1 \cdot Y \sqrt{\frac{XM}{T_1 Z}}$$

Q = Liquid Flow Rate, m^3/hr
Gas Flow Rate, $s.m^3/hr$
(at 1 bar abs. and 15.6°C)

C_V = Valve Flow Coefficient, U.S. units

$\triangle P$ = (P1 - P2) Pressure Drop psi
When $P_2 < \frac{P1}{2}$ let $P_2 = \frac{P1}{2}$

P_1 = Inlet Pressure, bar absolute

P_2 = Outlet Pressure, bar absolute

G_f = Specific Gravity of Fluid
eg: water = 1 @ 15.6ºC bar abs.

Gg = Specific Gravity of Gas
eg Air = 1 @ 15.6ºC bar abs.

T_1 = Absolute inlet temperature
(ºC + 273)

W = Fluid flow rate, kg/hr

Y = Expansion factor
(limits between 1 and 0.67)

X = Ratio of pressure drop $\triangle P$ to Absolute inlet pressure P_1

Z = Gas compressibility factor
(=1 for an ideal gas)

M = Molecular weight

F_f = Liquid critical pressure ratio factor

$$F_f = 0.96 - 0.28 \left(\frac{P_v}{P_c}\right)^{1/2}$$

P_v = Absolute vapour pressure of Liquid at inlet temperature, bars abs.

P_c = Absolute thermodynamic critical pressure, bars abs.

FLOW COEFFICIENT (CV) and FLOW FACTOR (KV) ANSI 150/300*

Valve Size	Kv	Cv
2"	41	48
3"	128	150
4"	336	394
6"	768	900
8"	1355	1,589
10"	2815	3,300
12"	3349	3,926
14"	4622	5,418
16"	7042	8,256
18"	8916	10,452
20"	12156	14,251
24"	22614	26,511
26"	25590	30,000
28"	28661	33,600
30"	32755	38,400
32"	40944	48,000
36"	47086	55,200
40"	71652	84,000
42"	81888	96,000
48"	100313	117,600

* See graphs on next page for Cv & Kv values. ie 600/900, 1500 and 2500 class values.

VALVE CRACKING PRESSURE

	SUPER TORQUE SPRING		HIGH TORQUE SPRING		LOW TORQUE SPRING		MINI TORQUE SPRING	
VALVE SIZE	psi	mbar	psi	mbar	psi	mbar	psi	mbar
2"	0.511	35	0.225	16	0.123	8	0.050	3
3"	0.617	43	0.298	21	0.110	8	0.054	4
4"	0.426	29	0.165	11	0.071	5	0.048	3
6"	0.353	24	0.194	13	0.086	6	0.043	3
8"	0.299	21	0.222	15	0.118	8	0.042	3
10"	0.308	21	0.231	16	0.081	6	0.040	3
12"	0.275	19	0.270	19	0.145	10	0.040	3
14"	0.255	18	0.226	16	0.086	6	0.043	3
16"	0.389	27	0.243	17	0.116	8	0.042	3
18"	0.320	22	0.249	17	0.126	9	0.041	3
20"	0.341	24	0.192	13	0.093	6	0.041	3
24"	0.266	18	0.207	14	0.064	4	0.040	3

- The Valve Cracking Pressure is the pressure required to lift the plates off the seat. The table above lists the cracking pressure required for a range of Class 150 check valve with Super Torque, Standard Torque, Low Torque and Mini Torque Inconel X750 springs installed. The value of the Cracking Pressure can be varied to suit specific customer requirements by using a different spring.

- The valve spring installed with Goodwin Wafer Check Valves operates as a matched pair of springs providing an independent action on each plate, which ensures synchronous closing.

Kv: The flow of water through a valve at 20°C in cubic meters per hour (m^3/hr) with a pressure drop of 1 bar.
Cv: The flow of water through a valve at 60°F in US gallons/minute (USgpm) at a pressure drop of 1 psi.

CRITICAL VELOCITY

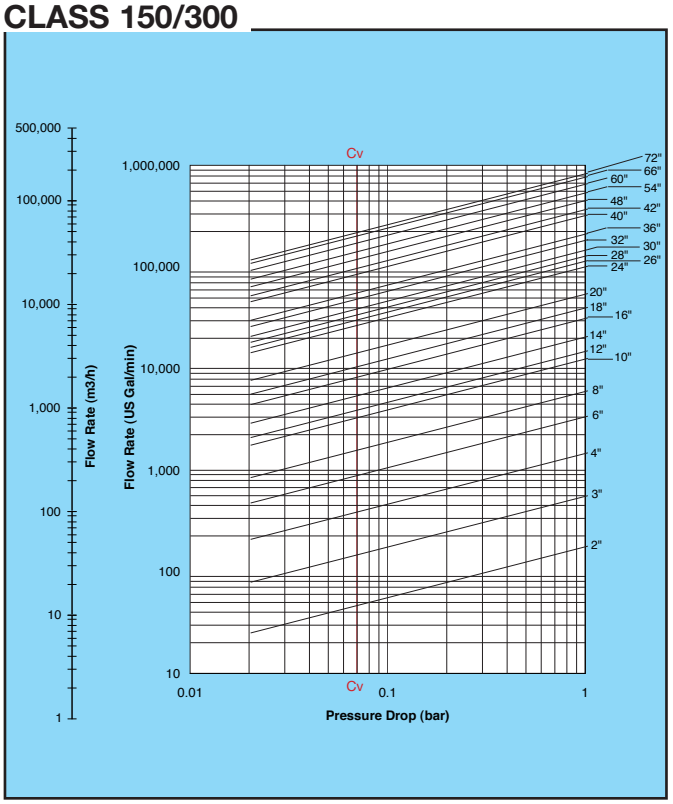
The critical velocity of a valve is that velocity of fluid required to keep the plates of the valve fully open. This condition is important for all check vlaves. If not reached then any pressure drop calculations would be invalid as the Cv of a valve is calculated on the basis of the valve being in full open position. With the valve plates only partially open, i.e. the flow velocity being less than the critical velocity of the valve, then a higher pressure drop will exists than would otherwise be calculated.

Goodwin International have designed their Dual Plate Check Valves such that the customer has an option of 4 different spring strengths:

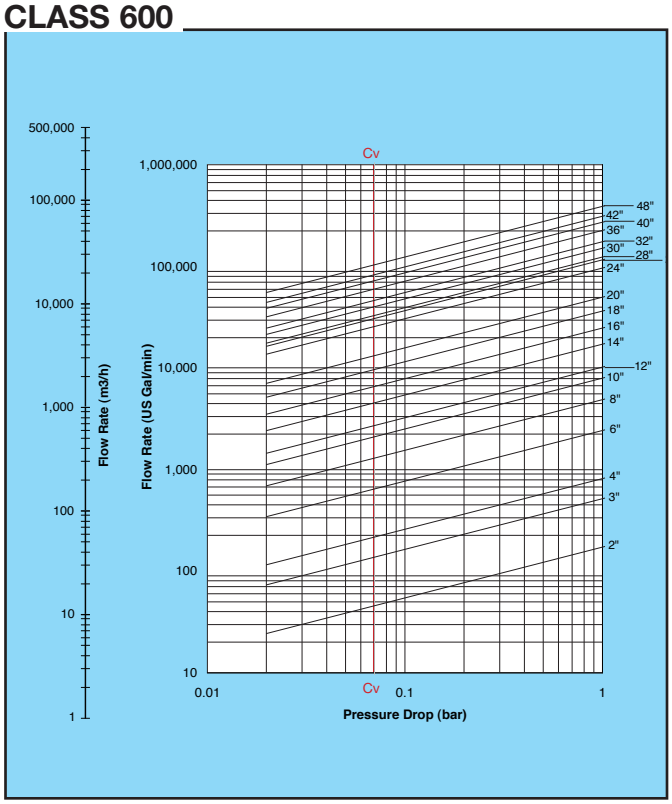
Super torque spring:- this has an average critical velocity in water of 4.4m/s.
High torque spring:- this has an average critical velocity in water of 3m/s. (This spring fitted as standard unless otherwise specified)
Low torque spring:- this has an average critical velocity in water of 2m/s.
Mini torque spring:- this has an average critical velocity in water of 1.5m/s.

PRESSURE DROP - FOR WATER AT 15.6°C

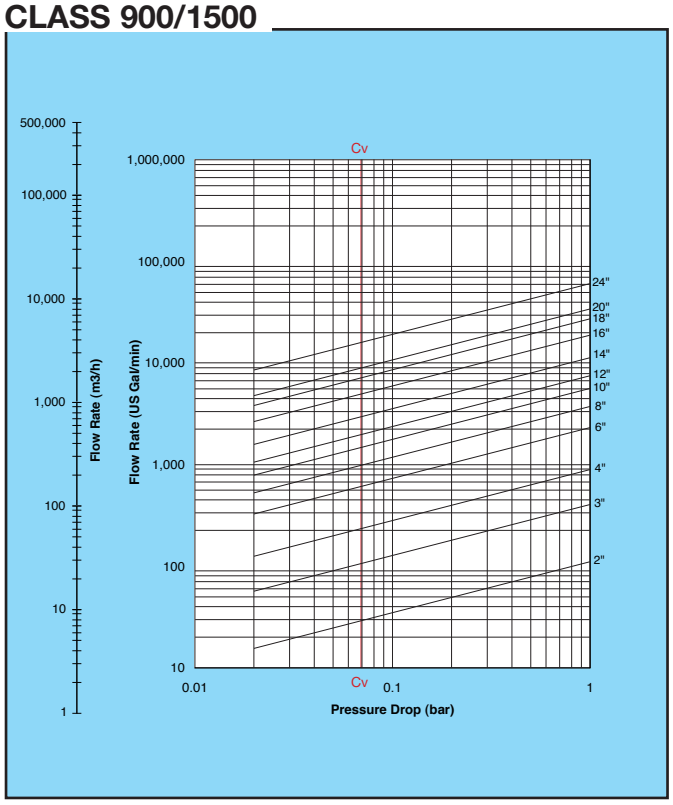
CLASS 150/300



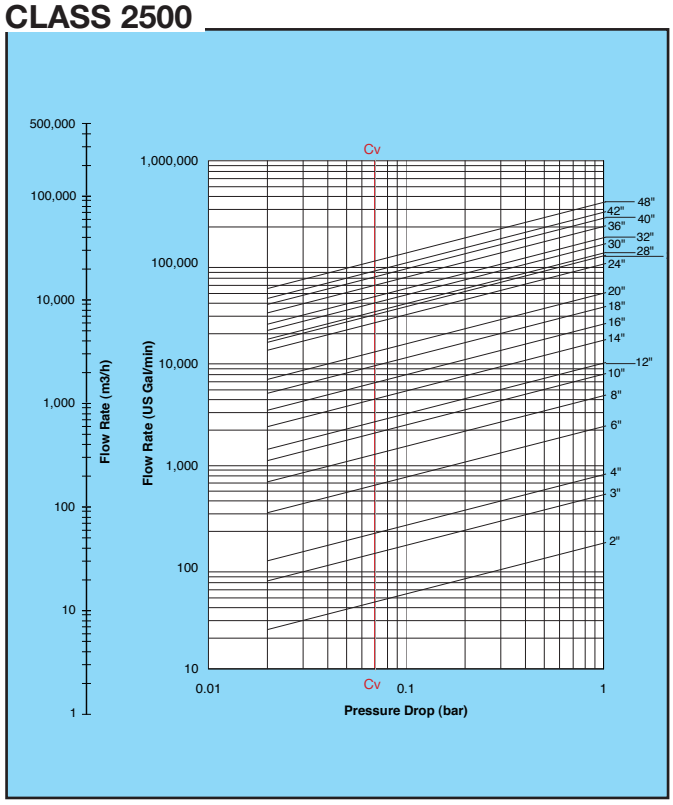
CLASS 600



CLASS 900/1500



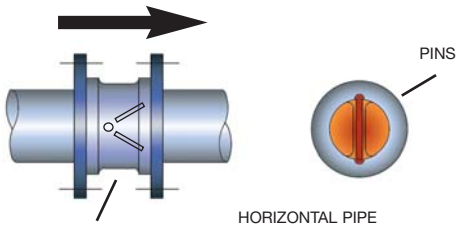
CLASS 2500



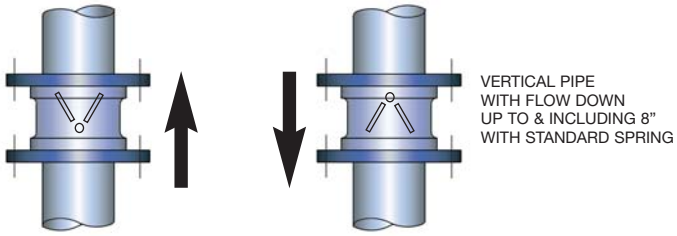
- Valves fitted to larger bore pipes will have lower pressure drops.
- For buttweld end Types BWR & BWA and hub end Type BHR (R) please refer to Goodwin for Cv values.
- Pressure drop versus flow, as depicted in the above graphs, have been established following tests carried out both at Delft Hydraulics Laboratories and from the flow test rig at Goodwin's factory. By combining these test results with area ratios a complete range of test results have been extrapolated.

BEST PRACTICE VALVE INSTALLATION

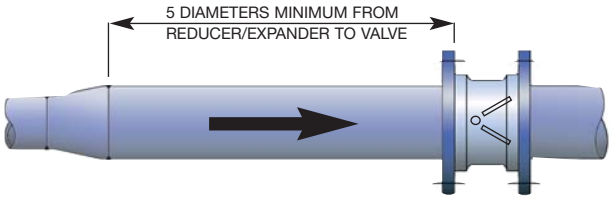
Piping components such as pumps, compressors, valves, reducers, bends, elbows, orifice plates, all create turbulent flow. To maximise the life of a check valve, any type of check valve, it should be installed as detailed below to ensure the valve is in non-turbulent flow.



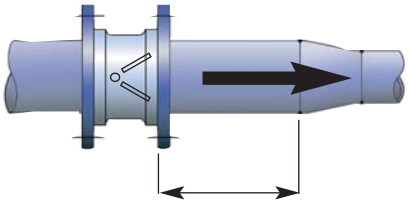
Goodwin Check Valve



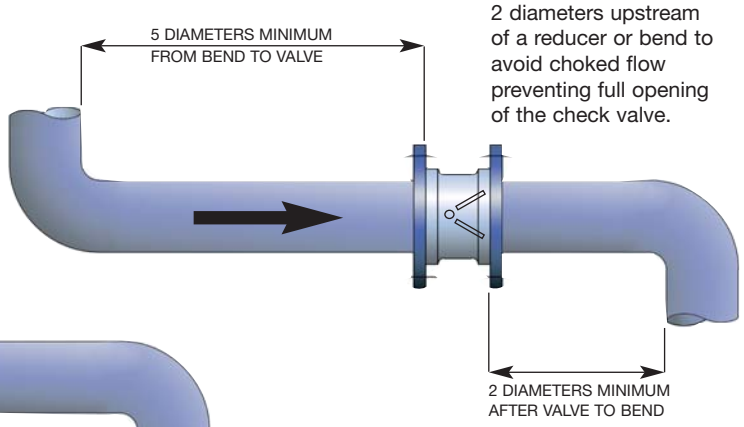
For non-horizontal flow directions, specific system dynamics will be required. Refer to Goodwin.

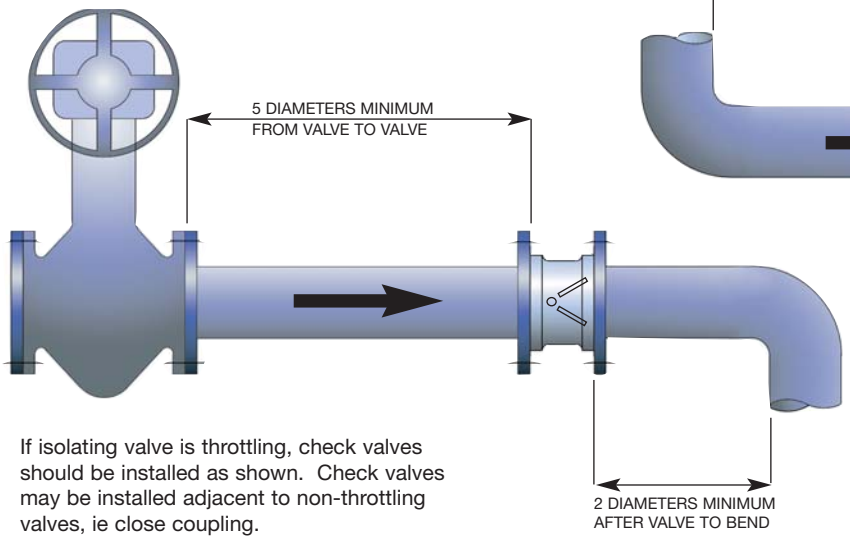


Check valve should be installed a minimum of 5 diameters downstream of a reducer/expander to ensure that the valve is in laminar and not turbulent flow.

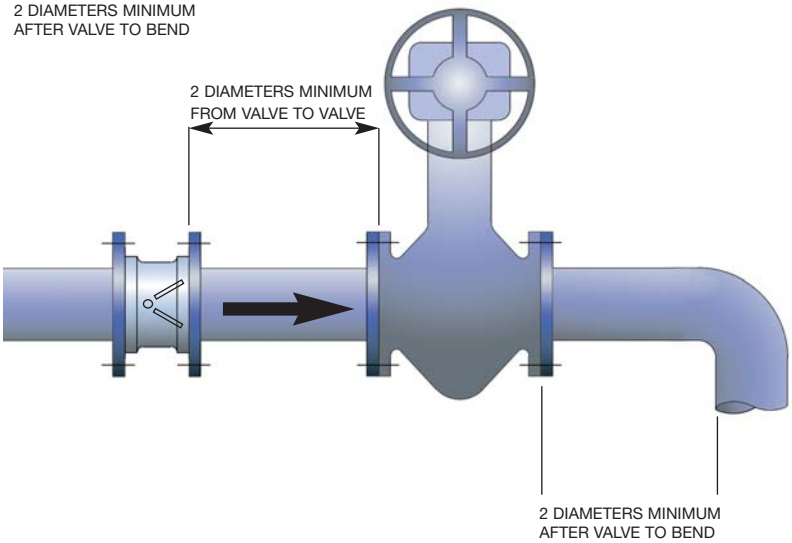


Check valves should be installed a minimum of 2 diameters upstream of a reducer or bend to avoid choked flow preventing full opening of the check valve.





If isolating valve is throttling, check valves should be installed as shown. Check valves may be installed adjacent to non-throttling valves, ie close coupling.



Check valves may be installed on the upstream of isolating valves.
If downstream valve is throttling, clearance as shown should be allowed to ensure full pressure recovery after check valve. Check valves may be installed directly on the inlet to the isolating valve if full port fully open. On ball valves disc clearance must be considered to ensure full operation of the ball valve.

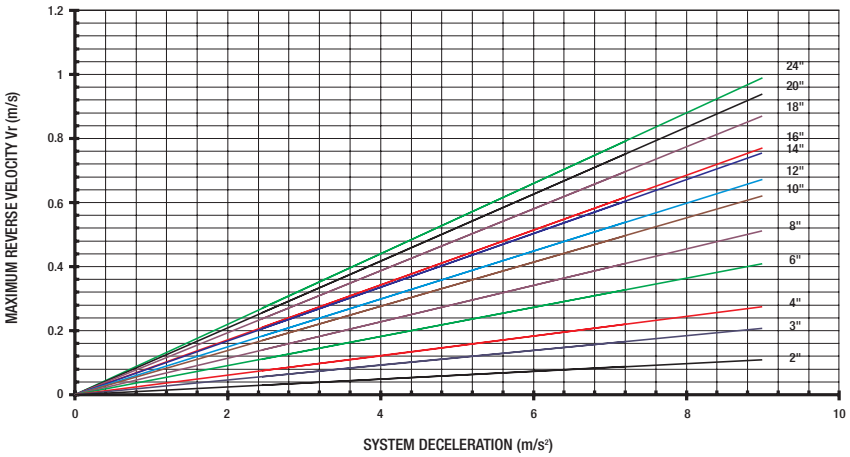
NOTE:
Goodwin check valves are not pigable.

Indicates direction of flow.

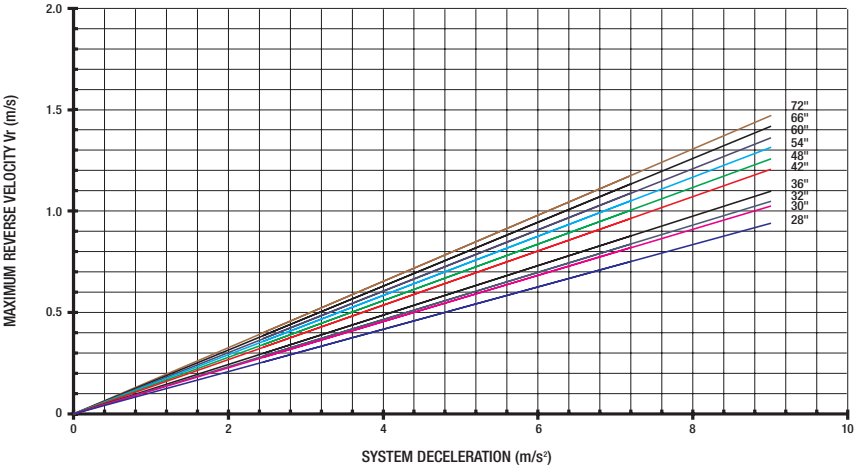
SUPER TORQUE SPRING

DYNAMIC CHARACTERISTICS - FOR WATER AT 15.6°C

2" to 24" Class 150/300



28" to 72" Class 150/300



◆ 4" – 12" Goodwin Check Valves with Super Torque Springs installed have Dynamic Characteristics similar to, or better than, an equivalent Nozzle Type Non-Slam Check Valve.

◆ 12" and larger Goodwin Check Valves with Super Torque Springs installed have Dynamic Characteristics approximately 20% slower than equivalent Nozzle Type Non-Slam Check Valves but at a fraction of the cost.

◆ Competitors' Dual Plate Check Valves do not exhibit the fast response of the Goodwin Super Torque Valve as they do not have the low weight and low inertia of the slim Goodwin plate design as illustrated on page 39.

◆ Super Torque Springs provide Goodwin Check Valves with good Cv figures. On some sizes Goodwin Check Valves have better Cv values than Nozzle Type Non-Slam Check Valves which cost many times more than Dual Plate Wafer Check Valves.

◆ Maximum Reverse Flow Velocities for a given system deceleration will be reduced for higher pressure Goodwin Check Valves due to the smaller flow area through the valve. This is reflected in a reduced Cv factor as shown on page 34.

◆ Valves are normally supplied with High Torque Springs which produce Maximum Reverse Velocities some 30% greater than valves equipped with Super Torque Springs. Customers requiring Super Torque Springs must specify such on their enquiry and order.

◆ The above graphs were produced by extrapolation of results obtained during testing at Delft Hydraulics Laboratory, The Netherlands.

VALVE SIZE (150lb)	VALVE COEFFICIENT (Cv)	
	GOODWIN DUAL PLATE CHECK VALVE	TYPICAL NOZZLE CHECK VALVE
6"	900	1250
8"	1589	1800
10"	3300	2800
12"	3926	4000
16"	8256	7500
20"	14251	13000
24"	26511	16100

ANTI PRESSURE SURGE (for ANSI 150lb and 300lb valves)

A DESIGN FOR SEVERE PUMP APPLICATIONS

In pump applications where pressure surge and water hammer problems are anticipated, correct check valve selection is critical. Historically, process and piping engineers when confronted with high system decelerations have invariably selected the large size, high weight and, consequently, high cost nozzle check valve. To a lesser extent, the damped swing check valve or swing check valve with bypass is occasionally used in such instances but these, likewise, suffer from high cost, size and weight and are, generally, a maintenance problem.

Goodwin can calculate and determine the dynamic performance of its check valves for given system decelerations. Where the demands of the application are beyond the capabilities of a standard Goodwin check valve, Goodwin will employ its APS# device. The APS device extends the suitability of the Dual Plate Check Valve into those pump applications which have previously been in the domain of the nozzle check valve.

APS stands for Anti Pressure Surge and is effected in the Goodwin Dual Plate Check Valve by fitting a pressure-sensitive flow-relieving valve in each plate. Essentially, the APS consists of a large piston valve held closed by Belleville washers whose pre-set load will not allow flow through the piston valve from the downstream side of the check valve until the downstream pressure exceeds by 10% the maximum static flow pressure on the downstream side of the valve.

The main function of the APS is not to relieve high pressure but to prevent it from occurring in the first place. It does this by allowing flow which releases excess pressure energy from the downstream side of the valve as the pressure increases on valve closure to the upstream of the valve thereby avoiding the occurrence of full downstream pressure increase. This downstream pressure increase is caused by the instantaneous halt of the column of fluid when the check valve closes and was determined in 1898 by Joukowsky who formulated the equation:

Pressure rise = speed of sound in the fluid line x Vr max x the fluid density
(where Vr max is the maximum reverse velocity of the fluid and is a function of the system deceleration and check valve type.)

Tests carried out at the Delft Hydraulics Laboratory in The Netherlands recorded a 40% reduction in the Joukowsky pressure that would have been seen in any check valve not fitted with APS had the same reverse flow velocity occurred and is little more than is experienced with the nozzle check valve.

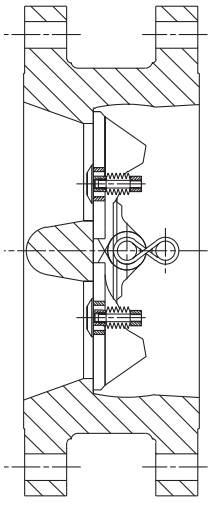
The cost effective solution

By utilizing the Dual Plate Check Valve fitted with APS the piping engineer avoids the following problems:

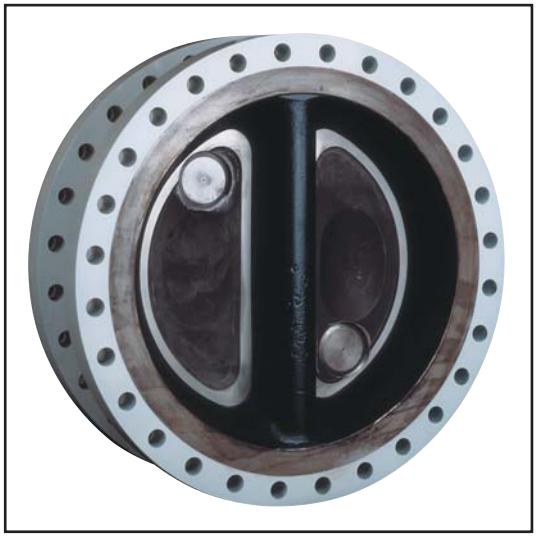
a) The higher pressure drops generally experienced in Nozzle Type Check Valves.
b) The size and weight penalty of the Nozzle and damped Swing Check Valves.
c) The very severe cost penalty (300 % and more) of the Nozzle and Swing Check Valves.

The APS can be fitted in all Goodwin Check Valves 12" and larger. Goodwin requires the following data to establish if its check valve should be fitted with the APS device to meet the demands of its application:

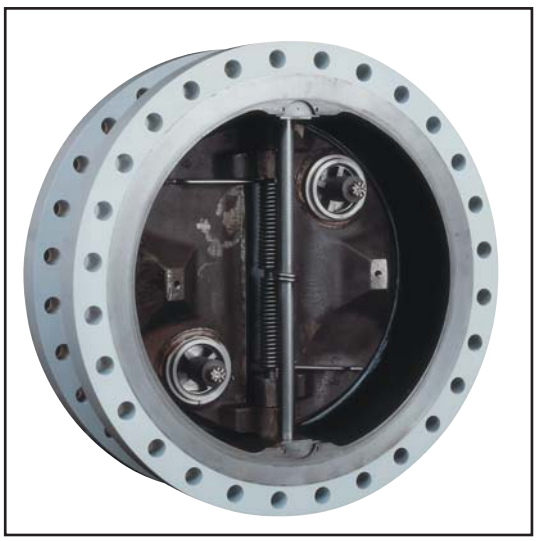
Valve Size & Pressure Class
Fluid
Fluid Density
Flowrate
Line Operating Pressure
Line Design Pressure
Temperature
Line Velocity
System Deceleration
Downstream pressure in the no flow condition, i.e. when the plates are closed



Schematic of a 32" 150lb Valve with APS.



32" ANSI 150lb Dual Plate Check Valve with APS, as viewed from valve upstream side.



32" ANSI 150lb Dual Plate Check Valve with APS, as viewed from valve downstream side.

Patent applied for.

Check valve selection based upon system deceleration characteristic

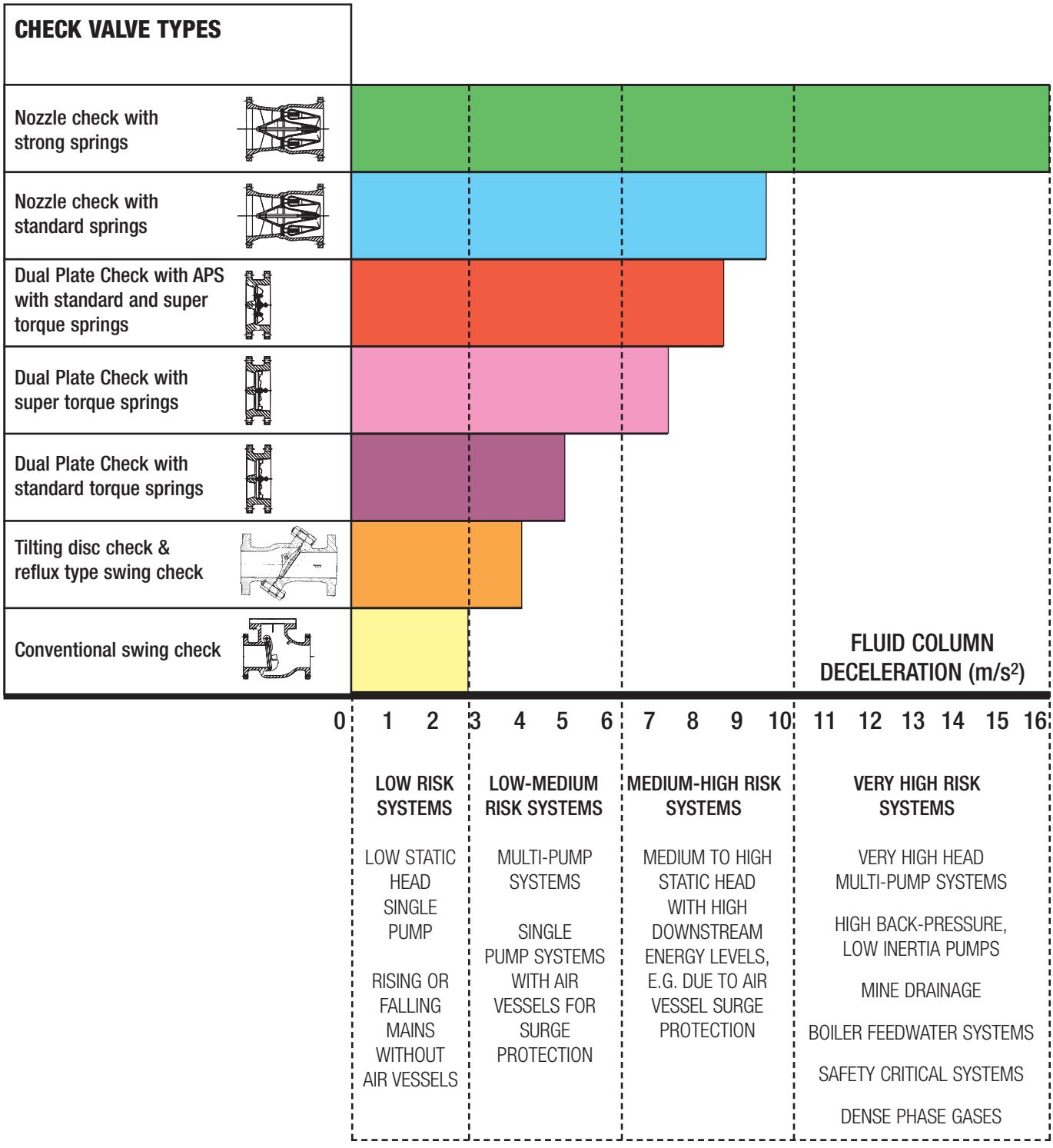
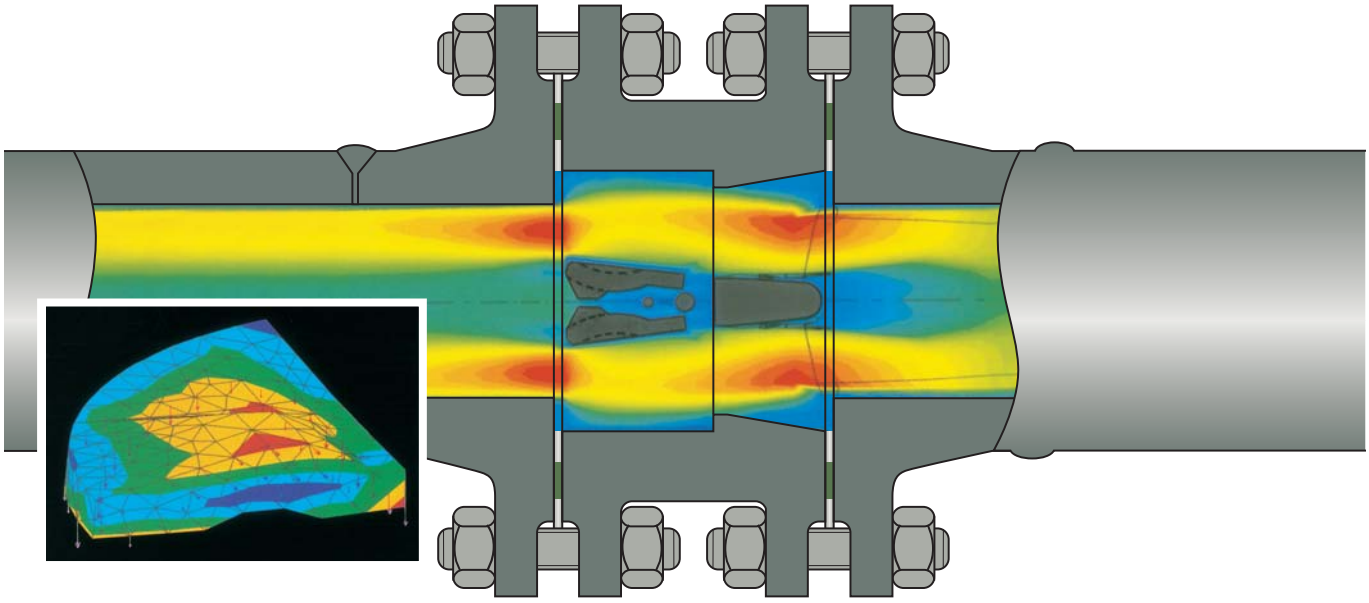


PLATE DESIGN & ATTRIBUTES



By taking advantage of recent advances in computer technology and combining the results of *FLUENT flow modelling and †ANSYS Finite Element Stress Analysis, Goodwin has been able to design a Dual Plate Wafer Check Valve that has a higher performance than had previously been developed.

The Goodwin Valve has a significantly lower pressure drop on high pressure valves than has been achieved before. This improvement has been secured by using a unique plate (Pat) which exhibits differential stiffness, while other areas remain rigid.

The success of this plate design has permitted our designers to maintain almost the same “D” throat area across the pressure range for any given size of valve. For example, when comparing throat areas with those of another leading manufacturer, the Goodwin valve was found to have areas as much as 25% greater giving the obvious benefits of increased flow and lower pressure drop. The benefit of the increased flow area is further enhanced on the outlet side of the valve where the Goodwin slim plates in the fully open position offer dramatically less restriction to flow as depicted in the adjacent photographs.

The Goodwin plate, by virtue of its design, has a lower mass; typically a Goodwin ANSI 2500lb plate weighs less than other suppliers ANSI 300lb plates. This factor decreases both the inertia of the plates and the friction at the plates hinges providing an opportunity to improve the valve response time.

The valve has been tested at Delft Hydraulics Test Laboratories in The Netherlands and independent comparative tests using the Goodwin valve and a valve from another major international Dual Plate Check Valve manufacturer were carried out. The results show that the Goodwin design has a significantly lower pressure drop for a given flow and valve size than the other manufacturer’s valve.

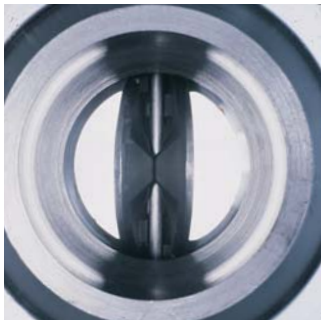
There are vast benefits for users of Goodwin’s design because of its reduction in the operating costs normally associated with energy losses and reduced output in high velocity oil and gas flow line production facilities. The Goodwin valve opens up opportunities for operating companies to develop “best value” solutions for their cost reduction programs.

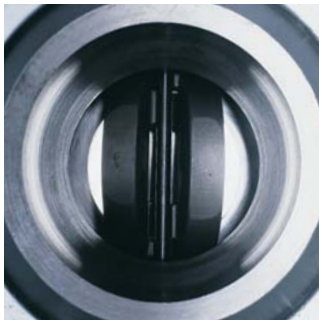
* FLUENT is a registered trademark of Fluent Inc., USA.
† ANSYS is a registered trademark of Swanson Analysis Systems.
(Pat) = Patented Internationally.

Flow area as viewed from bar end.

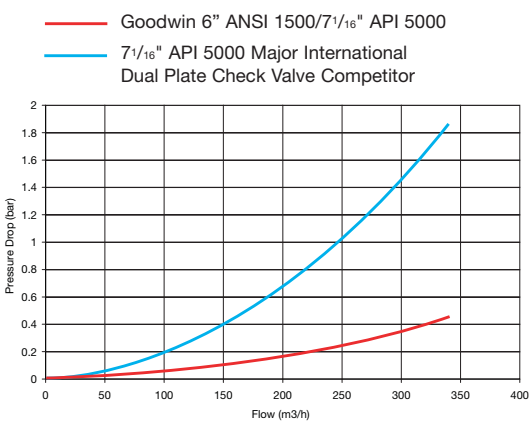
▲ Goodwin
▼ 6" ANSI 1500/7 1/16" API 5000

▲ Major Competitor
▼ 6" ANSI 1500





Flow area as viewed through flange on outlet side of valve.



LARGE DIAMETER CHECK VALVES

Goodwin specializes in the manufacture of large diameter valves, being capable of manufacturing valves to 144" diameter in all materials and relevant pressure classes.

Applicable Flange Standards

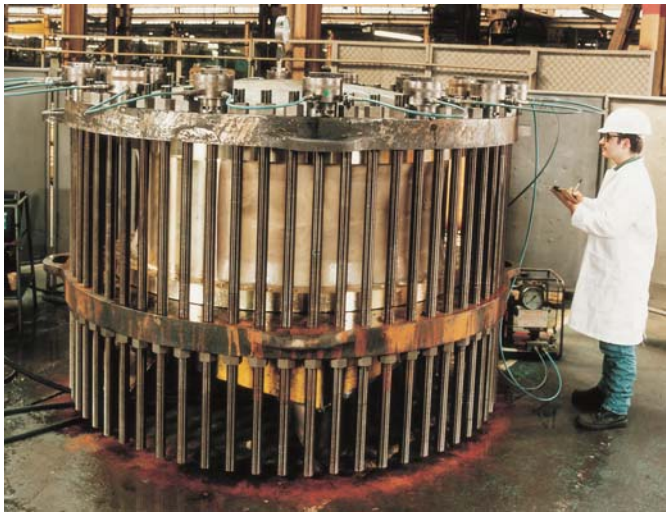
26" – 60": ANSI B16.47 Series A
ANSI B16.47 Series B

66" – 144": AWWA C207 Class B, D, E & F and Taylor Forge.

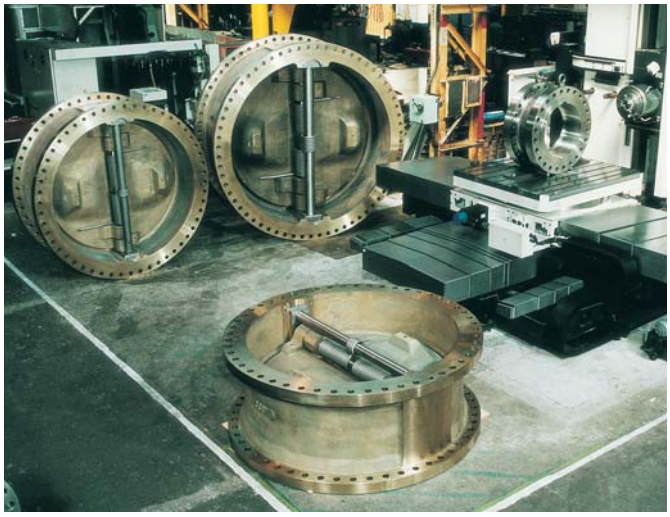
With its in-house foundry and pattern shop, Goodwin is able to closely control the quality and integrity of these very large valve castings.

Often the larger valves are supplied into water applications. Typical materials of construction are Ni-Resist Iron, Rubber lined Carbon Steel, Aluminium Bronze, Duplex Stainless Steel and CF8M Stainless Steel. Goodwin can supply these materials and others as listed on page 5.

52" 150lb Dual Plate Check Valve



84" 150 lb valve undergoing hydrotest in Goodwin factory



Two 66" 150 lb and one 84" 150 lb Check Valves in Aluminium Bronze

The two photographs above show valves supplied to Ibn Rushd (SABIC) for the Utilities Plant at its PTA & Aromatics Complex in Yanbu, Saudi Arabia. The 84" is installed on the seawater Intake line and a total of three 66" valves are installed on the seawater discharge pumps.

Many large diameter valves are required in Desalination plants where Goodwin has gained extensive experience. With these plants seawater is converted into potable water. Stagnant seawater poses significant corrosion problems if the correct materials are not selected. Goodwin recommends the use of Inconel 625 spring in both stagnant seawater and oxygenated brine applications.

Large diameter Goodwin dual plate check valves are utilised in a wide variety of industries and increasingly so in the LNG market, where valves are in service at temperatures of -161ºC. The adjacent photograph shows one such valve cooling down for cryogenic testing at -196ºC at Goodwin International's in-house cryogenic test facility.

70" 150 lb valve cooling down for cryogenic test.

FIRETESTED DUAL PLATE CHECK VALVES

There is an increasing demand by oil company majors for soft seated check valves to be approved and certified firesafe for use in some hydrocarbon service applications. For example, on oil and gas production platforms and in Liquefied Natural Gas (LNG) plants. Two such projects to which Goodwin has supplied where firetest approved and certified designs were mandatory were Amerada Hess' South Arne (Denmark) gas production platform and valves installed in the gas transmission system of the Nigeria LNG (viz. Shell) Bonny Island LNG export facility.

Goodwin International has had firetests conducted on a number of resilient seated valves by an independent facility and witnessed by Lloyds Register of Shipping. The basis of the testing is the valve being subjected to a 30 minute "burn" during which time the soft seat is partially or totally destroyed. During the "burn" and later, after cooling, the leakage across the valve is measured and has to meet specific requirements.

Goodwin is approved and certified firesafe for all sizes in pressure classes ANSI 150 to ANSI 900. The valves tested met the performance requirements stated in the following standards:

BS 6755 Part 2 1987: Testing of Valves
Specification for fire type-testing requirements

API 6FA 2nd Edition 15th February 1994
Specification for Firetest for Valves

API 6FD 1st Edition 15th February 1995
Specification for Fire Test for Check Valves

16" 600 lb BFR Flanged Check Valve undergoing firetest

For a firesafe installation many oil company specifications insist on flanged or solid lug valves in hydrocarbon service. With wafer type valves with exposed long bolting, in the event of fire, these bolts would be subject to direct flame impingement which would then lead to bolt expansion and subsequent "dropping" of the valve. The line fluid would then feed the fire. With solid lug and flanged designs this problem is avoided.

Many companies specify and use wafer type valves in hydrocarbon service preferring, where deemed necessary, to protect the bolting by other means such as bolt shrouds and fireshields.

Score (Europe) Limited
Engineering Research, Design, Manufacture & Repair

Fire Test Certificate

Certificate in Accordance with Specifications
B.S. 6755 PART 2 1987: API 6FA 2nd EDITION 15 FEBRUARY 1994
and API 6FD 1 ST EDITION 15 FEBRUARY 1995
a CHECK VALVE
Body Material ASTM A216 WCB
Seat Material VITON B FR58/90
Size 16" Class ANSI 150
Manufactured by GOODWIN INTERNATIONAL
has been tested by Score (Europe) Limited on 24/07/98
at Score's Cowdenbeath works and has complied with the requirements.

This certificate must be read in conjunction with test report S71997-5

Test carried out by R HEPBURN / W HAY Score (Europe) Limited

Test witnessed by WAIVED - by Manufacturer
Test witnessed by W CAMPBELL - Lloyds Register

To Certifying Authority

FIRETEST COVERAGE MATRIX

ANSI RATING /SIZE	150	300	600	900
2"	TEST (Report No 71997-1)		TEST (Report No 71997-2)	
3"	COVERED		COVERED	
4"				
6"	TEST (Report No 71997-3)		TEST (Report No 71997-4)	
8"	COVERED		COVERED	
10"				
12"				
14"	TBC		TBC	
16"	TEST (Report No 71997-5)		TEST (Report No 71552-1)	
AND ABOVE	COVERED		COVERED	

CRYOGENIC TESTING

Goodwin International is capable of pressure testing at temperatures from room temperature down to -196° C.

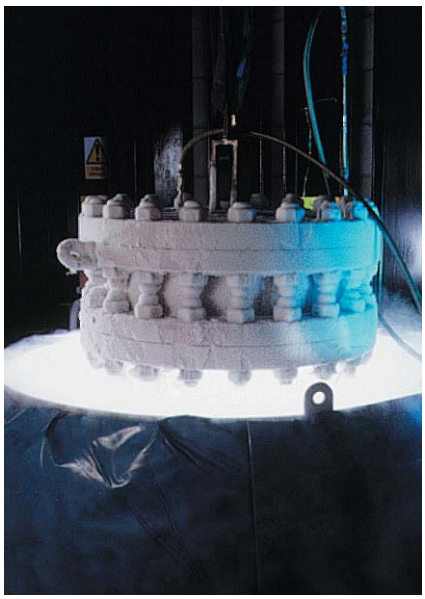
Cryogenic testing is conducted by immersing the valve in Liquid Nitrogen to cool to the desired temperature which is monitored at a number of locations on the valve, both internally and externally.

Once temperature has stabilised, the pressure test commences using pure Helium or 99% Helium / 1% Nitrogen mix as the test medium. Pressure can be increased in increments and seat leakage measured at each increment. Test pressure depends on the rating of the valve and the maximum is limited by the Cold Working Pressure as designated by ASME B16.34.

Seat leakage is measured with calibrated flow meters. Valve Inspection and Test Standard API 598 defines the maximum permissible leakrate with air or inert gas at ambient temperature conditions as 700cc/minute/inch bore diameter. For cryogenic service Goodwin manufactures, as standard, its valves with a maximum leakrate of 500cc/minute/ inch bore diameter with Helium at -196°C. Goodwin has selected this maximum leakrate in response to the requirements of LNG plant designers. Following the seat leak test, valve body integrity is tested whereby the entire body cavity is pressurised and a shell leak detection test carried out using a Mass Spectrometer.

Goodwin has supplied to a number of the world's prestigious LNG (Liquefied Natural Gas) export projects. The vast majority of valves are of 316 Stainless Steel construction for use in Liquefied Natural Gas service at a temperature of -161°C. Additionally, a large number of valves are of LTCS body construction for low temperature service applications.

Increasingly, engineering contractors and client companies have ever more stringent specifications whereby the degree of shut-off is now much tighter than has previously been demanded of Dual Plate Check Valves. On a number of LNG projects, in response to customers' design requirements, Goodwin has supplied valves to far lower permissible leakrates than the 500cc/minute/inch bore diameter. Goodwin's ability to meet these more stringent customer shut-off requirements is achievable due to Goodwin's unique and patented pressure sensitive plate design.



24"ANSI 150lb Check Valve on Cryogenic Test

Typical Test Procedures

BS 6364
Shell SPE 77/306

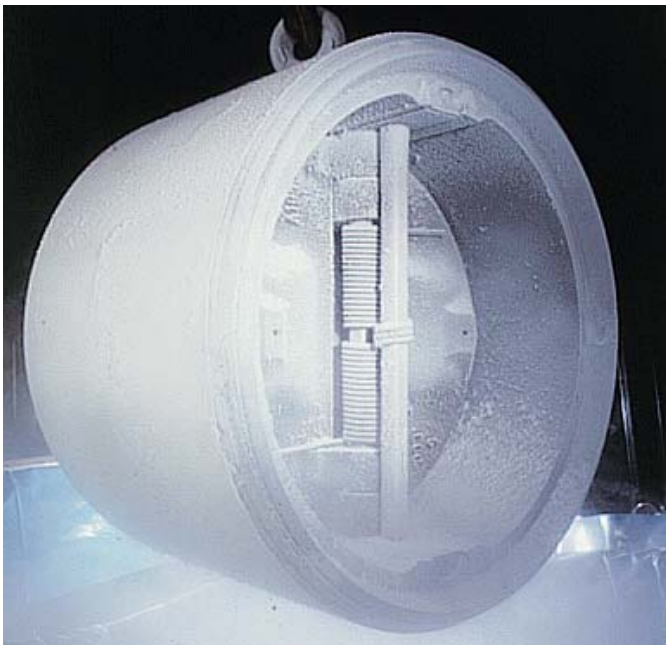
Acceptance Standards

Seat Leakage: API598 - 700 cc/min/inch bore

Outside Leakage (body): Shell SPE 77/306 - zero leakage.

Cryogenic Test Facility/Explosion Proof Chamber.

Goodwin has over 20 years of in-house cryogenic testing experience. Having its own cryogenic and high pressure gas test facility enables Goodwin to test valves in-house as large as 72" at temperatures down to -196°C and pressures to 6000psig/414barg.



42"ANSI 600# Buttweld end Check Valve after Cryogenic Test with test plates removed.

GOODWIN FACILITIES & RESOURCES

CAD facilities in Goodwin design office

Goodwin's Check Valve manufacturing facilities in Stoke-on-Trent, England, comprise a Steel and Super Nickel alloy foundry (Goodwin Steel Castings) and a well equipped CNC machine shop with full design, fabrication, inspection and test facilities (Goodwin International). The ISO 9001 foundry specialises in producing high integrity pressure vessel castings from a few kilos to 12,000kg in finished machined weight. The materials cast by the foundry are detailed on page 48 of the catalogue and include carbon and low alloy steels, stainless steels, duplex stainless steels and super nickel alloys such as Hastelloy® and Alloy 625. Goodwin's ability to produce the special alloys is enhanced by their in-house 10 tonne AOD refining furnace.

The design, machine and assembly shops cover some 9400 m^2 and are equipped with 31 modern CNC machine tools that are the core of the production and are supplemented by many conventional machine tools.

The test facilities include five hydraulic hydrostatic test rigs, the largest of which has a 2500 tonne hydraulic ram and can test valves up to 60". Cryogenic testing is also carried out on site where valves are submerged in liquid nitrogen at -196°C and leak tested with helium gas.

Valve design is carried out using CAD and is verified on computers utilising finite element analysis - ANSYS. Both the foundry and the design, machining, assembly and test facilities are audited by the British Standards Institute and approved to BS EN ISO 9001:2000 (Certificate FM343 and FM13182).

Charging Goodwin Steel Castings 8 ton AOD refining vessel

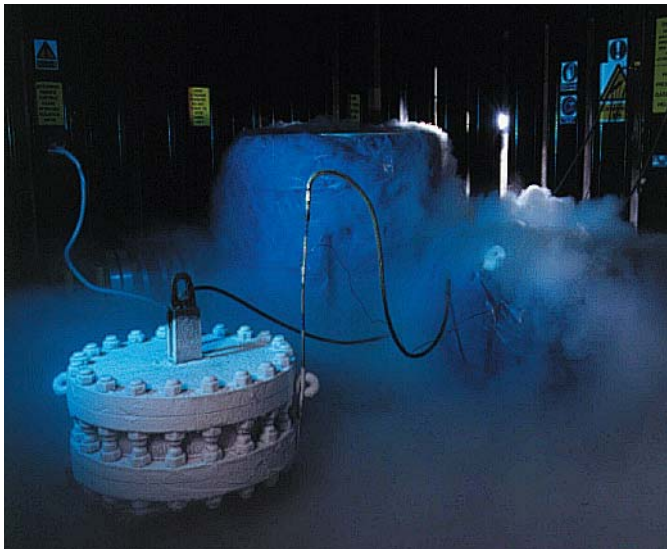
8 ton arc furnace at Goodwin Steel Castings

Three station CNC vertical borer with live spindle and tool changer

2500 tonne hydraulic test rig in Goodwin's Assembly bay

Four pallet CNC machining centre with auto tool changer

Twin Pallet CNC machining centre with 60 tool changer



Cryogenic test facility for helium leak testing

CERTIFICATION & TESTING

A Quality Management System accredited by BSI in accordance with BS EN ISO 9001:2000 is maintained

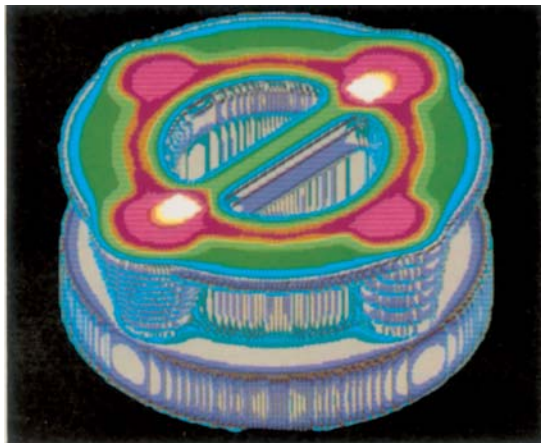
The Standard GOODWIN Check Valve features:-

- Designed, manufactured, assembled and tested in accordance with Quality Assurance System accredited by BSI to BS EN ISO 9001:2000
- Designed and tested to API 594.
- All bodies, plates and trim material are certified to BS EN 10204 3.1 as a minimum.
- All new castings are sample approved by dimensional checks (wall thickness etc.) and radiography, 100% coverage to ASTM E446/E186, Level 2 minimum, or ultrasonic testing to ASTM A609, Level "A".
- Surface finish to MSS SP 55 on cast bodies and plates.
- Traceablilty per melt (not batch of ingot) is maintained throughout all manufacturing processes for bodies, plates and trim.
- All valves are hydrostatically tested (Shell and Seat) to API 598 with unique traceability to certification.
- Firetest approved and certified to BS 6755 Pt2, API 6FA & API 6FD for pressure classes ANSI 150lb to ANSI 900lb
- Additional testing to be specified on the inquiry and Purchase Order.

Extensive in-house testing and laboratory facilities are available including:

- Pressure Testing
- Flow Testing
- Low Temperature (-46°C) and cryogenic temperature (-196°C) Pressure Testing
- High Temperature Pressure Testing to 550°C
- High Pressure Gas Testing
- Helium Leak Testing (Mass Spectrometer)
- Tensile / Bend / Impact / Hardness Testing
- Corrosion Testing
- Metallography
- Magnetic Particle
- Dye Penetrant
- Ultrasonic Examination
- Radiography
- Chemical Analysis
- Alloy Verification / Positive Material Identification (PMI)
- Ferritscope Verification
- Finite Element Analysis

Other examination Methods or Acceptance criteria to comply with the customer's own specification may be substituted if agreed with the Company at the time of quotation.



COMPUTER MODELLING

Goodwin Steel Castings model all cast Valve Bodies on their finite element analysis computer. This computer modelling system develops casting feeding and gating designs that will ensure "right first time" production of high integrity castings, when metal is actually poured. The finite element analysis solidification program includes both thermal analysis and X-ray simulation. It is, therefore, possible to predict where defects will occur in a given casting and engineer them out by adjustment of the riser and gating system on the casting.This optimisation process is a feature of Goodwin Steel Castings' Quality Assurance system, accredited by BSI to BS EN ISO 9001:2000. Goodwin Steel Castings was the first steel foundry in Europe to develop and be accredited by BSI (British Standards Institute) for a design system, which gives rise to delivered on time, higher integrity castings, at more competitive prices.

RADIOGRAPHY

Radiography is conducted inhouse using 8 MeV Linear Accelerator X-Ray machine with developing and viewing facilities

Method: ASME V Art 2 or ASME B16.34 Appendix 1

Options: 100% of All castings
100% of 10% of castings
Critical Areas* of All castings
Critical Areas* of 10% of castings

Acceptance: ASME VIII Div 1 Appendix 7 or ASME B16.34 Appendix 1

*Critical Areas as defined by ASME B16.34

The Company's operators / interpreters for all forms of Non-Destructive Testing are qualified to SNT Level2

MAGNETIC PARTICLE/ DYE PENETRANT

Method: MPI to ASME V Art 7 or ASME B16.34 Appendix II
DPI to ASME V Art 6 or ASME B16.34 Appendix III

Options: 1) 100% of All castings/forgings
2) 100% of 10% of castings/forgings
3) 100% of all machined surfaces

Acceptance: MPI to ASME VIII Div 1 Appendix 7
or ASME B16.34 Appendix II
DPI to ASME VIII Div 1 Appendix 7
or ASME B16.34 Appendix III

ULTRASONIC EXAMINATION

Method: ASME V Art 5 or ASME B16.34 Appendix IV

Options: 1) 100% of All castings/forgings
2) 100% of 10% of castings/forgings
3) Critical Areas* of All castings/forgings
4) Critical Areas* of 10% castings/forgings

Acceptance: ASME SA 388 or ASME B16.34 Appendix IV

*Critical Areas as defined by ASME B16.34

CORROSION TESTING & METALLOGRAPHY

- Intercrystaline corrosion
- Strauss and Huey tests
- Crevice corrosion
- Pitting Corrosion
- Typical Standards - ASTM G48, A262, G31, G36
- Ferrite counting
- Phase checks
- Graph size/inclusion counts
- Macro and Micro photography
- Typical Standards - ASTM E562, E112, E45

CHEMICAL ANALYSIS

- 24 channel, direct reading spectrograph. Includes determination of the volatile elements such as carbon, sulphur and nitrogen.
- Portable PMI (Positive Material Identification)
- Carbon/Low alloy steels
- Stainless/Duplex/6Mo steels
- Nickel alloys
- Cobalt alloys

ASME B16.34 PRESSURE / TEMPERATURE RATINGS

MAXIMUM NON-SHOCK WORKING PRESSURES (Standard Class), BAR.

Temperature °C	MAXIMUM NON-SHOCK WORKING PRESSURES (Standard Class). BAR.																													
	150lb SERIES					300lb SERIES					600lb SERIES					900lb SERIES					1500lb SERIES					2500lb SERIES				
	ASTM A216 WCB	ASTM A105	ASTM A352 LCC	ASTM A350 LF2	ASTM A217 WC6	ASTM A216 WCB	ASTM A105	ASTM A352 LCC	ASTM A350 LF2	ASTM A217 WC6	ASTM A216 WCB	ASTM A105	ASTM A352 LCC	ASTM A350 LF2	ASTM A217 WC6	ASTM A216 WCB	ASTM A105	ASTM A352 LCC	ASTM A350 LF2	ASTM A217 WC6	ASTM A216 WCB	ASTM A105	ASTM A352 LCC	ASTM A350 LF2	ASTM A217 WC6	ASTM A216 WCB	ASTM A105	ASTM A352 LCC	ASTM A350 LF2	ASTM A217 WC6
-29 to 38	19.6	19.6	19.8	19.6	19.8	51.1	51.1	51.7	51.1	51.7	102.1	102.1	103.4	102.1	103.4	153.2	153.2	155.1	153.2	155.1	255.3	255.3	258.6	255.3	258.6	425.5	425.5	430.9	425.5	430.9
50	19.2	19.2	19.5	19.2	19.5	50.1	50.1	51.7	50.1	51.7	100.2	100.2	103.4	100.2	103.4	150.4	150.4	155.1	150.4	155.1	250.6	250.6	258.6	250.6	258.6	417.7	417.7	430.9	417.7	430.9
100	17.7	17.7	17.7	17.7	17.7	46.6	46.6	51.5	46.6	51.5	93.2	93.2	103.0	93.2	103.0	139.8	139.8	154.6	139.8	154.4	233.0	233.0	257.6	233.0	257.4	388.3	388.3	429.4	388.3	429.0
150	15.8	15.8	15.8	15.8	15.8	45.1	45.1	50.2	45.1	49.7	90.2	90.2	100.3	90.2	99.5	135.2	135.2	150.5	135.2	149.2	375.6	375.6	250.8	375.6	248.7	320.8	320.8	418.1	320.8	414.5
200	13.8	13.8	13.8	13.8	13.8	43.8	43.8	48.6	43.8	48.0	87.6	87.6	97.2	87.6	95.9	131.4	131.4	145.8	131.4	143.9	219.0	219.0	243.2	219.0	239.8	365.0	365.0	405.4	365.0	399.6
250	12.1	12.1	12.1	12.1	12.1	41.9	41.9	46.3	41.9	46.3	83.9	83.9	92.7	83.9	92.7	125.8	125.8	139.0	125.8	139.0	209.7	209.7	231.8	209.7	231.8	349.5	349.5	386.2	349.5	386.2
300	10.2	10.2	10.2	10.2	10.2	39.8	39.8	42.9	39.8	42.9	79.6	79.6	85.7	79.6	85.7	119.5	119.5	128.6	119.5	128.6	199.1	199.1	214.4	199.1	214.4	331.8	331.8	257.1	331.8	357.1
350	8.4	8.4	-	8.4	8.4	37.6	37.6	-	37.6	40.3	75.1	75.1	-	75.1	80.4	112.7	112.7	-	112.7	120.7	187.8	187.8	-	187.8	201.1	313.0	313.0	-	313.0	335.3
400	6.5	6.4	-	6.5	6.5	34.7	34.7	-	34.7	36.5	69.4	69.4	-	69.4	73.3	104.2	104.2	-	104.2	109.8	173.6	173.6	-	173.6	183.1	289.3	289.3	-	289.3	304.9
450	-	-	-	-	4.6	-	-	-	-	33.7	-	-	-	-	67.7	-	-	-	-	101.4	-	-	-	-	169.0	-	-	-	-	281.8
500	-	-	-	-	2.8	-	-	-	-	25.7	-	-	-	-	51.5	-	-	-	-	77.2	-	-	-	-	128.6	-	-	-	-	214.4
538	-	-	-	-	1.4	-	-	-	-	14.9	-	-	-	-	29.8	-	-	-	-	44.7	-	-	-	-	74.5	-	-	-	-	124.1

Temperature °C	MAXIMUM NON-SHOCK WORKING PRESSURES (Standard Class). BAR.																													
	150lb SERIES					300lb SERIES					600lb SERIES					900lb SERIES					1500lb SERIES					2500lb SERIES				
	ASTM A351 CF8M / A351 CF3M	ASTM A351 CF8C	UNS S31803	UNS 32760	ASTM A494 CW6MC 625 ALLOY*	ASTM A351 CF8M / A351 CF3M	ASTM A351 CF8C	UNS S31803 / J92205	UNS 32760 / J93380	ASTM A494 CW6MC 625 ALLOY*	ASTM A351 CF8M / A351 CF3M	ASTM A351 CF8C	UNS S31803 / J92205	UNS 32760 / J93380	ASTM A494 CW6MC 625 ALLOY*	ASTM A351 CF8M / A351 CF3M	ASTM A351 CF8C	UNS S31803 / J92205	UNS 32760 / J93380	ASTM A494 CW6MC 625 ALLOY*	ASTM A351 CF8M / A351 CF3M	ASTM A351 CF8C	UNS S31803 / J92205	UNS 32760 / J93380	ASTM A494 CW6MC 625 ALLOY*	ASTM A351 CF8M / A351 CF3M	ASTM A351 CF8C	UNS S31803 / J92205	UNS 32760 / J93380	ASTM A494 CW6MC 625 ALLOY*
-29 to 38	19.0	19.0	20.0	20.0	20.0	49.6	49.6	51.7	51.7	51.7	99.3	99.3	103.4	103.4	103.4	148.9	148.9	155.1	155.1	155.1	248.2	248.2	258.6	258.6	258.6	413.7	413.7	430.9	430.9	430.9
50	18.4	18.7	19.5	19.5	19.5	48.1	48.8	51.7	51.7	51.7	96.2	97.5	103.4	103.4	103.4	144.3	146.3	155.1	155.1	155.1	240.6	243.8	258.6	258.6	258.6	400.9	406.4	430.9	430.9	430.9
100	16.2	17.4	17.7	17.7	17.7	42.2	45.3	50.7	50.7	51.5	84.4	90.6	101.3	101.3	103.0	126.6	135.9	152.0	152.0	154.6	211.0	226.5	253.3	253.3	257.6	351.6	377.4	422.2	422.2	429.4
150	14.8	15.8	15.8	15.8	15.8	38.5	42.5	45.9	45.9	50.3	77.0	84.9	91.9	91.9	100.3	115.5	127.4	137.8	137.8	150.6	192.5	212.4	229.6	229.6	250.8	320.8	353.9	382.7	382.7	418.2
200	13.7	13.8	13.8	13.8	13.8	35.7	39.9	42.7	42.7	48.3	71.3	79.9	85.3	85.3	96.7	107.0	119.8	128.0	128.0	145.0	178.3	199.7	213.3	213.3	241.7	297.2	332.8	355.4	355.4	402.8
250	12.1	12.1	12.1	12.1	12.1	33.4	37.8	40.5	40.5	46.3	66.8	75.6	80.9	80.9	92.7	100.1	113.4	121.4	121.4	139.0	166.9	189.1	202.3	202.3	231.8	278.1	315.1	337.2	337.2	386.2
300	10.2	10.2	10.2	10.2	10.2	31.6	36.1	38.9	38.9	42.9	63.2	72.2	77.7	77.7	85.7	94.9	108.3	116.6	116.6	128.6	158.1	180.4	194.3	194.3	214.4	263.5	300.7	323.8	323.8	357.1
350	8.4	8.4	-	-	8.4	30.3	34.8	-	-	40.3	60.7	69.5	-	-	80.4	91.0	104.3	-	-	120.7	151.6	173.8	-	-	201.1	252.7	289.6	-	-	335.3
400	6.5	6.5	-	-	6.5	29.4	33.9	-	-	36.5	58.9	67.8	-	-	73.3	88.3	101.7	-	-	109.8	147.2	169.5	-	-	183.1	245.3	282.6	-	-	304.9
450	4.6	4.6	-	-	4.6	28.8	33.5	-	-	33.7	57.7	66.9	-	-	67.7	86.5	100.4	-	-	101.4	144.2	167.3	-	-	169.0	240.4	278.8	-	-	281.8
500	2.8	2.8	-	-	2.8	28.2	28.2	-	-	28.2	56.5	56.5	-	-	56.5	84.7	84.7	-	-	84.7	140.9	140.9	-	-	140.9	235.0	235.0	-	-	235
538	1.4	1.4	-	-	1.4	25.2	25.2	-	-	25.2	50.0	50.0	-	-	50.0	75.2	75.2	-	-	75.2	125.5	125.5	-	-	125.5	208.9	208.9	-	-	208.9

(*) (*) Extrapolations from materials with similar CR/NI/MO content
All valves are hydrostatically shell and seat pressure tested to API 598
Shell test: 1.5 x CWP // Seat test: 1.1 x CWP.

MATERIAL SPECIFICATIONS

	ASTM GRADE	MATERIAL DESCRIPTION	UNS DESIGNATION	MIN UTS (Nmm2)	(ksi)	MIN YIELD (Nmm2)	(ksi)	TYPICAL IMPACT (J)	PREn†	NOMINAL COMPOSITION C	Cr	Ni	Mo	Cu	N	V	W	Nb
	A126 Cl B	Cast Iron	F12102	214	71	-	-	-	-	-	-	-	-	-	-	-	-	-
GENERAL	A216 WCB	Carbon Steel	J03002	485	70	250	36	-	-	0.23	-	-	-	-	-	-	-	-
PURPOSE	A105	Forged Carbon Steel	K03504	485	70	250	36	-	-	0.23	-	-	-	-	-	-	-	-
	B148 C95800	Aluminium Bronze	C95800	600	87	250	36	-	-	-	-	4.5	-	79min	-	-	-	-
	A487 4N/4C	Low Alloy Steel	J13047	620	90	415	60	-	-	0.20	0.5	0.5	0.25	-	-	-	-	-
	A352 LCB	Low Temp Carbon Steel	J03003	450	65	240	35	27@ -46˚C(-50˚F)	-	0.23	-	-	-	-	-	-	-	-
	A352 LCC	Low Temp Carbon Steel	J02505	485	70	275	40	27@ -46˚C(-50˚F)	-	0.23	-	-	-	-	-	-	-	-
LOW	A350 LF2	Low Temp Carbon Steel	K03011	485	70	250	36	27@ -46˚C(-50˚F)	-	0.23	-	-	-	-	-	-	-	-
TEMP	A352 LC3	Low Temp Alloy Steel	J31550	485	70	275	40	27@ -101˚C(-150˚F)	-	0.10	-	3.5	-	-	-	-	-	-
	A351 CF8M	Cryogenic Stainless Steel	J92900	485	70	205	30	80@ -190˚C(-320˚F)	27	0.08*	19	10	2.50	-	-	-	-	-
	A351 CF3M	Cryogenic Stainless Steel	J92800	485	70	205	30	80@ -196˚C(-320˚F)	27	0.03*	19	10	2.50	-	-	-	-	-
	A217 WC6	Chrome Moly Steel	J12072	485	70	275	40	-	-	0.10	1.25	-	0.50	-	-	-	-	-
HIGH	A217 C5	Chrome Moly Steel	J42045	620	90	415	60	-	-	0.10	5.0	-	0.50	-	-	-	-	-
TEMP	A217 C12	Chrome Moly Steel	J82090	620	90	415	60	-	-	0.10	9.0	-	1.00	-	-	-	-	-
	A351 CF8M	Stainless Steel	J92900	485	70	205	30	-	27	0.08*	19	10	2.50	-	-	-	-	-
	A351 CF8C	Stainless Steel	J92710	485	70	205	30	-	20	0.08*	19	10	0.5*	-	-	-	-	8 x C
	A217 CA15	Chrome Stainless Steel	J91150	620	90	450	65	-	-	0.10	13	-	-	-	-	-	-	-
HARD	A487 CA6NM	Low Temp Chrome	J91540	760	110	515	80	-	-	0.03	13	4.5	0.75	-	-	-	-	-
WEARING		Stainless Steel																
	A351 CF8M	Stainless Steel	J92900 S31600	495	70	205	30	-	27	0.08*	19	10	2.5	-	-	-	-	-
	A890 4A & A995 4A	22% Chrome Duplex	S31803 J92205	620	90	415	60	45 @ -40˚C (-40˚F)	34	0.03*	22	5.5	3	-	0.15	-	-	-
	-	Ferralium ® 255-3SC	S32550	720	105	450	65	45 @ -40˚C (-40˚F)	39	0.08*	25	6	3.5	2	0.2	-	-	-
	A890 6A & A995 6A	Super Duplex 25% Cr	S32760 J93380	725	105	450	65	-	41	0.03*	25	7.5	3.5	0.75	0.25	-	0.75	-
	A351 CK3MCuN	Super Austenitic	S31254 J93254	550	80	260	38	-	44	0.025*	20	18	6.5	0.75	0.2	-	-	-
CORROSION	A494 CU5MCuN	High Nickel 825	N08826	520	75	240	35	-	-	0.03	21	41	3	2	-	-	-	0.9
RESISTANT	A494 CW-6MC	High Nickel 625	N06625 N26625	485	70	275	40	-	-	0.03	21	62	9	-	-	-	-	3.5
MATERIAL	A494 CW-12MW	Hastelloy ® C276	N10276	495	72	275	40	-	-	0.03	16	57	17	-	-	0.35	4	-
	A494 N-7M	Hastelloy ® B2	N10665	525	76	275	40	-	-	0.03	1*	67	32	-	-	-	-	-
	A494 CX2MW	Hastelloy® C22	N06022	550	80	280	45	-	-	0.02*	22	56	13	-	-	0.3	3	-
	B367C2/B348Gr.2	Titanium	R50400	345	50	275	40	-	-	0.10*	-	-	-	-	-	-	-	-

†PREn = Pitting Resistance Equivalent number

*=max

VALVE FLANGE BOLTING*

STUDS

BOLT GRADE INCH	ALLOY TYPE	TYPICAL DUTY	MIN TEMP. °F	MAX TEMP °F	TENSILE STRENGTH T/Inch^2	YIELD STRENGTH 0.2% PROOF STRESS MIN (T/inch^2)	% ELONGATION	HARDNESS HB	LIMITING RULING SECTION (INCH)	NUT GRADES INCH SERIES	CONDITION AND HEAT TREATMENT
-	-	General Purpose	-4	572	26	-	-	-	-	Carbon Steel	-
BL L7	1% Chromium molybdenum steel	General Purpose	-148	752	56 51	47 43	14 14	248/335 223/310	2.5 4	2H 4. 7 or 8 (L4, 7 or 8 with L7 bolts)	Hardened and tempered Harden 1562°F to 1616°F Temper 1112°F min.
B7A	1% Chromium-molybdenum steel (higher mo)	General Purpose	32	842	56	47	13	248/335	4	2H 4. 7 or 8	Hardened and tempered Harden 1562°F to 1652°F OQ Temper 1112°F
B6	12% Chromium steel	Hard wearing General Purpose	32	932	50 42	38 32	15	185/272 223/310	1.5 4	6 or 8 6F or 8F	Hardened and tempered Harden 1742°F to 1868°F OQ or AC. Temper 1112°F min.
B16	1% Chromium-molybdenum-vanadium steel	General Purpose Mid Temp	32	968	56	47	13	248/335	4	4, 7 or 8	Hardened and tempered Harden 1706°F to 1778°F OQ Temper 1112°F
B16A	1% Chromium-molybdenum-vanadium boron steel	General Purpose Mid Temp	32	1049	55	43	13	248/335	4	7 or 8	Hardened and tempered Harden 1778°F to 1868°F OQ or WQ. Temper 1202°F min.
B8 L8 B8X L8X	Austenitic chromium-nickel 18/8 type steel	Cryogenic High Temp	-418	1057	35 56	13.5 45	35 12	183 max. 350 max.	- 0.75	8. 8F 8X, 8FX	Solution treated 1382°F to 2012°F WQ Cold worked after treatment
B8T, L8T B8C, L8C B8TX, L8TX B8CX, L8CX	Stabilized austenitic austenitic chromium-nickel 18/8 type steel	High Temp High Temp High Temp High Temp	-418	1057	35 56	13.5 12	35 12	183 max. 350 max.	- 0.75	8T 8C	Solution treated 1000C to 1100C WQ Cold worked after solution treatment
B8M, L8M B8MX L8MX	Austenitic-chromium-nickel-molybdenum steel	Cryo/High Cryogenic	-418	1112	35 56	13.5 45	35 12	183 max. 350max.	- 0.75	8M	Solution Treated 1832°F to 2012°F WQ Cold worked after treatment
B17B L17B	Precipitation hardening austenitic nickel-chromium steel	Cryogenic	-418	1202	58	38	15	248/341	-	17B	Solution treated and aged 1h at 1778°F to 1814°F OQ or WQ reheat 1328°F for 16h
B8OA L80A	Precipitation hardening nickel-chromium-titanium-aluminium alloy	High Temp	-418	1382	65	40	15	285/360	-	80A	Solution treated and aged 8h at 1916°F AC 16h at 1292°F AC

NUTS

NUT GRADE IDENTIFICATION SYMBOL	ALLOY TYPE	TYPICAL MIN TEMP °F	TYPICAL MAX TEMP °F	TYPICAL CONDITIONS AND HEAT TREATMENT	HARDNESS HB
2H	Carbon Steel	32	842	Hardened and Tempered. Harden 1580°F Temper 752°F min.	248/352
4. L4	Carbon-molybdenum	-148	968	Hardened and Tempered. Harden 1616°F Temper 1022°F min.	248/352
7	1% Chromium-molybdenum steel	32	1067	Hardened and tempered. Harden 1562°F to 1616°F OQ Temper 1112°F min.	248/352
6, 6F	12% Chromium steel molybdenum steel	32	1067	Hardened and tempered. Harden 1796°F to 1832°F OQ or AC Temper 1112°F min.	223/310
8, 8F 8. 8FX	Austenitic-chromium nickel 18/8 type steel	- 418	1067	Solution Treated 1832°F to 2012°F WQ Cold Worked After Solution Treatment	183 m 350 ma
8T 8C 8TX, 8CX	Stabilized Austenitic Chromium-nickel18/8 type steel	- 418	1067	Solution Treated 1832°F to 2012°F WQ Cold Worked After Solution Treatment	183 max 350 max
8M 8MX	Austenitic-chromium nickel molybdenum steel	- 418	1112	Solution Treated 1832°F to 2012°F WQ Cold Worked After Solution Treatment	183 max 350 max
17B	Precipitation Hardening Austenitic Nickel-Chromium steel	- 418	1112	Solution Treated and aged 1hr at 1778°F to 1814°F OQ or WQ. Reheat 1328°F got 16 hrs.	248/341
80A	Precipitation Hardening Nickel-chromium Aluminimum Alloy	- 418	1382	8 hrs at 1976°F AC 16 hrs at 1282°F AC	285/360

*Will not be supplied unless specifically stated on inquiry and order

CERTIFICATION AND APPROVALS

SUPPLIER No. 42851


CERTIFICATE OF REGISTRATION

Quality Management System

Goodwin International Limited

Newstead Industrial Estate
Trentham
Stoke-on-Trent
Staffordshire
United Kingdom
ST4 8HU

Operate a Quality Management System which complies with the requirements of BS EN ISO 9001:2000 for the activities detailed in the scope of registration.

Certificate No: FM 00343

Signed on behalf of BSI

Originally registered: 17 Aug 1994

BSI Management Systems


CERTIFICATE OF REGISTRATION

Quality Management System

This is to certify that:
Goodwin International Limited
Newstead Industrial Estate
Trentham
Stoke-on-Trent
Staffordshire
ST4 8HU
United Kingdom

Hold Certificate No: FM 00343

and operate a Quality Management System which complies with the requirements of BS EN ISO 9001:2000 for the scope detailed on the following page.

For and on behalf of BSI:

Certification Manager, Systems Assessment

Originally registered: 17 Aug 1994 Latest Issue: 5 Sep 2003 Page: 1 of 2

BSI Management Systems


Achilles

Joint Qualification System

for suppliers to the Oil Industry in Norway and Denmark

Certificate of Qualification

Awarded to

GOODWIN INTERNATIONAL

Company Reg.no: 468115

Achilles Id. 12283

Achilles Information Centre hereby confirms that GOODWIN INTERNATIONAL is qualified in the Achilles Joint Qualification System for suppliers to the Oil Industry in Norway and Denmark. The qualification concerns the product and service categories listed in the appendix.

Issued Date: 8-dec-2006

Expiry Date: 01-Jan-2008


PRESSURE EQUIPMENT DIRECTIVE 97/23/EC
QUALITY ASSURANCE MODULE
CERTIFICATE OF CONFORMITY

Certificate No: CE 55079

(Continuation Sheet)
Additional Information

SCOPE OF CERTIFICATE VALIDITY

Design, manufacture, final inspection and testing of:

- Dual plate check valves
- Wedgeplug valves

- for use in oil, gas, petrochemical and other industries.

Materials include:

- all types of steel and iron from carbon to super duplex
- Non-ferrous alloys including nickel based, titanium etc.

For and on behalf of the BRITISH STANDARDS INSTITUTION
Notified Body Number 0086

Signature
A Boyd
General Manager
Certification

Date 01 March 2002

This Certificate is invalid for products manufactured outside its scope. BSI, Notified Body Number 0086 must be informed and agree intended changes

Prepared by: BSI Product Services, Maylands Avenue, Hemel Hempstead, Hertfordshire, HP2 4SQ, UK. Telephone: +44 (0)1442 230442 Fax: +44 (0)1442 231442

Page 2 of 2


PRESSURE EQUIPMENT DIRECTIVE 97/23/EC
QUALITY ASSURANCE MODULE
CERTIFICATE OF CONFORMITY

Certificate No: CE 55079

Product type	Pressure Accessories
Name and address of manufacturer	Goodwin International Limited Goodwin House Leek Road Stoke-on-Trent Staffordshire ST1 3NR
Name and address Of certificate holder	Goodwin International Limited Newstead Industrial Estate Trentham Stoke-on-Trent Staffordshire ST4 8HU
Date of application For assessment	21 June 2001
Certificate issued on the basis of	Examination under the requirements of Council Directive 97/23/EC Module H of the Pressure Equipment Directive, as transposed into UK law by the Pressure Equipment Regulations SI 1999 No. 2001
Date of assessment	21-22 February 2002
Documents annexed to this Certificate	4268264 dated, 22 February 2002

For and on behalf of the BRITISH STANDARDS INSTITUTION
Notified Body Number 0086

Signature
A Boyd
General Manager
Certification

Date 01 March 2002

This Certificate is invalid for products manufactured outside its scope. BSI, Notified Body Number 0086 must be informed and agree intended changes

Prepared by: BSI Product Services, Maylands Avenue, Hemel Hempstead, Hertfordshire, HP2 4SQ, UK. Telephone: +44 (0)1442 230442 Fax: +44 (0)1442 231442

Page 1 of 2


Score (Europe) Limited
Engineering Research, Design, Manufacture & Repair

Fire Test Certificate

Certificate in Accordance with Specifications
B.S. 6755 PART 2 1987, API 6FA 2nd EDITION 15 FEBRUARY 1994
and API 6FD 1 ST EDITION 15 FEBRUARY 1995
a CHECK VALVE
Body Material ASTM A216 WCB
Seat Material VITON B FR58/00
Size 16" Class ANSI 150
Manufactured by GOODWIN INTERNATIONAL
has been tested by Score (Europe) Limited on 24/07/98
at Score's Cowdenbeath works and has complied with the requirements

This certificate must be read in conjunction with test report S71997-5

Test carried out by R HEPBURN / W HAY Score (Europe) Limited

Test witnessed by WAIVED - by Manufacturer
Test witnessed by W CAMPBELL - Lloyds Register

To Certifying Authority


СИСТЕМА СЕРТИФИКАЦИИ ГОСТ Р
ГОССТАНДАРТ РОССИИ

СЕРТИФИКАТ СООТВЕТСТВИЯ

№ РОСС GB.АЯ45.В04159

Срок действия с 22.03.2006 по 21.03.2009

6964303

ОРГАН ПО СЕРТИФИКАЦИИ РОСС RU.0001.11АЯ45

ПРОДУКЦИЯ

Затворы обратные типов BR, BFR, BFT, BSR, BTR, BHR, BWR, BWA, DN 40-3500 (1 1/2"-144"), PN 20-420 кгс/см² (класс ANSI 150-2500), API 594, API 598
Серийный выпуск

код ОК 005 (ОКП): 37 4240

СООТВЕТСТВУЕТ ТРЕБОВАНИЯМ НОРМАТИВНЫХ ДОКУМЕНТОВ

ГОСТ 12.2.063-81, ГОСТ 13252-91 (п.п. 1.2, 1.3, 2.7, 2.14, 2.15, 2.18, разд. 3, 5), нормам и правилам Госгортехнадзора России

код ТН ВЭД России: 8481 30 910 0

ИЗГОТОВИТЕЛЬ

GOODWIN International Ltd.
Goodwin House, Leek Road, Stoke-on-Trent, England, ST1 3NR

СЕРТИФИКАТ ВЫДАН

GOODWIN International Ltd.
Goodwin House, Leek Road, Stoke-on-Trent, England, ST1 3NR
тел. 44(0)178 222 0000, факс 44(0)178 220 8060

НА ОСНОВАНИИ

- протоколов испытаний № МИ38-5711 от 31.01.2006 ИЦ НП "СЦ НАСТХОЗ", рег. № РОСС RU.0001.21МН26;
- акта о результатах анализа состояния производства от 07.02.2006;
- письма № 52/2137 от 14.10.1999 ГШ СМИ МЗ РФ;
- писем № 01/08/919-06-23 от 01.02.2006 Росморречфлота и № 01-06/3926 от 08.02.2006 ФТС РФ

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Руководитель органа Н.В. Фадеков

Эксперт М.М. Померанцев

Сертификат имеет юридическую силу на всей территории Российской Федерации


ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ЭКОЛОГИЧЕСКОМУ, ТЕХНОЛОГИЧЕСКОМУ И АТОМНОМУ НАДЗОРУ

РАЗРЕШЕНИЕ

№ РРС 00-21043

На применение

Оборудование (техническое устройство, материал):
Затворы обратные типов BR, BFR, BFT, BSR, BTR, BHR, BWA, BWR с условными проходами DN от 40 до 3500 (от 1 1/2" до 144") на условное давление PN от 20 до 420 кгс/см² (классы ANSI от 150 до 2500).

Код ОКП (ТН ВЭД): 37 4240 (8481 30 910 0)

Изготовитель (поставщик): Фирма "GOODWIN International Ltd." (Великобритания).

Основание выдачи разрешения: Техническая документация, заключение экспертизы промышленной безопасности НП "СЦ НАСТХОЗ" № 260 от 02.03.2006 г.

Условия применения:
1. Обеспечение соответствия поставляемой трубопроводной арматуры требованиям правил промышленной безопасности, действующих в Российской Федерации.
2. Применение трубопроводной арматуры на объектах подконтрольных Ростехнадзору.

Срок действия разрешения до 01.06.2009

Дата выдачи 01.06.2006

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