

Valbart™ CEGV Compact Expanding Gate Valve



Expanding gate reliability

The Valbart CEGV compact expanding gate valve is a fabricated body-expanding gate valve manufactured and tested in accordance with API 6D, latest edition. Its design is fully compliant to ASME Section VIII, Division 1 (ASME Boiler and Pressure Vessel Code: Rules for Construction of Pressure Vessels). Additionally, the design meets API 6D isolation features of block and bleed, double isolation bleed (DIB), double block and bleed, cavity relief, and other requirements

commonly specified in the pipeline industry. The compact expanding gate design features a full-bore diameter, with a compact, non-through conduit design providing a compact and lightweight valve package. Valbart expanding gate valves are engineered to achieve tight shutoff at high and/or low pressures in liquid or gas services. The expanding gate and segment design provides a high-integrity seal for a variety of critical applications, while affording lower operating friction.

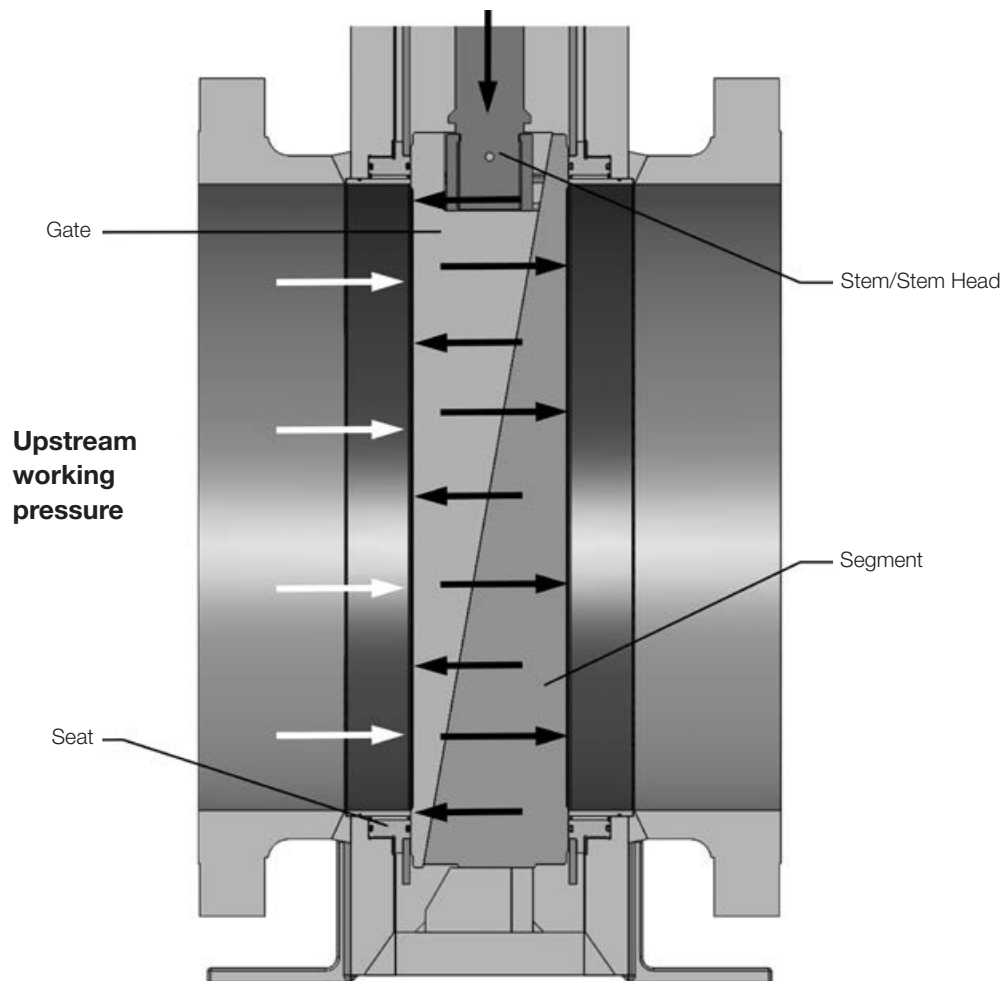


Figure 1: Compact expanding gate sealing

Positive sealing mechanism

The expanding gate and segment design of the CEGV is designed to push against the seats for positive sealing, even at low pipeline pressures. As the gate and segment expand against each other and move into the closed position, the contact pressure against the seats increases, creating a positive seal in both the upstream and downstream directions. The mechanical action of the gate/segment expansion does not require pipeline pressure to assist in the sealing, providing a positive seal at low pipeline pressures. In addition, the wedging action of the gate/segment multiplies the loading against the seats, creating high seating forces that are unaffected by higher pipeline pressures. A positive seal is accomplished, regardless of the pressure within the pipe.

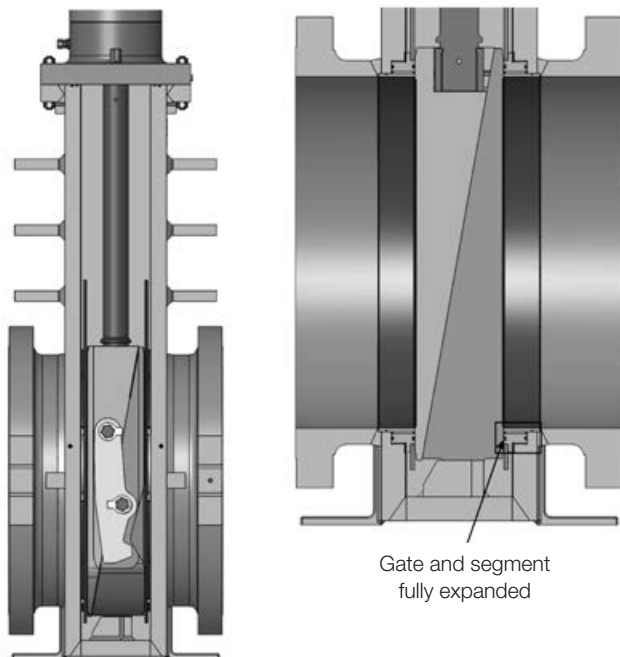


Figure 2a: CEGV sealing mechanism in fully closed position

The sealing mechanism of the CEGV operates as follows:

- Gate and segment components move up and down to open and close positions of the valve.
- At the closed position **Figure 2a**, a stop in the body stops motion of the segment, while the stem continues to drive the gate downward. This relative motion causes the gate and segment to expand outward against the seats.
- The gate and segment expand against both seats, allowing simultaneous upstream and downstream sealing.
- Positive contact between the gate/segment and seats creates a tight seal, regardless of pipeline pressure.
- In the open position **Figure 2b**, the gate and segment are contracted, allowing contact-free movement during opening and closing strokes, which extends the lifespan of the valve based on friction-free operation.
- On opening stroke from the closed position, the control arm engages the guide plate and pivots, causing the gate and segment to un-wedge and contract inward, away from the seats.
- As the stem travels to the fully open position, the gate and segment remain contracted together, allowing for friction free movement, with lower operating torque.

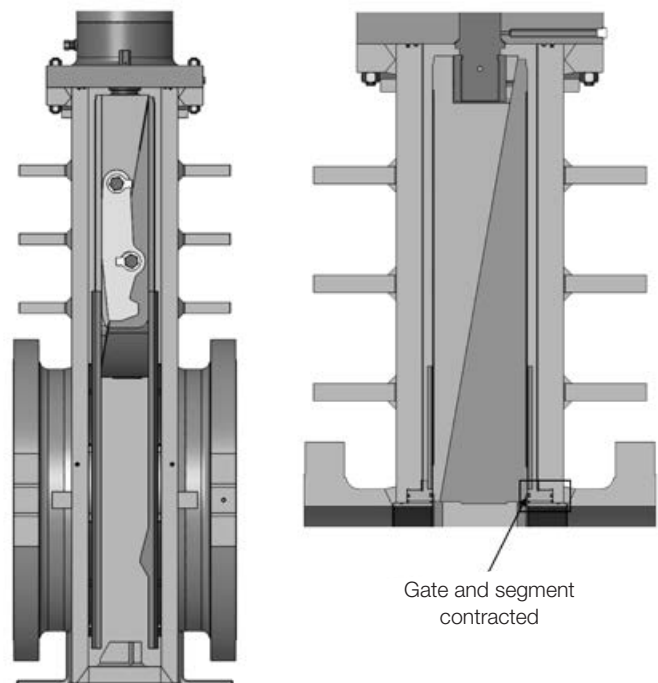


Figure 2b: CEGV sealing mechanism in fully open position

Sealing application capabilities

Compact expanding gate valves are typically used in the oil and gas industry for installation in liquid products and secondary recovery, midstream and downstream pipelines. Typical applications include, but are not limited to:

- Tank and station valves
- Manifold valves
- Kicker valve on launcher/receiver stations
- Meter bypass valves
- Emergency shutdown valves
- Transmission and distribution pipelines

The CEGV engineered bore sealing mechanism utilizes a soft seal enclosed within a metal-to-metal seat providing positive uncompromising isolation for severe/heavy-duty services involving:

- Abrasive fluids/sandy services
- High-temperature services
- Service conditions requiring full reliability such as emergency shutdown valves (ESDV)

Double block and bleed (DBB) (API 6D)

In its closed position, two seating surfaces provide sealing against pressure from both ends of the valve, with a means of venting or bleeding pressure in the cavity between the seating surfaces. See **Figure 3**.

Double isolation and bleed (DIB) (API 6D)

In its closed position, each of the two seating surfaces provides a seal against pressure from a single source, with a means of venting or bleeding pressure in the cavity between the seating surfaces. See **Figure 4**.

Bi-directional, bubble-tight sealing

Valve seats are designed to seal against upstream or downstream pressure sources in either direction with the cavity vented. See **Figure 5**.

Block and bleed (BB) types A and B (API 6D):

In the closed position, at least one sealing surface provides sealing against pressure from one end of the valve (P_A or P_B) with the body cavity vented ($P_C = 0$).

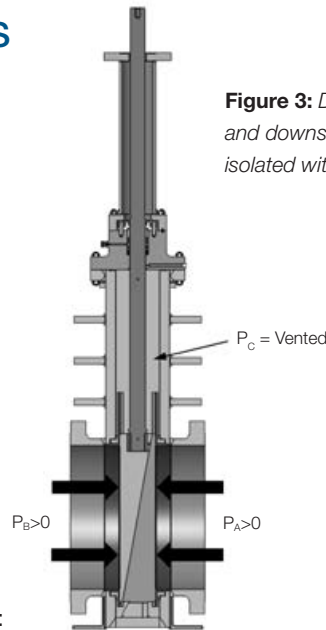


Figure 3: DBB: Upstream side (P_A) and downstream side (P_B) simultaneously isolated with cavity vented

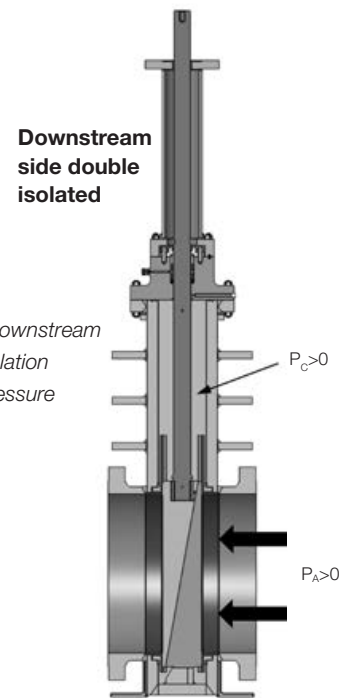


Figure 4: DIB: Downstream seat provides isolation against cavity pressure

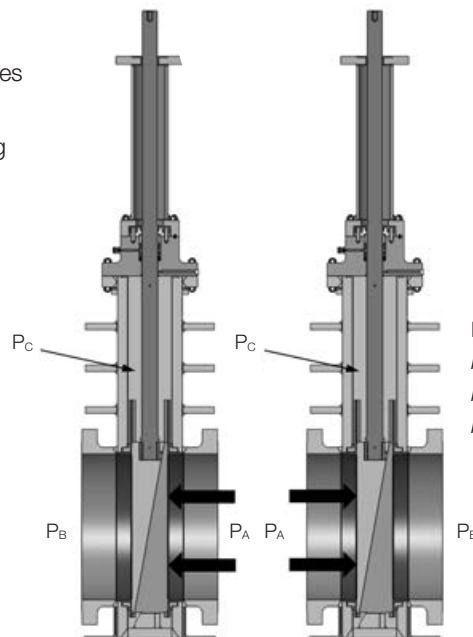


Figure 5: Bi-directional sealing
 P_A – Upstream pressure
 P_B – Downstream pressure
 P_C – Cavity pressure

Design features

Fabricated body construction with engineered ribs profile

The compact expanding gate valve has a robust fabricated design with a high strength-to-weight ratio. The wall sections and ribs have been engineered using state-of-the-art finite element analysis for optimizing strength over weight and ensuring material is placed where needed. This minimizes body and seat deflection and assures solid sealing performance up to the valve's rated pressure. See **Figure 6**.

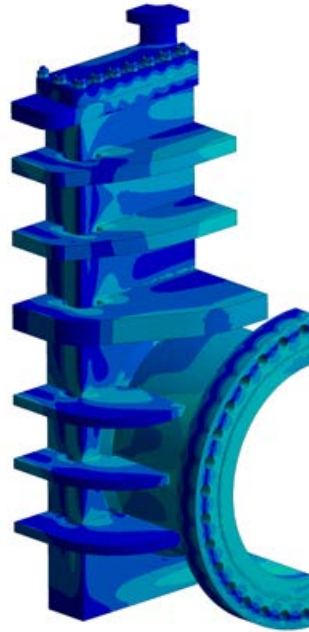


Figure 6: FEA analysis on valve body

Positive sealing at all line pressures

The wedging action of the gate and segment components against the seats ensures a positive seating load at all line pressures. As the operating force is increased, the wedging mechanism increases the load against the seats, creating an even tighter seal. See **Figure 7a**.



Figure 7a: Gate and segment expanded against seats

Low-friction, long-life seats

A control arm contacts the guide plate as the valve is opened, causing the control arm to pivot and “un-wedge” the gate and segment from each other. This allows friction-free travel to the open position, reducing operating loads and decreasing wear on the sealing components. See **Figure 7b**.

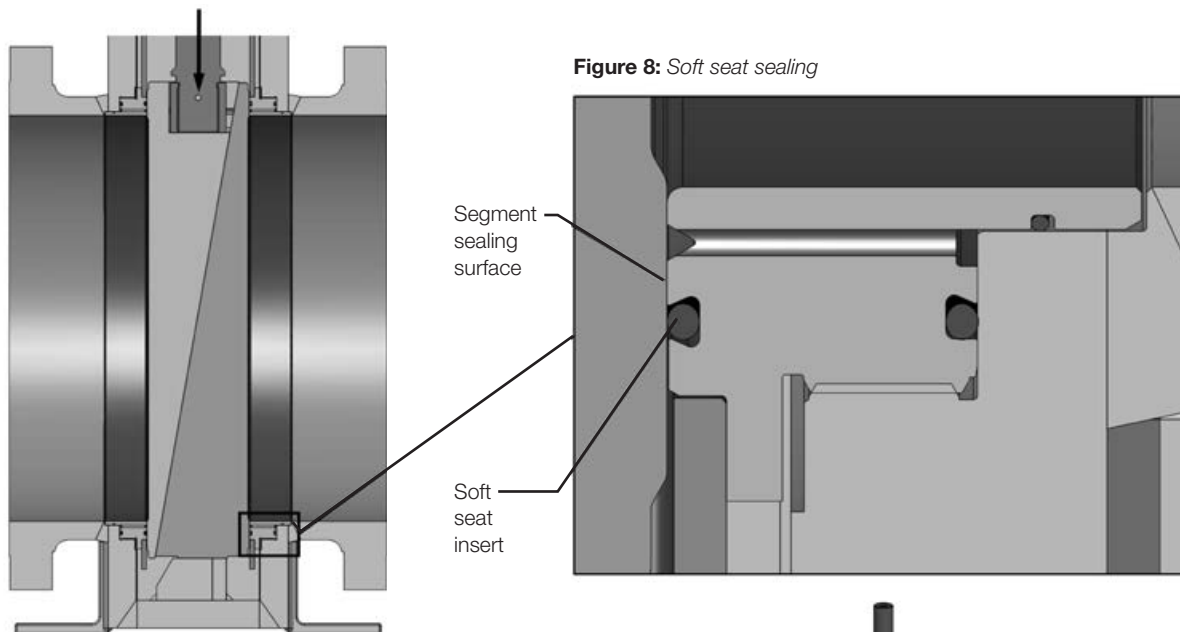


Figure 7b: Gate and segment contracted by connected arm

Design features — Continued

Soft seat enhances sealing

A soft seat insert provides added sealing capability and ensures positive sealing in cases of intermittent wear of the seating surfaces during regular operation. The soft seat insert adapts itself to any minor surface irregularities on the gate or segment and provides optimal sealing. See **Figure 8**.



Compact design

The non-through conduit design allows for a much more compact installation with associated weight savings over the through conduit design, where there are no requirements for pipeline pigging.

No side loads to the stem

The expanding gate and segment design ensures low operating thrust. The stem is guided by a low-friction coated bearing. See **Figure 9**.

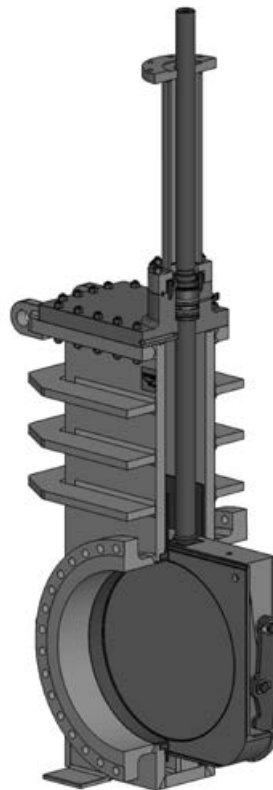


Figure 9:
Stem guiding

Design features — Continued

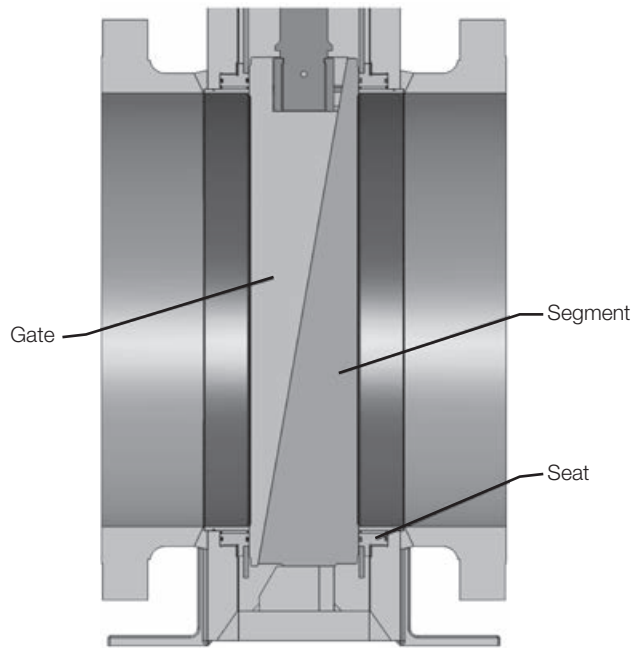


Figure 10: ENP sealing surfaces

ENP-coated sealing surface

The gate and segment sealing surfaces are machined, lapped and plated with electroless nickel (ENP) for a robust sealing area that minimizes friction between sealing surfaces.

See **Figure 10**.

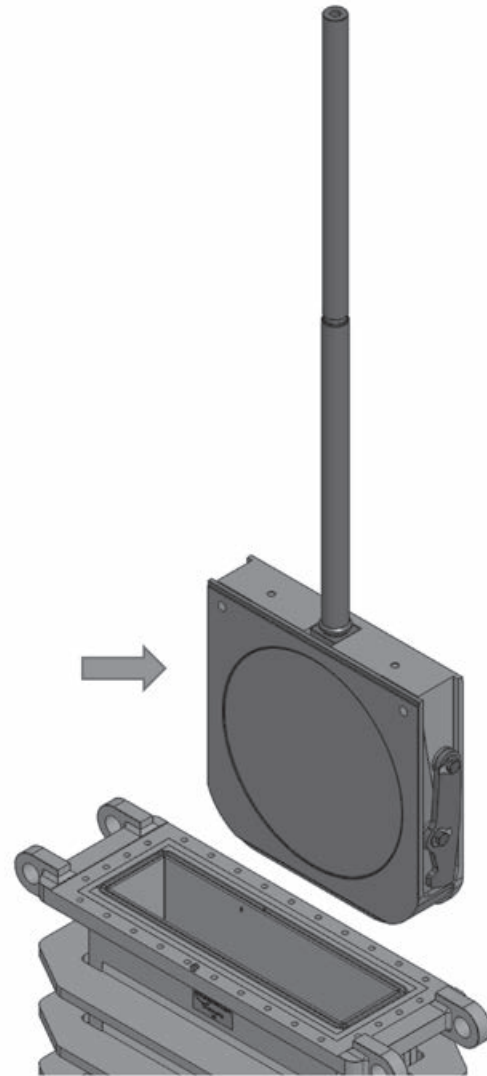


Figure 11: Top-entry design

Top-entry design

Simplified maintenance and repair are enabled by the top-entry design that allows for easy access to valve components while the valve is still in-line. Equipment downtime is dramatically reduced as trim and internal components can be replaced with ease in a relatively short period of time. See Figure 11.

Design features — Continued

Chevron-style stem seal

PTFE chevron packing provides an effective, low-friction stem seal, for long life under adverse operating conditions. The double packing set design has been emissions tested and certified to ISO 15848-1, while the additional graphite ring provides compliance to API 607/6FA fire safety standards. A sealant injection fitting is provided for emergency sealing if needed. See **Figure 12**.

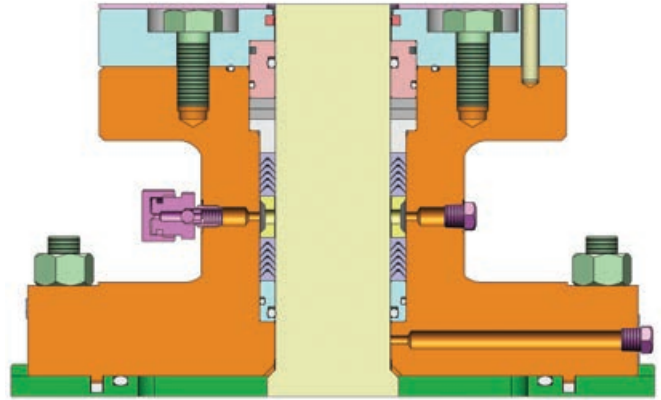


Figure 12: Stem and body to bonnet sealing arrangement design, stem guiding system and emergency seal injection point

Flowserve Energized Packing (FEP)

Spring-energized lip seal combined with proven Chevron packing technology makes this the ideal packing to eliminate emissions in critical applications. Qualified to the rigorous requirements of the ISO 15848-1 standard. See **Figure 13**.

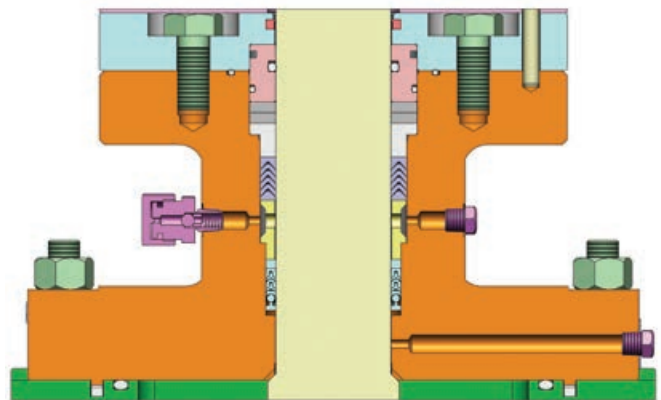
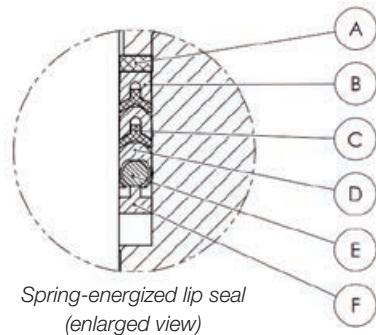


Figure 13: Stem seal showing Flowserve Energized Packing (FEP) configuration

FEP packing details		
Item	Description	Material
A	Backup	PEEK®
B	V-ring	TFM
C	Spacer	RPTFE
D	Jacket	TFM
E	Spring	ELGILOY®
F	Retainer	PEEK

® PEEK is a registered trademark of Victrex plc Corp.

® ELGILOY is a registered trademark of Elgiloy Specialty Metals.

Sealant injector

The Valbart CEGV incorporates a stem sealant injector design to enable the injection of sealant to restore the sealing capability of the valve in the event of stem seal failure. See **Figure 14**.

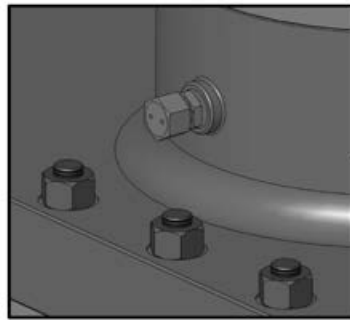
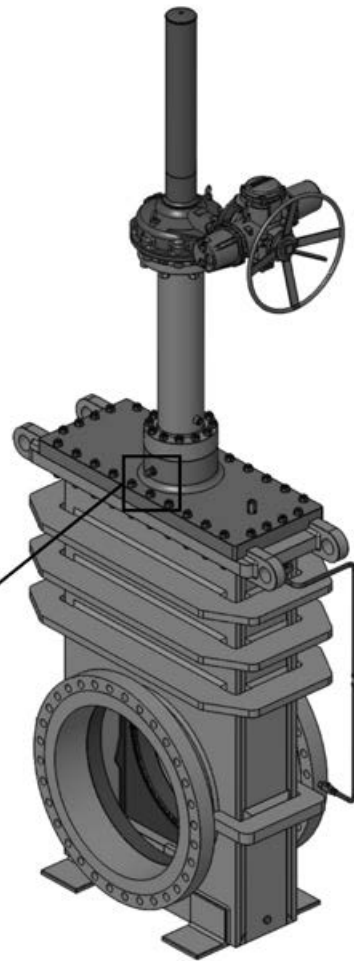


Figure 14: Sealant injector



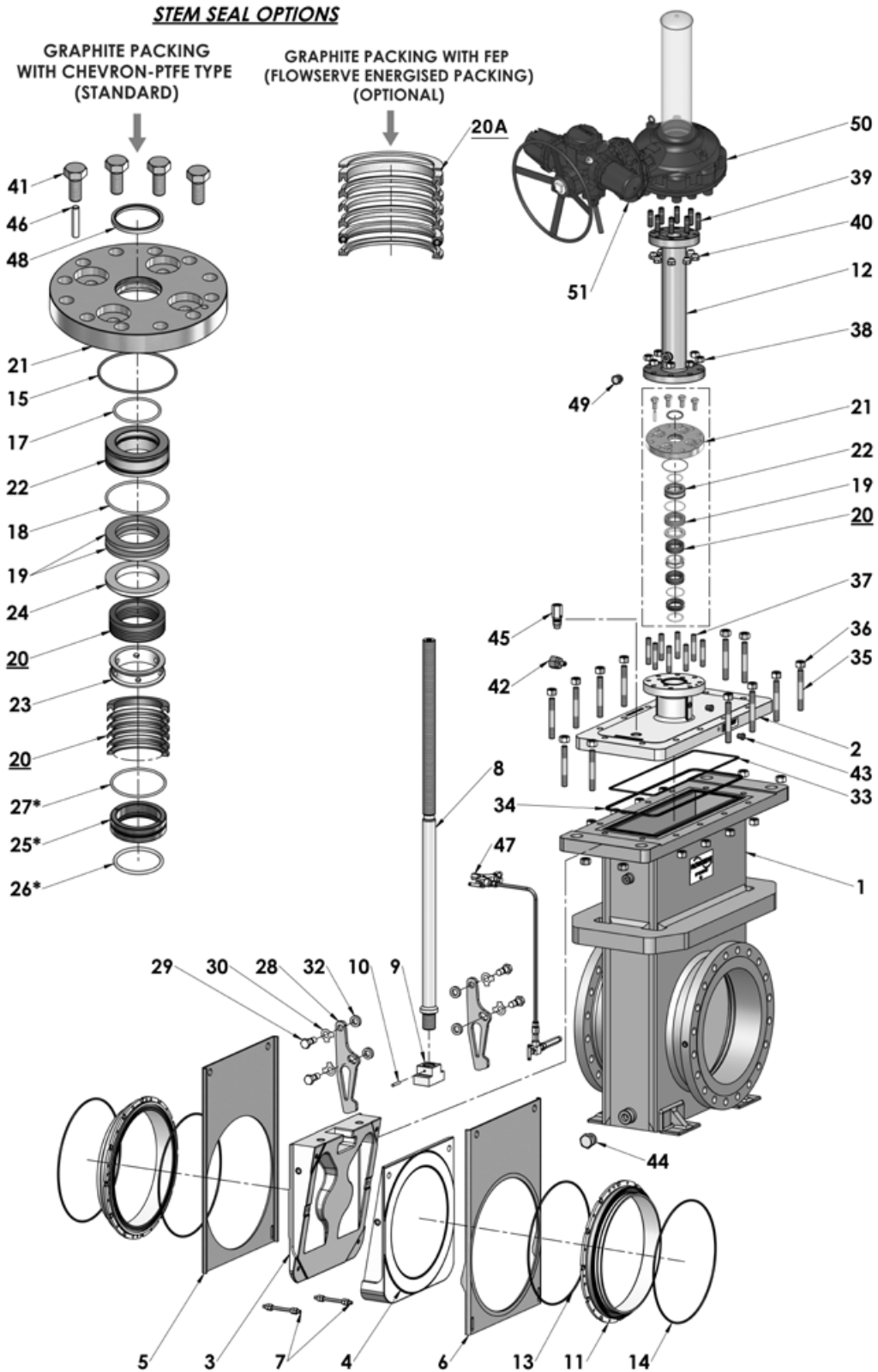
CEGV specifications

Table 1: Specification compliance summary

Sizes	12 to 36 in ⁽¹⁾	
Pressure ratings	ASME Classes 150 and 300	
Design	API 6D, ASME BPVC SEC VIII	
End connection	Flanged RF/RTJ	
Face to face	As per API 6D – B16.10	
Trim area	Full bore to API 6D dimensions	
Stem seal	PTFE (Chevron) / Flowserve Energized Packing (FEP)	
Flow direction	Bi-directional (preferred segment side upstream)	
Leakage rates	API 6D, ISO 5208 (rate A soft seat; rate D metal seat)	
Operating temperature range	Standard carbon steel	-29°C to 121°C (-20.2°F to 250°F)
	Low-temperature carbon steel	-46°C to 121°C (-50.8°F to 250°F)
Fire-safe	API 6FA, API 607	
Fugitive emissions	ISO 15848 – 1 (BH)	

(1) Other sizes available upon request

CEGV exploded view



CEGV bill of materials

Table 2: Compact expanding gate valve bill of materials

No.	Component	Material (-29°C to 121°C) (-20.2°F to 250°F)	Material (-46°C to 121°C) (-50.8°F to 250°F)
1	Body	ASTM A516 Gr. 70 (ASTM A105N - WN Flange/PUP)	ASTM A516 Gr. 70 (ASTM A350 Gr. LF2 - WN Flange/PUP)
2	Bonnet	ASTM A216 Gr. WCB/WCC	ASTM A352 Gr. LCC/LCB
3	Gate	ASTM A216 Gr. WCB/WCC + ENP + AFT ⁽²⁾	ASTM A352 Gr. LCC/LCB + ENP + AFT ⁽²⁾
4	Segment	ASTM A216 Gr. WCB/WCC + ENP + AFT ⁽²⁾	ASTM A352 Gr. LCC/LCB + ENP + AFT ⁽²⁾
5	Guide	ASTM A516 Gr. 70 + ENP	ASTM A516 Gr. 70 + ENP
6	Guide reaction	ASTM A516 Gr. 70 + ENP	ASTM A516 Gr. 70 + ENP
7	Guide holder assembly	ASTM A322 Gr. 4140 + A193 Gr. B7M + A194 Gr. 2HM	ASTM A322 Gr. 4140 + A320 Gr. L7M + A194 Gr. 7M
8	Stem	ASTM A564 TP.630 (17-4 PH) + AFT ⁽²⁾	ASTM A564 TP.630 (17-4 PH) + AFT ⁽²⁾
9	Stem head	ASTM A564 TP.630 (17-4 PH) + AFT ⁽²⁾	ASTM A564 TP.630 (17-4 PH) + AFT ⁽²⁾
10	Stem head pin	ASTM A564 TP.630 (17-4 PH)	ASTM A564 TP.630 (17-4 PH)
11	Seat	ASTM A105N + ENP + AFT ⁽²⁾	ASTM A350 Gr. LF2 + ENP + AFT ⁽²⁾
12	Yoke	ASTM A516 Gr. 70 + A106 Gr. B (PIPE)	ASTM A516 Gr. 70 + A333 Gr. 6 (PIPE)
13	Seat face O-ring	FKM	FKM / HNBR
14	Seat backface O-ring	FKM	FKM / HNBR
15	Environmental O-ring	FKM	FKM / HNBR
17	Gland inner O-ring	FKM	FKM / HNBR
18	Gland outer O-ring	FKM	FKM / HNBR
19	Stem packing fire-safe	Graphite	Graphite
20/20A	Stem packing	PTFE (Chevron)/Flowserve Energized Packing (FEP) ⁽³⁾	PTFE (Chevron)/Flowserve Energized Packing (FEP) ⁽³⁾
21	Packing retainer	ASTM A322 Gr. 4140	ASTM A322 Gr. 4140
22	Gland	ASTM A276 Gr. 410 / SS316	ASTM A276 Gr. 410 / SS316
23	Lantern ring	ASTM A276 Gr. 410 ⁽³⁾ / SS316 ⁽³⁾ / PTFE*	ASTM A276 Gr. 410 ⁽³⁾ / SS316 ⁽³⁾ / PTFE*
24	Spacer	Tin bronze	Tin bronze
25*	Bearing	ASTM A276 Gr. 410 / SS316	ASTM A276 Gr. 410 / SS316
26*	Bearing inner O-ring	FKM	FKM / HNBR
27*	Bearing outer O-ring	FKM	FKM / HNBR
28	Arm	ASTM A516 Gr. 70	ASTM A516 Gr. 70
29	Arm pin (shoulder screw)	ASTM A193 Gr. B7M	ASTM A320 Gr. L7M
30	Tab washer	SS 316	SS 316
31	Pin holder	ASTM A516 Gr. 70 ⁽¹⁾	ASTM A516 Gr. 70 ⁽¹⁾
32	Arm spacer	ASTM A516 Gr. 70	ASTM A516 Gr. 70
33	Bonnet gasket	FKM	FKM / HNBR
34	Bonnet fire-safe gasket	Graphite	Graphite
35	Body to bonnet stud	ASTM A193 Gr. B7M	ASTM A320 Gr. L7M
36	Body to bonnet nut	ASTM A194 Gr. 2HM	ASTM A194 Gr. 7M
37	Yoke to bonnet stud	ASTM A193 Gr. B7M	ASTM A320 Gr. L7M
38	Yoke to bonnet nut	ASTM A194 Gr. 2HM	ASTM A194 Gr. 7M
39	Yoke to gear stud	BS 3692 Gr. 8.8	ASTM A320 Gr. L7
40	Yoke to gear nut	ASTM A563 Gr. B	ASTM A194 Gr. 7
41	Packing retainer to bonnet bolt	ASTM A193 Gr. B7M	ASTM A320 Gr. L7M
42	Stem injection fitting	SS316 / SS316L	SS316 / SS316L
43	Stem backseat port plug	ASTM A105N	ASTM A350 Gr. LF2
44	Drain fitting	ASTM A105N	ASTM A350 Gr. LF2
45	Bleeder	SS 316 / SS316L	SS 316 / SS316L
46	Dowel pin	SS 316	SS 316
47	Relief valve fitting	SS316 / SS316L	SS316 / SS316L
48	Dust seal	Nitrile / Nylon	Nitrile / Nylon
49	Yoke plug	ASTM A105N	ASTM A350 Gr. LF2
50	Gear unit	Limitorque® manufacturer standard	Limitorque manufacturer standard
51	Actuator	Limitorque manufacturer standard	Limitorque manufacturer standard

(1) - Only for size 30 in and larger

(3) - Applicable for FEP stem seal design

(2) - AFT: Anti-friction treatment

(*) - Not applicable for FEP stem seal design

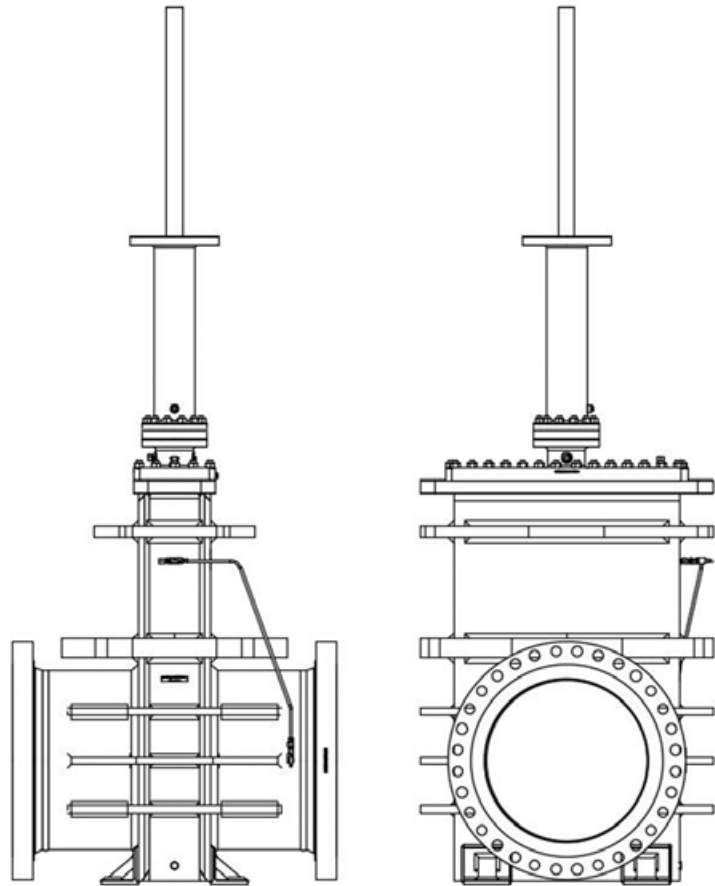
Configurations and options

Actuation

Hand-operated valves are supplied with a multi-turn gear operator based on the size, rating and customer requirements.

For automated operation, valves can be supplied with the following actuation types.

- Electric actuators
- Pneumatic actuators
- Hydraulic actuators
- Gas over oil actuators



Available configurations

Size and pressure ratings¹	150 to 300; 12 to 36 in ¹
Flow direction	Bidirectional
End connection	Flanged RF/RJ
Stem seal	PTFE Chevron packing with graphite ring/ Flowserve Energized Packing (FEP)
Seating	Elastomeric seated
Gaskets	Elastomeric seals, fire-safe graphite
Operating Standard Temperature Range	-29°C to 121°C (-20°F to 250°F)

(1) Contact Flowserve for other sizes.

Engineering data

Valve testing

Each Flowserve Compact Expanding Gate Valve is tested in accordance with API 6D prior to shipping.

Standard performance tests

- Visual and dimensional check
- High-pressure hydrostatic shell test
- High-pressure hydrostatic seat test
- Low-pressure pneumatic seat test
- Double block and bleed
- Cavity relief seat test
- Stem backseat test

Qualification and certifications

- API 6D monogram
- Fire safe – API 6FA
- Fugitive emissions – BS EN ISO 15848-1

Table 3: Leakage rate specification compliance¹

Standard	Soft Seated	Cryogenic
API 6D	ISO 5208 Rate A	Consult factory

(1) Leakage rates mentioned above are standard.

Table 4: API 6D standard testing pressure values^{2,3}

ASME Class	Body Hydrotest Pressure		Seat Hydrotest Pressure		Pneumatic Seat Test Pressure ⁴	
	bar	psi	bar	psi	bar	psi
150	30	435	22	319	5.5	80
300	77.55	1,124	57	825		

(2) Typical, but rating pressure could change for different materials.

(3) Conversion factors: 1 bar = 14.5 psi

(4) Pneumatic seat test is optional; test pressures provided as reference.

Dimensions and weights – Classes 150 and 300

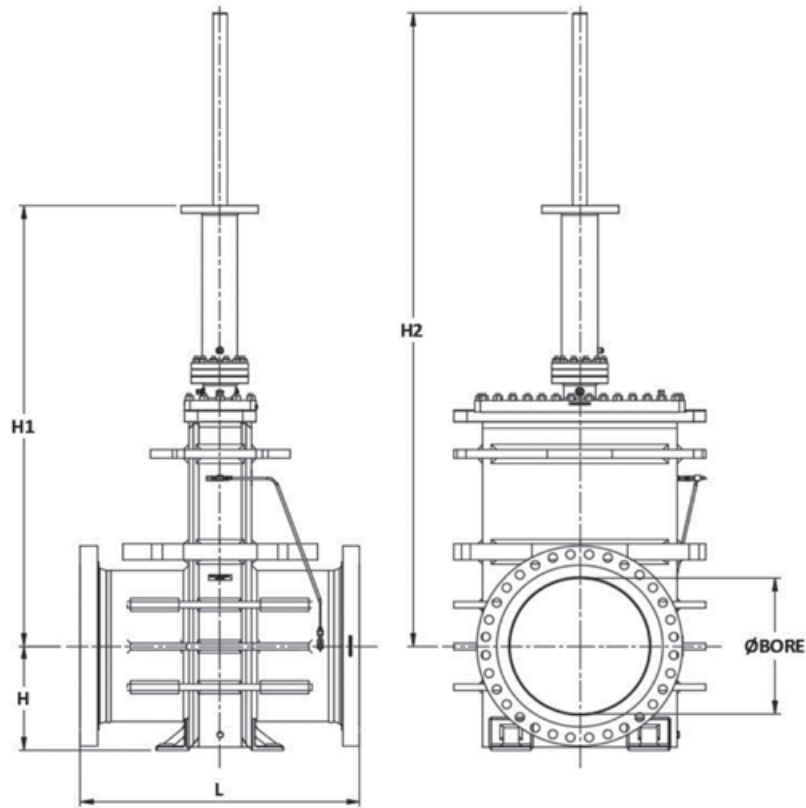


Table 5: Class 150

Nominal Valve Size [in]	Nominal Bore Passage [mm]-[in]		L [mm]-[in]						H [mm]-[in]		H1 [mm]-[in]		H2 [mm]-[in]-stem fully extended-		Weight*			
			RF		WE		RJ								RF/RJ [kg]-[lb]		BW [kg]-[lb]	
12	303	11.94	356	14.00	502	19.75	368	14.50	320	12.60	1,230	48.43	1,706	67.15	630	1,389	592	1,305
16	385	15.19	406	16.00	610	24.00	419	16.50	381	15.00	1,416	55.75	1,986	78.19	996	2,196	930	2,050
18	436	17.19	432	17.00	660	26.00	445	17.50	391	15.39	1,571	61.85	2,202	86.67	1,400	3,086	1,260	2,778
20	487	19.19	457	18.00	711	28.00	470	18.50	400	15.75	1,726	67.95	2,459	96.81	1,750	3,858	1,520	3,351
24	589	23.19	508	20.00	813	32.00	521	20.50	492	19.37	1,971	77.60	2,837	111.69	2,166	4,775	2,130	4,696
30	735	28.94	660	26.00	914	36.00	(1)	(1)	557	21.93	2,384	93.86	3,468	136.54	3,850	8,488	3,280	7,231
36	874	34.44	813	32.00	1,016	40.00	(1)	(1)	661	26.02	2,754	108.43	3,978	156.61	6,052	13,342	5,250	11,574

* Weight tolerance: ± 5%

Table 6: Class 300

Nominal Valve Size [in]	Nominal Bore Passage [mm]-[in]		L [mm]-[in]						H [mm]-[in]		H1 [mm]-[in]		H2 [mm]-[in]-stem fully extended-		Weight*			
			RF		WE		RJ								RF/RJ [kg]-[lb]		BW [kg]-[lb]	
16	385	15.19	838	33.00	838	33.00	854	33.63	381	15.00	1,421	55.94	2,083	82.01	1,368.0	3,016	1,200	2,646
20	487	19.19	991	39.00	991	39.00	1,010	39.75	413.5	16.28	1,736	68.35	2,468.5	97.19	2,241.5	4,942	2,022	4,458
24	589	23.19	1,143	45.00	1,143	45.00	1,165	45.88	492	19.37	1,999	78.68	2,856.5	112.46	2,984.0	6,579	2,890	6,371
30	735	28.94	1,397	55.00	1,397	55.00	1,422	56.00	571	22.48	2,404	94.65	3,487	137.28	4,640.0	10,229	4,295	9,469
36	874	34.44	1,727	68.00	1,727	68.00	1,756	69.13	661	26.02	2,809	110.59	4,033	158.78	7,956.0	17,540	7,806	17,209

* Weight tolerance: ± 5%

Mounting operators

Flowserve offers Limitorque actuation to provide reliable automation of the Flowserve CEGV. Limitorque has a long history of engineering high-performance, long-lasting actuators for a variety of industries. Matching the Limitorque actuator with the Flowserve compact expanding gate valve results in an automated valve package complete with single-source engineering, supply and service.

Limitorque offers MX electric actuators **Figure 15**, complete with V Series **Figure 16** gearbox and controls, to meet any valve thrust and customer application requirement. State-of-the-art, non-intrusive control systems allow operators to calibrate and locally control the actuator and valve without removing the actuator cover.



Figure 15: Limitorque MX electric actuator

Actuators are available with SIL capability for meeting enhanced safety integrity requirements. Various digital protocols and network communications can be offered for compatibility with numerous controls systems, including Modbus, DeviceNet and Foundation Fieldbus. Limitorque heavy-duty electric actuators provide the reliability, robustness and features to meet the needs of the oil and gas industry.

Different actuators or special applications are available upon request.



Figure 16: Limitorque V Series bevel gearboxes are easily adapted for motorized operation by MX actuators

Table 7: Topworks data

Valve Size	Class	ASME Working Pressure	Stem Data			Block and Bleed Thrust	Block and Bleed Torque	Stroke		Turns to Open Valve
			ACME ⁽¹⁾	Threads	Starts			mm	in	
NPS	Class	psig	in	per in	#	lbf	ft lb	mm	in	# of turns
12	150	285	1.5	6	2	11,769	162	355.6	14.0	42
12	300	740	1.5	6	2	30,780	425	355.6	14.0	42
16	150	285	1.5	6	2	21,200	293	455.7	18.0	54
16	300	740	1.75	5	2	55,438	765	455.7	18.0	45
18	150	285	1.75	5	2	27,136	423	510.5	20.1	50
18	300	740	2	4	2	71,193	1,108	510.5	20.1	40
20	150	285	2	4	2	32,648	601	555.0	21.9	44
20	300	740	2.25	4	2	85,542	1,574	555.0	21.9	44
24	150	285	2.25	4	2	45,156	934	663.3	26.1	52
24	300	740	2.375	3	2	118,190	2,445	663.3	26.1	39
30	150	285	2.675	3	2	67,424	1,663	810.0	31.9	48
30	300	740	2.875	3	2	177,446	4,348	810.0	31.9	48
36	150	285	3.125	3	2	91,054	2,680	947.0	37.3	56
36	300	740	3.375	3	2	238,288	7,013	947.0	37.3	56

(1) For Acme threads 2.875 to 3.375 in, stem can be provided with 2.5 TPI as an option on customer request.



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