DVPL

PLUNGER VALVE

PRESSURE, LEVEL, FLOW & LEAKAGE MANAGEMENT

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Where Control Meets Reliability

PROUDLY
MANUFACTURED IN INDIA

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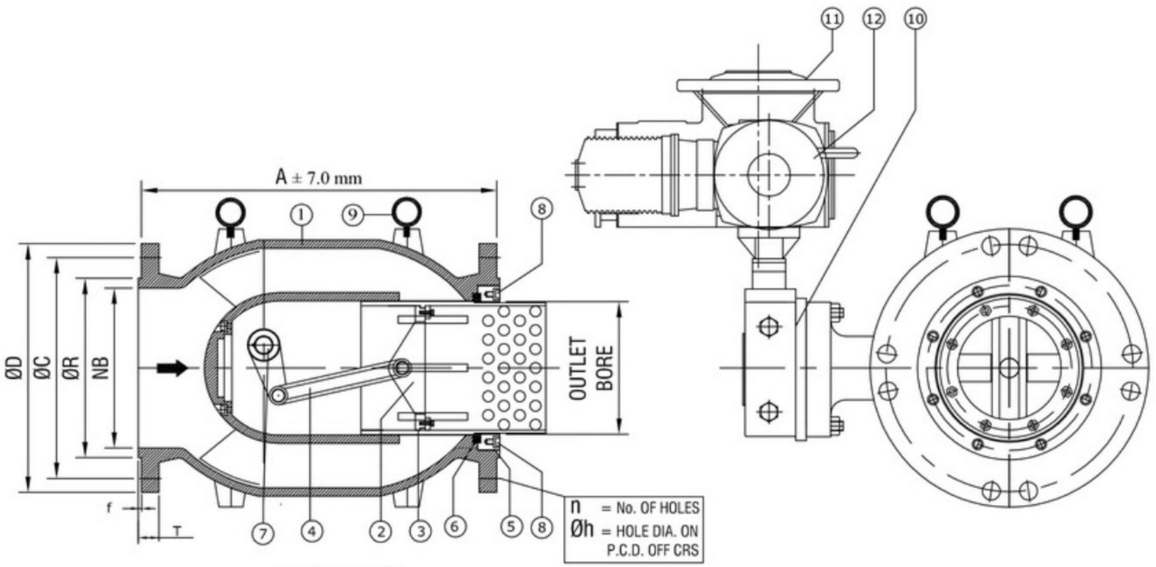
PRESSURE,
FLOW, LEVEL,
& **LEAKAGE**
SOLUTIONS

THE VALVE VALUE

Smart Control. Smooth Flow. DVPL Inside

What is a Needle or Plunger Valve? A needle valve, also known as a plunger valve, is a type of axially operating control valve designed to precisely regulate flow and pressure in pipelines. It features a cylindrical or conical plunger (or piston) that moves linearly inside a flow sleeve, adjusting the annular opening through which fluid passes. This design enables smooth, vibration-free throttling, making it especially suitable for modulating applications in water supply, treatment plants, and hydroelectric systems. Unlike standard on/off valves, needle/plunger valves offer fine control across the full stroke, maintain flow stability even under high differential pressures, and are engineered to minimize cavitation and erosion. They are widely used where accuracy, durability, and energy efficiency are critical.



CLOSE POSITION
(WITHOUT GEAR & ACTUATOR)

MATERIALS OF CONSTRUCTION

SL. No.	DESCRIPTION	MATERIAL	SPECIFICATION
1	BODY	DUCTILE IRON	DIN 1693 Gr. GGG-50 / IS:1865 Gr. 500/7
2	PISTON CONNECTING PART		
3	PISTON	STAINLESS STEEL	ASTM A276 TYPE-304
4	SHAFT CRANK	STAINLESS STEEL	ASTM A276 TYPE-304
5	SEALING RING FLANGE	STAINLESS STEEL	ASTM A276 TYPE-304
6	SEAL, SEAT	EPDM RUBBER	-
7	BUSH	L.T.BRONZE	IS:318 Gr. LTB-2
8	FLANGE BOLTS	STAINLESS STEEL	ASTM A276 TYPE-304
9	EYE BOLT FOR LIFTING	CARBON STEEL	IS:4190
10	GEAR BOX	MFR'S STD.	-
11	HANDWHEEL	ATTACHED WITH ACTUATOR	
12	ACTUATOR (Regulating Type)	'AUMA / ROTORK' MAKE ACTUATOR	

HYDROSTATIC TEST PRESSURE FOR PN-10

BODY TEST PRESSURE :- 15 Kg./Cm²(g) WITH WATER DURATION 5 MIN.
SEAT TEST PRESSURE :- 10 Kg./Cm²(g) WITH WATER DURATION 2 MIN.

NOTES

1. ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.
2. VALVES DESIGN & FACE TO FACE AS PER DVPL'S STD.
3. TESTING STD. : AS PER EN 12266-1
4. TOLERANCE SHALL BE APPLICABLE AS PER STANDARD PRACTICE.
5. FLANGED ENDS SHALL BE RAISED FACED & DRILLED TO BSEN 1092-2 PN-10 TABLE-8.
6. OUTLET BORE AREA WILL BE LESS THAN 15-20% OF INLET BORE AREA.
7. VALVE SHOULD BE CLOSED WITH CLOCKWISE ROTATION OF HAND WHEEL, DIRECTION OF 'OPEN' & 'SHUT' SHOULD BE MARK ON HAND WHEEL.
8. PAINTING:- ALL VALVES SHALL BE PAINTED WITH RAL BLUE 5005 LIQUID EPOXY PAINT WITH MINIMUM 250 MICRONS D.F.T. BOTH INSIDE & OUTSIDE.
9. MARKING:- BRAND / SIZE / RATING / HEAT NO. & SL. NO.

CLIENT'S REF.	
PROJECT	-
P.O No.	-
CONTRACTOR	-
CLIENT	-

DVPL
DURGA VALVES PRIVATE LIMITED
ICHAPUR ROAD, CANAL SIDE, HOWRAH-4 (W.B.)

2024	INITIAL	DATE
DRAWN	B.DAS	01.06.2024
CHECKED	S.PAL	01.06.2024
APPROVED	P.ROY	01.06.2024
	JOB NO. J-****	SCALE : N.T.S.

DIDF ELECTRICALLY ACTUATOR OPERATED PLUNGER TYPE FLOW CONTROL VALVE.

DRAWING No. : DVPL / DI-PLV / 13509 — REV. 0

REFERANCE DRAWING	REV	ZONE	APPVD BY	DATE	PARTICULARS
			P.Roy		
	0	-	P.Roy	01.06.2024	ISSUED FOR APPROVAL
	REVISION				

Durga Valves Pvt. Limited ★ ICHAPUR HOWRAH

PLUNGER VALVE

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Needle (Plunger) Valve – Technical Description

Valve Type:
Axially guided plunger-type control valve designed for modulating service in water applications. Often referred to as a needle valve due to the plunger's tapering cylindrical form.

Size & Model:
100 mm to 1600 mm | DVPL-NV | PN 10, 16, 25, 40
Working Temp.: -10 °C-80 °C.

Flow Control Mechanism:
The internal plunger (piston) moves axially inside a cylindrical flow sleeve. This movement regulates the cross-sectional flow area, enabling precise throttling from full open to near-zero flow.

Construction Features:

- Body: Robust, Ductile Iron (SG Iron) body built to withstand water hammer and cyclic pressure.
- Seat: Metal or elastomeric seat ring to ensure leak-tight closure.
- Plunger/Needle: Streamlined and contoured for pressure energy dissipation, minimizing cavitation and turbulence.
- Guide Rails: Ensure axial alignment and smooth motion of the plunger.
- Actuation: Operated by a manual, electric, depending on control requirements.

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1. **Operation Principle:**
   - Water enters axially.
   - The plunger restricts or permits flow via axial displacement.
   - Flow occurs through annular spaces, which vary with plunger position—ideal for pressure modulation.
2. **Design Advantages:**
   - Capable of controlling high differential pressures.
   - No vibration due to centrally guided design.
   - Low maintenance due to minimal moving parts.
   - High durability in throttling applications.
3. **Mounting Orientation:**
   - Designed for horizontal pipeline installation.
   - Flow direction is clearly marked on the body to ensure correct installation.
4. **End Connection:**
   - Flanged as per standard pressure class (e.g., PN10/16/25).
   - Matches commonly used piping systems in water infrastructure.
5. **Sealing:**
   - Double sealing—primary metal-to-metal and secondary elastomeric ring—ensures tight shutoff and long-term performance.
6. **Corrosion Protection:**
   - Internal and external surfaces are fusion bonded epoxy coated to meet potable water and wastewater standards.

Applications in Water Management

Flow Regulation in Gravity Mains:

- Used to control flow into Distribution Networks, Reservoirs, DMAs, Branches or Open Canals.

Pressure Control in Pumping Stations:

- Modulations of flow under varying pressures to avoid pipe bursts and hydraulic shock.

Surge Pressure Management:

- Prevents water hammer by controlling valve closure/opening rates during pump start/stop.

Level Control in Reservoirs or Tanks:

- Maintains desired water levels by adjusting outflow based on sensor or manual input.

Energy Dissipation in High Head Systems:

- Absorbs and dissipates energy in high-head applications like mountain-fed reservoirs or dam outlets.

Remote Control Systems:

- Integrates with SCADA systems using electric or hydraulic actuators for automated operation used for Pressure, Flow, Level, and Leakage management.

Irrigation Networks:

- Ensures efficient flow control to match varying field demands in irrigation projects.

Pressure Reducing Stations:

- Controls downstream pressure in distribution networks to prevent pipe bursts and optimize delivery.

Flow Control in Treatment Plants:

- Regulates flow through filtration units, clarifiers, and discharge lines.

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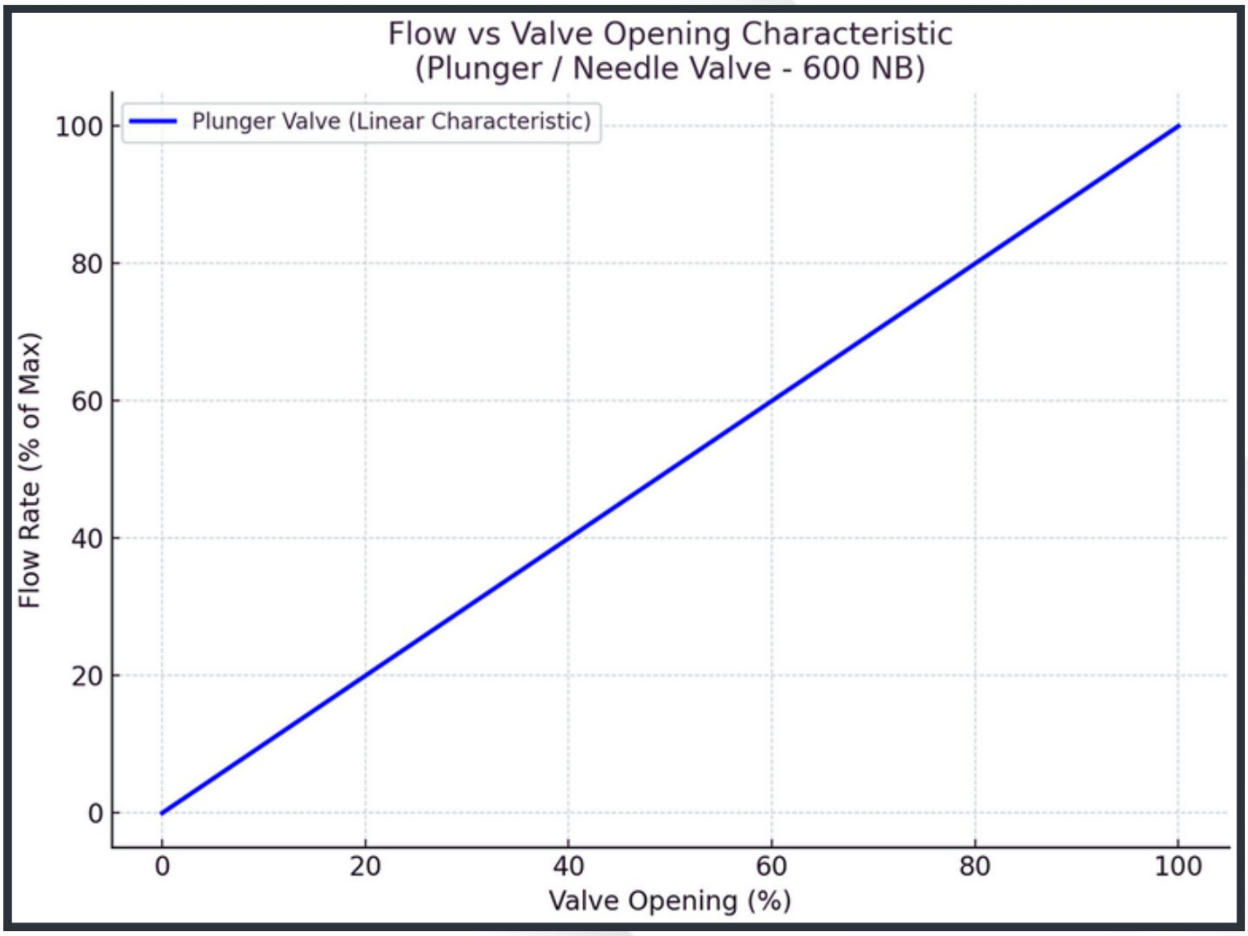

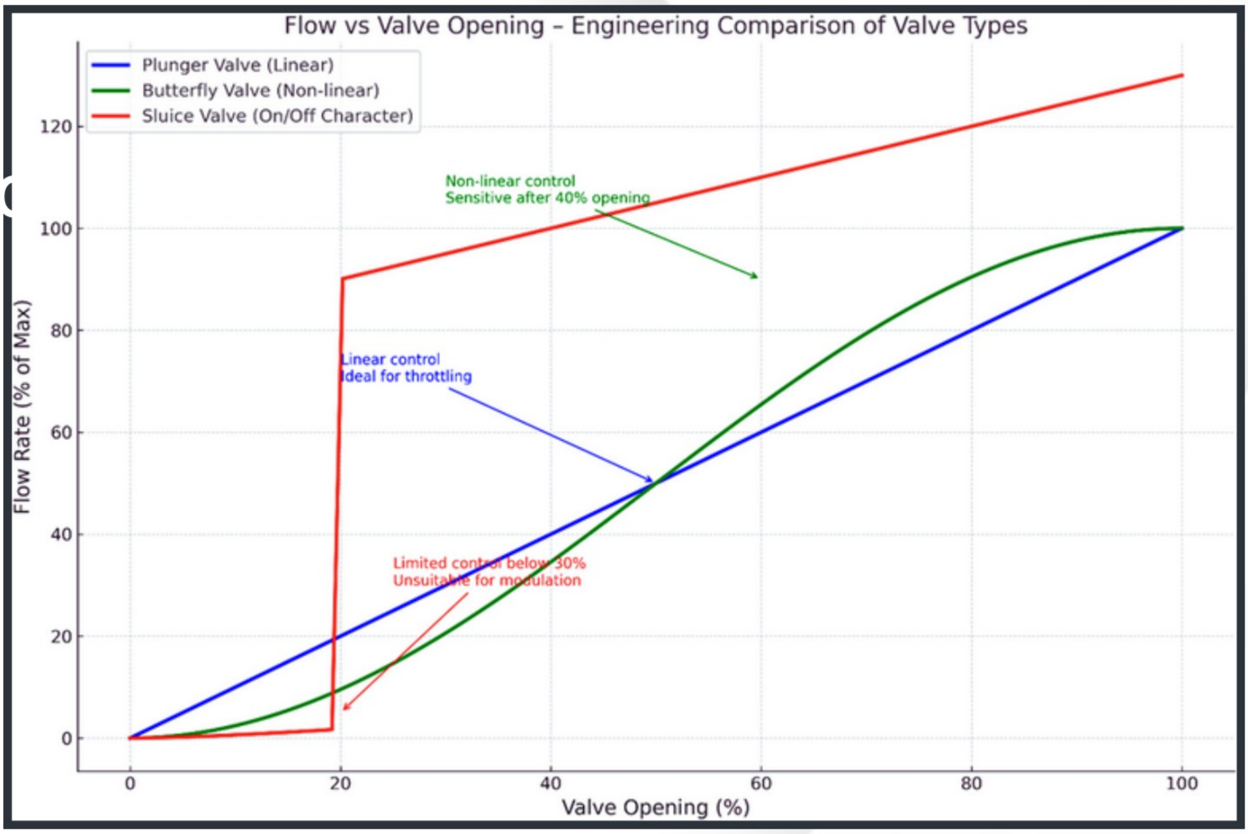

PLUNGER
VALVE

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Here's the Flow vs. Valve Opening Curve for the Plunger (Needle) Valve – 600 NB, showing a near linear flow characteristic. This behavior is typical of plunger valves due to their precise axial throttling mechanism, making them ideal for applications requiring accurate and stable flow regulation.

Here's the Flow vs. Valve Opening Comparison for:

- Plunger Valve: Linear and predictable flow control across the full stroke — ideal for modulation.
- Butterfly Valve: Non-linear, with slow flow increase initially and rapid rise beyond 30–40% opening.
- Sluice Valve (Gate Valve): Very low control at initial opening; acts like an on/off valve — not suitable for throttling.

This comparison shows why plunger valves are preferred in applications requiring accurate flow regulation, pressure control, and level management.

Engineering Notes:

- Plunger Valve (Blue):
- Offers linear control — ideal for precise throttling, modulating flow, and pressure management across the entire stroke.
- Butterfly Valve (Green):
- Provides non-linear control — flow increases slowly until ~40% opens, then ramps up steeply. Suitable for applications where space-saving and low-pressure drop are more critical than precision.
- Sluice Valve (Red):
- Functions like an on/off valve — poor flow control at low openings. It should not be used for throttling due to high turbulence and seat wear at partial openings.

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What Causes Cavitation?

- Cavitation is a phenomenon where vapor bubbles form in a liquid due to local pressure dropping below the liquid's vapor pressure.
- When these bubbles travel to a higher-pressure zone, they collapse violently, producing intense shock waves.
- These shock waves can severely damage surrounding components such as valves, pipes, and fittings.

How Cavitation Works – In Simple Terms

- Water at sea level and 21°C (70°F) has a vapor pressure of approximately 101.3 kPa absolute (or 0 kPa gauge).
- In a pipeline, a restriction (like a valve, fitting, or orifice plate) causes increased flow velocity.
- According to Bernoulli's Principle, as velocity increases, pressure decreases.
- If the pressure drops below the vapor pressure, vapor bubbles form in the liquid.
- As the liquid passes beyond the restriction and slows down, the pressure rises again.
- Once the pressure exceeds the vapor pressure, the bubbles collapse, generating intense localized shock waves.
- This collapse:
    - Sounds like "rocks rolling through the pipe"
    - Can cause pitting and erosion of nearby metal surfaces.

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How a Needle (Plunger) Valve Helps in Mitigating Cavitation

A needle (plunger) valve is specifically designed to minimize and control cavitation due to the following key engineering features:

1. Axial Flow Control Design
   - The plunger moves axially inside a cylindrical sleeve, allowing the flow to remain symmetrical and streamlined, which reduces turbulence—a key trigger of cavitation.
2. Progressive Annular Throttling
   - Instead of a single-point restriction, flow is throttled through an annular gap between the plunger and sleeve.
   - This ensures even pressure reduction across the valve length, minimizing sharp pressure drops that typically cause cavitation.
3. Multi-Stage Pressure Dissipation (Optional Design)
   - Some needle valves can incorporate multi-stage plunger profiles or anti-cavitation cages to spread out the energy loss gradually, keeping internal pressures above vapor pressure levels.
4. Central Guiding and Vibration-Free Movement
   - The plunger is centrally guided, eliminating side loads and ensuring stable axial motion. This prevents vibration, another factor that can worsen cavitation effects.
5. Material and Coating Resistance
   - Needle valves are often built with hard-faced or stainless steel plungers and cavitation-resistant sleeves, ensuring longer service life even under high-pressure differentials.
6. Suitable for High Head Dissipation
   - Ideal for dam outlets, pump discharge lines, and hydroelectric bypasses where high pressure heads must be safely reduced without damaging the infrastructure.

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Centering the Cavitation Burst

- The design ensures that implosions occur in the center of the valve/pipeline—not near walls or components.
- This extends the service life of the valve and surrounding piping.
- Various trim options are available:
  - Vanned trim
  - Slotted trim
  - Perforated trim

Customizable for Every Application

- Proper trim selection is critical for effective cavitation control.
- Trim designs are chosen based on:
  - Flow conditions
  - Pressure differential
  - Application-specific requirements

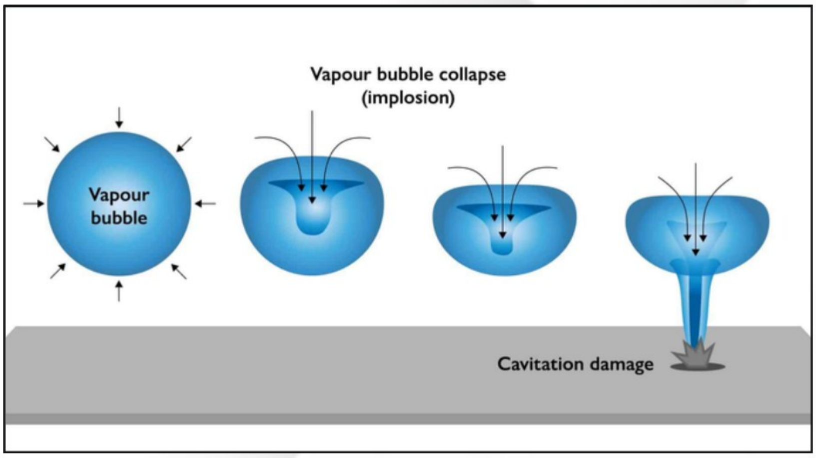
Summary

✓ Cavitation occurs due to pressure dropping below vapor pressure, causing bubble formation and collapse.

✓ Conventional shut-off valves are not suitable for throttling, as they lead to cavitation damage.

✓ Plunger valves offer centered flow, linear control, and customizable trims—minimizing cavitation risk.

✓ Choosing the right valve type and trim configuration ensures longer life, energy efficiency, and reduced maintenance.



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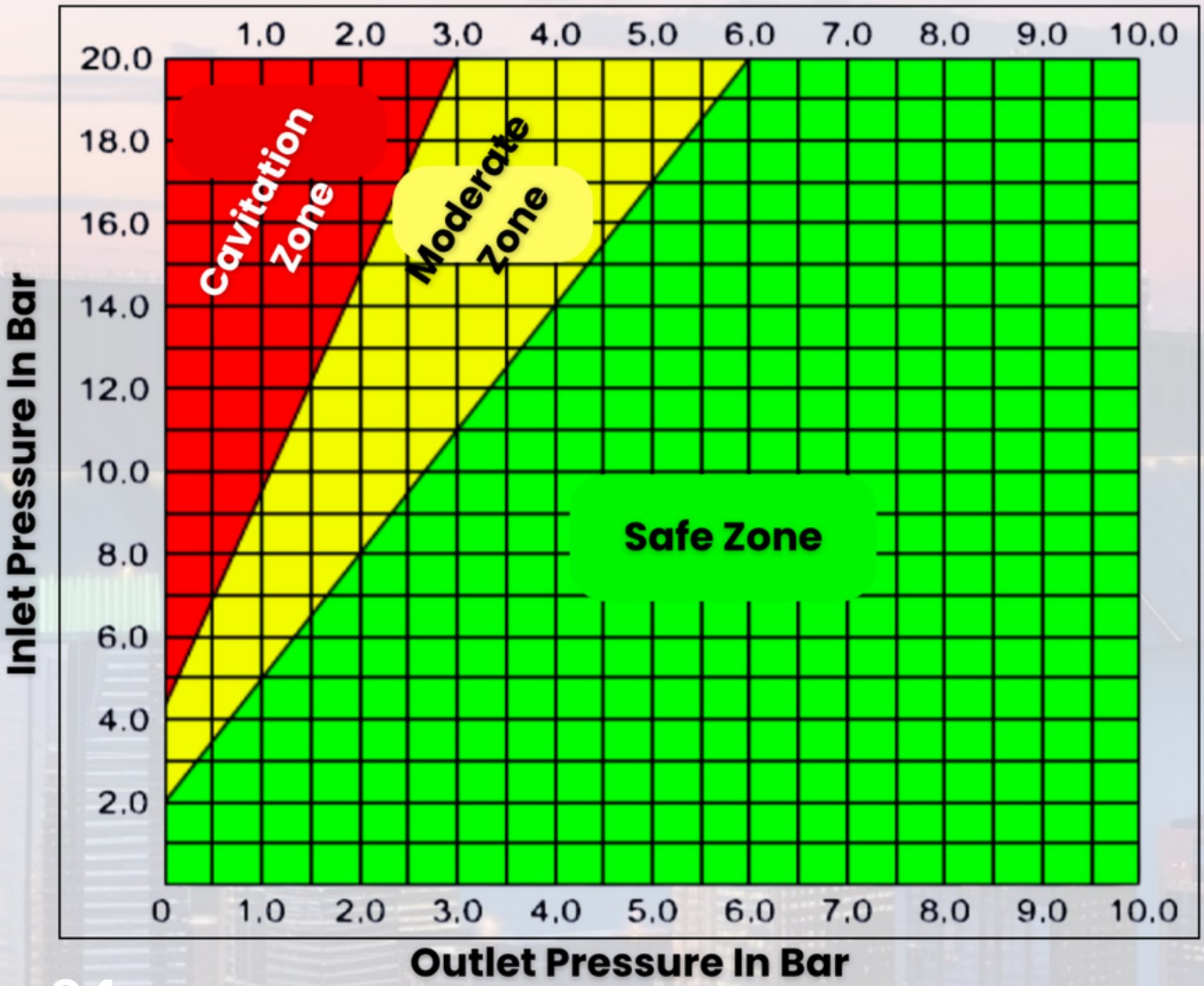

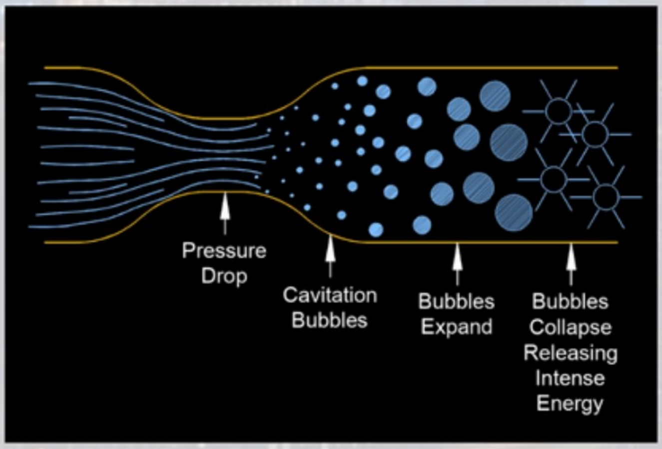

CAVITATION GUIDE
FOR REFERENCE

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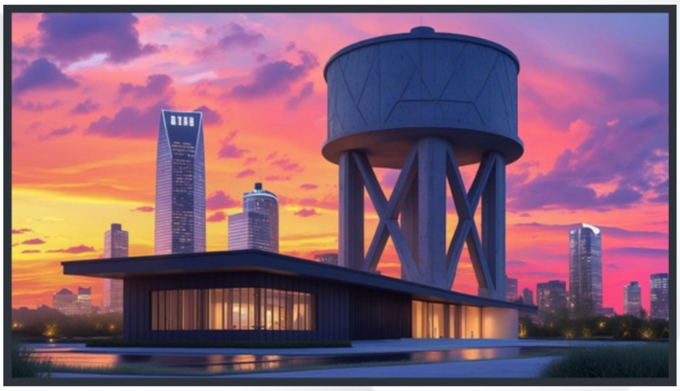
Disclaimer:

The flow curves presented above are representative illustrations based on typical engineering behavior and should not be used as a substitute for project-specific performance data. Actual flow characteristics may vary depending on manufacturer design, installation conditions, and system pressure. Always consult the valve manufacturer's certified technical documents and conduct field validation where precise control is critical.



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