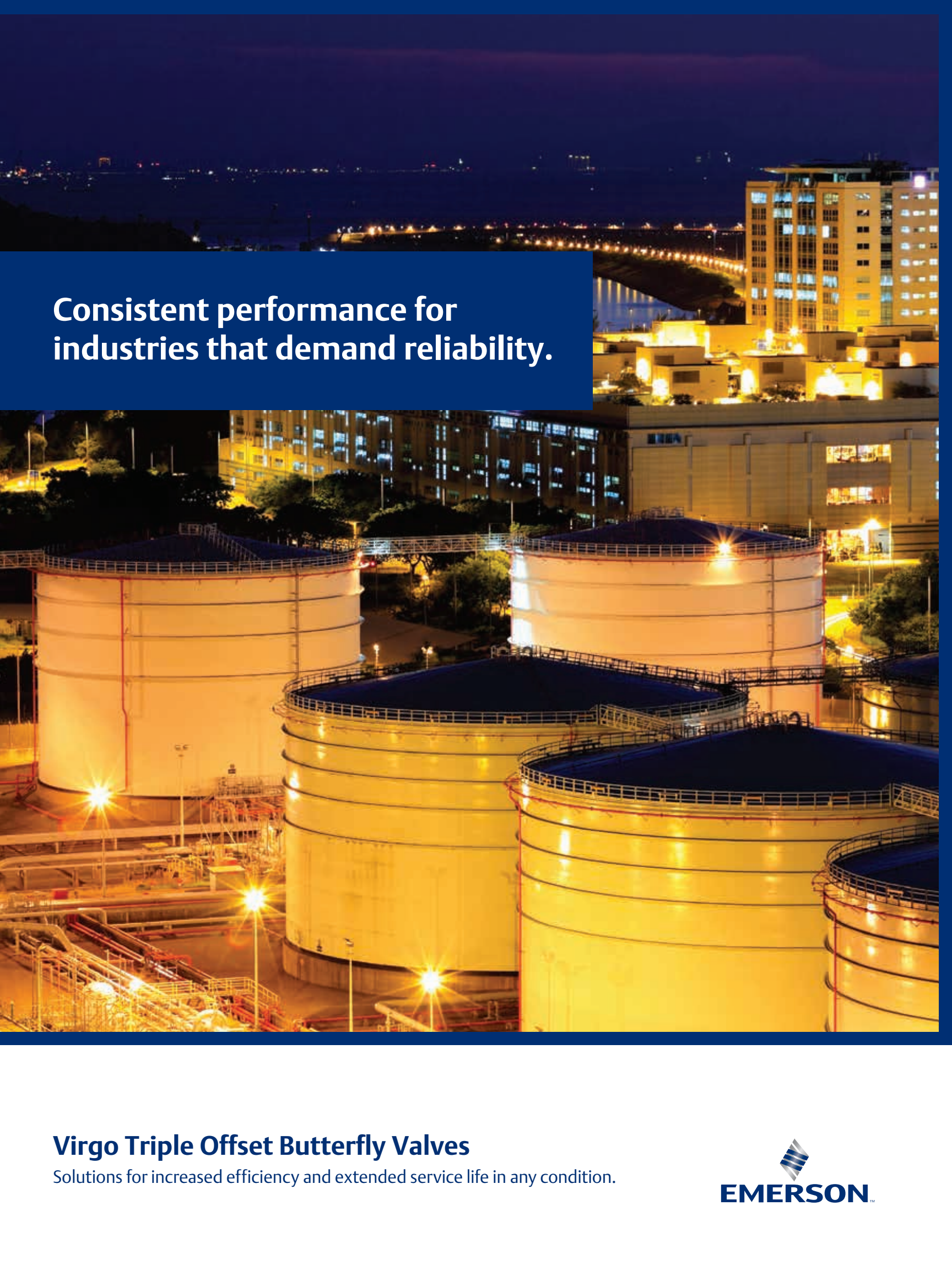


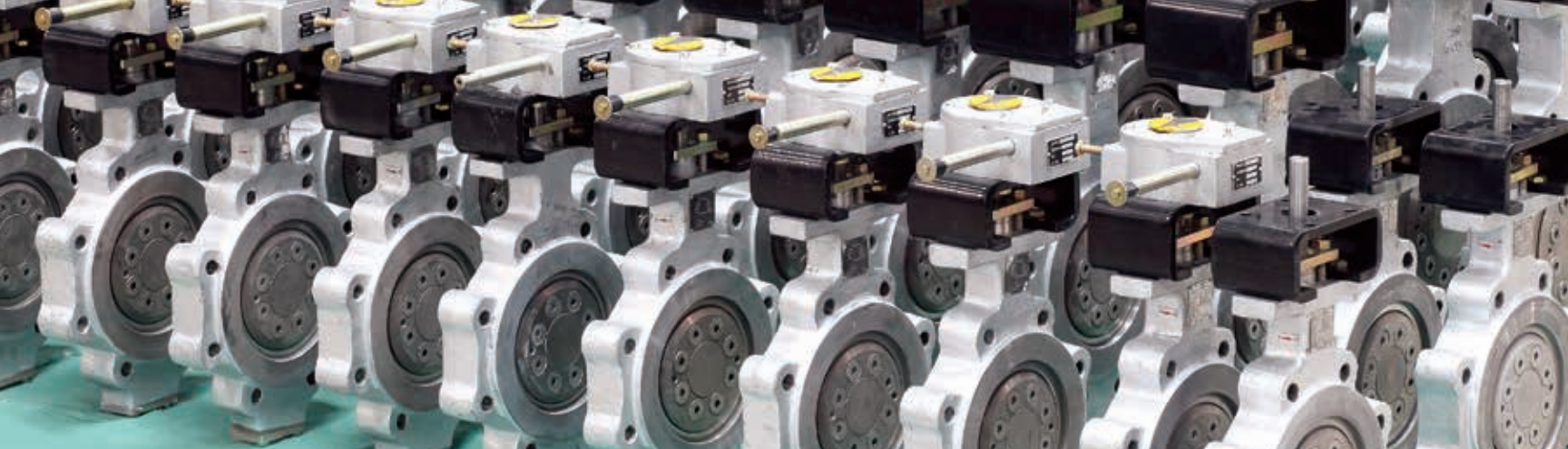


**Consistent performance for
industries that demand reliability.**

Virgo Triple Offset Butterfly Valves

Solutions for increased efficiency and extended service life in any condition.





Minimal maintenance. Small footprint. Zero leakage. What else could you want in a process valve?

Leaking valves pose safety and environmental hazards and result in operating losses. Your company suffers costly downtime when the process is taken offline to repair or change out valves. Replace unreliable equipment with Virgo's Triple Offset Butterfly Valves from Emerson.

The Virgo Triple Offset Valve (TOV) is a quarter-turn, metal-to-metal sealing, zero leakage valve. Lighter weight compared to other types of valves, it features low operating torques, high cycle life, an inherently fire-safe design, a one-piece shaft with blowout-proof construction, sealed bearings, and adjustable shaft seals for low emissions.

Virtually maintenance-free, the Virgo TOV provides a longer service life at a lower cost than competing valves.

The versatility of design and construction allows for use in various applications and within a broad range of temperatures.

Unlike conventional butterfly and gate valves whose seats are chafed with every stroke, the design of the Virgo TOV provides a non-rubbing, open/close operation. Additionally, its torque-assisted seal assures tight shut-off and uniform contact without wear which translates to better performance over a longer life.

Virgo Triple Offset valves are the ideal choice for isolation. Where automation is required, actuation packages are available such as emergency shutdown, Safety Instrumented Systems (SIS), line break systems and remote operations.

Virgo TOV provides consistent performance with demanding processes, such as steam, vacuum, high pressure and cycled services. The Virgo TOV is relied upon in oil and gas process lines, refineries, power plants, sea water treatment facilities, pump stations, wastewater effluent treatment plants, circulating water systems, desalination facilities and cooling water system applications.



COMMON APPLICATIONS

- Isolation
- Fire Protection
- Storage and Transfer
- On / Off
- Safety Instrumented Systems
- Bypass Stations
- Emergency Shut-Down



PERFORMANCE ADVANTAGES

The Virgo triple offset design material configurations afford the highest level of safety, compliance and performance in even the toughest applications

Highly reliable — Virgo products are designed using the latest engineering tools and manufactured in our state-of-the-art facilities, resulting in products that are built to last.

Lightweight and compact — The Virgo TOV footprint is half the size of the typical gate valve, making it an ideal substitute. It is compact and lightweight enough to keep in spares inventory for rapid replacement when other valves fail.

Easy automation — Low torque and standardized mounting design allow for easy integration in a variety of automated systems.

Long life expectancy — Virgo TOV's metal-to-metal sealing and non-rubbing features mean less wear, resulting in extended service life.

THE VIRGO TRIPLE OFFSET VALVE CONFORMS TO API 609 DESIGN SPECS, MAKING IT APPLICABLE ACROSS A WIDE RANGE OF INDUSTRIES.

REFINING

- Isolation
- Steam supply
- Sulfur condenser switch
- FGD
- FCC
- Terminals and tank farms
- Coker plants
- Fire suppression

PETROCHEMICALS / CPI

- Flare gas
- Manifold isolation
- Hydrocarbon gas service
- Pump isolation
- ESDV

UTILITIES

- Water pipelines
- District storage and distribution
- Steam service

POWER PLANTS

- Pump isolation
- Condenser cooling
- Heat exchanger
- Suppression system
- Condensate cooling water
- Steam generation
- Gas turbine isolation

OTHERS

- LNG
- GTL
- Tanks and terminals
- Abrasive services
- Fire suppression
- Mining
- Salt water distillation
- Marine

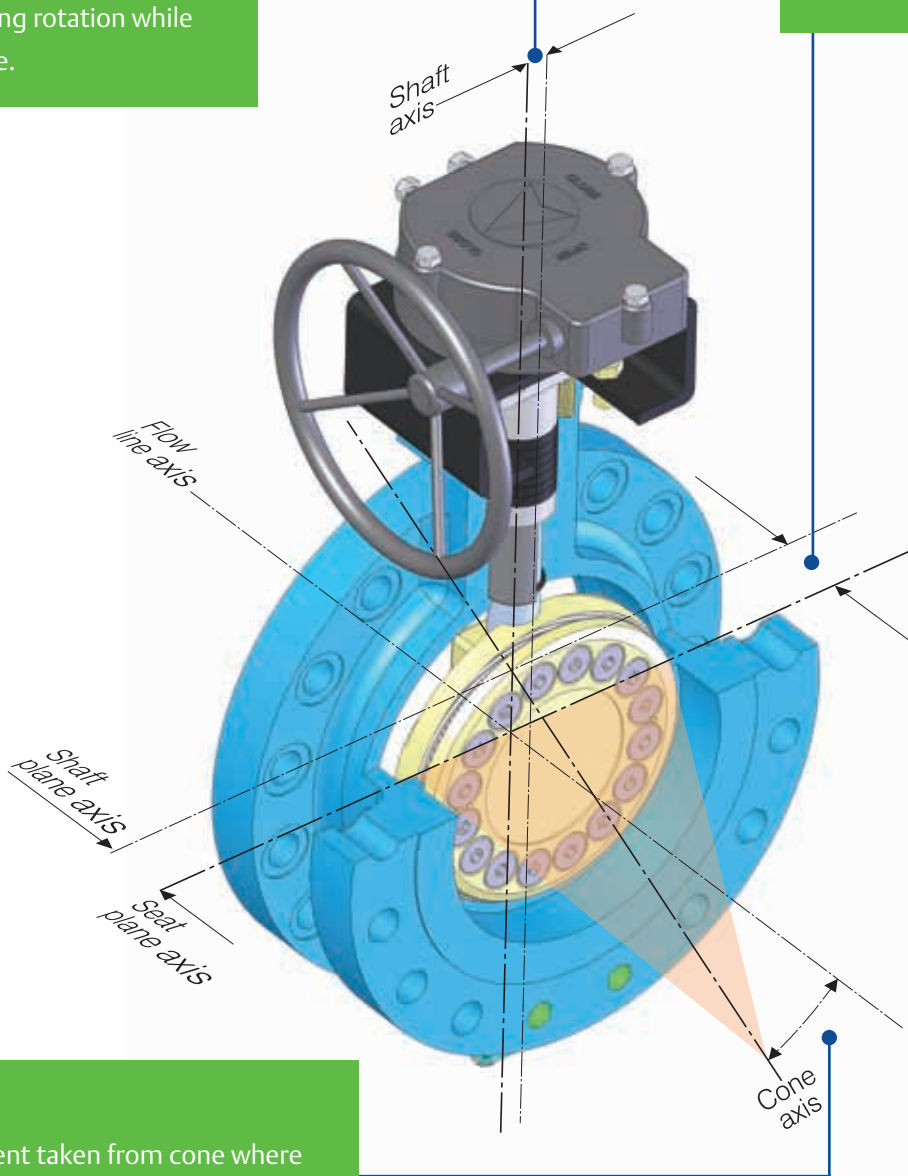
Technical Details

OFFSET 1

First offset is a distance by which shaft is displaced from normal to flow line axis, thereby giving camming effect and reduced rubbing rotation while operating the valve.

OFFSET 2

Second offset is between shaft plane and seat plane, which allows complete sealing contact around the seat.



OFFSET 3

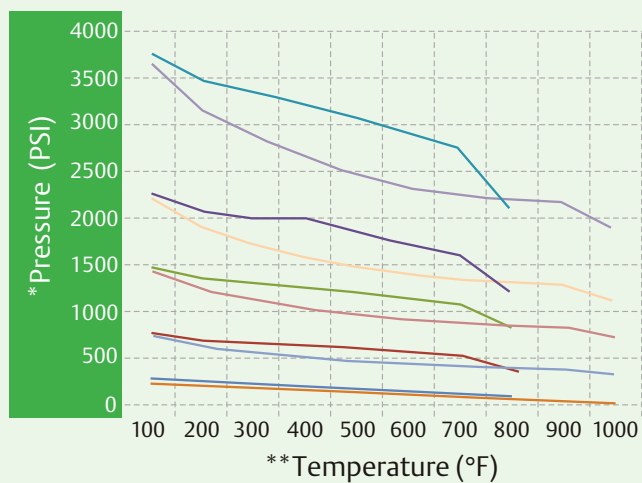
The seal is a segment taken from cone where apex of the cone is offset (3rd) from the flow line axis, which eliminates rubbing completely.

Valve Size	Hydro Seat Testing (Drops per minute)		Gas Seat Testing (Bubbles per minute)	
	TriTork	Metal Seated Valve (Gate & Ball)	TriTork	Metal Seated Valve (Gate & Ball)
<2"	0	0	0	0
2-1/2" - 6"	0	2 / NPS	0	4 / NPS
8" - 12"	0	2 / NPS	0	4 / NPS
>14"	0	2 / NPS	0	4 / NPS

- Notes:
- Gas test is carried out using air.
 - For metal seated valves, allowable leakage rate values are taken from API 598.
 - As per API 598, 'Zero' drops means no visible leakage per minimum specified test duration for liquid test and 'Zero' bubbles means less than one bubble per minimum specified test duration for gas test.
 - Performance is in preferred direction only.
 - NPS = Nominal Pipe Size

	Body	Size	Rating
Double Flanged (Short Pattern)		3" to 56"	150, 300
		3" to 48"	600
Double Flanged (Long Pattern)		3" to 56"	150
		3" to 36"	300, 600
Lug / Wafer		3" to 56"	150, 300
		8" to 24"	600

PRESSURE-TEMPERATURE RATING (AS PER ASME B16.34)

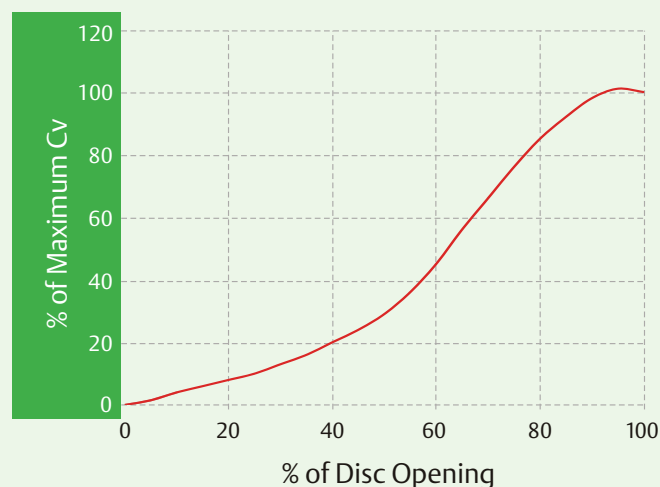


■ WCB # 1500 ■ WCB # 900 ■ WCB # 600 ■ WCB # 300 ■ WCB # 150
 ■ CF8M # 1500 ■ CF8M # 900 ■ CF8M # 600 ■ CF8M # 300 ■ CF8M # 150

Notes: * For higher pressure classes, please contact your Emerson Automation Solutions representative.

** Standard seal 575° F limit. Optional seals available for higher temperatures.

TYPICAL FLOW CHARACTERISTICS



REFERENCE STANDARDS

Design and Manufacturing	API 609 (Category B), ASME B16.34, BS EN 593
Face-to-Face / End-to-End	API 609, ASME B16.10, ISO 5752 Series 13, ISO 5752 Series 14
End Connection	ASME B 16.5 for flanged end up to 24" / ASME B16.47 for larger size Series A and B
Testing	API 598, ANSI / FCI 70-2
Safety	SIL3
Fire Test	API 607 / ISO 10497-5, API 6FA
Fugitive Emission Testing	MESC 77/312, ISO 15848-1
Material Conformance	NACE MR 01-75
Product Compliance	Pressure Equipment Directives PED (97/23/EC), EAC

*Note: Environmental restrictions may apply. End User's responsibility to request

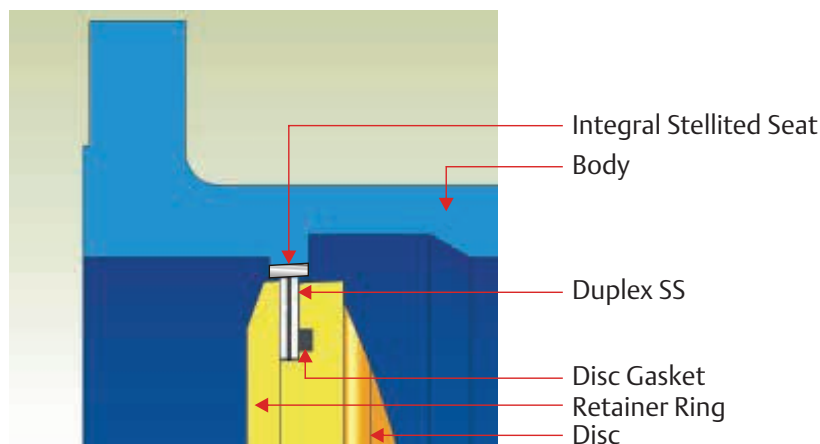
Design Features

LOW EMISSION SHAFT SEAL

Adjustable shaft packing with multiple graphite rings located between two anti-extrusion rings control fugitive emission and give longer packing life. Gland packing with live loading is available as an option.

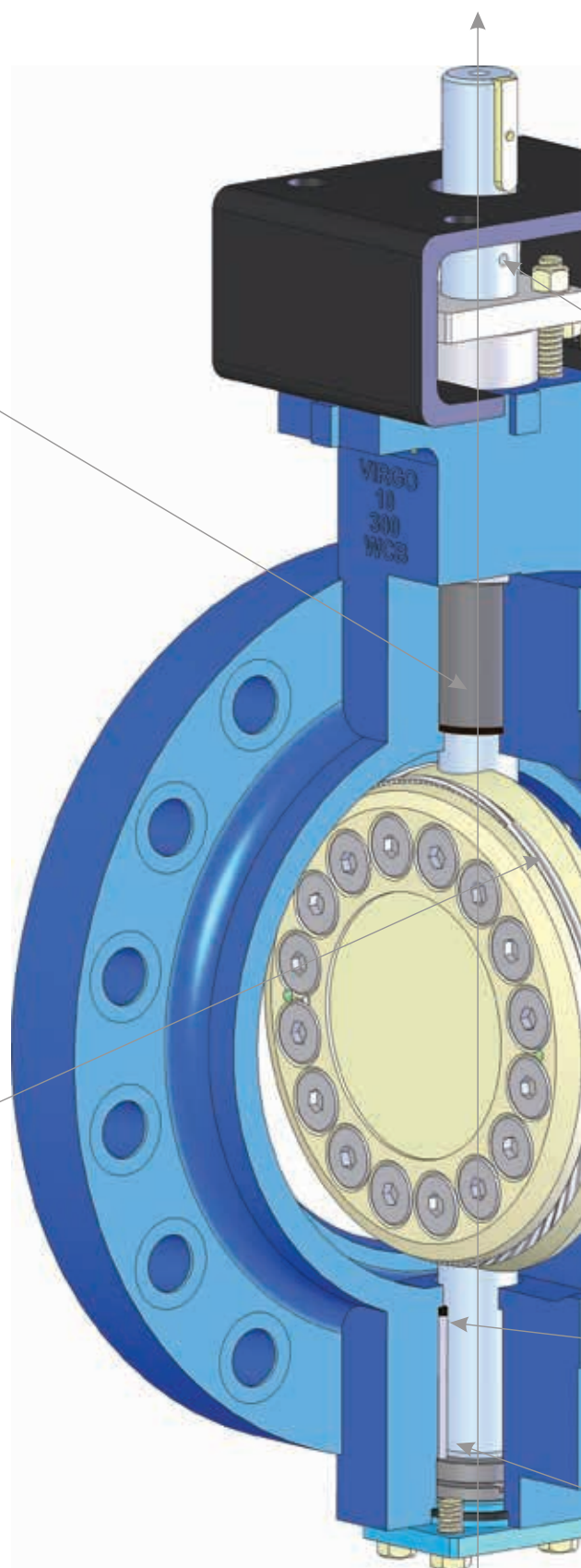
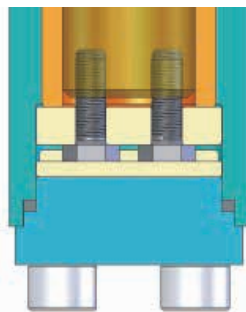
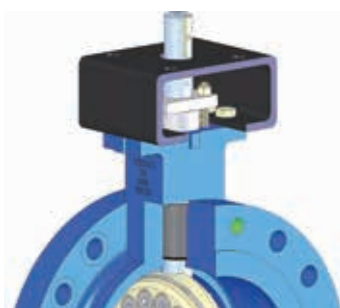
METAL-TO-METAL 'ZERO' LEAKAGE

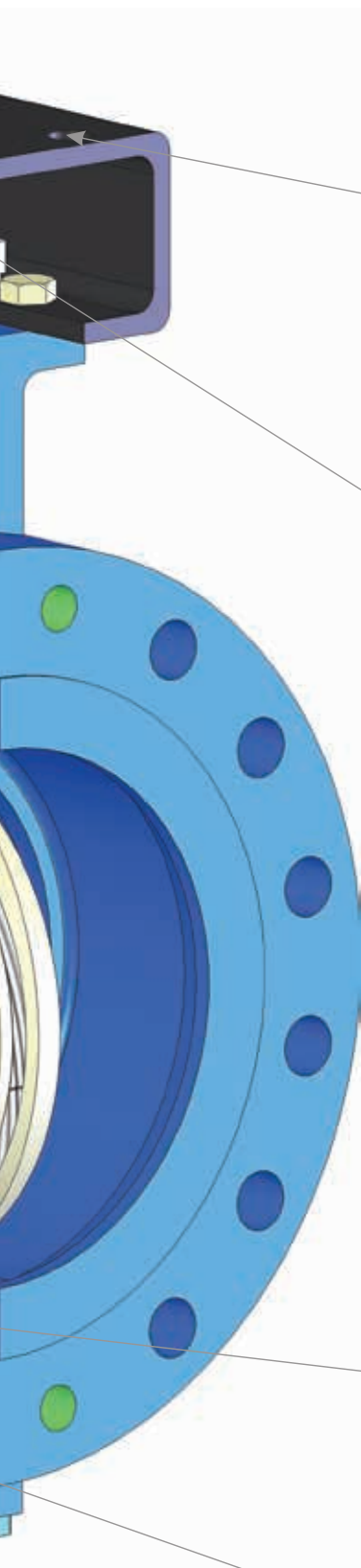
Laminated resilient seal ring flexes to give uniform wedging effect and ensures 'ZERO' leakage. Resiliency of seal ring allows for the valve body and disc to expand or contract relative to each other without the risk of jamming while maintaining tight shut-off. Seal ring, secured but not locked in the disc by retainer ring and bolting, has radial freedom of movement. Spiral wound gasket behind seal ring ensures leak proof joint.



EXTERNALLY RETAINED BLOW-OUT PROOF DESIGN

Engineered gland design gives shaft blow-out proof protection externally, conforming to the requirements of API 609, (Category B).



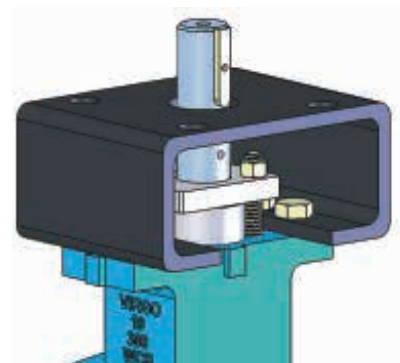


STANDARD MOUNTING

Bracket top side drilling and shaft connection as per ISO 5211.

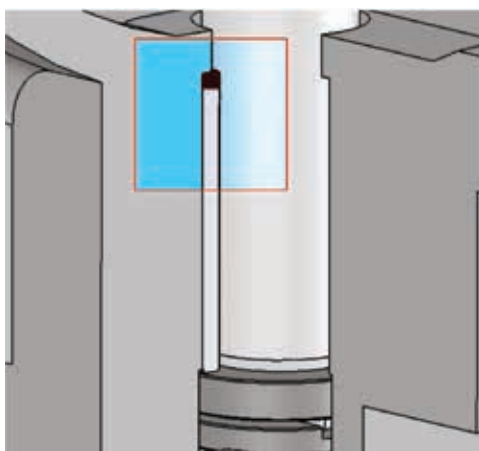
EXTERNAL INDICATOR FOR DISC POSITION

Disc position is indicated by dimple on shaft. When the dimple is in-line with flow axis, disc is open.



BEARING PROTECTION

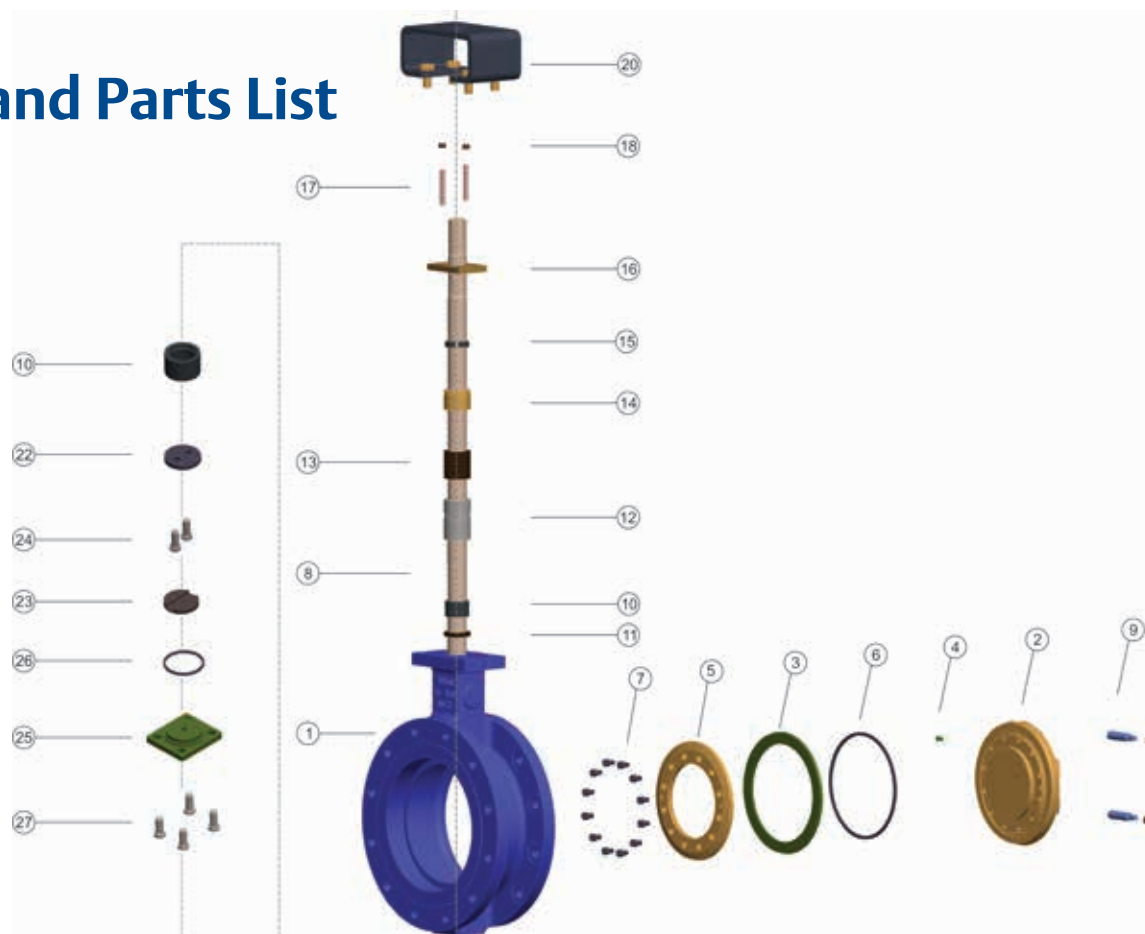
Graphite ring in bearing ensures protection against ingress of line media in to the bearing surface and thus avoids jamming of shaft.



ONE-PIECE SHAFT

One-piece shaft is guided by long bearings, which are placed nearer to disc for close support. Bearings are super finished and nitrided for trouble free life. Within the pressure boundary area, the shaft design provides added strength.

Diagram and Parts List



No.	Description	Carbon Steel	Stainless Steel
1	BODY	ASTM A216 Gr. WCB*	ASTM A351 Gr. CF8M*
1a	SEAT (INTEGRAL WITH BODY)	(STELLITE®) COBOLT CHROMIUM ALLOY 21	(STELLITE®) COBOLT CHROMIUM ALLOY 21
2	DISC	ASTM A216 Gr. WCB (with ENP)	ASTM A351 Gr. CF8M
3	SEAL RING**	DUPLEX+ GRAPHITE #	DUPLEX+ GRAPHITE #
4	SEAL RING LOCATING PIN	SS 316	SS 316
5	RETAINER RING	ASTM A516 Grade 60 (with ENP)	ASTM A240 TYPE 316
6	DISC GASKET**	SPIRAL WOUND SS316 +GRAPHITE	SPIRAL WOUND SS316+ GRAPHITE
7	RETAINER SCREWS	ASTM A193 Gr. B8M	ASTM A193 Gr. B8M
8	SHAFT	ASTM A479 TYPE 410	ASTM A564 TYPE 630
9	DISC PIN [§]	ASTM A479 TYPE 410	ASTM A564 TYPE 630
10	BEARING	ASTM A479 TYPE 316 (NITRIDED)	ASTM A479 TYPE 316 (NITRIDED)
11	BEARING PROTECTOR**	GRAPHITE	GRAPHITE
12	SPACER	ASTM A479 TYPE 316	ASTM A479 TYPE 316
13	GLAND PACKING**	GRAPHITE	GRAPHITE
14	GLAND	ASTM A479 TYPE 316	ASTM A479 TYPE 316
15	ANTI-BLOW OUT RING	ASTM A479 TYPE 316	ASTM A479 TYPE 316
16	GLAND PLATE	CARBON STEEL	STAINLESS STEEL
17	GLAND STUD	ASTM A193 Gr. B7M	ASTM A193 Gr. B8M
18	GLAND NUT	ASTM A194 Gr. 2HM	ASTM A194 Gr. 8M
19	SHAFT KEY (Not Shown)	UNS G10400	UNS G10400
20	BRACKET	CARBON STEEL	STAINLESS STEEL
21	BRACKET HEXBOLT	ASTM A193 Gr. B7M	ASTM A193 Gr. B8M
22	THRUST WASHER	ASTM A479 TYPE 316 (NITRIDED)	ASTM A479 TYPE 316 (NITRIDED)
23	STOP WASHER	ASTM A479 TYPE 316 (NITRIDED)	ASTM A479 TYPE 316 (NITRIDED)
24	ADJUSTABLE SCREW	ASTM A193 Gr. B8M	ASTM A193 Gr. B8M
25	BOTTOM FLANGE	ASTM A516 Grade 60	ASTM A240 TYPE 316
26	BOTTOM FLANGE GASKET**	SPIRAL WOUND SS316+ GRAPHITE	SPIRAL WOUND SS316+ GRAPHITE
27	BOTTOM FLANGE SCREWS	ASTM A193 Gr. B7M	ASTM A193 Gr. B8M

Notes: # Solid metal seal ring can be made available on request.

* Other materials of construction such as Alloy Steel, Super Austenitic SS, Inconel®, Duplex SS, Super Duplex SS, etc. can be made available on request.

** Available as spares

§ For 3" and 4" sizes, "Disc Keys" are used.

PRODUCT SELECTION CODES

Series	Ends	Size		Rating	Body	Disc	Seat (Integral)	Seal Ring	Shaft	Operator	Application/Service
TTF	RF	03	26	1	41	41	H	TN	TV	B	C
TTG	RS	04	28	2	42	42	Z	89	A3	E	E
TTL	FF	06	30	3	43	43		I8	QI	G	F
TTW	FS	08	32	6	44	44		CY	C9	H	J
TTB	RT	10	34	9	45	45		D1	FW	P	P
	BW	12	36		46	46		64	D1	EH	Z
		14	40		47	47		ZQ	J3		
		16	42		30	30		ZZ	L6		
		18	48		31	31			ZZ		
		20	56		D9	D9					
		24			IN	IN					
					S9	S9					
					QN	QN					
					RF	RF					
					ZZ	ZZ					

Series	
TTF	Double Flanged (Short Pattern)
TTG	Double Flanged (Long Pattern)
TTL	Lug (End Connection with Tapped Holes)
TTW	Lug (End Connection with Thru Holes)
TTB	Butt Weld End connection

Ends	
RF	Raised Face Serrated
RS	Raised Face Smooth
FF	Flat Face Serrated
FS	Flat Face Smooth
RT	Ring Type Joint
BW	Butt Weld End

Size		
3 – 3"	16 – 16"	32 – 32"
4 – 4"	18 – 18"	34 – 34"
6 – 6"	20 – 20"	36 – 36"
8 – 8"	24 – 24"	40 – 40"
10 – 10"	26 – 26"	42 – 42"
12 – 12"	28 – 28"	48 – 48"
14 – 14"	30 – 30"	56 – 56"

Rating	
1	#150
2	#1500
3	#300
6	#600
9	#900

Body & Disc	
41	WCB
42	LCB
43	CF8
44	WCC
45	CF8M
46	CF3M
47	CF3
30	WC6
31	WC9
D9	LCC
IN	Inconel®
S9	Gr. 4A
QN	Gr. 5A
RF	Gr. 6A
ZZ	Others

Seat (Integral)	
H	Hard Faced (Stellite®)
Z	Others

Seal Ring	
TN	Duplex + Graphite
89	SS 316 + Graphite
I8	Inconel® 625 + Graphite
CY	XM 19 + Graphite
D1	Duplex
64	SS 316
ZQ	XM 19
ZZ	Others

Shaft	
TV	SS 410
A3	17-4 PH
QI	Inconel® 718
C9	F6a
FW	XM 19
D1	F 51
J3	F 53
L6	F 55
ZZ	Others

Operator	
B	Bare Shaft
E	Electrical Actuator
G	Gear Operator
H	Hydraulic Actuator
P	Pneumatic Actuator
EH	Electro - Hydraulic Actuator

Application/Service	
C	Cryogenic
E	Extended Shaft
F	Finned Bonnet
J	Jacketed
P	Purge applications
Z	Standard requirement

Example:

TTF	RF	08	1	41	41	H	TN	TV	G	Z
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This code stands for double flanged (short pattern), raised face serrated, 8" #150, body & disc WCB, seat hard faced (Stellite®), seal laminated duplex + graphite, shaft SS 410, gear operated without special requirements.

Butt Weld End Valves can be provided on request.

Stellite® is the registered trademark of the Kennametal Stellite Company.
Inconel® is a registered trademark of Special Metals Corporation.

Why Virgo?





RELIABLE PRODUCTS AT A COMPETITIVE PRICE

Emerson's investment in superior manufacturing equipment, an ongoing commitment to keep their employees well-trained and the quest for upper quartile performance are just a few items that drive our mission for the highest in-class quality. At the same time, our global supply chain and manufacturing allows us to produce products at very competitive prices when compared to other high-quality valve manufacturers.

EXPERT PROJECT MANAGEMENT

Virgo valves have been supplied to over 2300 projects around the globe, both large and small. We help our customers maintain project certainty by presale design collaboration, a structured project execution process and maintaining flexibility throughout the manufacturing process. The result is a responsive supplier that supports you throughout the process and meets the promised delivery dates.

SINGLE POINT ACCOUNTABILITY

Emerson owns the complete process from design, manufacturing, assembly, automation, proof testing, integration, and lifecycle coverage. Emerson goes to great lengths to maintain full process accountability that only a few industry-leading manufacturers can provide. This includes having our own in-house foundry, which enables Emerson to maintain the highest quality standards on all Virgo products.

LOCAL SUPPORT AND A GLOBAL PRESENCE

Our vast network of Sales Offices and Local Business Partners (LBPs) are available to support our customers around the globe. We provide our customers superior pre- and post-sales support, local inventory as well as a comprehensive range of other services.

SAFE, PROVEN PRODUCTS

We are committed to delivering quality products that meet or exceed our customers' expectations. This commitment starts with thorough testing of our products to ensure they comply with the latest standards and maintain the highest safety ratings. These products are then certified by respected third party organizations. Our commitment is backed by years of experience in many of the most demanding applications around the globe. We have supplied over 1 million valves to more than 150 of the world's leading EPCs, OEMs, and end users and they keep coming back to Emerson over and over.

For more information about Virgo Triple Offset Valves, contact your local Emerson sales office or Emerson Automation Solutions representative.



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