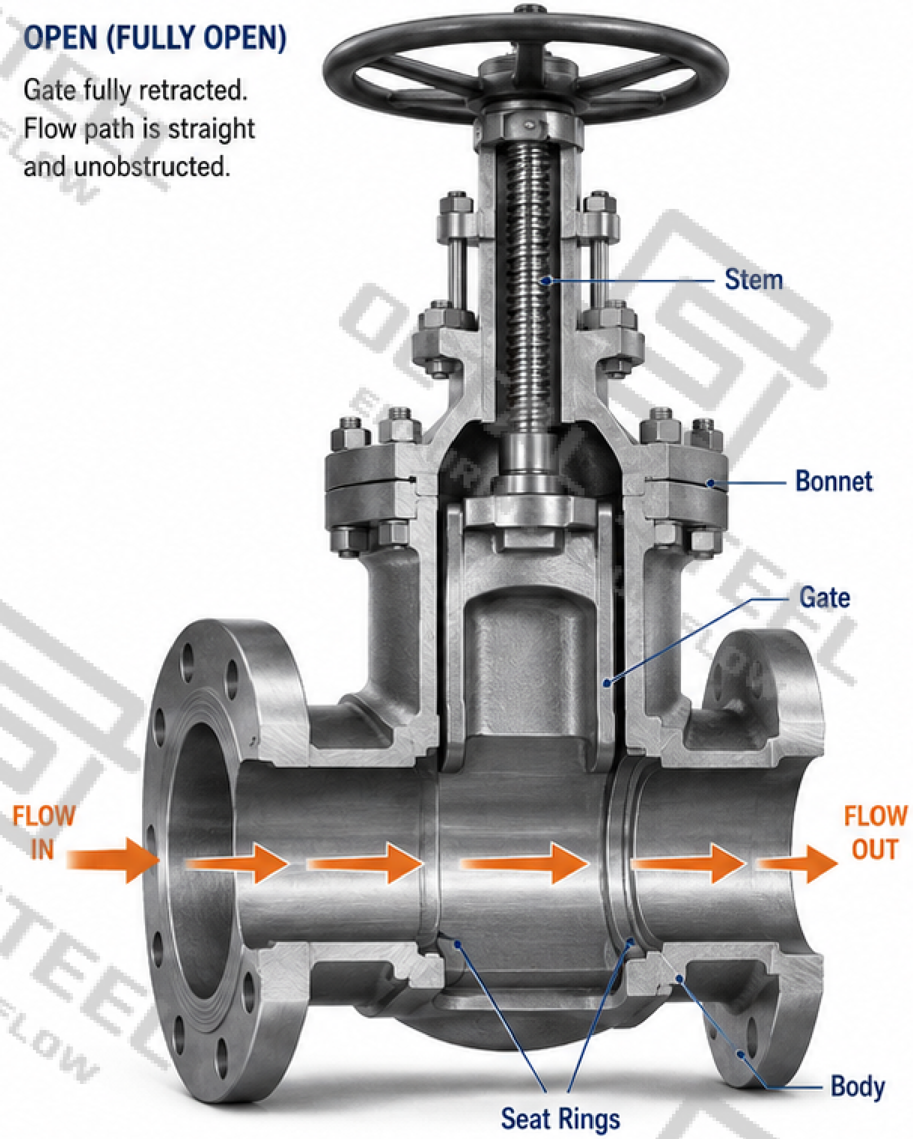
# Gate Valve Working Principle and Flow Path



### OPEN (FULLY OPEN)

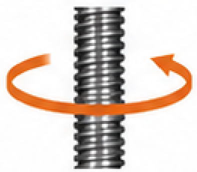
Gate fully retracted.
Flow path is straight
and unobstructed.



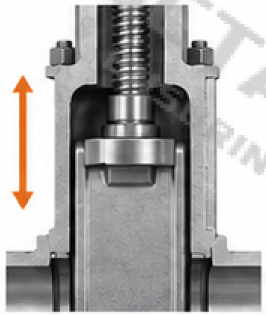

### HOW IT WORKS

**1. Handwheel / Gear**

**2. Stem Rotation**

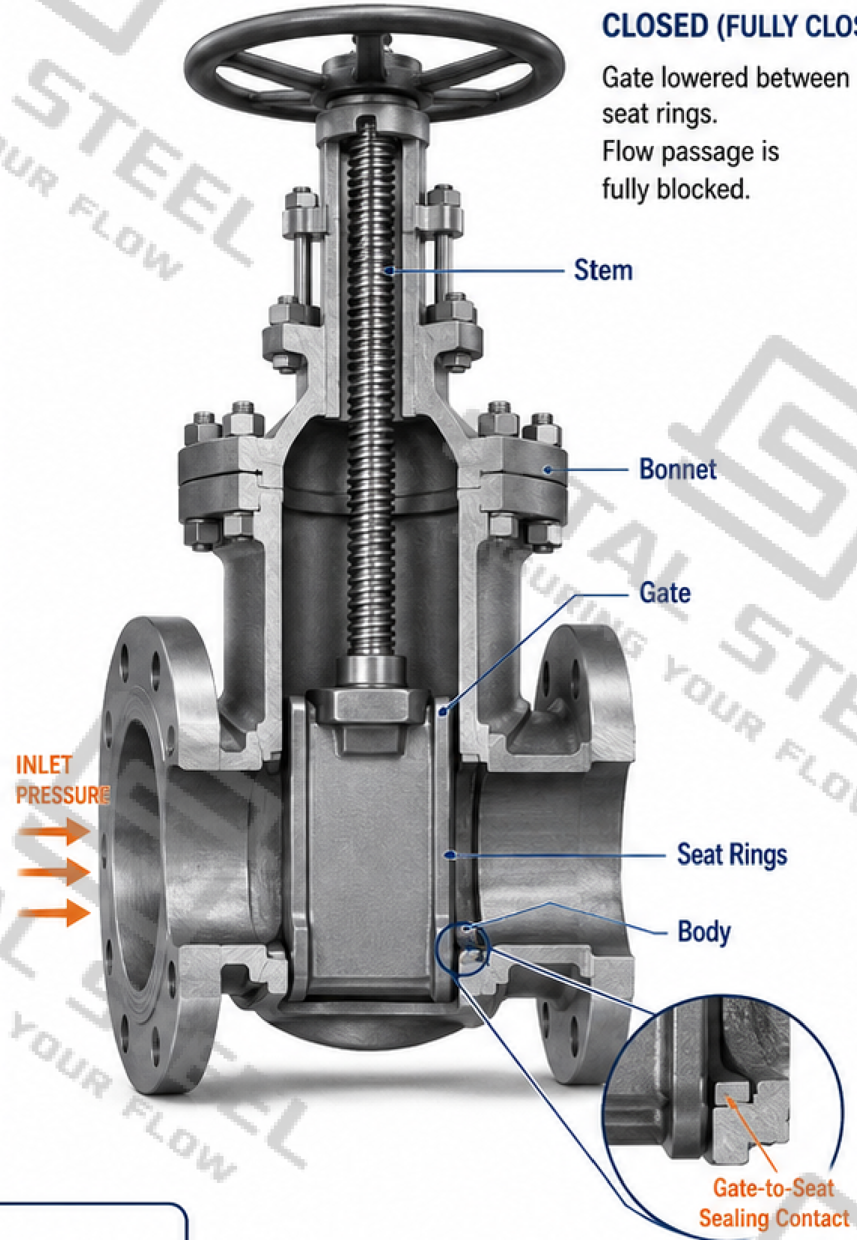


**3. Linear Gate Travel**



### CLOSED (FULLY CLOSED)

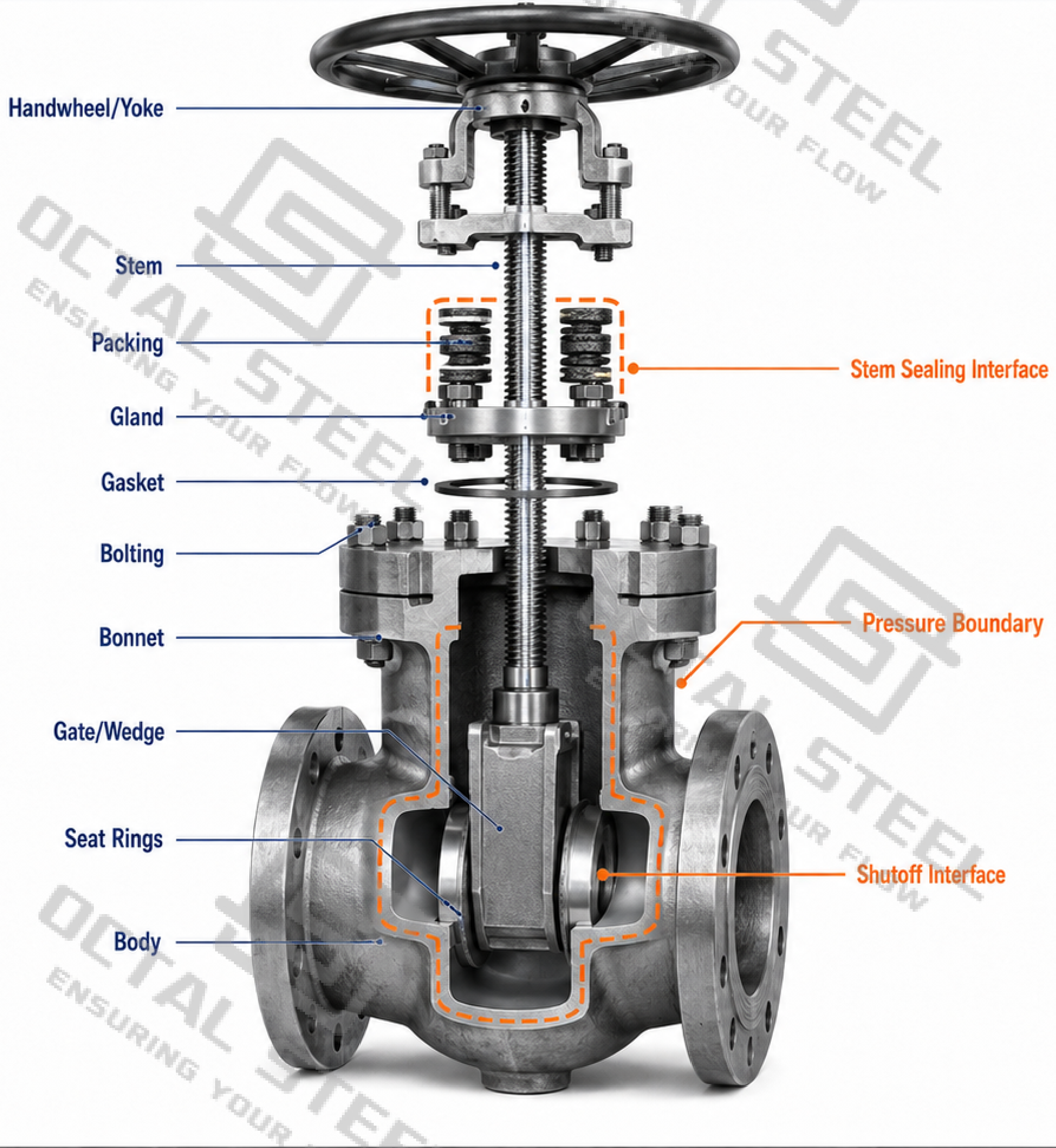
Gate lowered between
seat rings.
Flow passage is
fully blocked.




**ENGINEERING NOTE** Gate valves are intended primarily for fully open or fully closed isolation; prolonged partial opening can expose gate and seats to high local velocity and erosion.

# Gate Valve Main Components and Pressure Boundary

Technical Reference Sheet

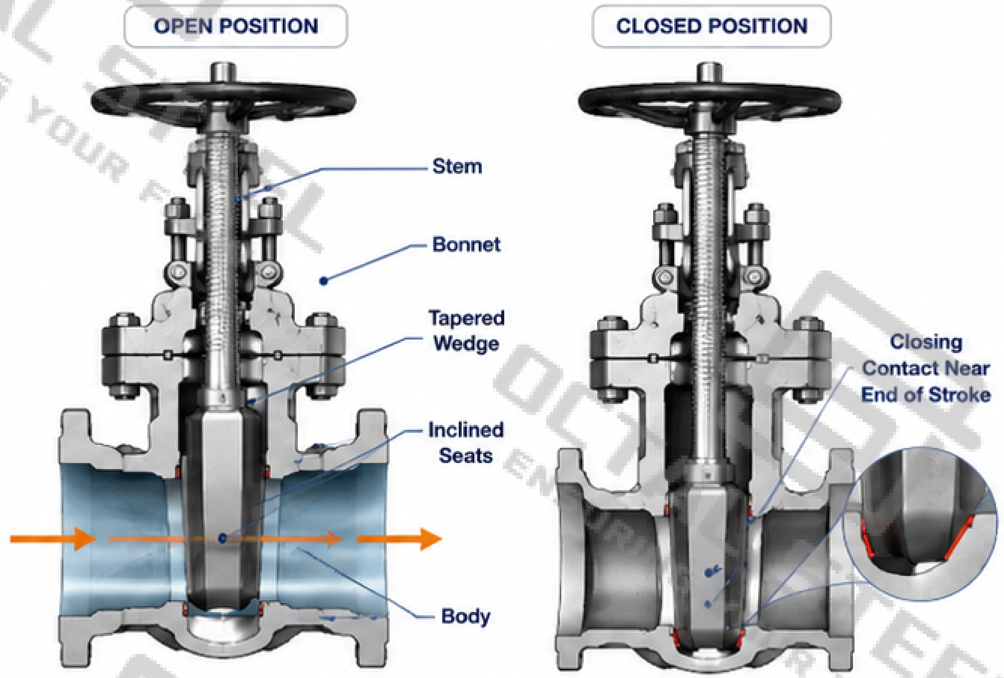


# Wedge and Slab Gate Valve Design



## WEDGE GATE VALVE

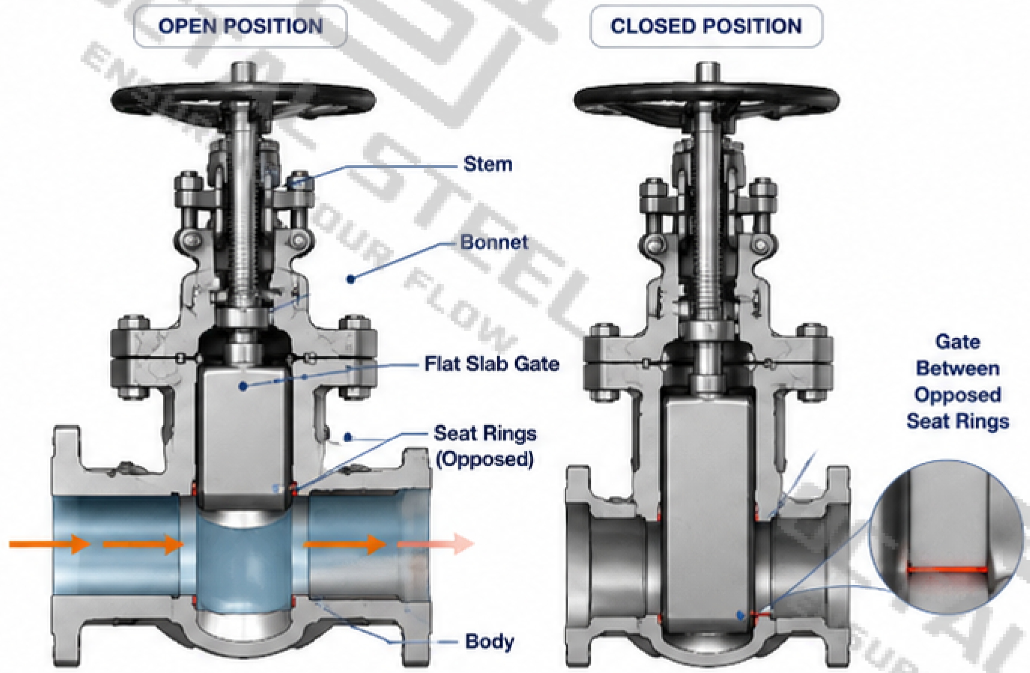
**Tapered Wedge – Inclined Seats**




Tapered wedge provides reliable sealing on inclined seats.
Contact occurs near the end of the closing stroke.

## SLAB GATE VALVE

**Flat Gate – Opposed Seat Rings**




Flat gate moves between opposed seat rings.
Provides a straight through-bore when fully open.

| ENGINEERING ASPECT | WEDGE GATE VALVE | SLAB GATE VALVE |
|---|---|---|
| **Gate Geometry** | Tapered (wedge-shaped) gate | Flat (slab) gate |
| **Seat Arrangement** | Two inclined seats matched to the wedge | Two opposed seat rings (parallel) |
| **Flow Passage (Fully Open)** | Gate lifted out of flow path; good straight bore | Through-bore concept; gate between seat rings |
| **Typical Selection Logic** | General isolation service, where reliable wedge seating and tight shutoff are prioritized. | Services where straight through-bore and minimal flow restriction are engineering priorities; actual bore continuity must be confirmed against pipeline and valve geometry. |

### ⚠ ENGINEERING NOTE

Slab gate valves are designed for straight through-bore service.

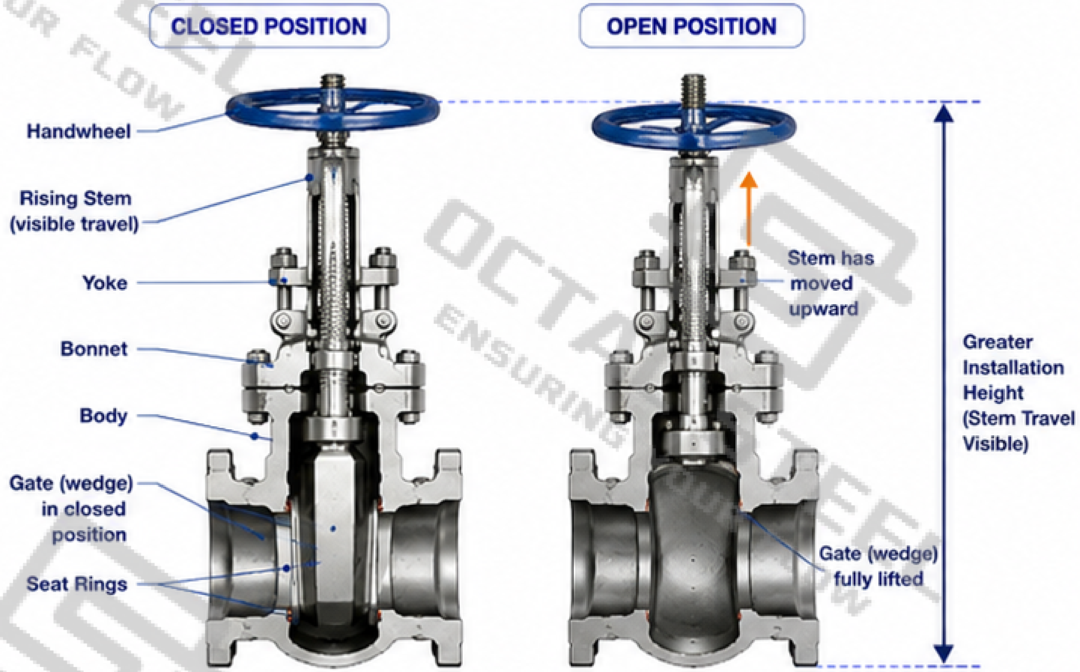
Actual bore continuity must be confirmed against pipeline and valve geometry, including body bore, seat ring ID, and installation interface.

ⓘ Valve design selection should be based on service conditions, pressure, temperature, medium, and project specification requirements.

# Rising and Non-Rising Stem Gate Valve Configurations

## RISING-STEM GATE VALVE

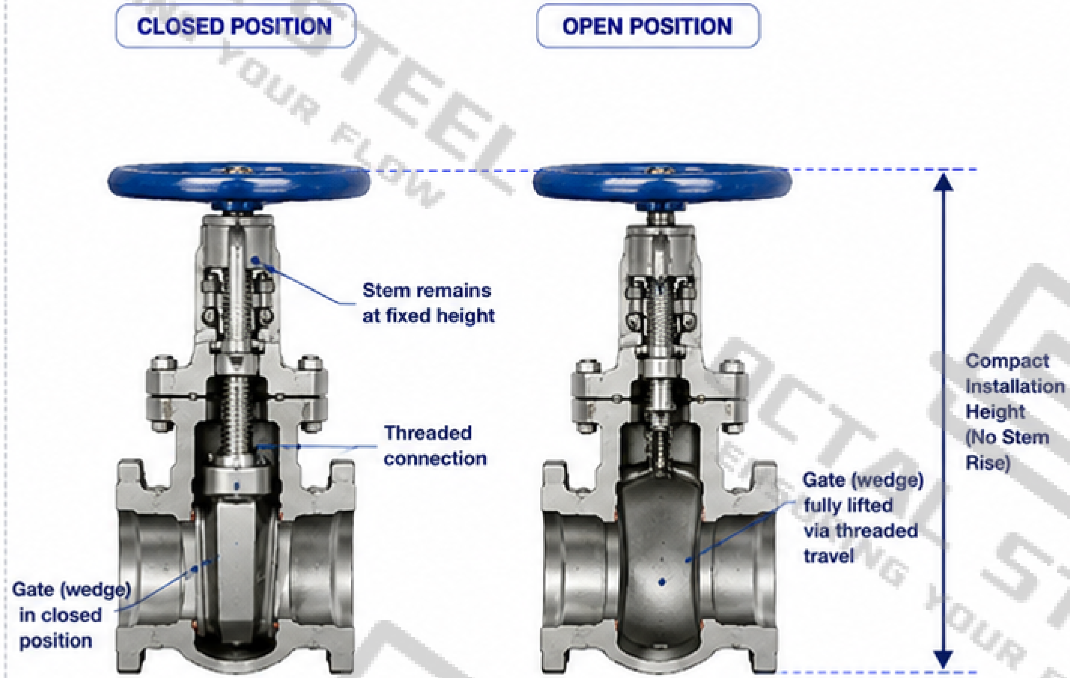
**Stem rises and provides visual position indication**




Rising stem provides a clear visual indication of valve position.
Suitable where sufficient vertical clearance is available.

## NON-RISING-STEM GATE VALVE

**Stem does not rise; internal threaded gate movement**




Non-rising stem design keeps overall height constant.
Ideal for low headroom and compact installations.

| ENGINEERING ASPECT | RISING-STEM GATE VALVE | NON-RISING-STEM GATE VALVE | NOTES |
|---|---|---|---|
| **Position Indication** | Stem rises with gate travel; position is visible from outside. | Stem does not rise; position indication requires indicator, switch, or actuator feedback. | Choose based on need for local visual indication vs space constraints. |
| **Vertical Clearance** | Requires additional headroom for full stem travel. | Lower overall height; suitable for limited overhead space. | Verify available installation height before selection. |
| **Thread Location** | Stem threads are located outside the pressure boundary (above bonnet). | Stem threads are located inside the pressure boundary (below bonnet). | Internal threads are in contact with process fluid. |
| **Maintenance Access** | Stem threads accessible for inspection and lubrication without pressure removal. | Internal threads not accessible without valve disassembly and depressurization. | Plan maintenance intervals according to service conditions. |

Selection between rising and non-rising stem gate valves should be based on installation space, required position indication, maintenance access, and service conditions.

# Gate Valve Bonnet and Pressure-Boundary Design

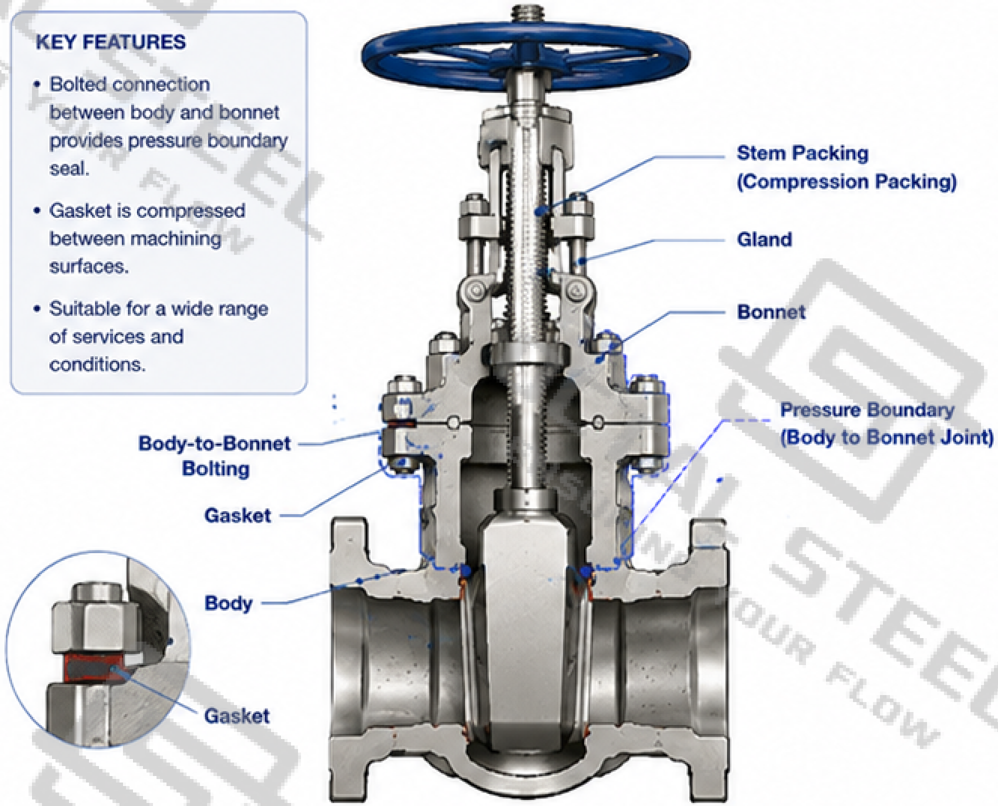


## BOLTED BONNET DESIGN

**Bolted body-to-bonnet joint with gasketed pressure boundary**

**KEY FEATURES**

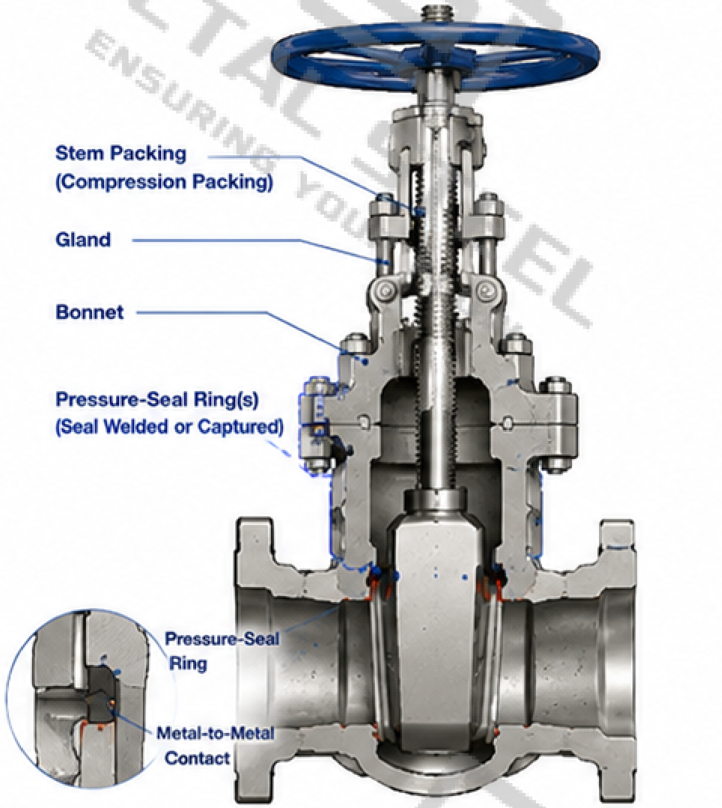
- Bolted connection between body and bonnet provides pressure boundary seal.
- Gasket is compressed between machining surfaces.
- Suitable for a wide range of services and conditions.




Pressure is contained by the gasket compressed between body and bonnet flange faces.

## PRESSURE-SEAL BONNET DESIGN

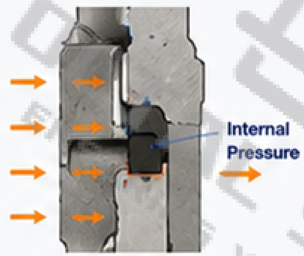
**Pressure-assisted seal at body-to-bonnet joint**




**KEY FEATURES**

- Pressure-seal ring(s) energize under internal pressure to improve sealing.
- Seal effectiveness increases as internal pressure increases.
- Typically used in high-pressure or critical service applications per design standard.

**PRESSURE-ASSISTED SEALING (SCHEMATIC)**




Internal pressure acts on the pressure-seal ring, driving it into the mating surface to enhance sealing.

Internal pressure energizes the pressure-seal ring(s), creating a metal-to-metal seal at the joint.

| DESIGN ASPECT | BOLTED BONNET | PRESSURE-SEAL BONNET |
|---|---|---|
| **Pressure-Boundary Joint** | Gasketed joint between body and bonnet flange faces. | Metal-to-metal joint assisted by pressure-seal ring(s). |
| **Sealing Mechanism** | Gasket compression by bolting. | Pressure energizes ring(s) to seal the joint. |
| **Disassembly** | Bonnet can be removed after bolts are loosened (if service allows). | Bonnet removal per applicable standard requirements. |
| **Typical Application** | General service applications across a broad range of conditions. | High-pressure or critical services where enhanced joint integrity is required. |
| **Applicable Standards** | ASME B16.34, API 600, EN 13709 and other applicable standards. | ASME B16.34, API 600 (PSB option), EN 13709 and other applicable standards. |

Bonnet design selection depends on applicable design standard, pressure, temperature and service conditions, as well as maintenance and inspection requirements.

# Gate Valve and Ball Valve Operating Comparison

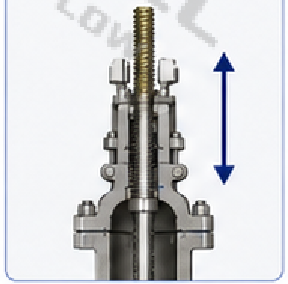


## GATE VALVE

Fully Open – Gate Lifted

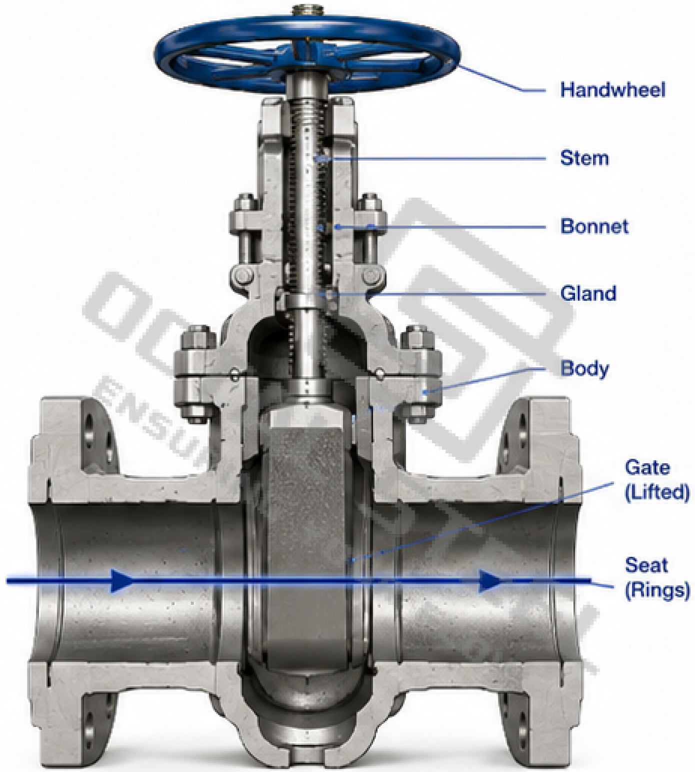
**CLOSURE MOVEMENT**

Linear gate travel
(Multi-turn)



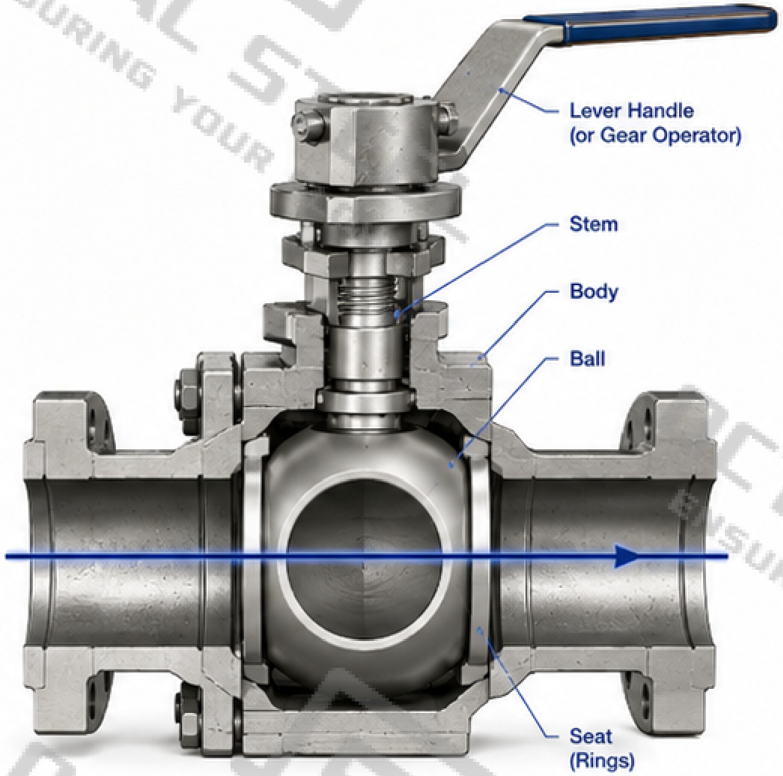
**OPERATING PATH**

Multi-turn
(Linear travel)



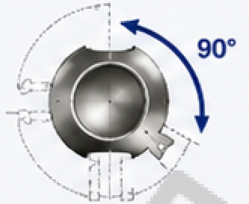

## BALL VALVE

Fully Open – Ball Bore Aligned




**CLOSURE MOVEMENT**

90-degree ball rotation
(Quarter-turn)




**OPERATING PATH**

Quarter-turn
(Rotate 90°)


| COMPARISON ASPECT | GATE VALVE | BALL VALVE |
|---|---|---|
| Closure Movement | Linear gate travel | 90-degree ball rotation |
| Operating Method | Multi-turn | Quarter-turn |
| Fully Open Flow Path | Gate retracts from the main flow passage | Ball bore aligns with the pipeline |
| Operating Speed | Generally slower | Generally faster |
| Pigging Consideration | Depends on gate and body construction | Depends on actual valve bore and pipeline bore. |
| Main Selection Factors | Gate design, stem, bonnet, seats and service conditions. | Ball support, bore, seat system, torque and service conditions. |

ⓘ Valve selection depends on service conditions and project requirements. Neither valve type is universally better.