

KNIFE GATE VALVE STYLES, APPLICATIONS, OPERATING CONDITIONS & INSTALLATIONS PERFORMANCE

When selecting a knife gate valve for an industrial application, understanding the various styles and features is essential to ensure optimal performance and longevity. Knife gate valves come in several configurations, each designed to handle specific media types and operational demands. From conventional valves suited for low-pressure scenarios to high-performance variants capable of withstanding high pressures and abrasive conditions, the choice of valve must align with the application requirements. This introductory guide explores the key valve styles, their applications, and the critical factors to consider, including media type, flow direction, and installation needs, to facilitate informed decision-making and enhance system reliability.

Knife Gate Valve Styles & Features

Conventional: Conventional knife gate valves are cost effective and simple in design and maintenance. The valves are rated to 150 CWP.

Unidirectional: A unidirectional knife gate valve can have either metal seats rated for higher temperatures or resilient seats that provide tighter shutoff. Additionally, a deflection cone may be incorporated to direct abrasive media away from the seat, thereby protecting the seat and enhancing the valve's longevity and performance. The valve achieves effective shutoff through gate jams and system pressure pushing the gate against the seat. Proper installation ensures flow assists in sealing. MSS SP-81 is the standard used to design stainless steel, bonnetless, flanged knife gate valves.

Knife Gate Valve Styles



Unidirectional

Bidirectional

Push Through

High Performance

Speciality

Bidirectional: A bidirectional knife gate valve facilitates the flow of media in both directions, potentially eliminating the necessity for supplementary valves and reducing concerns regarding valve orientation during installation. The valve offers bidirectional shutoff capabilities crucial for dead end service and backflow requirements. This functionality allows for the removal of downstream flange while maintaining connection and pressure on the upstream flange. Maintenance is reduced by replaceable seats and seals, combined with construction from durable materials that resist abrasion and corrosion.

Push Through: The push through style knife gate valve is designed to clean media from the gate and discharge it directly to the atmosphere. The valve is engineered without a packing chamber and is resilient seated for isolation service, primarily in abrasive slurry applications.

High Performance: High performance knife gate valves are engineered to withstand high pressures, high solids content and resist abrasion. The seats are protected by replaceable wear rings which effectively manage severe abrasive conditions. The valves are designed to meet ASME Class 150 and 300 flange pressure ratings. For carbon steel construction, Class 150 valves can withstand up to 285 psi, while Class 300 valves can handle up to 740 psi.

Specialty: Specialty knife gate valves include O-port designs for displacing solids, diverting flow, and handling dry materials, commonly used in applications involving hoppers. Additional specialty valves include lined valves engineered for enhanced durability and performance.



A specialized tapered body knife gate valve with a fabricated displacement pocket in the body which enables the valve to close against a standing column of dry, packed material.

Applications

Low Pressure: Unidirectional valve seats are tested at 40 psi in accordance with MSS-SP81 standards. For applications where the line pressure is below 40 psi, it is recommended to contact the valve manufacturer to ensure testing aligns with the actual service conditions.

Chemical: Valves for corrosive chemical applications require the use of liners or specialized body and gate materials capable of withstanding the corrosive nature of the environment. The materials are selected based on their ability to resist chemical reactions and maintain their structural integrity.

Slurry: Valves employed in slurry applications are designed with full porting, ensuring the absence of cavities that can accumulate grit from the slurry and prevent gate closure. Given that certain slurry applications are inherently abrasive, they can cause significant wear and tear on the valve components. These valves are typically constructed from abrasion-resistant materials to ensure durability and reliability when handling abrasive slurries and designed with specialized packing chambers with scraping rings to clean debris from the gate.

Vacuum Service: Valves intended for vacuum service operate in environments where pressure is notably lower than atmospheric levels. One of the primary challenges in vacuum service is the risk of media being drawn upward through the packing chamber. To address this issue, valves with bidirectional sealing seats are utilized to isolate the packing, effectively preventing air from entering the system.

Dry Material Handling: Dry material handling involves the transport and control of solid particles, powders, or granular materials. Due to the potential wear caused by these solids on valve components, materials selected include abrasion-resistant options like hardened metals. Certain applications require dry packing to prevent lubricant leaching and require the valve to be installed with the seat side facing upward to avoid media accumulation in the seat area.

Sanitary: Valves are designed with smooth, polished surfaces for easy cleaning to eliminate bacteria, residues, and other contaminants that could compromise product quality. Selected materials are resistant to corrosion and degradation from cleaning agents and sanitizers used in sanitary processes.

Free Discharge: Free discharge valves are typically used in industrial processes where the controlled release of fluids (liquids or gases) into an open environment or downstream system is necessary. In unique applications such as low-head free discharge on a dam outlet, special bonneted Throttling Knife Gate Valves are constructed with fully supported square gates to prevent vibration and cavitation.



Material handling knife gate valve on the bottom of a hopper.

Fugitive Emissions: Valves designed for fugitive emission applications are engineered to confine gases and vapors within the process, preventing their escape into the atmosphere. In knife gate valves, this containment is achieved through the use of a bonnet. Bonnet designs generally employ ring-style packing instead of rope-style packing, as the ring-style has a smaller surface area that is less prone to leakage.

Operating Conditions and Requirements

Type of Media: A high solids content slurry or an abrasive material requires valves with liners or wear-resistant components such as hardened gates and replaceable wear rings. Corrosive media requires corrosion resistant alloys such as stainless steel or special coatings or linings to protect the metal components. In applications that require shearing capabilities (like those found in recycled paper) valves with special serrated seats are designed to cut through heavy trash such as metal, plastics, glass and shards.

Flow Direction and Control: It is imperative to understand whether the process flow is in one or both directions. Valves must be specified for either isolating on/off service or for throttling flow control service. It is important to recognize that not all knife gate valves are suitable for control applications.

Industry Standard: The valve may need to comply with industry standards such as ANSI, ASME or API standards. Valves intended for use in food, beverage, pharmaceutical, or chemical processing industries may need to meet specific material and design criteria.

Shut-off: Zero-leakage is essential for valves that require absolute isolation. If leakage is allowed there are industry standards such as MSS SP-81 that define the acceptable leakage rates and testing procedures.

Temperature: High and low-temperature applications require the use of materials that can withstand specific thermal conditions without losing their mechanical properties. For high temperatures, this means using materials resistant to thermal expansion and degradation, while low temperatures require materials that maintain toughness and flexibility.

Pressure: The valve body must be designed to withstand the operating pressure without deformation or failure. High-pressure applications require thicker body walls to handle the stress. Valves with higher pressure ratings must adhere to specific standards, such as MSS SP-135 and ASME B15.34, and may require testing and certification to verify their capability to withstand the specified conditions.

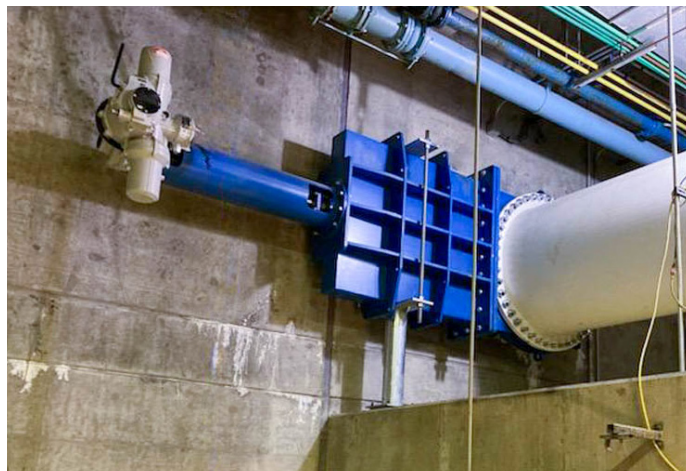
Installation

Orientation: Horizontal installations of large knife gate valves require additional support for both the gate and actuator. Roller gate supports ensure stable guidance and support for the gate during operation, thereby minimizing friction and wear. Similarly, actuator supports are crucial for preventing side load stresses that could lead to gate misalignment and compromise sealing effectiveness.

Space Constraints: Limited installation space may require a compact valve design with a specially designed actuation system to fit into the space. The valve may also be designed in a modular configuration allowing for the assembly of the valve in sections, facilitating easier installation in restricted areas.

Indoors: Indoor valve installations may require gate guards for safety to prevent finger pinching. Additionally, dust covers are utilized to shield the gate and actuator stem from falling and spraying materials, preventing buildup that could cause packing failure and increased actuating thrust.

Outdoors: Protecting valves from extreme outdoor temperatures involves various approaches to ensure reliable valve operation. These methods include using insulation blankets, employing heat tracing systems to maintain temperatures above freezing, selecting appropriate materials such as low-temperature elastomer seals and high-temperature alloys, and applying protective coatings to resist corrosion from moisture and UV light.



Bonneted knife gate valve installed horizontally with floor stand support to prevent gate misalignment.

Summary

Specifying a knife gate valve for a process system necessitates a comprehensive assessment of various factors, including valve style, application parameters, operating conditions, and installation requirements. Key considerations encompass media type, flow direction, isolation or control needs, shutoff requirements, adherence to industry standards, and operating conditions such as temperature and pressure. Installation considerations include valve orientation, spatial constraints, and environmental protection.

A thorough evaluation of these factors ensures the selection of a knife gate valve that provides reliable, efficient, and safe operation within the defined process parameters. Proper specification not only enhances system performance but also reduces maintenance costs and extends the valve's lifespan.

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