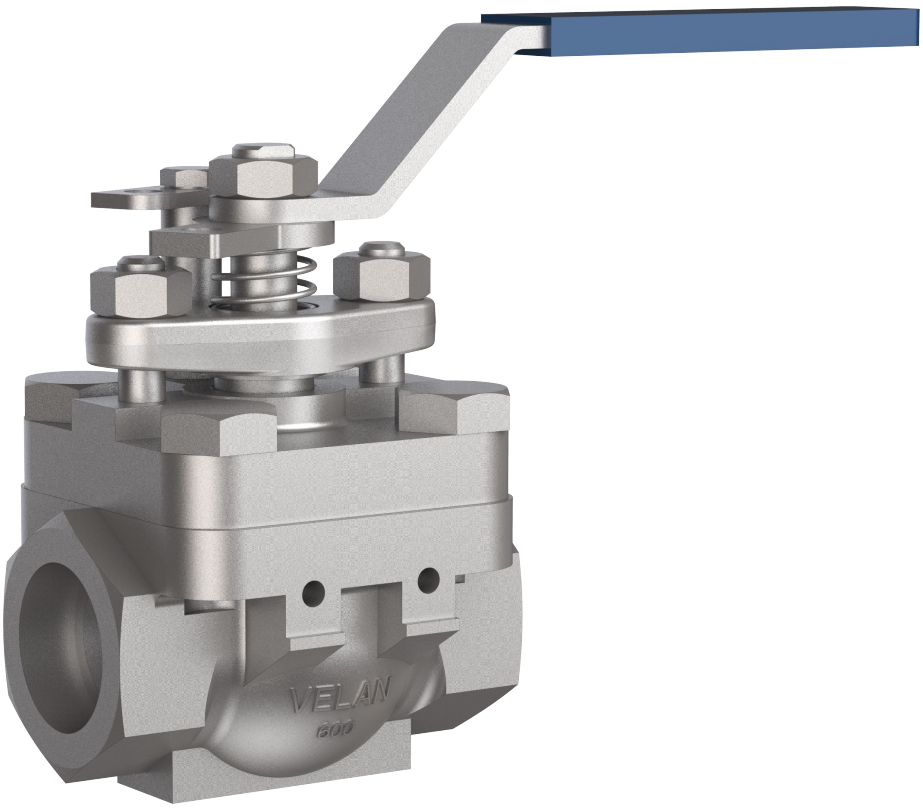
Memoryseal® TE-150/300/600 resilient-seated ball valves

Data sheet

Velan Memoryseal top-entry resilient-seated ball valves can be easily serviced or replaced in-line while the integrity of the valve is not affected. The exclusive Memoryseal seats compensate automatically for wear and fluctuations of pressure and temperature. Standard valves with MPTFE seats and graphite packing can handle steam service up to 250 psig (17.2 bar). Valves with carbon graphite filled seats are suitable for steam up to 450 psig (31 bar). These rugged, versatile, resilient-seated ball valves can meet NACE specifications(3).



Memoryseal NPS 3 (80) top-entry full port valve.

Specifications

Sizes	NPS ½ – 4 (DN 15 – 100)
Pressure rating	ASME Class 150, 300, 600
End connections	ASME B16.5
Port	Full and regular
Valve design	ASME B16.34, API 608(1)
Face-to-face	ASME B16.10 Flanged long or short pattern

(1) For latest revision compliance contact your local Velan office.
(2) API 607 Rev. 5 / ISO 10497 is optional, requires graphite packing.
(3) To ensure these valves meet NACE specifications, this requirement must be confirmed prior to placing the purchase order.

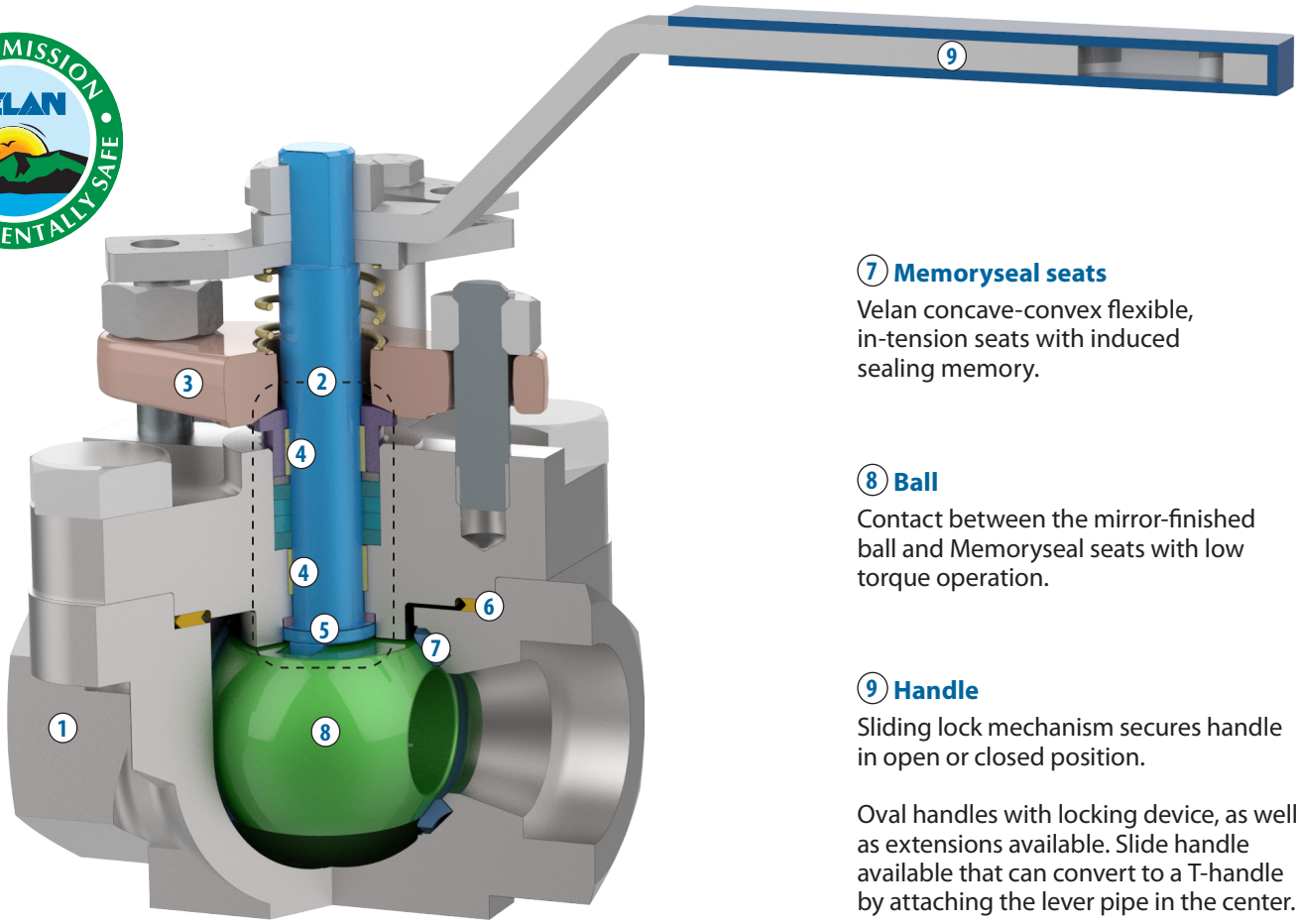
Features

- Multiple solid cup and cone type PTFE stem seal or graphite packing.
- Two-piece self-aligning packing flange and gland.
- Valve/packing meets ISO and API Fugitive Emissions Standards, and corrosion test requirements.
- Long cycle life.
- Low, uniform torques.
- Pressurized thrust washer prevents galling and provides secondary stem seal.
- Permits in-line access for seat replacement without disassembly in accordance with Velan installation instructions.
- ASME Section VIII bolting provides high sealing integrity of body gasket.
- AGA and CGA approved regular port, threaded ends (optional) NPS ½–2.
- Oval handles with locking device, as well as extensions available.
- Live-loaded single or double packing (optional).
- TA-Luft certified (optional) with live-loading packing.
- Valves are fire safe per API 607(2) / ISO 10497.
- Certified SIL 3.

Applications

- Fluids
- Semi-solids
- Corrosive services
- Steam services
- Chemical
- Oil & gas
- Petrochemical
- Pulp and paper processing

Design features



1 Body
Body with precision machined construction complies to ASME B16.34. Body-cover joint not affected by pipe stresses. Permits in-line access for seat replacement.

2 Packing chamber
Unique packing chamber design maintains low emissions control for reliable sealing and long lasting high cycle life. (See page 2.)

3 Packing flange
Self-aligning packing flange is independent of gland for equal compression of packing rings.

4 Stem guides
Upper and lower bushings prevent side load on packing rings. Eliminates premature wear, therefore enhancing packing life.

5 Stem
Stem shoulder assures blowout-proof protection. A floating stem eliminates thrust washer wear.

6 Gasket
Fully enclosed spiral wound graphite filled 316 gasket for a tight seal.

A secondary metal-to-metal contact area in addition to the primary gasket.

7 Memoryseal seats
Velan concave-convex flexible, in-tension seats with induced sealing memory.

8 Ball
Contact between the mirror-finished ball and Memoryseal seats with low torque operation.

9 Handle
Sliding lock mechanism secures handle in open or closed position.

Oval handles with locking device, as well as extensions available. Slide handle available that can convert to a T-handle by attaching the lever pipe in the center.

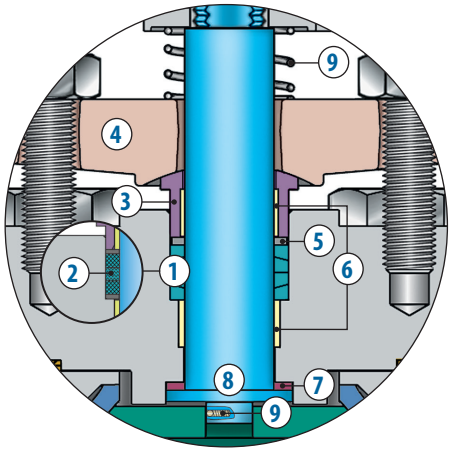
Cavity pressure relief
Memoryseal seats are designed to relieve overpressure in the ball/body cavity. (See page 4.)

Anti-static design
Eliminates static electrical buildup between stem, ball and body. (See page 3.)

Actuator mounting
Tapping for mounting actuators standard.

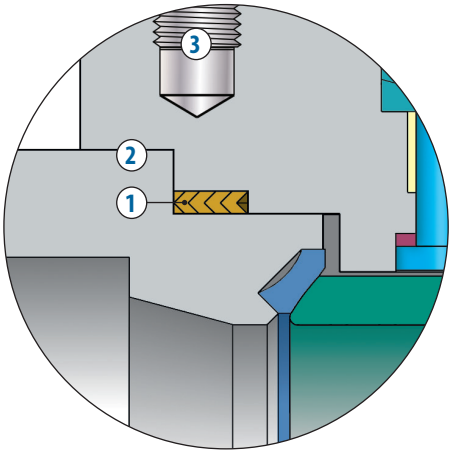
Packing chamber and body seals

Dual qualified to API 641 and ISO-15848-1 fugitive emission requirements[1]



The unique E-20 packing chamber design maintains low emissions control for long lasting high cycle life. Valve packing is 100 ppm Low emission (Low-E).

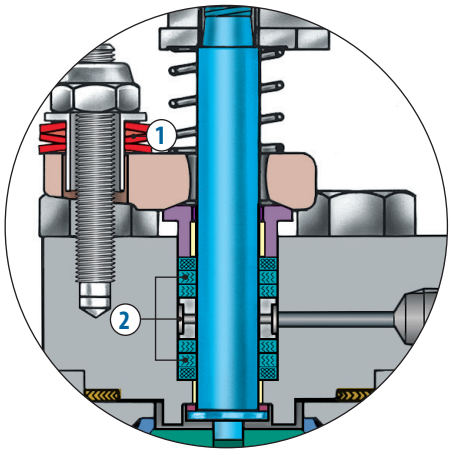
1. PTFE packed valves are dual qualified to API 641 and ISO-15848-1, up to NPS 4 Class 600. Packing rings made in cup and cone type PTFE.
2. Graphite packed valves are dual qualified to API 641 and ISO-15848-1, up to NPS 4 Class 600. Packing rings made in braided and die-formed flexible Graphite, tested to API 622.
3. Specially machined gland bushing provides self-alignment to packing flange.
4. Adjustable self-aligning packing flange is independent of gland for equal compression of packing rings.
5. Packing washer provides anti-extrusion of the PTFE/graphite packing for enhanced seal performance.
6. Upper gland sleeve and lower stem bushing prevent side load on packing rings. Eliminates premature wear, enhancing packing life.
7. Pressurized PTFE thrust washer prevents galling and provides secondary stem seal.
8. Floating stem eliminates thrust washer wear and stem shoulder assures blowout-proof safety.
9. Anti-static design
   Ball-to-stem spring device eliminates static electrical buildup between stem, ball, and body for NPS 2–4 (DN 50–100) full port.
   A separate external coil spring device that grounds stem to body is included in the full size range.



Memoryseal body seal designs incorporate a secondary metal-to-metal contact area in addition to the primary gasket. Both the bolting and mid-flange meet ASME Section VIII standards for a superior seal.

1. Primary gasket is fully enclosed spiral wound graphite filled 316.
2. Secondary metal-to-metal contact
3. ASME Section VIII bolting

Alternative packing chamber with live-loading and lantern ring options

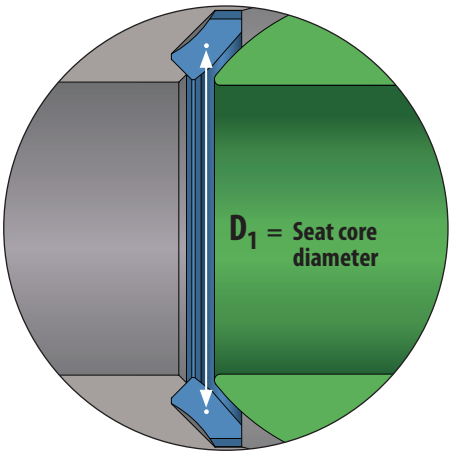


Velan's double packed arrangement uses the E-20 packing style, a double stacked live-loaded packing flange, and lantern ring.

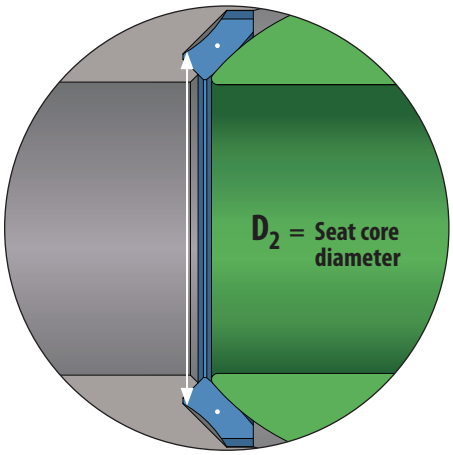
1. Live-loading packing flange with double stacked Belleville springs maintain the packing load for low maintenance and extended cycle life.
2. Double set of graphite packing rings, a lantern ring and leakoff for diverse applications such as vacuum service, leakage monitoring, seal injection and maintenance.

Velan Memoryseal® ball valve technology

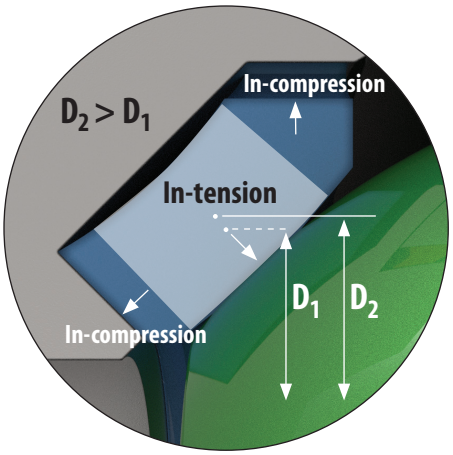
Memoryseal® seat Before assembly



Memoryseal® seat After assembly



Memoryseal® seat Induced sealing memory



Sealing memory

The Velan sealing memory is induced into the seats during the assembly process, when the ball is inserted into the valve body it partially flattens the seat, creating a tensile stress in the center of the seat.

As a result, the seat core increases in diameter from D_1 to D_2 and, like a stretched elastic band, pushes against the ball. This ensures reliable sealing even at vacuum or low pressures.

Seat strength

A seat in-tension is stronger than a seat in compression because the tensile strength of MPTFE in-tension is 3600 psi (25 MPa) versus only 1800 psi (12.5 MPa) for MPTFE in compression. Greater strength means less fatigue, superior sealing ability, and longer cycle life.

The Memoryseal seat is the only successful seat design in-tension rather than compression and will outlast other extreme seat designs.

Lower torques

Velan in-tension seats produce more uniform torque because the seat deflects into the cavity behind it to accommodate slight differences in machining tolerances or the normal expansion of MPTFE as temperature increases. MPTFE expands approximately seven times as much as metal.

Cavity pressure relief

Memoryseal seats are designed to relieve overpressure in the ball/body cavity. This capability is influenced by many variables including fluid characteristics, variations in pressure, seat materials, seat compression, temperature, and thermal cycles.

Positive release of cavity over-pressure to the upstream side is ensured by bypassing the upstream seat through a drilled hole in the ball. This option is preferred in certain services such as liquid chlorine.

When the valve is in the open position, pressure relief is always through the vent in the top of the ball adjacent to the stem connection. For further information on cavity relief contact our Quarter-turn marketing department

Concave-convex flexible, in-tension seats with induced sealing memory

Benefits of Memoryseal seats include:

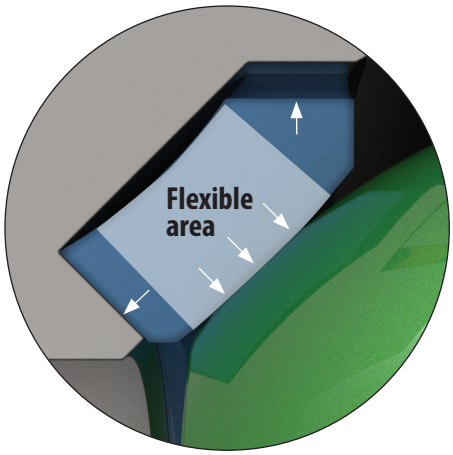
- Greater strength
- Less fatigue
- Positive bi-directional shutoff
- Uniform torque
- Compensate for temperature fluctuations
- Eliminate cold flow effects
- High cycle life

The large flexible area of the Memoryseal seat offers superior sealing.

Greater flexible strength equals greater performance with Memoryseal® seats

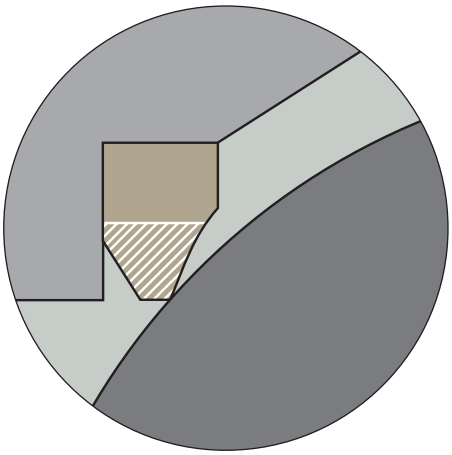
Velan Memoryseal® ball valve technology versus competing designs

Memoryseal® in-tension flexible seat



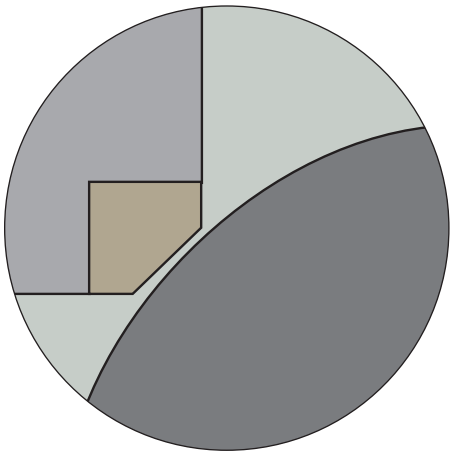
- ☑ Larger seat with smaller seating contact
- ☑ Larger seat with smaller seating contact
- ☑ Seat in-tension, stronger, 3600 psi tensile strength
- ☑ Greater flexible strength = tightness on low-pressure service
- ☑ Greater flexibility = lower torque
- ☑ Greater flexibility = better shock resistance to high DP
- ☑ Greater flexibility = compensation for pressure and temperature fluctuation
- ☑ Greater flexibility = longevity

Competitive Flexible seat



- ☒ Smaller, weaker seat
- ☒ Minimal flexible area, susceptible to fatigue
- ☒ Seat in compression, only 1800 psi tensile strength
- ☒ Can leak in low-pressure service due to fatigue
- ☒ Minimal flexibility; conservative torque
- ☒ Minimal flexibility, weak shock resistance to high DP
- ☒ Moderate compensation for pressure and temperature fluctuation
- ☒ Moderate flexibility = premature wear

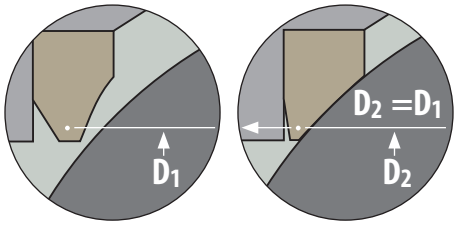
Non-flexible Jam seat



- ☒ Much smaller seat
- ☒ No flexibility, high compres-sion: susceptible to cold flow
- ☒ Seat in compression, only 1800 psi tensile strength
- ☒ Can leak in low-pressure service due to fatigue
- ☒ No flexibility, high compression, susceptible to high torque and severe torque variation
- ☒ No flexibility, no shock resistance to high DP
- ☒ No compensation for pressure and temperature fluctuation
- ☒ No flexibility = short cycle life

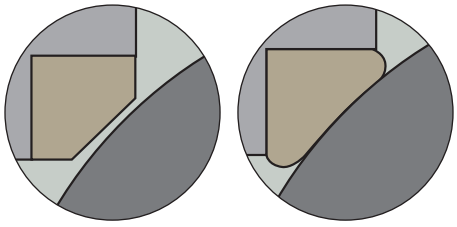
The competing seat design illustrations shown on this page are general in nature and are not intended to show the exact design or performance of any specific manufacturer.

Before assembly **After assembly**



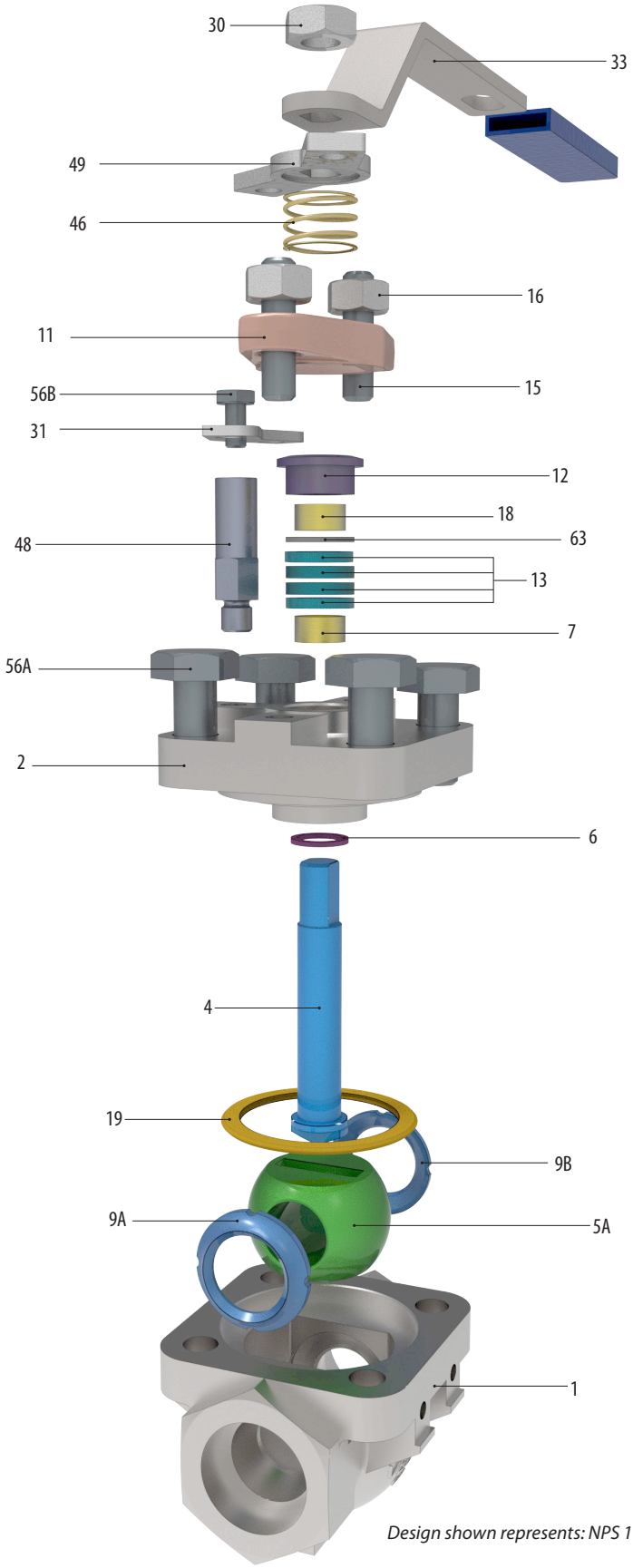
After assembly the seat diameter D_1 does not increase. Seat contact is in compression, not tension.

Before assembly **After assembly**



Exploded view: Top-entry

ASME Class	Full port	Regular port
150	NPS 2–3 (DN 50–80)	NPS ½–4 (DN 15–100)
300	NPS 2–3 (DN 50–80)	NPS ½–4 (DN 15–100)
600	NPS ⅜–1½ (DN 10–40)	NPS ½–2 (DN 15–50)



Design shown represents: NPS 1 (DN 25) Class 600

Standard materials: TE-150/300/600

PART		Carbon steel	Stainless steel
1	Body	ASTM A216 WCB	ASTM A351 CF8M
2	Bonnet	ASTM A216 WCB	ASTM A351 CF8M
4	Stem	ASTM A276 Grade 316 Cond. A stainless steel	
5	Ball	ASTM A276 Grade 316 Cond. A stainless steel	
6	Thrust washer	RPTFE	
7	Stem bushing	RPTFE	
9A, 9B	Seat	MPTFE / PTFE / RPTFE / C-RPTFE	
11	Packing flange	ASTM A216 WCB or A105	ASTM A351 CF8M
12	Gland bushing	ASTM A276 304	
13	Packing rings	Die-formed flexible graphite or PTFE	
15	Gland stud	ASTM A193 Grade B7M	ASTM A193 Grade B8M CL 2
16	Gland stud nut	ASTM A194 Grade 2HM	ASTM A194 Grade 8M
18	Gland bushing sleeve	RPTFE	
19	Gasket	Gr. 316L or 347 SS / Graphite (spiral wound)	
30	Handle nut	ASTM F594 Grade 304	
31	Lock plate	ASTM A240 Gr. 304 stainless steel	
33	Handle	ASTM A240 Grade 304	
46	Spring	ASTM A313 Gr. 302 stainless steel	
48	Stop pin	ASTM A276 Gr. 304 stainless steel	
49	Stop plate	ASTM A240 Grade 304	
56A	Hexagon head cap screw	ASTM A193 Grade B7M	ASTM A193 Grade B8M CL2
56B	Hexagon head cap screw	ASTM F593 Grade 304	
63	Packing washer	ASTM A240 Gr. 316 stainless steel	

Other materials available

Technical specifications: design and testing

Pressure-temperature rating	Shell: ASME B16.34
	Valve: See seat materials
Shell wall thickness	ASME B16.34
Face-to-face	ASME B16.10 Flanged long or short pattern
Flange dimensions	ASME B16.5
Valve testing	ASME 598
Fire safe testing	API 607 rev 5 (5)

Note: Other end connections and actuation available upon request.

Testing and quality assurance

All our valves are tested in our factory to guarantee their performance in the field.

- Shell test performed at 150% max. cold working pressure(1).
- Low pressure closure test preformed at 60 to 100 psig(2).
- RT examination of bonnet/body critical areas as defined in ASME B16.34(3).
- ISO 15848-2 Fugitive emissions production test up to 450 psi Helium(4).
- MT/PT of bonnet/body entire surface(4).
- Functional test of all accessories such as actuator and external switches(4).

(1) *Tests performed as per API 598.*
(2) *Test performed with air or nitrogen as per API 598.*
(3) *Available upon request. Extended RT or any other NDE also available upon request.*
(4) *Available upon request.*

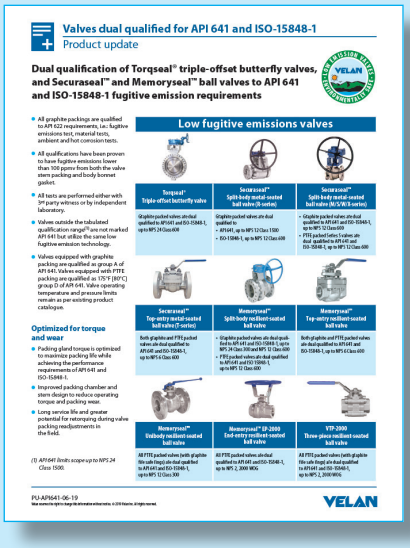
Certifications

Velan offers a wide range of certifications of compliance with regulatory requirements:

- PED
- ATEX
- IEC 61508 SIL 3 Capable
- GOST/EAC

Fugitive Emission Qualifications

- API 641 (methane)
- ISO 15848-1 (methane)
- TA Luft (helium)(4)
- Velan's FE qualifications have been surveyed and audited by leading organizations around the world such as Bureau Veritas, Lloyds Register and TA Luft.


Valves dual qualified for API 641 and ISO-15848-1
Product update
Dual qualification of Torqseal® triple-offset butterfly valves, and Securaseal™ and Memoryseal™ ball valves to API 641 and ISO-15848-1 fugitive emission requirements
Low fugitive emissions valves
Optimized for torque and wear
PU-API641-06-19
VELAN

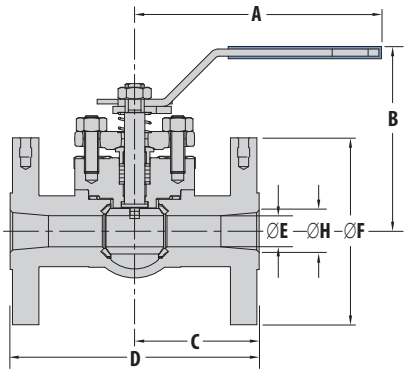
To download the latest information on valves qualified for API 641 and ISO-15848-1 go to velan.com and first log into or create a My Velan member account.

Under the Resources tab at the top of the page, scroll down to Literature, click on the Literature category dropdown menu and select Product updates.

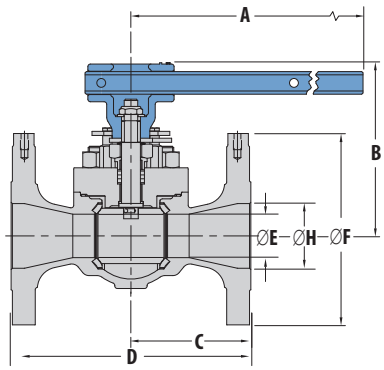
The Document code: PU-API_641-06-19 can be found at this link.

Dimensions, weights, and Cvs: Flanged end connection

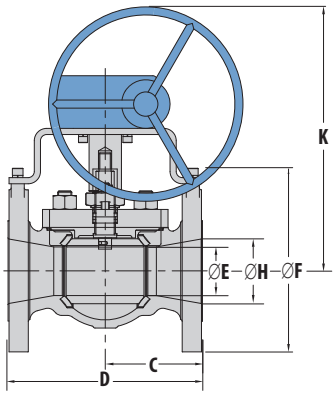
Lever handle



Slide handle



Gear



Flanged

Size NPS DN	ASME Class 150 regular port									
	A	B	C	D	ØE	ØF	ØH	K	lb / kg	C_V
½ 15	4.63 118	3.48 88	2.13 54	4.25 108	0.44 11	3.5 89	0.49 12	–	4.5 2	8
¾ 20	4.63 118	3.6 91	2.31 59	4.62 117	0.56 14	3.88 99	0.75 19	–	6.5 3	13
1 25	6.44 164	4.82 122	2.5 64	5 127	0.81 21	4.25 108	1 25	–	10 4.5	34
1½ 40	7.55 192	5.66 144	3.25 83	6.5 165	1.19 30	5 127	1.5 38	–	19.6 9	65
2 50	7.55 192	5.92 150	3.5 89	7 178	1.5 38	6 152	2 51	–	28 13	104
3 80	11.91 303	6.45 164	4 102	8 203	2 51	7.5 191	3 76	–	46 21	200
4 100	33 838	8.99 228	4.5 114	9 229	3 76	9 229	4 102	–	102 46	540

Flanged

Size NPS DN	ASME Class 300 regular port									
	A	B	C	D	ØE	ØF	ØH	K	lb / kg	C_V
½ 15	4.63 118	3.48 88	2.75 70	5.5 140	0.44 11	3.75 95	0.49 12	–	5.7 3	8
¾ 20	4.63 118	3.6 91	3 76	6 152	0.56 14	4.62 117	0.75 19	–	8.9 4	13
1 25	6.44 164	4.82 122	3.25 83	6.5 165	0.81 21	4.88 124	1 25	–	13.3 6.0	34
1½ 40	7.55 192	5.66 144	3.75 95	7.5 191	1.19 30	6.12 155	1.5 38	–	25 11	65
2 50	7.55 192	5.92 150	4.25 108	8.5 216	1.5 38	6.5 165	2 51	–	35 16	104
3 80	20 508	7.97 202	5.56 141	11.12 282	2 51	8.25 210	3 76	–	64 29	200
4 100	–	–	*6* *152*	12 305	3 76	10 254	4 102	16.3 414	128 58	540

Flanged

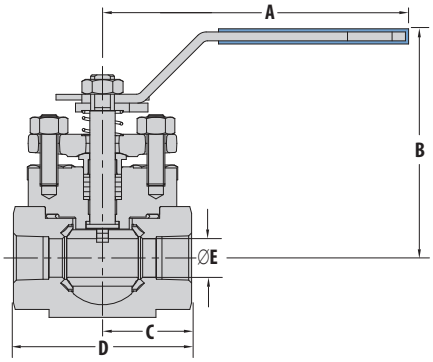
Size NPS DN	ASME Class 600 full port								
	A	B	C	D	ØE	ØF	K	lb / kg	C_V
½ 15	4.63 118	3.6 91	3.25 83	6.5 165	0.5 13	3.75 95	–	7.7 3	26
¾ 20	6.44 164	4.82 122	3.75 95	7.5 191	0.75 19	4.62 117	–	13.6 6	75
1 25	7.55 192	5.66 144	4.25 108	8.5 216	1 25	4.88 124	–	22 10	103
1½ 40	10.5 267	7.16 182	4.75 121	9.5 241	1.5 38	6.12 155	–	37 17	206
2 50	–	–	5.75 146	11.5 292	2 51	6.5 165	14.66 372	37 17	322

Notes:

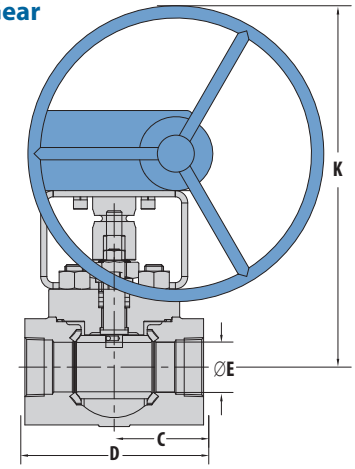
Contact velan for bare stem dimensions
For other sizes and pressure classes, contact your local Velan office.
Dimensions shown in inches (mm)
Kv is the metric equivalent of Cv. Kv = Cv x 0.864

Dimensions, weights, and Cvs: Butt weld, socket weld, and threaded end connection

Lever handle



Gear



Butt weld

Size NPS DN	ASME Class 150 regular port						
	A	B	C	D	ØE	lb / kg	Cv
3 80	11.91 303	6.45 164	5.56 141	11.12 282	2 51	44 20	200
4 100	33 838	8.99 228	6 152	12 305	3 76	86 39	540

Butt weld

Size NPS DN	ASME Class 300 regular port							
	A	B	C	D	ØE	K	lb / kg	Cv
3 80	20 508	7.97 202	5.56 141	11.12 282	2 51	--- ---	64 29	200
4 100	–	–	6 152	12 305	3 76	16.29 414	128 58	540

Butt weld, socket weld, and threaded

Size NPS DN	ASME Class 600 regular port							
	A	B	C	D	ØE	K	lb / kg	Cv
½ 15	4.63 118	3.48 88	1.31 33	2.63 67	0.44 11	–	2.4 1	8
¾ 20	4.63 118	3.6 91	1.63 41	3.25 83	0.56 14	–	3.4 2	13
1 25	6.44 164	4.82 122	1.88 48	3.75 95	0.81 21	–	6.9 3.1	34
1½ 40	7.55 192	5.66 144	2.44 62	4.88 124	1.19 30	–	14.4 7	65
2 50	10.5 267	7.16 182	3 76	6 152	1.5 38	–	24 11	104
2½ 65	–	–	3.63 92	7.25 184	2 51	14.85 377	44 20	200
3(1) 80	–	–	3.63 92	7.25 184	2 51	14.85 377	44 20	200

Butt weld, socket weld, and threaded

Size NPS DN	ASME Class 600 full port							
	A	B	C	D	ØE	K	lb / kg	Cv
⅜ 10	1.31 33	3.5 89	2.63 67	4.63 118	0.44 11		2.5 1	8
½ 15	1.63 41	3.63 92	3.25 83	4.63 118	0.5 13		3.5 2	12
¾ 20	1.88 48	4.81 122	3.75 95	6.44 164	0.75 19		7 3	30
1 25	2.44 62	5.69 145	4.88 124	7.56 192	1 25		14.5 7	70
1 ½ 40	3 76	7.19 183	6 152	10.5 267	1.5 38		23.5 11	104
2 50	3.63 92	14.88(1) 378(1)	7.25 184	12(1) 305(1)	2 51		70 32	200
3(2) 80	1.88 48	4.81 122	3.75 95	6.44 164	0.75 19		7 3	30

(1) Dimensions apply to the socket weld and the threaded end connections only.

(2) Rating is limited to 740 psig (WCB) or 720 psig (CF8M)

Notes:

Contact velan for bare stem dimensions.
For other sizes and pressure classes, contact your local Velan office.
Dimensions shown in inches (mm)
Kv is the metric equivalent of Cv. Kv = Cv x 0.864

Standard actuation compliant to API 608

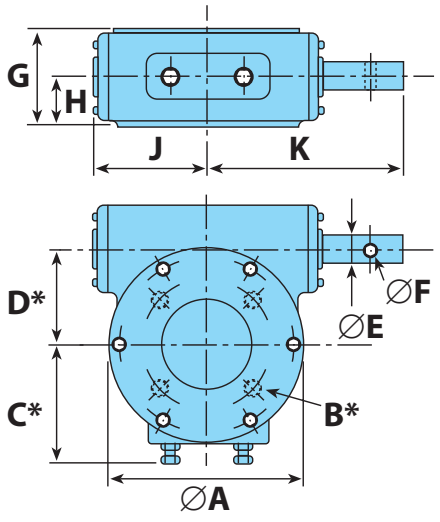
API 608 standard compliant configurations for the resilient-seated ball valves types shown below are available with the following actuation and handle options (position "J" in the figure number). Other options are available in non-API 608 configurations.

Product	Port	ASME Class	Size NPS	Size DN	Lever handle (W)	Slide[1]/ Oval handle (H)	Gear (G)	Bare stem (B)
TE	Regular	150	½	15	• Lever handle	● Oval handle		
			¾	20	• Lever handle	● Oval handle		
			1	25	• Lever handle	● Oval handle		
			1 ½	40	• Lever handle	● Oval handle		
			2	50	• Lever handle	● Oval handle		
			3	80	• Lever handle			
			4	100		• Slide handle[1]		
		300	½	15	• Lever handle	● Oval handle		
			¾	20	• Lever handle	● Oval handle		
			1	25	• Lever handle	● Oval handle		
			1 ½	40	• Lever handle	● Oval handle		
			2	50	• Lever handle	● Oval handle		
			3	80		• Slide handle[1]		
			4	100			• Gear G0-2 & Ø12 HD	● Bare stem
		600	½	15	• Lever handle	● Oval handle		
			¾	20	• Lever handle	● Oval handle		
			1	25	• Lever handle	● Oval handle		
			1 ½	40	• Lever handle	● Oval handle		
			2	50	• Lever handle			
			3	80			• Gear G0-2 & Ø12 HD	● Bare stem
	Full	600	½	15	• Lever handle	● Oval handle		
			¾	20	• Lever handle	● Oval handle		
			1	25	• Lever handle	● Oval handle		
			1 ½	40	• Lever handle			
			2	50			• Gear G0-2 & Ø12 HD	● Bare stem

• Stocking replenishment program ● Available with factory lead times

(1) All slide handles convert to a T-handle by removing the screw holding the pipe while using the second hole to attach the pipe to the pipe holder.

Manual gear operators



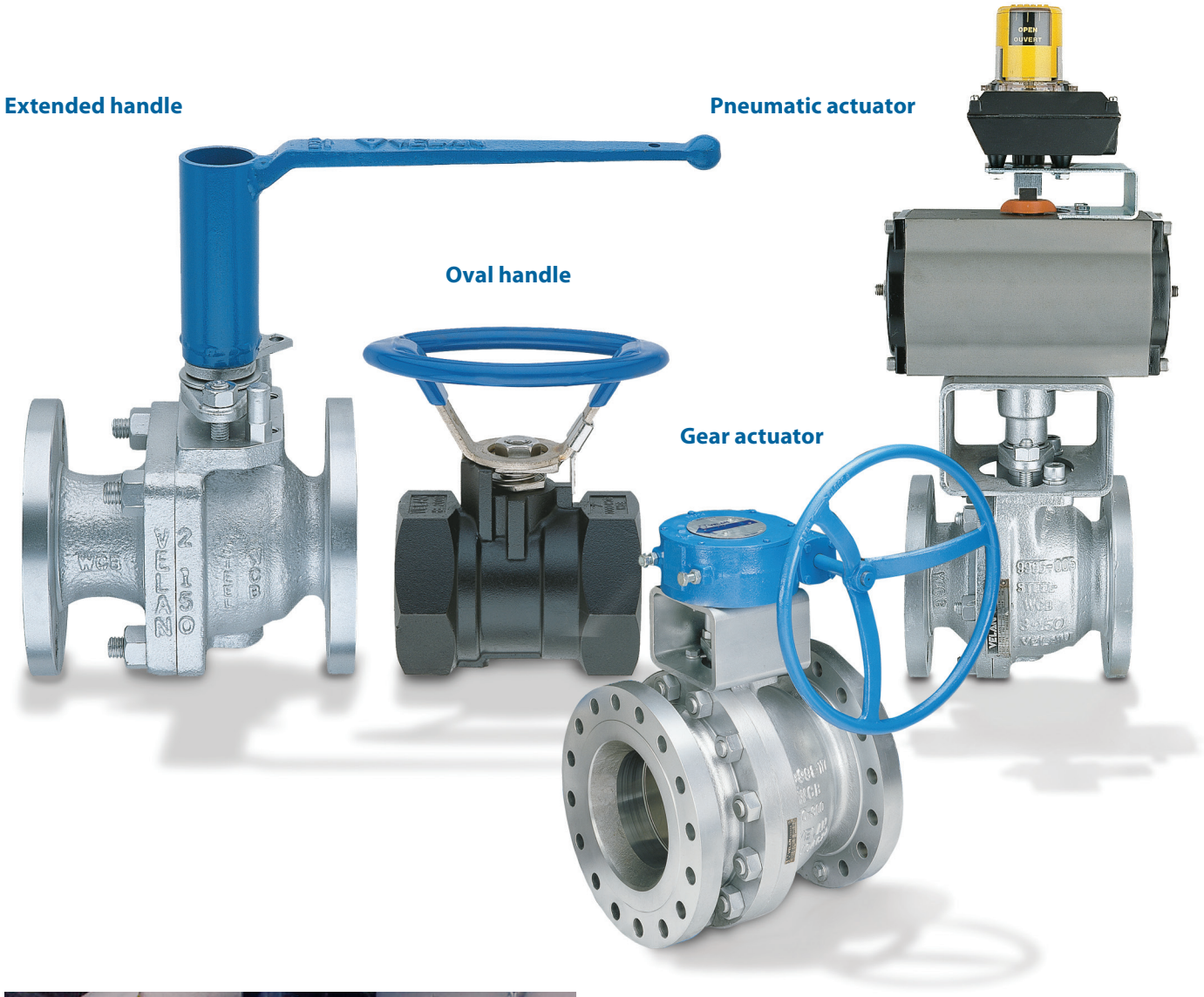
Torque ratings

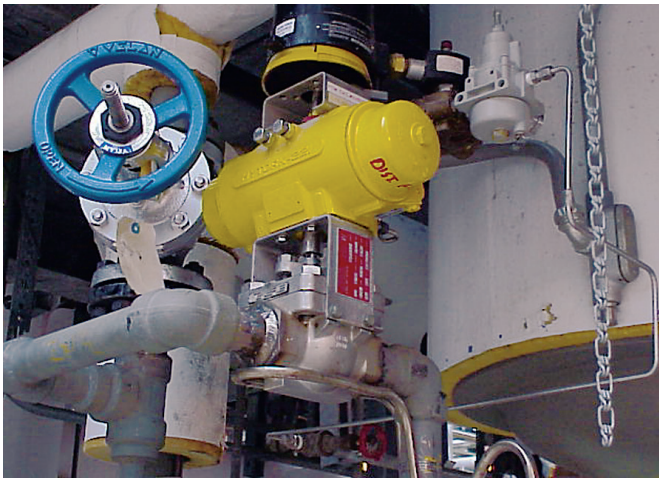
Unit	Ratio	Max. output torque		Max. shaft diameter		Weight		Efficiency
	Basic	lb•in	Nm	in	mm	lb	kg	Basic
G0-2	30:1	4,800	542	1.437	36	22	10	0.25
G0-3	50:1	9,000	1,017	2.250	57	29	13	0.25
G0-4	80:1	21,000	2,373	3.250	83	70	32	0.25

Type	Dimensions - in/mm									
	ØA	B*	C*	D*	ØE	ØF	G	H	I	J
G0-2	6.37 162	4 x ⅜ - 16 UNC 3 ⅞" (98.4 mm)	4.00 102	2.50 64	0.75 19	0.18 4.57	3.50 89	1.50 38	3.18 81	8.00 203
G0-3	7.12 181	4 x ½ - 13 UNC 5" (127 mm)	4.25 108	3.12 79	0.75 19	0.18 4.57	3.75 95	1.50 38	3.50 89	8.00 203
G0-4	10.00 254	4 x ¾ - 10 UNC 6 ½" (165 mm)	5.75 146	4.50 114	1.00 25	0.25 6.35	4.50 114	2.25 57	5.18 132	9.81 249

** Mounting holes straddle center line.*

Special handles, actuators and locking devices





Top-entry ball valve installation.

Automated valves and control

Velan ball valves are available in a variety of automation packages and include pneumatic, electric, and hydraulic. Velan also supplies automated packages with integral control actuation.

Automation is done either by Velan at its own facilities located around the world or by authorized automation centers. In either case, automation is done in accordance with strict guidelines of quality assurance, engineering standards, and performance.

Thanks to Velan's flexible automation program, we can offer the best actuation package and accessories to meet the customer's needs, whatever their performance and commercial requirements.

Velan maintains *"Specification for Valve Automation"* and *"Quarter Turn Actuation Standards"* documents. Only those automation centers that adhere to these standards and are approved by Velan audits earn the status of "Authorized Velan Automation Center."

This program ensures our ball valves can be automated by a wide range of actuators and accessories, regardless of whether the actuation is done at Velan or at an authorized automation center.

All automated ball valves from Velan or authorized automation centers have a discrete serial number data sheet on permanent file. This permanent record contains the source of supply and data on all components such as actuators, solenoid valves, limit switches, and positioners. All the test data—such as operational and seat leak tests—are recorded as well.

Automated packages with integral control actuation.

Sizing of actuators

Elements affecting valve torque

The torque requirements of soft seated ball valves depend on many factors.

Valve design and material selection

- **Seat design and material selection**

  Velan seats were developed to ensure maximum flexibility and low torque. The friction force depends on the seat material, and the applicable torque multipliers are shown in the seat material selection table (pg. 15).

- **Ball: free-floating or trunnion-mounted?**

  A free floating ball is forced against the down-stream seat by the fluid pressure and the resulting torque is a product of the friction force and the seat/ball contact radius. The fluid load is carried by the bearings in a trunnion-mounted ball valve, resulting in a lower torque overall.

- **Stem seal**

  The torque resulting from the stem-packing friction depends on the packing chamber depth, the type of materials, and the size of the stem/packing rings – smaller the valve, the greater the importance of the stem seal factor.

Service conditions

- **Differential pressure**

  The breakaway torque increases substantially with the differential pressure on larger ball valves. On small ball valves, up to NPS 1 (DN 25), where the stem packing friction is higher than the ball/seat torque, the overall torque remains approximately the same.

- **Frequency of operation**

  When a valve remains in the closed position for extended periods of time, the breakaway torque increases due to the resilient material filling the voids in the ball caused by machining and other problems.

- **Fluid influence**

  The torque tends to be lower with oils, but higher with gas or other liquids with solids or slurries. Dirt and solid particles can become embedded in the seats, which greatly increases the torque. Note that torque data on the product pages is the result of laboratory tests with clean water at ambient temperature.

- **Influence of temperature**

  Within the operating temperature range, the torque, in most cases, remains constant–except at low cryogenic levels when the seats become more rigid.

- **Limitation to speed of actuation**

  Resilient materials such as virgin MPTFE or reinforced PTFE (RPTFE) can be damaged by a fast turning ball under pressure. The speed limits for closing or opening the ball valves for sizes:

  - NPS ½–2½ (DN 15–65), 0.5 second
  - NPS 3–6 (DN 80–150), 1 second

Actuator torque requirement calculations

Important:

1. Published factors are to be used as a guide.
2. The actuator selection has to be based also on economic considerations. A valve that has an important function, or one that is out of reach for service, should have a larger actuator than would normally be selected.

Table 1 **Seat factor "MF" and seat material selection**

Seat material	Application and Limitations					Factor "MF" (1)
	Temp. range °F (°C)	Chemical	Radiation	Valve type	Service application	
PTFE (T) Virgin polytetrafluoroethylene	-100 to 400 (-73 to 204) *See note (2)*	All except: • Molten alkali metals • Liquid or gaseous fluorine • A few fluorochemicals (i.e., CLF_3 and OF_2)	10^4 RAD	TE-150/300/600	Chemical and cryogenic service.	1.0
RPTFE (G) 15% Glass reinforced	-100 to 450 (-73 to 232)	All except: • Molten alkali metals • Liquid or gaseous fluorine • A few fluorochemicals (i.e., CLF_3 and OF_2)	10^4 RAD	TE-150/300/600	Used as standard for low and medium pressure service for steam service up to 150 psig (10.3 bar).	1.0
C-RPTFE (C) Carbon graphite reinforced PTFE	-100 to 500 (-73 to 260) *See note (3)*	All except: • Molten alkali metals • Liquid or gaseous fluorine • A few fluorochemicals (i.e., CLF_3 and OF_2) • Fluid media with carbon	10^4 RAD	TE-150/300/600	For high temperature and high pressure service. For steam up to 450 psig (31 bar).	1.0
MPTFE (E) Modified polytetrafluoroethylene	-100 to 450 (-73 to 232)	All except: - Molten alkali metals - Liquid or gaseous fluorine - A few fluorochemicals (i.e., CLF_3 and OF_2)	10^4 RAD	TE-150/300/600	For low and medium pressure service. Particularly recommended for use on styrene and butadiene.	1.0
UHMW-PE (U) Ultra high molecular weight polyethylene	-60 to 200 (-51 to 93)	At temperatures below 140°F (60°C), the material is unaffected by a large number of solvents. It is attacked by aromatic and halogenated hydrocarbons and strong oxidizing agents (nitric acid, oleum and halogens).	10^7 RAD	TE-150/300/600	Where high chemical resistance and abrasion resistance are required.	1.3

Table 2 **Fluid factor "FF"**

Liquid	Factor "FF" (1)
Clean particle-free, non-lubricating (e.g.: water, alcohol or solvents)	1.0
Clean particle-free, lubricating oil	0.5 to 0.8
Slurry (liquids carrying solids) or heavy corroded and contaminated system	1.3 to 2.0
Gas or saturated steam, clean and wet	1.0
Gas or superheated steam, clean and dry	1.3
Gas, dirty (e.g.: natural gas)	1.2 to 1.5

Table 3 **Frequency of operation factor "OF"**

Liquid	Factor "0F" (1)
Once per day or greater	1.0
Once per week or greater	1.3
Once per month or greater	1.4
Once per four-month or greater	1.5

Notes:

(1) The seat, fluid, and frequency of operation factors should be considered as a guide only and should be adjusted according to experience and judgment. Velan is not responsible directly or indirectly for actuator selection by third parties.

(2) Down to -325°F (-198°C) for cryogenic service with special seats for Class 150/300. For temperatures below -100°F (-73°C), our cryogenic seat must be used the standard seat is not to be used for these lower temperatures.

(3) Down to -325°F (-198°C) for cryogenic service with special seats for Class 600. For temperatures below -100°F (-73°C), our cryogenic seat must be used the standard seat is not to be used for these lower temperatures.

Typical examples for sizing actuators based on actuator torquing equation

To obtain the torque requirements for an actuator:

Step 1
Determine the basic, maximum torque "**TT**" for a particular valve and pressure differential from *Torque tables* on page 18.

Step 2
Determine the seat factor "**MF**", from *Table 1* page 15.
For MPTFE or RPTFE, the factor is 1.0.

Step 3
Determine the fluid factor "**FF**", from *Table 2* page 15.

Step 4
Determine the frequency of operation factor "**OF**", from *Table 3* page 15.

Using the data from **Steps 1–4**, the actuator torque equation "**AT**" can now be established:

AT = TT x MF x FF x OF = lbf•in (Nm)

AT = (Step 1) x (Step 2) x (Step 3) x (Step 4) = lbf•in

Example for a top-entry flanged in CF8M, regular port:

Application:	Water
Service:	Clean water. Differential pressure 100 psid (6.8 bar)
Service temp.:	70°F (21°C)
Cycle time:	Every 6 hours
Valve size:	TE-150, NPS 4 (DN 100)
Seat material:	MPTFE
Actuator:	Pneumatic actuator with spring return, fail closed
Air supply:	90 psig (6.2 bar)

Sizing of torque:

TT = 1350 lbf•in (153 Nm), For ΔP = 100 psid (6.8 bar).

MF = 1 (MPTFE) (*Table 1* page 15)

FF = 1.3 (*Table 2* page 15)

OF = 1 (*Table 3* page 15)

Minimum break torque required

AT = 1350 (153 Nm) x 1 x 1.3 x 1 = 1755 lbf•in (199 Nm)

Selection of actuator:

In the example below, 1755 lbf•in (199 Nm) is the minimum required valve break torque or the minimum required actuator output torque.

Since allowances for the fluid type, seat material, and frequency of operation have already been incorporated into the torque calculation, additional safety factors are not required.

However, it is good practice to apply an additional 1.5 multiplier to the break torque when selecting a pneumatic actuator. This will ensure smooth operation and protection from occasional reduction of air pressure.

This is sufficient data when constant torque type actuators such as rack and pinion double acting or electric actuators are used.

However, when scotch-yoke type, spring return–fail closed, or spring return–fail open actuators are used, factor the break torque by 0.70 for run torque and by 0.80 for reseat torque.

Pressure / temperature ratings: TE-150/300/600

Carbon steel: ASTM A216-WCB

Temp. °F °C	Psig Bar							
	Class 150			Class 300				Class 600
	PTFE[1]	RPTFE & MPTFE	C-RPTFE	PTFE[1]	RPTFE	MPTFE	C-RPTFE	C-RPTFE[2]
-20°F	285	285	285	740	740	740	740	1480
-29°C	20	20	20	51	51	51	51	102
0°F	285	285	285	740	740	740	740	1480
-18°C	20	20	20	51	51	51	51	102
100°F	285	285	285	740	740	740	740	1480
38°C	20	20	20	51	51	51	51	102
150°F	272	272	272	633	649	710	710	1295
66°C	19	19	19	44	45	49	49	89
200°F	260	260	260	527	557	680	680	1110
93°C	18	18	18	36	38	47	47	77
250°F	245	245	245	420	466	588	588	925
121°C	17	17	17	29	32	41	41	6
300°F	230	230	230	313	374	470	470	740
149°C	16	16	16	22	26	32	32	51
350°F	207	215	215	207	283	353	353	555
177°C	14	15	15	14	20	24	24	38
400°F	100	192	192	100	192	235	235	370
204°C	7	13	13	7	13	16	16	26
450°F	N/A	100	100	N/A	100	100	118	185
232°C		7	7		7	7	8	13
500°F	N/A	N/A	0	N/A	N/A	N/A	0	0
260°C			0				0	0

Stainless steel: ASTM A351-CF8M

Temp. °F °C	Psig Bar							
	Class 150			Class 300				Class 600
	PTFE[1]	RPTFE & MPTFE	C-RPTFE	PTFE[1]	RPTFE	MPTFE	C-RPTFE	C-RPTFE[2]
-70°F	275	275	275	720	720	720	720	1440
-57°C	19	19	19	50	50	50	50	99
0°F	275	275	275	720	720	720	720	1440
-18°C	19	19	19	50	50	50	50	99
100°F	275	275	275	720	720	720	720	1440
38°C	19	19	19	50	50	50	50	99
150°F	255	255	255	617	631	670	670	1260
66°C	18	18	18	43	44	46	46	87
200°F	235	235	235	513	543	620	620	1080
93°C	16	16	16	35	37	43	43	75
250°F	225	225	225	410	454	532	532	900
121°C	16	16	16	28	31	37	37	62
300°F	215	215	215	307	366	426	426	720
149°C	15	15	15	21	25	29	29	50
350°F	203	205	205	203	277	319	319	540
177°C	14	14	14	14	19	22	22	37
400°F	100	189	189	100	189	213	213	360
204°C	7	13	13	7	13	15	15	25
450°F	N/A	100	100	N/A	100	100	107	180
232°C		7	7		7	7	7	12
500°F	N/A	N/A	0	N/A	N/A	N/A	0	0
260°C			0				0	0

(1) Valves with PTFE packing are limited to 400°F (204°C).

(2) Maximum 450°F (232°C) for valves with trunnion balls.

Notes:

During the valve selection, please take note that Memoryseal ball valves can be used at the minimum cold temperatures indicated above, except for severe service applications where the media going through the valve is very cold, below -20° F, and the ambient temperature is much warmer and humid. In such extreme applications ice will build up around the valve, especially around the packing area making the valve inoperable.

Pressure rating intermediate to tabulated values are determined by linear interpolation between temperatures.

Materials and trim selection for steam service

Steam	Type and size	Seat	Packings
150 psig (10.3 bar)	All	MPTFE and RPTFE	Graphite
250 psig (17.2 bar)	TE-300/600	MPTFE and RPTFE	Graphite
450 psig (31 bar)	TE-300/600 NPS ½–4 (DN 15-100)	C-RPTFE	Graphite
500 psig (34.5 bar)	TE-300/600 NPS ½–4 (DN 15-100)	Graphite	Graphite

Torque tables: Flanged end connection

Seats: MPTFE, PTFE, RPTFE, C-RPTFE for TE-150/300/600
Packing: PTFE standard temperature range between -20°F (-29°C) and 400°F (204°C)
Net torque values for clean fluids: lb•in and Nm

TE-150/300/600 Regular port – lb·in

Size	Maximum Differential Pressure - Psi								
NPS	0	100	200	300	400	500	600	700	740
½	45	45	45	45	45	45	45	45	45
¾	70	70	70	70	70	70	80	88	90
1	130	130	130	130	135	150	160	180	200
1½	240	240	240	275	320	365	430	490	525
2	420	420	430	480	525	620	700	780	810
3	600	600	650	825	1100	1400	1800	–	–
4	1350	1350	1650	2100	2325 (1)	–	–	–	–
6	2000	2854	4446	6037	7151 (1)	–	–	–	–

TE-150/300/600 Regular port – Nm

Size	Maximum Differential Pressure - Bar								
DN	0	6.9	13.8	20.7	27.6	34.5	41.4	48.3	51
15	5	5	5	5	5	5	5	5	5
20	8	8	8	8	8	8	9	10	10
25	15	15	15	15	15	17	18	20	23
40	27	27	27	31	36	41	49	55	59
50	47	47	49	54	59	70	79	88	92
80	68	68	73	93	124	158	203	–	–
100	153	153	186	237	263 (1)	–	–	–	–
150	226	323	502	682	808 (1)	–	–	–	–

TE-150/300/600 Full port – lb·in

Size	Maximum Differential Pressure - psi								
NPS	0	100	200	300	400	500	600	700	740
½	70	70	70	70	70	70	80	88	90
¾	130	130	130	130	135	150	160	180	200
1	240	240	240	275	320	365	430	490	525
1½	420	420	430	480	525	620	700	780	810
2	600	600	650	825	1100	1400	1800	–	–
3	1350	1350	1650	2100	2325 (1)	–	–	–	–
4	2000	2854	4446	6037	7151 (1)	–	–	–	–
6	4250	7098	12296	17494	21132 (1)	–	–	–	–

TE-150/300/600 Full port – Nm

Size	Maximum Differential Pressure - bar								
DN	0	6.9	13.8	20.7	27.6	34.5	41.4	48.3	51
15	8	8	8	8	8	8	9	10	10
20	15	15	15	15	15	17	18	20	23
25	27	27	27	31	36	41	49	55	59
40	47	47	49	54	59	70	79	88	92
50	68	68	73	93	124	158	203	–	–
80	153	153	186	237	263 (1)	–	–	–	–
100	226	323	502	682	808 (1)	–	–	–	–
150	4480	802	1389	1977	2388 (1)	–	–	–	–

(1) The indicated torque values are for 740 psi or 51 bar only.

Note:
Values in Nm have been calculated by multiplying lb.in values by 0.113.

How to order Memoryseal® TE-150/300/600 resilient-seated ball valves

Type of connection	Size of connection		Model number/ Class	Port	Type	Body		Trim (ball, stem)		Seat	Standard compliance		Actuation
A	B		C	D	E	F		G		H	I		J
F	0	8	0	0	6	0	2	S	S	E	1	W	

Example: NPS 2 (DN 50) flanged, top-entry, 150 Class, regular port valve in carbon steel with stainless steel trim, MPTFE seats, graphite packing, and NACE, exposed body bolting with lever handle.

A TYPE OF CONNECTION

B	Butt weld	R	Flanged ring joint
C	Combination (socket weld/threaded)	S	Thread NPT
E	Welded studs (butt-weld)	W	Socket weld
F	Flanged B16.5 (B16.47 series A)	Z	Socket weld

B SIZE OF CONNECTION

Sizes shown in NPS (DN)

02	⅜ (10)	04	¾ (20)	07	1½ (40)	09	2½ (65)	12	4 (100)
03	½ (15)	05	1 (25)	08	2 (50)	10	3 (80)		

C MODEL NUMBER / CLASS[1]

G	TE-600	0	150	2	600

E TYPE

6	Top-entry

F BODY MATERIAL

02	A105, WCB	14	SS F316L, CF3M	25	LCB	36	SS F321H
03	CrMo F1, WC1	15	SS F347, CF8C	26	LF2/LCB	38	LC1
04	CrMo F5, C5	18	SS F321	27	LF3/LC3	39	LC2
05	CrMo F11, WC6	19	Monel M35	28	SS F317, CG8M	47	SS F347H
06	CrMo F22, WC9	20	Inconel 625	29	SS F317L, CG3M		
09	CrMo F9, C12	21	Hastelloy C	31	LCC		
11	SS F304, CF8	22	Titanium Gr. 5	32	SS F51, 4A, CD3MN		
12	SS F304L, CF3	23	Alloy 20 (CN7M)	34	F91/C12A		
13	SS F316, CF8M	24	LF1	35	SS F44 (254SMO) CK3MCuN		

Consult Velan for other materials.

G TRIM MATERIAL (ball/stem)

Code	Ball	Stem	Code	Ball	Stem
AY	Alloy 20	Alloy 20	SN	316 Cr. plated	Nitronic 50
HC	Hastelloy C	Hastelloy C	SP	316 Cr. plated	316
PR	316 Cr. plated	630	SR	316	630
SB	304	304	SS	316	316

H SEAT MATERIAL

C	Graphite-reinforced PTFE	G	Glass-reinforced PTFE	T	PTFE
E	MPTFE	P	Peek, with 30% glass	U	UHMWPE

I STANDARD COMPLIANCE

Standard configurations for Top-entry (TE-150/300) ball valves are available in the following configuration options:	TE-150/300/600			
	1	2	3	4
API 608[2]	✔	✔	✔	✔
API 641/ISO 15848-1, dual qualified100 ppm Low-E[3]	✔	✔	✔	✔
API 607, Fire safe[4]	✔	✔		
NACE, exposed body bolting[5]	✔		✔[6]	
Non-NACE[5]		✔		✔

For all other resilient-seated ball valves, please use the following options[7]

A	PTFE packing, not fire safe, no special requirements	J	Vacuum
C	Chlorine	T	Bonnet, double packing
G	Oxygen, with and without extended bonnet	Z	Graphite packing, fire-tested to API 607, no special requirements
H	Cryogenic		

J ACTUATION[2]

A	Air or hydraulic actuator	G	Gear actuator	M	Motor actuator
B	Bare stem	H	Oval or slide handle[8]	W	Lever

(1) Actual valve pressure temperature ratings depend on choice of materials, consult catalogue/data sheet for details.

(2) Not all actuation options are available in an API 608 compliant configuration (Refer to page 11 for Standard actuation compliant to API 608). In the event the customer prefers a non-compliant actuation option, they should select A or Z (position "I" in figure number).

(3) Refer to fugitive emissions product update document (PU-API641) for qualified size/class range.

(4) Fire-tested to API 607 Rev 5 or later. Fire safe applicable to B16.34 ferritic and austenitic materials. e.g. position "F" body materials: 02, 03, 04, 05, 06, 09, 11, 12, 13, 14, 15, 18, 24, 25, 26, 27, 28, 29, 31, 34, 36, 38, 39, 47. Consult Velan for other materials.

(5) Velan valves for NACE service (as indicated by figure number and/or description) comply with the metallurgical requirements of the current NACE MR0103/ISO 17495 and NACE MR0175/ISO 15156 standards. This compliance is applicable to internal components in contact with the process fluid, as well as Body (body/bonnet and body/body-end) bolting.

NOTE: Material selection is dependent on the actual environment and it is therefore the equipment end user's responsibility to ensure that the selected materials are suitable for the intended service. In this respect, we also refer to NACE MR0103/ISO 17495 for definitions of exposed bolting (bolting that is exposed directly to the sour environment or otherwise denied direct atmospheric exposure) and non-exposed bolting (bolting that is not exposed directly to the sour environment and is directly exposed to the atmosphere at all times). Please contact Velan for any questions regarding the application of our products for NACE service.

(6) CAUTION: Not fire-safe. Typically suitable for chemical applications with non-flammable fluids only where controlled material metallurgy of pressure retaining components and wetted parts in accordance with NACE MR0103/ISO 17495 or NACE MR0175/ISO 15156 standards is preferred.

(7) Consult Velan for ordering instructions.

(8) All slide handles convert to a T-handle by removing the screw holding the pipe while using the second hole to attach the pipe to the pipe holder.

Headquartered in Montreal, Canada, Velan has several international subsidiaries.
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