DFT INC

MSV-100® Control Valve for Medium Service Applications

DFT® MSV-100® Control Valve

DFT® designs products using the latest CAD, FEA, and CFD design technology software and manufactures in Exton, PA.

Features & Benefits of DFT® Control Valves

Compact Size & Straight-thru Design

- Straight-thru Venturi design results in smooth flow transitions – no torturous path
- Straight-thru flow path reduces turbulence and results in high pressure recovery

Larger Cv's and Higher Flow Capacity

- High Pressure Recovery results in higher Cv's
- Up to twice the flow capacity of comparably sized Globe Style Control Valves

Position Seating – Class V Shutoff

- With Position Seating, the actuator only has to position the shut off element (the ball) in the center of the flow stream
- Pressurized fluid media acting on the ball creates the force required for shutoff
- The higher the pressure in the flow stream, the greater the seating force, the tighter the shutoff
- Achieves Class V Shutoff with metal to metal seating

Low Actuation Cost

- Position Seated designs require much lower actuator force than Force seated Globe Style designs
- Lower Actuator force requirements result in smaller, more cost-effective actuators
- Lower Actuator force results in less wear and longer actuator life

Wide Range of Applications

- The MSV-100® is designed for ANSI Class 600, Class 900 and Class 1500 applications
- Gas, Liquid, Steam, and Slurry applications
- Pressures up to 3,750 PSIG
- Temperatures up to 1,000 F
- Fine Modulating Control with 200:1 Turndown Ratio
- Standard On/Off applications

Cavitation Control

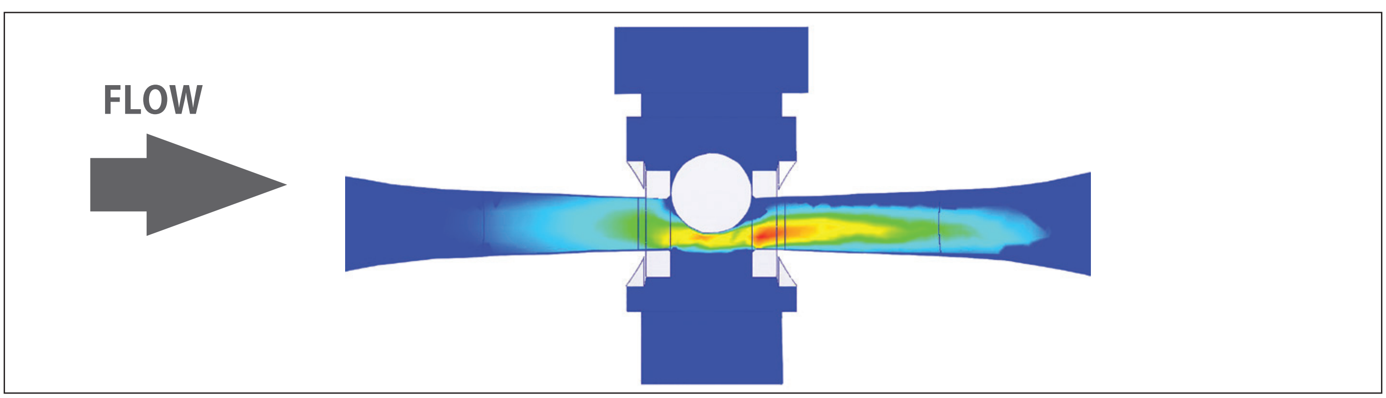
- The MSV-100® Straight-thru Venturi design is based on the Bernoulli Principal
- If cavitation occurs, it will happen in the valve outlet Recovery Area
- The lowest flow velocity and highest pressure in the valve outlet Recovery Area are in the center of the fluid flow profile and not next to metal surfaces, greatly reducing the potential for Cavitation damage
- See the CFD Velocity profile below

Self - Purging Design

- The Straight-thru Venturi/Bernoulli based design that generates the lowest pressure in the highest velocity portion of the flow stream results in a Self-Purging vacuum effect that prevents particulate from building up in the valve body cavities

Low Maintenance Costs

- No special tools are required to maintain the MSV-100®
- Trim components made of hardened metals designed to handle cavitating service, leading to long service life



Shown above is a CFD model of the velocity field in a MSV-100® Control Valve.

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MSV-100®

Control Valve for Medium Service Design Features

DFT® Model MSV-100® Control Valve Features

- Valve body sizes: 1″ to 4″*
- Pressure class: ANSI 600, 900, and 1500
- Maximum pressure of 3,700 psig
- Pressure differential > 1000 psi (69 bar)
- Maximum temperature to 1000°F (538°C)
- Body: Carbon, Alloy, or Stainless steel
- ANSI Raised Face Ends
- Top entry to internal trim
- Flow characteristics: Linear
- Pneumatic, Electric, or Manual Actuation
- Modulating or On/Off Service
- Gas, Liquid, and Steam Applications
- Class V shutoff

Codes & Standards

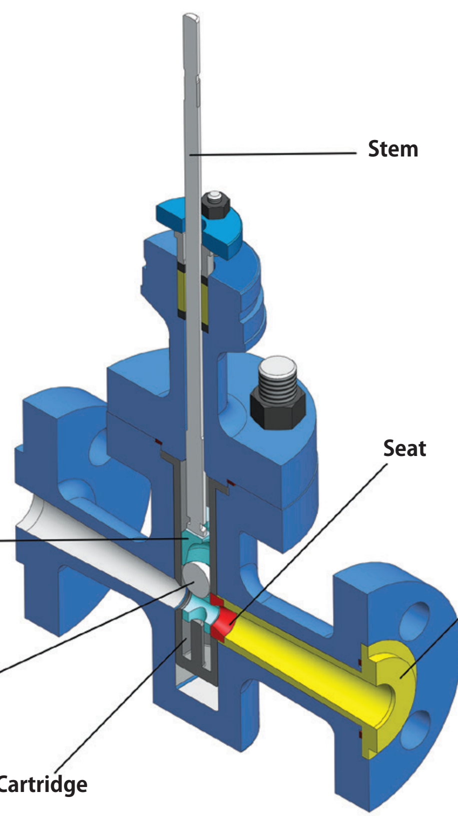
- ASME B16.5
- ASME B16.34 s
- ANSI/FCI 70-2
- ANSI/ISA 75.01
- ANSI/ISA 75.08.01
- MSS-SP 25

* Larger sizes, consult factory.

Venturi Straight-thru Design

The **MSV-100® Control Valve** features an in-line straight-thru venturi flow design. The control element, a spherical ball, is contained by a cage that positions the ball relative to the downstream seat by means of linear stem travel.

There are no close clearances between the moving parts (i.e. cage, ball and seat). These features enable the valve to operate smoothly and efficiently across a wide range of temperatures and/or in fluids carrying suspended particles such as slurries. FCI 70 Class V shutoff is standard.



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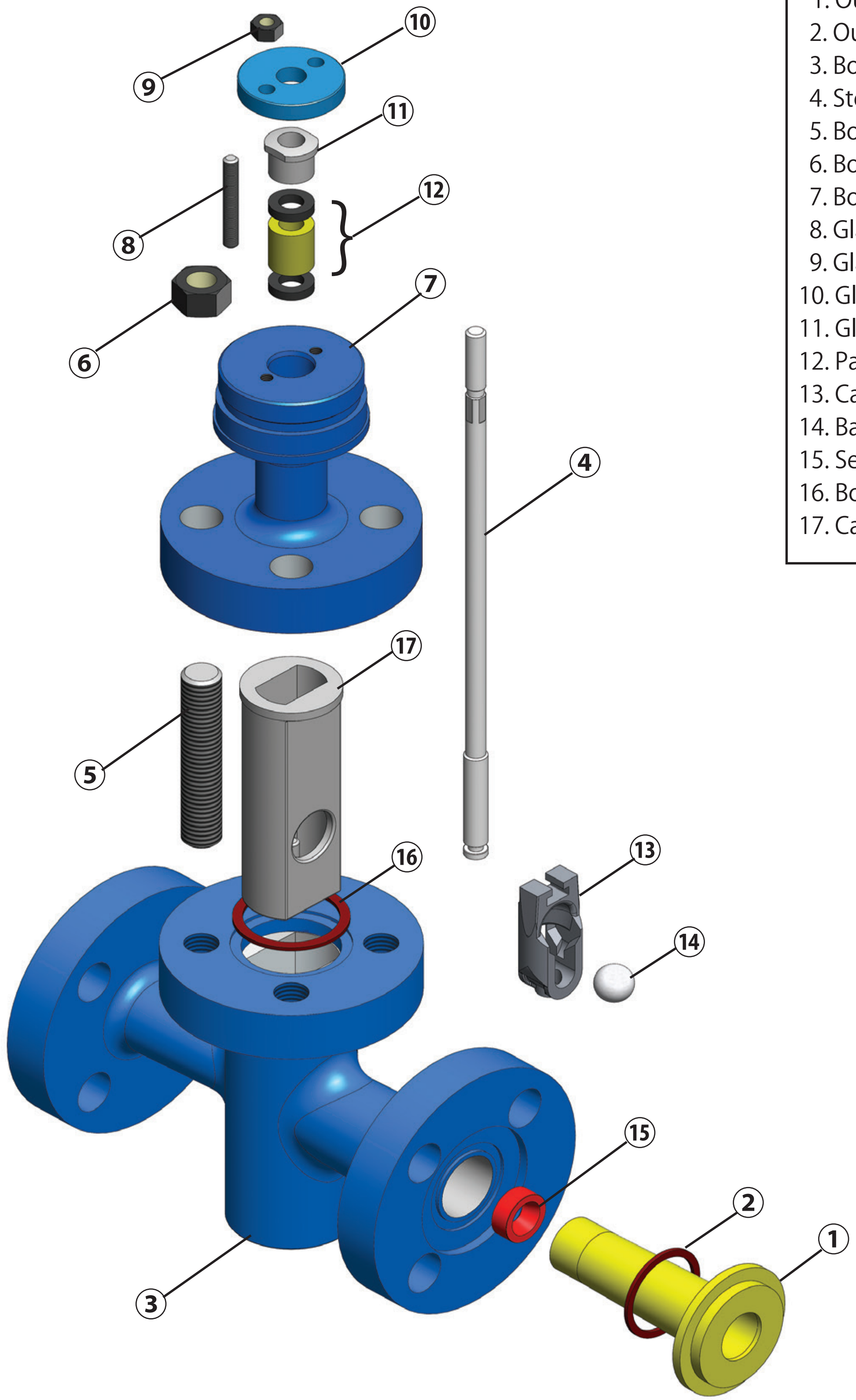
MSV-100® Control Valve
Nomenclature

1. Outlet Liner
2. Outlet Gasket
3. Body
4. Stem
5. Bonnet Stud
6. Bonnet Nut
7. Bonnet
8. Gland Follower Stud
9. Gland Follower Nut
10. Gland Follower
11. Gland
12. Packing Set
13. Cage
14. Ball
15. Seat
16. Bonnet Gasket
17. Cartridge



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DFT® MSV-100®

Materials of Construction*

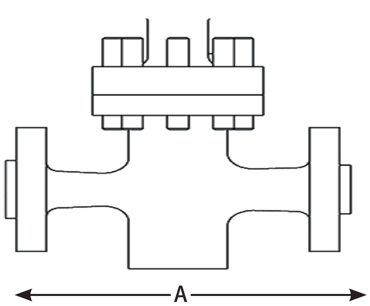
COMPONENT	CARBON STEEL	ALLOY STEEL	STAINLESS STEEL
Bonnet/Bottom Cover	A216 WCB	A217 WC9	A351 CF8M
Stem	17-4PH		
Cage	Stellite / Stellite lined		
Gland	303 SS		
Follower	Carbon Steel		316 SS
TRIM STYLE			
Ball	440C		Stellite®
Seat	422 SS Heat Treated & Hardened		Stellite®
Liner	17-4PH		
SEALS			
	Low Temperature <350° F (177° C)		350 - 1000° F (177 - 538° C)
Packing	Teflon Chevron Style		Graphite
Bonnet	Spiral Wound Gasket 304/Graphite		

* Standard materials of construction are shown. NACE, corrosion resistant, and other special trims available upon request. Contact the factory for more information.

Face to Face Dimensions

Nominal Valve Size		ASME PRESSURE CLASS					
		600		900		1500	
NPS	DN	in	mm	in	mm	in	mm
1	25	8.25	210	11.50	292	11.50	292
1 1/2	40	9.88	251	13.12	333	13.12	333
2	50	11.25	286	14.75	375	14.75	375
3	80	13.25	337	17.38	441	18.12	460
4	100	15.50	394	20.12	511	21.87	530

Note: RTJ ends also available upon request.



RAISED FACE

CV Rates

MSV-100® CV					
NPS	DN	Port (in)	Travel (in)	Trim	CV
1	25	0.68	1.25	1	23.7
		0.51	0.95	0.75	11.3
		0.34	0.71	0.5	4.69
1 1/2	40	1.02	1.83	1 1/2	53.5
		0.68	1.25	1	21.6
		0.51	0.95	0.75	10.4
2	50	1.36	2.59	2	95.1
		1.02	1.83	1 1/2	50.3
		0.68	1.25	1	20.2
3	80	201.3	3.54	3	213.9
		1.36	2.59	2	86.5
		1.02	1.83	1 1/2	45.5
4	100	366.4	4.54	4	366.4
		201.3	3.54	3	201.3
		1.36	2.59	2	81.0

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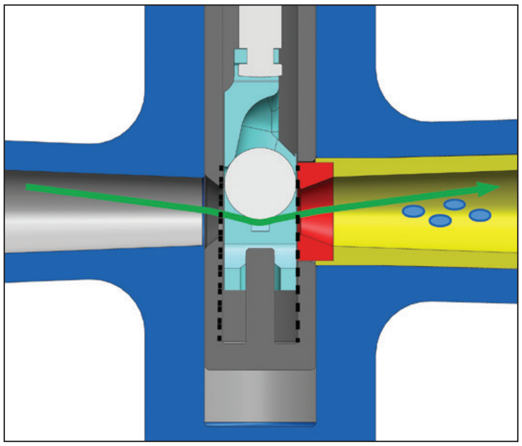
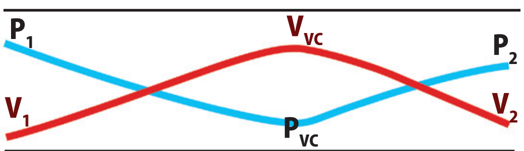
The Bernoulli Principle

Energy per unit volume at inlet = Energy per unit volume at outlet

$$P_1 + 1/2\,\rho\, v_1^{\,2} + \rho g h_1 = P_2 + 1/2\,\rho\, v_2^{\,2} + \rho g h_2$$

Where: **P = Pressure Energy; $1/2\,\rho\, v^2$ = Kinetic Energy; $\rho g h_1$ = Potential Energy**





The best example of the Bernoulli Principle is often called the "Bernoulli Effect" which states that fluid pressure decreases as fluid velocity increases and visa versa.

The illustration on the left shows the typical change in pressure and velocity as the fluid moves through the valve.

As the fluid flow enters the valve inlet it is introduced to and moves through a Converging Nozzle. As the fluid moves through the Converging Nozzle it flows through a smaller and smaller cross sectional area. That ever decreasing cross sectional area results in an increase in the velocity of the fluid flow. Consistent with the Bernoulli Effect, as the fluid velocity increases, the pressure decreases.

The fluid flow reaches its maximum velocity as it moves through the seat area, which is the smallest cross sectional area in the flow path. The fluid flow reaches its minimum pressure (Pvc) at the same point it reaches its maximum velocity (Vvc). This point is called the Vena Contracta.

As the fluid flow reaches the Recovery Area in the valve outlet, it is introduced to a Diverging Nozzle. As the fluid moves through the Diverging Nozzle it flows through a larger and larger cross sectional area. That ever increasing cross sectional area results in a decrease in velocity of the fluid flow. Consistent with the Bernoulli Effect, as the fluid velocity decreases, the pressure increases.

Cavitation Control

The MSV-100's Bernoulli Principal based design enhances its ability to effectively manage Cavitating applications.

Using the same illustration above, at the Inlet Pressure (P1) the fluid flow is all liquid. As the fluid passes through the valve seat, the pressure drops below the Vapor Pressure of the fluid. Once that occurs, vapor bubbles begin to form in the fluid. This is called Flashing. Flashing will continue as the pressure continues to drop to its lowest point at the Vena Contracta (Pvc). In the MSV-100®, due to it's straight-thru Venturi design, the highest velocity and the lowest pressure occur in the center of the fluid profile, which is in the center of the fluid flow.

When the fluid flow is introduced to the Recovery Area of the valve, the velocity decreases and pressure increases above the vapor pressure. When the pressure recovers above the vapor pressure, the vapor bubbles implode. This implosion is called Cavitation. Cavitation can have very damaging effects on metal surfaces inside valves.

When the Cavitating fluid reaches the Recovery Area in the MSV-100®, the lowest velocity and the highest pressure (P2) occur in the center of the fluid profile, which is in the center of the fluid flow and not along the metal surface. This tends to greatly reduce the potential for damage due to Cavitation. This leads to longer life in Cavitating applications.

In the event that Cavitation does occur next to metal surface, it will occur in the valve outlet that has a specially designed outlet liner that is made of hardened metal. Again, this design results in a reduced potential for metal damage from Cavitating fluids.

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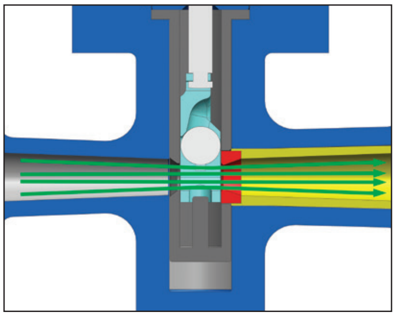
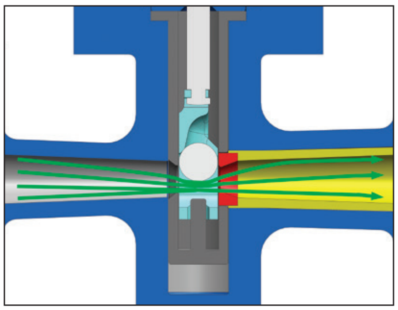
DFT® Control Valve Operation



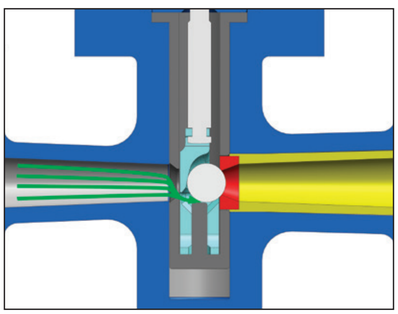
Full Open Position

In the full open position a straight-thru flowpath exists and the valve operates with the inherently high flow capacity of a venturi. The ball is firmly held out of the flow stream by four inclined pads on the cage which oppose the pressure differential force.
The Bernoulli pressure differential moves the suspended particles towards the center of the fluid stream, preventing them from settling out into the body. This keeps the valve clean and free of material deposits in all positions during the valve stroke.



Intermediate Throttling Position

In the intermediate throttling position, the ball rests on the four cage pads and is opposed by the differential pressure force caused by the Bernoulli effect. The stable suspension of the ball throughout the valve stroke permits extremely close and repeatable control throughout the entire valve stroke. The ball does not pinwheel or chatter.



Closed Position

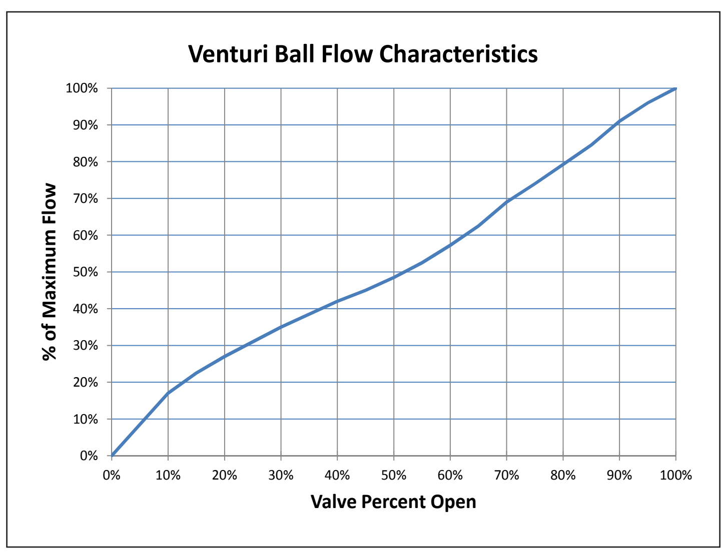
The downward stroke of the actuator moves the ball into the center of the flow path. The actuator does not provide the force to shut off the valve. The pressurized fluid media acting on the ball generates the force required for shutoff.

In the closed position, pressure moves the ball into the conical seating surface and holds it in place. Line contact between the ball and the seat results in high surface loads between the seat and the ball producing tight closure. As pressure increases, the seat load increases, improving the seal. During each valve stroke, the ball rotates and repositions itself presenting a new sealing surface to the seat, prolonging the tight shutoff capability. Temperature changes do not affect the tight shutoff since there is freedom of movement between the ball and the seat. The ball cannot become wedged into the seat. The guide pin is used to set the ball position, and during normal operation it has no other function.

Flow Characteristics

MSV-100® Flow Characteristics

The classic DFT® design has a linear flow characteristic. Linear characteristic provides superb control over a wide range. DFT's venturi-ball design is a unique and robust design that works efficiently with the physics of the fluid flow. Incoming flow enters through the nozzle to the control area. The smoothly converging nozzle lowers turbulence as the flow moves around the curved control path. Note that only rounded surfaces and cones are used for the control function. As the flow exits the valve, the diverging nozzle controls expansion and recovery so that no turbulence is added to the flow stream. This design provides a superior, smooth flow control.



Trim Type		Description	Service	Leakage	Trim characteristic
LSV-100® Top Guided Trim		Top guided, unbalanced, single seat trim. This style trim is suitable for pressure drops up to 600 psi in a non-cavitating environment. Your most economic choice for standard control applications.	Up to 6" Standard Class 150 Class 300	Class IV	Quick Opening Linear Equal %
MSV-100® Venturi Ball Design		Our unique venturi ball design provides superior control, long life and low maintenance costs for moderate pressure drop applications. The MSV-100® is designed for flanged applications. Seat replacement is accomplished on the bench.	Up to 4" Moderate Class 600 Class 900 Class 1500	Class V	Linear
Hi-100® Venturi Ball Design		This unique venturi ball design provides superior control, long life and low maintenance costs for severe pressure drop applications. The Hi-100® is designed for in-line repair using quick change trim.	Up to 12" Severe Class 150 through Class 4500	Class V	Linear

Warranty

Each DFT® Inc. product is warranted against defects in material and workmanship for a period of one year after being placed in service, but not exceeding 18 months after shipment, when these products are properly installed, maintained and used within the service and temperature and pressure ranges for which they were designed and manufactured, and provided they have not been subject to accident, negligence, alteration, abuse, misuse or the like. This warranty extends to the first purchaser only. All defective material must be returned to the person from whom you purchased the product, transportation prepaid, free of any liens or encumbrances and if found to be defective will be repaired free of charge or replaced, at the warrantor's or DFT's option.

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