Butterfly Buffer Check Valve Introduction

1. Product Introduction

1.1 Definition and Function

The butterfly buffer check valve, also recognized as a butterfly - type non - return valve with buffer function, is an essential component in pipeline systems. Its fundamental function is to prevent the backflow of media within pipelines. By allowing media to flow in a single direction, it safeguards the integrity of the pipeline system and the connected equipment. In various applications, such as water supply and drainage, industrial processes, and heating, ventilation, and air - conditioning (HVAC) systems, the valve plays a crucial role in maintaining the proper flow of media, preventing reverse flow that could lead to equipment damage, process disruptions, and potential safety hazards.

1.2 Working Principle

Typically, a butterfly buffer check valve consists of a valve body, a butterfly - shaped valve disc, a buffer mechanism (which may include springs, dampers, or hydraulic components in some designs), and a hinge or pivot mechanism for the valve disc. When the medium flows in the forward direction, the pressure of the medium exerts a force on the valve disc. This force overcomes the resistance of the buffer mechanism (if present) and causes the valve disc to rotate around the hinge or pivot, opening the valve and allowing the medium to pass through with relatively low resistance.

When the flow of the medium stops or reverses, the buffer mechanism comes into play. In the case of spring - based buffer systems, the springs push the valve disc back towards the closed position. The springs are designed to provide a controlled closing force, gradually reducing the speed at which the valve disc closes. This controlled closing action helps to prevent sudden and forceful closures that could generate water hammer effects. In hydraulic - or damper - based buffer mechanisms, the movement of the valve disc is dampened by the resistance provided by the hydraulic fluid or the damper. As the medium starts to reverse, the buffer mechanism restricts the rapid movement of the valve disc, allowing it to close in a more gradual and controlled manner, effectively reducing the impact of backflow and minimizing the potential for water hammer.

1.3 Structure and Components

- **Valve Body**: The valve body is usually constructed from materials such as cast iron, cast steel, or stainless steel. In applications where the medium is corrosive, stainless - steel valve bodies are preferred to ensure long - term durability and corrosion resistance. The body is designed to provide a robust housing for the internal components and to offer a smooth - flowing passage for the media. It has flanges or other connection types at both ends to enable easy installation within the pipeline system. The internal surface of the valve body may be machined or coated to reduce friction and improve the flow characteristics of the media.
- **Valve Disc**: The butterfly - shaped valve disc is a key component of the valve. It is typically made of metal, such as carbon steel or stainless steel, and may have a rubber - coated or elastomer - lined surface. The rubber or elastomer lining enhances the sealing performance of the valve when it closes, preventing leakage. The disc is designed to rotate freely around the hinge or pivot mechanism, and its shape is optimized to provide efficient flow control and minimal resistance during normal

operation.

- **Buffer Mechanism**: The buffer mechanism is what sets the butterfly buffer check valve apart from a standard butterfly check valve. Springs are a common component in the buffer mechanism. These springs are carefully selected and calibrated to provide the appropriate closing force. They are installed in a way that they can act on the valve disc to close it gradually when the flow reverses. In more advanced designs, hydraulic dampers or cylinders may be used. These hydraulic components use the resistance of hydraulic fluid to control the movement of the valve disc. A small piston within the hydraulic cylinder moves in response to the change in flow direction, and the flow of hydraulic fluid through a restricted orifice or valve controls the speed of the piston, and thus the closing speed of the valve disc.
- **Hinge or Pivot Mechanism**: This mechanism allows the valve disc to rotate. It is usually made of high - strength materials to withstand the mechanical stresses associated with the repeated opening and closing of the valve. The hinge or pivot mechanism is designed to ensure smooth and reliable operation of the valve disc, with minimal friction. It may be lubricated to further reduce wear and improve the longevity of the valve.

1.4 Applications

Butterfly buffer check valves find extensive applications in various fields:

- **Water Supply and Drainage Systems**: In water supply networks, these valves are installed at the outlets of pumps. They prevent the backflow of water, protecting the pumps from damage due to reverse rotation. In sewage treatment plants, they ensure that sewage flows in the correct direction, preventing the contamination of clean water sources. For example, in a large - scale water supply system for a city, multiple butterfly buffer check valves are installed at different pump stations to safeguard the integrity of the water distribution network.
- **Industrial Processes**: In industries such as chemical, petrochemical, and food and beverage, these valves are used to control the flow of process fluids. In a chemical plant, they prevent the backflow of corrosive chemicals, protecting pumps, reactors, and other equipment. In a food and beverage factory, they ensure that the product - related fluids flow in the intended direction, maintaining product quality and preventing cross - contamination.
- **HVAC Systems**: In heating, ventilation, and air - conditioning systems, butterfly buffer check valves are used to control the flow of water or other heat - transfer fluids. They prevent the backflow of fluids, which could disrupt the proper functioning of the system, such as causing uneven heating or cooling. For instance, in a commercial building's HVAC system, these valves are installed in the chilled water and hot water pipelines to ensure efficient operation of the system.

2. Typical Installation Schematic Diagram

2.1 Installation on Horizontal Pipelines

1. **Pipeline Preparation**: Prior to installation, the pipeline ends must be thoroughly cleaned. Remove any debris, dirt, rust, or foreign objects. Ensure that the pipeline is straight and has the correct diameter and flange specifications to match the valve. Check for any signs of damage or deformation in the pipeline that could affect the

installation and operation of the valve. Use appropriate cleaning tools, such as wire brushes or high - pressure water jets, to clean the pipeline ends.

2. **Valve Placement**: Place the butterfly buffer check valve horizontally on a stable support. Align the valve's flanges with those of the pipeline, making sure that the bolt holes are perfectly aligned. The arrow on the valve body indicating the normal flow direction of the media must be consistent with the actual flow direction of the pipeline. Use alignment tools, such as alignment pins or a straight - edge, to ensure accurate alignment.

3. **Connection Installation**: Insert bolts through the aligned bolt holes of the valve and pipeline flanges. Install washers and nuts on the bolts. Tighten the bolts evenly in a cross - pattern to ensure a secure and leak - proof connection. The torque applied to the bolts should comply with the manufacturer's recommendations to avoid over - tightening or under - tightening, which could lead to flange leakage. Use a torque wrench to accurately apply the specified torque.

4. **Installation of Auxiliary Components**: Install maintenance gate valves at both the inlet and outlet sides of the check valve. These gate valves are used to isolate the check valve during maintenance, repair, or replacement procedures, allowing the pipeline system to remain in operation while the valve is being serviced. Additionally, install an inlet filter upstream of the check valve to protect it from any small particles or impurities in the water that could potentially damage the internal components, such as the valve disc and the buffer mechanism. The filter should be of an appropriate size and type to effectively remove contaminants based on the characteristics of the media.

5. **Final Inspection**: After installation, 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 or components during the installation process. Inspect the flange gaskets for any signs of distortion or damage that could cause leakage. Test the valve by allowing a small amount of media to flow through it (under controlled conditions) to ensure that it opens and closes smoothly.

2.2 Installation on Vertical Pipelines

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

2. **Flange Connection**: Similar to horizontal installation, align the flanges of the valve and the pipeline. Connect them using bolts, washers, and nuts, and tighten the bolts evenly in a cross - pattern. 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**: Ensure 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, usually upward or downward as specified by the manufacturer. Double - check the orientation before finalizing the installation to avoid incorrect operation.

4. **Installation of Auxiliary Components**: As in horizontal installations, install maintenance

gate valves and an inlet filter. Also, consider installing an automatic 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. The air - release valve should be selected based on the size and pressure rating of the pipeline.

3. Maintenance and Troubleshooting

3.1 Maintenance

- **Regular Inspection**:
    - **Visual Inspection**: Conduct a visual inspection of the valve at least once a year, or more frequently in high - risk or high - use applications. Check for any signs of leakage at the flange connections, around the valve disc, or from the valve body. Look for corrosion on the valve body, valve disc, and other metal components. Any signs of rust or pitting should be addressed promptly to prevent further degradation. Inspect the valve body for any cracks or signs of physical damage that could compromise its structural integrity.
    - **Component Inspection**: Inspect the valve disc for wear, damage, or improper sealing. The disc should move freely within the valve body and close tightly when there is a reverse flow attempt. Check the condition of the buffer mechanism. For springs, ensure they have sufficient elasticity and show no signs of corrosion or breakage. In hydraulic - based buffer mechanisms, check for any oil leakage, and ensure that the hydraulic components are functioning properly. Inspect the hinge or pivot mechanism for any signs of wear or looseness. The components should move smoothly with minimal friction.
- **Cleaning**:
    - **Internal Cleaning**: Periodically clean the internal components of the valve. This can be done by flushing the valve with clean water or a suitable cleaning agent (compatible with the valve materials) if there is a significant amount of sediment or debris accumulation. In some cases, the valve may need to be disassembled (following the manufacturer's instructions) for a more thorough cleaning of the valve disc, buffer mechanism, and other internal parts. Use appropriate cleaning tools, such as brushes or solvents, to remove stubborn deposits without damaging the components.
    - **External Cleaning**: Keep the exterior of the valve clean to prevent the accumulation of dirt, dust, and corrosive substances. Regularly clean the valve body, flanges, and any exposed parts using a suitable cleaning tool and cleaning solution. This helps to maintain the appearance of the valve and also reduces the risk of external corrosion. Use a wire brush or a pressure washer (with appropriate settings) to clean the exterior surfaces.
- **Lubrication**:
    - **Moving Parts Lubrication**: Lubricate the moving parts of the valve, such as the valve disc pivot points and the components of the buffer mechanism (if applicable), with a suitable lubricant. The lubricant should be compatible with the materials of the valve and the media flowing through it. Lubrication helps to reduce friction, ensures smooth operation of the components, and extends

the lifespan of the valve. Follow the manufacturer's recommendations regarding the type of lubricant to use and the frequency of lubrication. Apply the lubricant evenly to all moving parts, ensuring that it reaches the critical areas.

- **Testing**:
  - **Function Testing**: Periodically perform function tests on the butterfly buffer check valve to ensure its proper operation. This can involve simulating backflow conditions (under controlled and safe circumstances) to check the response of the valve disc and the buffer mechanism. Use appropriate testing equipment to measure the pressure differentials across the valve and the closing time of the valve disc. In some cases, professional testing services may be required to accurately assess the valve's performance. Monitor the valve's performance over time and compare it with the manufacturer's specifications to detect any deviations.
  - **Leakage Testing**: Conduct leakage tests regularly to ensure the integrity of the valve's seals. This can be done using methods such as pressure testing or bubble testing. Pressure testing involves applying a specified pressure to the valve and monitoring for any pressure drops, which could indicate leakage. Bubble testing involves applying a soap - solution to the suspected leakage areas and looking for the formation of bubbles, which would confirm the presence of a leak. Use calibrated pressure gauges and high - quality soap - solutions for accurate testing.

3.2 Troubleshooting

- **Leakage**:
  - **Flange Leakage**: If leakage is detected at the flange connections, first check whether the bolts are tightened evenly. 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. Inspect the flange surfaces for any irregularities or damage that could prevent a proper seal.
  - **Valve Disc Leakage**: Leakage through the valve disc may be due to worn - out sealing surfaces, damage to the valve disc, or the presence of foreign objects between the valve disc and the valve seat. Inspect the valve disc thoroughly. If the sealing surface is worn, it may be possible to repair it by grinding or replacing the sealing material. If the valve disc is damaged, it should be replaced. Clean the valve seat to remove any debris or deposits. Use appropriate inspection tools, such as magnifying glasses or bore scopes, to detect small defects in the sealing surfaces.
- **Failure to Prevent Backflow**:
  - **Valve Disc Malfunction**: If the valve fails to prevent backflow, the valve 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 valve disc. Replace any worn or damaged components. Check the

pivot points of the valve disc to ensure that they are not seized or obstructed.

  - **Buffer Mechanism Failure**: A malfunctioning buffer mechanism can also lead to the failure of the valve to prevent backflow. For springs, if they are weak or broken, they may not provide sufficient force to close the valve disc. In hydraulic - based buffer mechanisms, issues such as oil leakage, clogged hydraulic lines, or malfunctioning hydraulic components can affect the closing process. Check the buffer mechanism components and replace or repair as necessary.
  - **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 flange connections are secure, and all auxiliary components (such as the inlet filter) 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 valve disc or a vibrating buffer mechanism component. 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.

4. Performance Characteristics

- **Efficient Backflow Prevention**: Butterfly buffer check valves are highly effective in preventing backflow. The design of the valve disc, along with the buffer mechanism, ensures that the valve can quickly and reliably close when backflow occurs. The tight - sealing valve disc, often with a rubber or elastomer lining, provides an effective barrier against reverse flow, protecting the pipeline system and equipment from the negative impacts of backflow.
- **Water Hammer Reduction**: One of the key performance features of these valves is their ability to reduce water hammer. The buffer mechanism, whether spring - based or hydraulic - based, controls the closing speed of the valve disc. By closing the valve disc in a more gradual manner, the sudden pressure spikes associated with water hammer are significantly reduced. This is crucial in maintaining the integrity and longevity of the pipeline system, as water hammer can cause damage to pipelines, pumps, and other components.
- **Low Flow Resistance**: Despite the presence of the buffer mechanism, butterfly buffer check valves are designed to have relatively low flow resistance. The streamlined shape of the valve body and the valve disc allows the media to pass through with minimal pressure drop. This ensures efficient operation of the pipeline system, reducing energy consumption associated with pumping the media through the

pipeline.

- **Robust and Durable Construction**: Constructed from high - quality materials such as cast iron, cast steel, and stainless steel, these valves are built to be robust and durable. They can withstand high pressures, mechanical stresses, and, in some cases, corrosive media, ensuring long - term reliable operation with minimal maintenance requirements. The use of quality materials also contributes to the valve's resistance to wear and tear, extending its service life.
- **Easy Installation and Maintenance**: The design of butterfly buffer check valves allows for relatively easy installation, with standard flange connections that are compatible with most pipeline systems. Maintenance tasks, such as inspection, cleaning, and component replacement, can be carried out with relative ease. The availability of clear installation and maintenance instructions, along with the use of common - sized components, simplifies the process for trained professionals, reducing the overall maintenance cost and downtime.
- **Flexible Application**: These valves can be installed in both horizontal and vertical pipelines, making them suitable for a wide range of applications in various industries. Their adaptability to different pipeline orientations and flow conditions further enhances their versatility and usability. Whether in a large - scale industrial pipeline or a small - scale residential plumbing system, these valves can effectively perform their function of preventing backflow and reducing water hammer.