Lift Check Valve Introduction

1. Product Introduction

1.1 Definition and Function

A lift check valve is a type of non - return valve that plays a vital role in pipeline systems. Its fundamental function is to allow media, such as liquids or gases, to flow in a single direction while preventing backflow. The valve operates automatically based on the pressure differential of the flowing media. When the pressure of the forward - flowing media exceeds the pressure on the downstream side, the valve opens, enabling the media to pass through. Conversely, when the flow stops or reverses, the valve closes immediately to block the backflow, safeguarding downstream equipment from potential damage, such as pump damage due to reverse rotation, and maintaining the integrity of the process flow.

1.2 Working Principle

The working principle of a lift check valve is centered around the movement of a disc within the valve body. The disc is designed to move vertically (up and down) along a guide or stem within the valve. When the media flows in the forward direction, the dynamic pressure of the flowing media exerts an upward force on the disc. This force overcomes the weight of the disc and any frictional resistance in the guide or stem, causing the disc to lift off its seat and move upwards. As the disc rises, it creates an open passage for the media to flow through the valve.

Once the flow velocity decreases or the flow direction reverses, the pressure on the downstream side of the valve increases relative to the upstream side. This change in pressure differential causes the disc to drop back down onto its seat due to gravity and the force of the reverse - flowing media. The disc then forms a tight seal against the seat, effectively preventing the backflow of the media. In some advanced lift check valve designs, a spring may be incorporated to assist in the closing of the disc, ensuring a faster and more reliable shut - off, especially in situations where the backpressure is relatively low or when quick response is required to prevent significant backflow.

1.3 Structure and Components

- **Valve Body**: The valve body serves as the main housing for all internal components. It is commonly constructed from materials such as cast iron, cast steel, stainless steel, or high - strength plastics. The choice of material depends on various factors, including the type of media (e.g., corrosive or non - corrosive), operating pressure, and temperature. For instance, in a chemical processing plant handling corrosive fluids, a stainless - steel valve body is preferred to resist corrosion. The valve body has an inlet and an outlet, which are designed to connect to the pipeline. Its internal cavity is shaped to accommodate the vertical movement of the disc and to provide a smooth flow path for the media when the valve is open.
- **Disc**: The disc is the key component responsible for controlling the flow of media. It is typically made of metal, such as carbon steel or stainless steel, and often has a sealing surface. The sealing surface may be coated with materials like rubber, elastomers, or other high - performance sealing compounds to enhance the sealing ability when the disc seats against the valve seat. The disc is designed to fit precisely within the valve body and move freely along the guide or stem. Its size and shape are

optimized to ensure proper flow control and effective backflow prevention.

- **Guide or Stem**: The guide or stem is essential for guiding the vertical movement of the disc. It is usually made of durable materials, such as stainless steel, to withstand the mechanical stresses and friction during the disc's operation. The guide provides stability to the disc, preventing it from tilting or binding as it moves up and down. In some designs, the guide may be integrated with the valve body, while in others, it is a separate component that is precisely fitted to ensure smooth movement of the disc.
- **Valve Seat**: The valve seat is located at the bottom of the valve body (in the case of a vertical - flowing lift check valve) and serves as the sealing surface for the disc. It is often made of hard - wearing materials, such as alloy steels or specialized metal alloys, to withstand the repeated contact and pressure from the disc during opening and closing operations. The surface of the valve seat is carefully machined to ensure a flat and smooth finish, which is crucial for achieving a tight seal when the disc closes.
- **Spring (Optional)**: Some lift check valves are equipped with a spring. The spring is positioned above the disc (in a vertical - oriented valve) and is designed to apply a downward force on the disc. This force helps the disc to close more quickly and tightly when the flow stops or reverses. The spring force is calibrated to be strong enough to assist in closing but not so strong that it hinders the opening of the disc during normal forward flow. High - quality springs, often made of corrosion - resistant materials like stainless - steel alloys, are used to ensure long - term reliability and consistent performance.

1.4 Applications

- **Water Supply and Distribution Systems**: In municipal water supply networks, lift check valves are frequently installed at the outlets of pumps. When the pumps are in operation, the valves open to allow water to flow into the distribution system. In the event of a power failure or pump malfunction, the valves close instantly to prevent the backflow of water, protecting the pumps from damage and maintaining the pressure in the water supply system. They are also used in residential and commercial plumbing systems to prevent water from flowing back into the supply lines, ensuring the proper functioning of fixtures and preventing contamination.
- **Industrial Processes**: In various industrial sectors, lift check valves are essential for maintaining process integrity. In the chemical industry, they are used to prevent the backflow of corrosive chemicals, protecting pumps, reactors, and other equipment. For example, in a chemical plant where different chemicals are being pumped and mixed, lift 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 prevent the backflow of product - related fluids, maintaining product quality and preventing cross - contamination. In a beverage bottling line, lift check valves are installed in the pipelines carrying the beverage from the production tanks to the filling machines to ensure a one - way flow and prevent any backflow that could affect the product quality.
- **HVAC Systems**: In heating, ventilation, and air - conditioning systems, lift check valves are used to control the flow of water or refrigerant. In water - based HVAC systems, such as chilled water or hot water loops, these valves prevent the backflow

of water, ensuring that the fluid flows in the correct direction through the system. This helps to maintain the efficiency of the heating or cooling process and protects the pumps and other components from damage. In refrigerant lines, lift check valves prevent the reverse flow of refrigerant, which could disrupt the refrigeration cycle and lead to system failures.

- **Power Generation Plants**: In power generation facilities, lift check valves are used in various applications. In steam - driven power plants, they are installed in steam pipelines to prevent the backflow of steam when the turbines are shutting down or there is a change in steam pressure. This protects the turbines and other equipment from damage caused by reverse steam flow. In water - treatment processes within power plants, lift check valves are used to ensure the proper flow of water through filters, ion - exchange resins, and other treatment devices, preventing backflow that could contaminate the treatment process or damage the equipment.

2. Typical Installation Schematic Diagram

2.1 Installation on Horizontal Pipelines

1. **Pipeline Preparation**: Prior to installing the lift check valve, the pipeline ends must be thoroughly cleaned. Use tools such as wire brushes, sandblasters, or high - pressure water jets to remove dirt, rust, debris, and any other foreign materials from the inside and outside of the pipeline ends. Inspect the pipeline for any signs of damage, such as cracks, dents, or deformations. If any damage is detected, repair or replace the affected sections as necessary. Measure the diameter of the pipeline to ensure compatibility with the valve's connection size.
2. **Valve Placement**: Place the lift 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. Pay close attention to the flow - direction arrow marked on the valve body, ensuring that it points in the direction of the intended media flow. Use alignment tools, such as alignment pins or a straight - edge, to achieve accurate alignment.
3. **Connection Installation**: For flanged connections, insert bolts through the aligned bolt holes of the valve and pipeline flanges. Place a suitable gasket between the flanges to create 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 specifications to ensure a secure and leak - free connection. In the case of 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 proper engagement of the threads. Tighten the valve until it is firmly seated, but avoid overtightening, as this may 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 lift check valve. These isolation valves enable the valve to be isolated from the pipeline system during maintenance, repair, or replacement operations without shutting down the entire system. Additionally, install a strainer or filter upstream of the check valve to protect it from small particles or debris in the media that could potentially damage the disc, guide, or other internal components.
5. **Final Inspection**: After the installation is complete, conduct a visual inspection to

verify that all connections are tight and the valve is properly aligned. Check for any signs of damage to the valve body, disc, guide, or other components that may have occurred during installation. Inspect the flange gaskets or thread seals for any indications of leakage. Perform a functional test by allowing a small amount of media to flow through the valve (under controlled conditions) to ensure that it opens and closes smoothly and effectively prevents backflow.

2.2 Installation on Vertical Pipelines

1. **Vertical Alignment**: When installing the lift check valve on a vertical pipeline, use appropriate lifting equipment, such as a crane or hoist, to carefully lower the valve into position. Ensure that the valve is perfectly vertical. Utilize a plumb bob or a laser - level to check and maintain the vertical alignment throughout the installation process. Any misalignment can significantly 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. In most cases, for vertical - installed lift check valves, the media flow should be upward to ensure proper operation of the disc. Incorrect orientation will lead to improper valve operation 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 interfere with the flow of the media and the performance of the valve.

3. Maintenance and Troubleshooting

3.1 Maintenance

- **Regular Inspection**:
  - **Visual Inspection**: Conduct visual inspections of the lift 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 visible damage to the disc, such as cracks, wear on the sealing surface, or deformation. Inspect the valve body for corrosion, especially if it is made of metal, and check for any loose or missing components. Examine the guide or stem for signs of wear, corrosion, or misalignment.
  - **Function Testing**: Periodically perform function tests on the valve to ensure its proper operation. Simulate normal flow conditions and observe the

opening and closing of the disc. Monitor the movement of the disc to ensure it moves smoothly along the guide or stem without any binding or abnormal resistance. Also, simulate backflow conditions (under controlled and safe circumstances) to verify that the valve closes tightly and effectively prevents backflow. Use 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 significant sediment, debris, or scale accumulation inside the valve, internal cleaning is required. In some cases, the valve may need to be disassembled (following the manufacturer's instructions) to clean the disc, valve seat, guide, and other internal components. Use a mild cleaning agent and soft brushes to remove the deposits gently. Rinse all components thoroughly with clean water and ensure they are completely dry before reassembling the valve.
- **Lubrication**: Lubricate the moving parts of the valve, such as the guide or stem, to reduce friction and ensure smooth operation. Use a lubricant that is compatible with the valve materials and the media flowing through it. Apply the lubricant according to the manufacturer's recommendations, usually at specific intervals. Regular lubrication helps to extend the lifespan of the valve and prevents premature wear of the moving components.
- **Component Replacement**: Over time, components of the lift check valve may wear out or become damaged and need to be replaced. If the disc shows signs of significant wear, cracks, or loss of its sealing ability, replace it with a new disc of the same type and specification. Similarly, if the guide or stem is worn, corroded, or damaged, it should be replaced. When replacing components, ensure proper installation and alignment to maintain the valve's performance. Also, replace the valve seat if it is damaged or has excessive wear, as a damaged seat can lead to leakage and poor backflow prevention.

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 can occur due to several reasons. A worn - out or damaged disc sealing surface may fail to create a tight seal against the valve seat. Inspect the disc carefully and replace it if there are signs of wear, cracks, or damage. Foreign objects trapped between the disc and the valve seat can also cause leakage. Disassemble the valve (if necessary) and clean the disc and valve seat thoroughly to remove any debris. Additionally, check if the disc is properly aligned on the guide or stem and if it moves freely. Misalignment or binding of the disc can prevent it from seating correctly, resulting in leakage.

- **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 obstruction of the disc's movement. Inspect the disc for any signs of wear, such as uneven wear on the edges or damage to the sealing surface. Clean the disc and the guide or stem to remove any debris that may be hindering its movement. Check if the disc is binding or sticking to the guide or stem, and if so, lubricate the moving parts or replace any damaged components.
  - **Spring Failure (if applicable)**: In lift check valves with a spring - assisted closing mechanism, a weak or broken spring may not provide sufficient force to close the disc. Check the spring for signs of fatigue, corrosion, or breakage. Replace the spring if it is damaged or no longer provides the required force. Test the new spring to ensure it is calibrated correctly to assist in the proper closing of the disc.
  - **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 components are properly assembled. Check that the flow - direction arrow on the valve body is correctly aligned with the direction of media flow. A misaligned valve or a loose connection can cause the valve to malfunction and allow backflow.

- **Abnormal Noise or Vibration**:
  - **Loose Components**: Abnormal noise or vibration during the operation of the valve may be caused by loose components. Check if the bolts connecting the valve to the pipeline are tight. Loose bolts can cause the valve to vibrate as the media flows through it. Also, inspect the internal components, such as the disc, guide, or stem. If any of these components are loose or have excessive play, they can generate noise and vibration. Tighten any loose parts or replace components that are damaged or worn.
  - **Flow - Related Issues**: High - velocity flow or turbulence in the pipeline can also cause noise and vibration. Excessive flow velocity can cause the disc to vibrate rapidly as it opens and closes. Install flow - straightening devices or adjust the flow rate in the pipeline to reduce turbulence. In some cases, the noise and vibration may be due to water hammer, which is a sudden pressure

surge caused by the rapid change in flow. Install surge - suppression devices, such as shock absorbers or air chambers, to mitigate the effects of water hammer.

4. Performance Characteristics

- **Effective Backflow Prevention**: Lift check valves are highly effective in preventing backflow due to their design. The disc, when properly seated against the valve seat, creates a tight seal that blocks the reverse flow of media. The combination of gravity, the force of the reverse - flowing media, and (in some cases) the spring force ensures quick and reliable closure, protecting downstream equipment and maintaining the integrity of the pipeline system.


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