Micro - Resistance Slow - Closing Butterfly Check Valve Introduction

1. Product Introduction

1.1 Definition and Function

The micro - resistance slow - closing butterfly check valve is a specialized device designed to safeguard pipeline systems by preventing the backflow of media. It plays a crucial role in maintaining the integrity and proper operation of pipelines in various applications, such as water supply and drainage, industrial processes, and HVAC systems. By allowing media to flow in only one direction, it protects downstream equipment from damage caused by reverse flow, and also helps to prevent issues like water hammer, which can be highly destructive to pipelines.

1.2 Working Principle

Typically, a micro - resistance slow - closing butterfly check valve consists of a valve body, two semi - circular valve discs, a return spring, an oil storage cylinder, a set of slow - closing small cylinders, and a needle valve (micro - regulator). When the inlet medium exerts thrust, it smoothly pushes open the two valve discs. Simultaneously, the pressure of the inlet medium enters the lower part of the piston in the oil storage cylinder. This pressure forces the piston to move, and the oil in the upper part of the piston is then pushed through the needle valve into the ends of the small cylinders on both sides of the valve body. As a result, the piston rods in the small cylinders extend.

When the inlet medium pressure drops below the outlet pressure, indicating a potential backflow situation, the medium starts to reverse its flow direction. At this moment, the valve discs begin to close automatically under the combined action of the spring force and the returning medium. However, due to the extended piston rods, the discs initially do not fully close. Approximately 20% of the flow area remains open, allowing the medium to pass through. This partial opening helps to dissipate the energy associated with water hammer, effectively reducing its impact. As the pressure oil in the rear chamber of the piston gradually enters the storage cylinder through the needle valve, the discs close at a slower rate. The closing process is thus divided into two stages: a relatively fast initial closing followed by a slow final closing. This two - step closing mechanism serves to prevent motor reversal and significantly reduce the noise and destructive force of water hammer.

1.3 Structure and Components

- **Valve Body**: Usually constructed from materials like cast iron, cast steel, or ductile iron, the valve body provides a sturdy housing for all internal components. It is designed to withstand high pressures and mechanical stresses during operation. In applications where the medium is corrosive, stainless - steel valve bodies may be used to enhance corrosion resistance and ensure long - term durability. The valve body also features a carefully designed flow passage to minimize resistance to the flow of media.
- **Valve Discs**: The two semi - circular valve discs are key components that control the flow of media. They are typically made of carbon steel or stainless steel, and often have a rubber - coated surface. The rubber coating improves the sealing performance when the discs close, preventing leakage. The discs are designed to move freely within the valve body, opening easily to allow forward flow and closing promptly to prevent backflow.

- **Return Spring**: The return spring is installed to assist in the closing of the valve discs. It provides the necessary force to close the discs when the inlet pressure drops and the backflow tendency occurs. The spring force is carefully calibrated to ensure that the discs close at an appropriate speed, neither too fast to cause water hammer nor too slow to allow excessive backflow.
- **Oil Storage Cylinder, Slow - Closing Small Cylinders, and Needle Valve**: These components work together to control the speed of the valve discs' closing. The oil storage cylinder stores hydraulic oil, and the slow - closing small cylinders, with their piston rods, play a crucial role in the two - step closing process. The needle valve regulates the flow rate of the oil. By adjusting the opening of the needle valve, the slow - closing time of the valve can be precisely tuned according to the specific requirements of the pipeline system. For example, in pipelines with high - flow rates or where water hammer is a significant concern, the needle valve can be adjusted to slow down the closing process more effectively.

1.4 Applications

Micro - resistance slow - closing butterfly check valves find wide applications in various fields:

- **Water Supply and Drainage Systems**: They are commonly installed in water purification plants, source water pipelines, sewage treatment plants, and seawater desalination facilities. In water supply pipelines, especially at the pump outlets, these valves prevent the backflow of water, protecting the pumps from damage due to reverse rotation and reducing the risk of water hammer, which could otherwise cause pipeline ruptures and equipment failures. In sewage systems, they ensure that sewage flows in the correct direction, preventing the contamination of clean water sources.
- **Industrial Processes**: In industries such as chemical, petroleum, and power generation, these valves are used to protect equipment and maintain the proper flow of process fluids. For instance, in a chemical plant, they prevent the backflow of corrosive chemicals, which could damage pumps, reactors, and other sensitive equipment. In power generation plants, they are installed in cooling water pipelines to safeguard the turbines and other components from the negative effects of backflow.
- **HVAC Systems**: In heating, ventilation, and air - conditioning systems, micro - resistance slow - closing butterfly 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, and protect the pumps and other components from damage.

2. Typical Installation Schematic Diagram

2.1 Installation on Horizontal Pipelines

1. **Pipeline Preparation**: Before installation, thoroughly clean the pipeline ends to 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.

2. **Valve Placement**: Place the micro - resistance slow - closing butterfly 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 appropriate 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 discs and the spring. 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 discs 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 discs, or from the valve body. Look for corrosion on the valve body, valve discs, 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 discs for wear, damage, or improper sealing. The discs should move freely within the valve body and close tightly when there is a reverse flow attempt. Check the condition of the spring; it should have sufficient elasticity to assist in the closing of the valve discs. If the spring shows signs of fatigue, corrosion, or breakage, it should be replaced. In valves with an oil - control system, inspect the oil storage cylinder, slow - closing small cylinders, and needle valve. Check for any oil leakage, and ensure that the needle valve can be adjusted smoothly. Examine the piston rods in the small cylinders for any signs of bending or damage.
- **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 discs, spring, 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 oil - control system (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 micro - resistance slow - closing butterfly 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 discs and the slow - closing mechanism. Use appropriate testing equipment to measure the pressure differentials across the valve and the closing time of the valve discs. 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 discs may be due to worn - out sealing surfaces, damage to the valve discs, or the presence of foreign objects between the valve discs and the valve seat. Inspect the valve discs thoroughly. If the sealing surface is worn, it may be possible to repair it by grinding or replacing the sealing material. If the valve discs are damaged, they 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 discs may not be closing properly. This could be due to wear, damage, or the presence of debris that is preventing the discs from closing tightly. Inspect and clean the valve discs. Replace any worn or damaged components. Check the pivot points of the valve discs to ensure that they are not seized or obstructed.

- **Spring Failure**: A weak or broken spring may not provide sufficient force to close the valve discs. 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 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 spring. 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

- **High - Efficiency Backflow Prevention**: Micro - resistance slow - closing butterfly check valves are highly effective in preventing backflow. The combination of the valve disc design, spring assistance, and the oil - control slow - closing mechanism ensures that the valve can quickly and reliably close when backflow occurs, protecting the pipeline system and equipment from the negative impacts of reverse flow. The two - step closing process provides an added layer of protection, minimizing the risk of backflow even in challenging operating conditions.
- **Water Hammer Reduction**: One of the most significant performance features of these valves is their ability to reduce water hammer. The slow - closing mechanism, which typically involves a two - step closing process, dissipates the energy associated with the sudden reversal of flow, reducing the pressure spikes that can cause damage to pipelines, pumps, and other components. This is crucial in maintaining the integrity and longevity of the pipeline system. The ability to control water hammer makes these valves suitable for use in pipelines with high - flow rates or where sudden changes in flow direction are likely to occur.
- **Low Flow Resistance**: Despite their complex structure and functionality, micro - resistance slow - closing butterfly check valves are designed to have a relatively low flow resistance. The smooth - flowing valve body and the optimized movement of the valve discs allow the media to pass through with minimal pressure drop, ensuring efficient operation of the pipeline system and reducing energy consumption. The streamlined design of the valve helps to maintain a high flow rate while minimizing the energy required to pump 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 micro - resistance slow - closing butterfly 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. The modular design of some valves also allows for quick and easy replacement of individual components.
- **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.

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