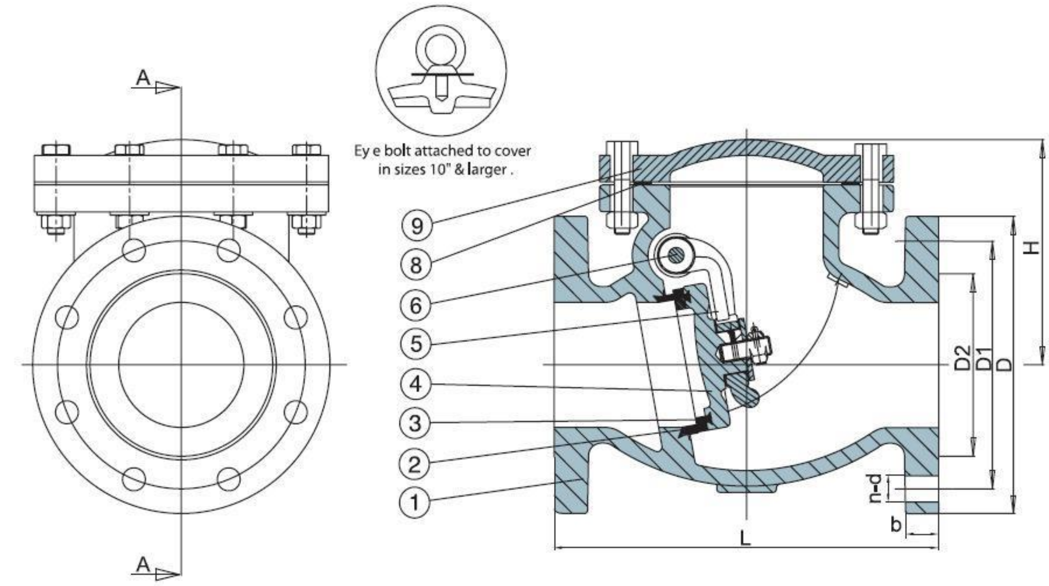
Swing Check Valve Introduction



1. Product Introduction

1.1 Definition and Function

A swing check valve is a crucial component in pipeline systems, designed to allow the flow of media (such as fluids or gases) in a single direction while preventing backflow. It belongs to the category of non - return valves and operates automatically based on the pressure differential of the flowing media.

The primary function of a swing check valve is to safeguard downstream equipment and processes. In a pumping system, for example, if the pump stops operating or there is a power failure, the swing check valve prevents the reverse flow of the fluid, which could cause the pump to run in reverse. Reverse rotation of the pump can lead to mechanical damage, such as shaft breakage, seal failure, and damage to the impeller. In industrial processes, preventing backflow is essential to maintain the integrity of the process, avoid contamination of different fluids, and ensure the proper functioning of reactors, heat exchangers, and other equipment.

1.2 Working Principle

The working principle of a swing check valve is relatively straightforward. Inside the valve body, there is a disc that is attached to a hinge or pivot mechanism. When the media flows in the forward direction, the dynamic pressure of the flowing media exerts a force on the disc. This force overcomes the weight of the disc and any resistance in the hinge mechanism, causing the disc to swing open. As the disc swings open, it creates an unobstructed passage for the media to flow through the valve.

When the flow velocity decreases or the flow direction reverses, the pressure differential across the valve changes. The pressure of the reverse - flowing media or the loss of forward - flow pressure causes the disc to swing back towards the valve seat. The disc then seats against the valve seat, forming a seal that prevents the backflow of the media. In some cases, a spring may be incorporated into the design to assist in the closing of the disc, especially in situations where the backpressure is relatively low or to ensure a quicker and more positive closure.

1.3 Structure and Components

- **Valve Body**: The valve body serves as the main housing for all internal components. It is typically made from materials such as cast iron, cast steel, stainless steel, or in some cases, high - strength plastics. The choice of material depends on factors like the type of media flowing through the valve, the operating pressure, and the environmental conditions. For example, in a water supply system where corrosion resistance is important, a stainless - steel valve body may be preferred. The valve body has an inlet and an outlet, which are designed to be connected to the pipeline. Its internal shape is engineered to facilitate the smooth movement of the disc and the flow of media, with a flat or slightly curved surface at the valve seat where the disc makes contact to ensure a good seal.
- **Disc**: The disc is the key component that controls the flow of media. It is usually made of metal, such as carbon steel or stainless steel, and may have a rubber or elastomeric coating on its sealing surface. The coating improves the sealing performance when the disc seats against the valve seat, preventing leakage. The disc is attached to the hinge or pivot mechanism in such a way that it can swing freely between the open and closed positions. The size and shape of the disc are designed to match the internal diameter of the valve body and to provide an effective barrier against backflow.
- **Hinge or Pivot Mechanism**: This mechanism connects the disc to the valve body and enables its movement. It is typically made of metal, such as stainless steel or brass, to ensure strength and durability. The hinge or pivot is designed to provide smooth and reliable operation, allowing the disc to open and close with minimal friction. In some designs, the hinge may be adjustable to fine - tune the disc's movement and optimize the valve's performance. For example, an adjustable hinge can be used to change the angle at which the disc opens and closes, which can be beneficial in systems with specific flow requirements.
- **Sealing Elements**: In addition to the coating on the disc, some swing check valves may have additional sealing elements. These can include rubber gaskets or O - rings placed around the valve seat or at the connections between the valve body and the pipeline. These sealing elements enhance the overall sealing performance of the valve, preventing leakage at the connections and ensuring a tight seal when the valve is closed. The choice of sealing material depends on the type of media and the operating temperature and pressure of the system. For example, in a high - temperature application, a high - temperature - resistant sealing material such as graphite - filled gasket may be used.
- **Spring (Optional)**: As mentioned earlier, some swing check valves may incorporate a spring to assist in the closing of the disc. The spring provides an additional force that helps the disc close more quickly and tightly, especially in situations where the backpressure of the reversed media is relatively low. The spring force is carefully calibrated to ensure that it does not impede the opening of the disc during normal forward flow but provides sufficient assistance during the closing process. The spring

is usually made of high - quality steel to withstand the repeated compression and extension cycles during the valve's operation.

1.4 Applications

- **Water Supply and Drainage Systems**: In municipal water supply networks, swing check valves are commonly installed at the outlets of pumps. When the pumps are operating, the valves open to allow water to flow into the distribution system. In case of a power outage or pump failure, the valves close immediately to prevent the backflow of water, protecting the pumps from damage and maintaining the pressure in the water supply system. In drainage systems, these valves prevent the backflow of sewage or stormwater. For example, in a building's sewer system, a swing check valve installed in the vertical drain pipe prevents sewage from flowing back into the lower - level units during periods of high flow or blockages in the main sewer line.
- **HVAC Systems**: In heating, ventilation, and air - conditioning systems, swing check valves play an important role in controlling the flow of air or water. In air - handling units, they are used to prevent the backflow of air in the ducts. This ensures that the conditioned air is distributed in the correct direction, maintaining the desired temperature and air quality in the building. In water - based HVAC systems, such as chilled water or hot water loops, these valves prevent the backflow of water. For instance, in a large commercial building's chilled water system, swing check valves are installed in the pipes connecting the chiller to the cooling coils. If there is a problem with the circulation pump or a sudden drop in pressure, the valves prevent the water from flowing back into the chiller, protecting it from damage.
- **Industrial Processes**: Swing check valves are widely used in various industrial applications. In the chemical industry, they are used to prevent the backflow of corrosive chemicals. For example, in a chemical plant where different chemicals are being pumped and mixed, swing check valves are installed in the pipelines to ensure that each chemical flows in the correct direction and does not contaminate other chemicals. In the food and beverage industry, these valves are used to maintain product quality. In a beverage bottling line, swing check valves are installed in the pipelines carrying the beverage from the production tanks to the filling machines. They prevent the backflow of the beverage, which could lead to contamination and spoilage. In the power generation industry, swing check valves are used in steam and water pipelines. In a steam turbine power plant, for example, they are installed in the steam supply lines to prevent the backflow of steam when the turbine is shutting down or there is a sudden change in the steam pressure.
- **Oil and Gas Industry**: In the oil and gas sector, swing check valves are used in pipelines to control the flow of oil, gas, or other hydrocarbons. They are installed at various points in the production, transportation, and processing stages. For example, in an oil well, a swing check valve may be installed in the wellhead to prevent the backflow of oil or gas when the pumping equipment is not operating. In a gas pipeline, these valves are used to prevent the reverse flow of gas, which could cause safety hazards and disrupt the operation of the pipeline system.

2. Typical Installation Schematic Diagram

2.1 Installation on Horizontal Pipelines

1. **Pipeline Preparation**: Before installing the swing check valve, the pipeline ends need to be thoroughly prepared. Clean the inside and outside of the pipeline ends using appropriate tools such as wire brushes, scrapers, or high - pressure water jets to remove any debris, dirt, rust, or foreign objects. Check the pipeline for any signs of damage, such as cracks or deformations. If there are any damaged sections, they should be repaired or replaced. Measure the diameter of the pipeline to ensure that it matches the size of the valve's connection ports.

2. **Valve Placement**: Place the swing check valve horizontally on a stable support near the pipeline. Align the valve's inlet and outlet ports with the corresponding ends of the pipeline. Make sure that the arrow marked on the valve body, indicating the normal flow direction of the media, is in the same direction as the intended flow in the pipeline. Use alignment tools such as alignment pins or a straight - edge to ensure accurate alignment.

3. **Connection Installation**: For flanged connections, insert bolts through the aligned bolt holes of the valve and pipeline flanges. Place a gasket between the flanges to ensure a tight seal. Install washers and nuts on the bolts and tighten them evenly in a cross - pattern using a torque wrench. The torque value should be in accordance with the manufacturer's recommendations to ensure a secure and leak - proof connection. For threaded connections, apply an appropriate thread sealant to the threads of the valve and the pipeline. Then, carefully thread the valve onto the pipeline, ensuring that the threads are properly engaged. Tighten the valve until it is firmly seated, but be careful not to overtighten, as this can damage the threads.

4. **Installation of Auxiliary Components**: Install maintenance isolation valves, such as gate valves or ball valves, on both the inlet and outlet sides of the swing check valve. These isolation valves allow the valve to be isolated from the pipeline system during maintenance, repair, or replacement procedures without shutting down the entire system. Additionally, install a strainer or filter upstream of the check valve to protect it from any small particles or debris in the media that could potentially damage the disc or affect the valve's operation.

5. **Final Inspection**: After the installation is complete, conduct a visual inspection to ensure that all connections are tight and the valve is properly aligned. Check for any signs of damage to the valve body, disc, or other components during the installation process. Inspect the flange gaskets or thread seals for any signs of leakage. Test the valve by allowing a small amount of the media to flow through it (under controlled conditions) to ensure that it opens and closes smoothly and that there is no backflow.

2.2 Installation on Vertical Pipelines

1. **Vertical Alignment**: When installing the swing check valve on a vertical pipeline, use appropriate lifting equipment, such as a crane or a hoist, to carefully lower the valve into position. Ensure that the valve is perfectly vertical. Use a plumb bob or a laser - level to check the vertical alignment during the installation process. Any misalignment can affect the operation of the disc and the overall performance of the valve.

2. **Flange or Threaded Connection**: Similar to horizontal installation, align the valve's connection ports with the pipeline. For flanged connections, follow the same procedure of inserting bolts, gaskets, washers, and nuts and tightening them evenly in a cross - pattern. For threaded connections, apply thread sealant and thread the valve onto the pipeline as described earlier. Provide additional support for the valve, such as pipe hangers or brackets,

to bear the weight of the valve and prevent excessive stress on the pipeline. The support should be installed at appropriate intervals along the pipeline to ensure stability.

3. **Orientation and Flow Direction**: Double - check that the flow - direction arrow on the valve body points in the correct direction. For vertical pipelines, the media flow direction should be in accordance with the valve's design. In most cases, when installed on a vertical pipeline, the flow should be upward to ensure proper operation of the disc. Incorrect orientation can lead to improper operation of the valve and failure to prevent backflow.
4. **Installation of Auxiliary Components**: Install maintenance isolation valves and a strainer or filter as in horizontal installations. Also, consider installing an air - release valve at the highest point of the pipeline section where the check valve is installed to vent any trapped air, which could affect the flow of the media and the performance of the valve.

3. Maintenance and Troubleshooting

3.1 Maintenance

- **Regular Inspection**:
  - **Visual Inspection**: Conduct a visual inspection of the swing check valve at regular intervals, typically at least once every six months or more frequently in high - risk or high - use applications. Check for any signs of leakage at the connection points (flanges or threads), around the disc, or from the valve body. Look for any visible damage to the disc, such as cracks, dents, or signs of wear. Inspect the valve body for corrosion, especially if it is made of metal, and check for any loose or missing components.
  - **Function Testing**: Periodically perform function tests on the valve to ensure its proper operation. This can be done by simulating normal flow conditions and observing the opening and closing of the disc. Also, simulate backflow conditions (under controlled and safe circumstances) to check if the valve can effectively prevent backflow. Use appropriate pressure gauges or flow meters to measure the pressure differentials and flow rates across the valve during these tests.
- **Cleaning**:
  - **External Cleaning**: Keep the exterior of the valve clean to prevent the accumulation of dirt, dust, and corrosive substances. Use a soft brush or cloth and a suitable cleaning solution to clean the valve body, flanges, and any exposed parts. Avoid using abrasive materials that could scratch or damage the surface of the valve.
  - **Internal Cleaning**: If there is a significant amount of sediment, debris, or scale accumulation inside the valve, it may be necessary to perform internal cleaning. In some cases, the valve can be disassembled (following the manufacturer's instructions) to clean the disc, valve seat, and other internal components. Use a mild cleaning agent and a soft brush to remove the deposits, and then rinse the components thoroughly with clean water. After cleaning, ensure that all components are dry before reassembling the valve.
- **Lubrication**: The hinge or pivot mechanism of the swing check valve may require lubrication in some cases. Use a suitable lubricant, such as a high - temperature - resistant grease or a silicone - based lubricant, to lubricate the hinge or pivot points.

This helps to reduce friction, ensure smooth movement of the disc, and extend the lifespan of the valve. Follow the manufacturer's recommendations regarding the type of lubricant to use and the frequency of lubrication.

- **Component Replacement**: Over time, the disc, hinge, or other components of the swing check valve may wear out or become damaged, and they may need to be replaced. If the disc shows signs of significant wear, cracks, or loss of its sealing ability, it should be replaced with a new one of the same type and 规格. Similarly, if the hinge is damaged, has excessive play, or is causing the disc to move unevenly, it should be replaced. When replacing components, ensure that the new components are compatible with the valve and are installed correctly.

3.2 Troubleshooting

- **Leakage**:
  - **Connection Leakage**: If leakage is detected at the connection points (flanges or threads), first check whether the bolts (for flanged connections) are tightened evenly or if the threads (for threaded connections) are properly sealed. For flanged connections, loosen and retighten the bolts in a cross - pattern to the recommended torque value. If the problem persists, the flange gaskets may be damaged. Replace the gaskets with new ones that are suitable for the valve's application, pressure, and temperature conditions. For threaded connections, check if the thread sealant has deteriorated and re - apply a suitable sealant. Inspect the flange surfaces or the threads for any irregularities or damage that could prevent a proper seal.
  - **Disc Leakage**: Leakage through the disc may be due to a damaged or worn - out disc, improper seating of the disc on the valve seat, or the presence of foreign objects between the disc and the seat. Inspect the disc carefully for any signs of damage, such as cracks, dents, or wear on the sealing surface. If the disc is damaged, replace it with a new one. Clean the valve seat thoroughly to remove any debris or deposits that could prevent the disc from seating properly. Check if the disc is correctly positioned on the hinge and if it can move freely without any obstructions.
- **Failure to Prevent Backflow**:
  - **Disc Malfunction**: If the valve fails to prevent backflow, the disc may not be closing properly. This could be due to wear, damage, or the presence of debris that is preventing the disc from closing tightly. Inspect and clean the disc. Replace any worn or damaged components. Check the hinge or pivot mechanism to ensure that it is not seized or obstructed and that the disc can move freely between the open and closed positions.
  - **Spring Failure (if applicable)**: In valves with a spring - assisted closing mechanism, a weak or broken spring may not provide sufficient force to close the disc. Check the spring and replace it if necessary. Test the spring's elasticity using a spring - testing device or by comparing it with a new spring of the same type.
  - **Incorrect Installation**: Incorrect installation can also lead to the failure of the valve to prevent backflow. Review the installation to ensure that the valve is

installed in the correct orientation, the connection points are secure, and all auxiliary components (such as the strainer) are functioning properly. Check the alignment of the valve within the pipeline and verify that the flow - direction arrow is correctly aligned.

- **Abnormal Noise or Vibration**:
  - **Loose Components**: Abnormal noise or vibration during the operation of the valve may be caused by loose components, such as a loose hinge, a vibrating spring (if present), or a misaligned disc. Check all components and tighten any loose parts. Use vibration - analysis tools or listen carefully to the valve during operation to identify the source of the noise or vibration.
  - **Flow - Related Issues**: High - velocity flow or turbulence in the pipeline can also cause noise and vibration. Consider installing flow - straightening devices or adjusting the flow rate in the pipeline to reduce these effects. Analyze the flow characteristics of the media using flow - measurement devices and consult with a fluid - dynamics expert if necessary. In some cases, the noise and vibration may be due to water hammer, which is a sudden pressure surge.