

# Valves

Valves are installed on pipelines to stop or control the product flow. There are two main categories of valves: control valves and shutoff valves. Control valves can be partially closed to throttle the product flow. Shutoff valves, also known as isolation valves or block valves, can only be either fully opened or closed to allow the product to flow uninterrupted or block it completely.

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Valves may have different anatomy depending on their type and manufacturer. However, most valves have the following basic components:

- Valve body
  - Valve bonnet
  - Valve seat
  - Plug
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The valve body is the casing that houses the entire valve system. The valve body is the part attached to a pipe during the installation, allowing the pipe to provide structural support.

The valve bonnet is the cover for the entire valve. During maintenance, workers will remove the valve bonnet to check and perform work on the valve.

The valve seat is the component that supports the plug to provide a tight seal. The valve seat is the stopping point for the plug when the valve is fully closed. Together, the valve seat and plug provide a tight seal that can stop the product flow.

The plug, also known as a closure device, is the movable component that creates a seal when closed. Despite the name, the plug refers to the main closing mechanism of the valve, such as a plug, ball, gate, or rotary component.

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There are different valve types depending on their closing mechanism and applications. Depending on their design, most valve types can be either shutoff or control valves. The following valve types are commonly used in pipeline systems to stop the product flow:

- Ball valve
  - Gate valve
  - Check valve
  - Butterfly valve
  - Diaphragm valve
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## Ball Valves

Ball valves use a ball with a hollow center as their stopping mechanism and requires a quarter ( $\frac{1}{4}$ ) turn to fully open or close. The ball naturally blocks all product flow unless its hollow center

is aligned with the pipe, in which case the product flows uninterrupted. Ball valves are typically used in emergency shutdown systems, as they are most effective as shutoff valves.

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### *Gate Valves*

Gate valves use a sliding gate as their stopping mechanism that requires multiple turns to fully open or close. The gate can be partially opened to limit the product flow or fully opened to allow the product to flow uninterrupted. Gate valves are especially useful for pipelines operating at lower pressures because heavy product flow could strain the gate and damage the valve altogether.

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### *Check Valves*

Check valves are a unique valve type that only allows the product to flow in one direction. Check valves activate upon detecting pressure higher on the output side than the input side, stopping potential backflows within the pipeline. As a result, workers typically do not have to manually operate check valves using handles or actuators.

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### *Butterfly Valves*

Butterfly valves use a rotatable disc that acts as a gate and requires a quarter ( $\frac{1}{4}$ ) turn to fully open or close. The product flows with a minimal interruption when the disc is rotated open (or parallel to the pipe's direction). Like gate valves, butterfly valves are useful in low-pressure applications that do not excessively stress the disc.

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### *Diaphragm Valves*

Diaphragm valves use an actuator to push down a flexible diaphragm (also known as a saddle) and control the product flow. As the diaphragm pushes down, it limits the open space within the valve and controls the product's flow rate.

Diaphragm valves are typically used for clean products like natural gas. Products with a high level of contaminants like crude oil could leave residue on the diaphragm and either cause the valve to fail or cause blockage.