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Insulation Gaskets: A Complete Guide

Insulation gaskets are integral components in various industrial applications, serving as a crucial barrier to prevent the transfer of heat, electricity, or fluids between two surfaces. This comprehensive guide will delve into the definition, functions, applications, parts, types, materials, industry standards, selection criteria, and installation practices for insulation gaskets.

Table of Contents

- 1. What is an Insulation Gasket?
- 2. Functions of Insulation Gaskets
- 3. Insulation Gasket Applications
- 4. Parts of an Insulation Gasket
- 5. Assembly of Insulation Gasket Kit Component:
- 6. Types of Insulation Gasket
- 7. Insulation Gasket Materials
- 8. Industry Standards and ANSI B16.5 Specificatic
- 9. Selection Criteria
- 10. Installation of Insulation Gasket



What is an Insulation Gasket?

An insulation gasket is a specialized sealing device designed to isolate different flange faces, preventing the flow of heat, electricity, or fluids between them. These gaskets are employed in diverse industries to enhance safety, efficiency, and environmental sustainability.

Functions of Insulation Gaskets

Insulation gaskets serve several essential functions within industrial systems:

01 Thermal Insulation

- Prevents heat transfer between two surfaces, reducing energy loss and promoting energy efficiency in heat exchange systems.

02 Electrical Insulation

- Acts as a barrier against electrical currents, preventing the risk of electric shock or equipment damage.

03 Corrosion Protection

- Shields components from corrosive substances, extending the lifespan of equipment and reducing maintenance costs.

04 Fluid Containment

- Isolates fluids to prevent leakage and cross-contamination, maintaining the system's integrity in pipelines and vessels.

Applications of Insulation Gaskets

Insulation gaskets find application in a wide range of industries, including:

01 Petrochemical

- Insulation gaskets are used in pipelines and flange connections to prevent heat loss and maintain temperature stability in the transportation and processing of petrochemical products.heat exchange systems.

02 Oil and Gas

- In oil and gas facilities, insulation gaskets isolate different sections of pipelines and flanges, preventing the risk of corrosion, ensuring electrical safety, and maintaining operational efficiency.

03 Power Generation

- Thermal power plants utilize insulation gaskets in steam and gas turbine systems to minimize heat loss, improve energy efficiency, and ensure the integrity of flange connections.

04 Chemical Processing

- In chemical processing plants, insulation gaskets play a crucial role in preventing the mixing of different chemicals and maintaining the temperature of fluids in various processes.

05 Water Treatment

- Insulation gaskets are used in water treatment plants to prevent heat loss from pipes and ensure the proper insulation of flange connections in water distribution systems.

06 HVAC Systems

- Heating, ventilation, and air conditioning (HVAC) systems benefit from insulation gaskets to control temperature and prevent energy loss in ducts and pipes.

07 Mining Operations

- Mines use insulation gaskets to isolate different sections of pipelines, preventing heat loss and maintaining efficient operations, especially in processes involving the transportation of fluids.

08 Food and Beverage Industry

- Insulation gaskets in food and beverage processing facilities help maintain temperature control and prevent contamination by properly sealing pipes and equipment connections.

09 Marine and Shipbuilding

- Insulation gaskets are utilized in marine applications to prevent heat transfer and protect against the corrosion of ship pipelines and flanges.

10 Pharmaceutical Industry

- Pharmaceutical manufacturing processes often require precise temperature control, and insulation gaskets contribute to maintaining these controlled environments by preventing heat transfer.

Parts of an Insulation Gasket

An insulation gasket typically consists of several vital parts that work together to provide effective sealing and insulation. The main components include-

01 Inner Core

- The inner core is the central part of the insulation gasket that provides the primary insulation. It is designed to resist heat transfer, electrical conductivity, or fluid penetration between flange faces.

02 Outer Covering

- The outer covering is a protective layer for the insulation gasket. It shields the inner core from environmental factors, physical damage, and corrosive substances. The choice of materials for the outer covering depends on the specific application requirements.

03 Bolt Holes

- Bolt holes are strategically placed openings in the insulation gasket through which bolts pass. These holes allow for secure fastening and proper gasket alignment between the flange faces. The number and arrangement of bolt holes depend on the type and design of the gasket.

04 Sealing Surface

- The sealing surface is the part of the insulation gasket that makes contact with the flange faces. A tight and effective seal prevents heat, electricity, or fluid transfer. The sealing surface is often designed to match the contour of the flange faces.

05 Washers (Optional)

- In specific configurations, insulation gaskets may include washers, which are thin, flat discs that distribute the load of the bolts evenly across the gasket. Washers can enhance the stability of the connection and prevent deformation of the gasket.

Assembly of Insulation Gasket Kit Components

The primary components of the insulation gasket kit consist of the polyethylene insulating sleeve and the mounting stud. Unlike the traditional nut and bolt system found in flanged joints, the insulation kits employ a stud with a washer and nut on each end of the flange joint. The process involves inserting the insulating sleeve into the bolt holes, with one insulator on each side of the flange, resulting in two insulators per bolt hole.

Following this, the mounting stud is placed into the insulating sleeves until threads on each stud become visible outside the flange. Subsequently, a flat steel washer is slid onto the stud at each end, and a nut is threaded onto each end before being tightened.

As nuts are tightened on each stud end, the flange insulation kit demonstrates superior strength to the conventional nut-and-bolt connection. In the traditional method of nut-bolt tightening, the entire clamping force is directed to the single set of threads on the bolt. However, in the case of a double-ended stud, as seen in a flange insulation kit, the clamping force is evenly distributed among the threads on each end of the stud and inside both nuts.



Types of Insulation Gaskets

Let's understand the characteristics and applications of each flange insulation gasket kit type:

Type E (Full Face Type Gasket)

a. Characteristics

- Full-face gaskets cover the entire flange facing.
- They are suitable for applications where complete flange isolation is required.
- They are often used in low-pressure systems.

b. Applications

 It is commonly employed when a complete seal is necessary to prevent fluid or gas leakage across the flange.





Type F (Raised Face Type Gasket)

a. Characteristics

- Raised face gaskets are designed to fit within the bolt circle of a flange.
- They provide targeted insulation around the raised portion of the
- Suitable for higher-pressure systems compared to full-face gaskets. `

b. Applications

 It is widely used in applications requiring a precise, targeted seal, such as in high-pressure pipelines and connections.

Type D (RTJ Type Gaskets)

a. Characteristics

- Ring Type Joint (RTJ) gaskets are designed explicitly for ring joint flanges.
- They have a metal ring with a soft sealing material that ensures a tight and reliable seal.
- Suitable for high-pressure and high-temperature applications

b. Applications

 It is commonly used in the oil and gas industries, especially in high-pressure wellheads and Christmas tree connections.





Metal Core with G10/G11 Gaskets

a. Characteristics

- Metal core gaskets typically have a central metal core for added strength and stability.
- Insulating materials like G10 or G11 often surround the core.
- Offers a combination of structural integrity and insulating properties

b. Applications

- It is ideal for applications where mechanical strength and electrical insulation are crucial, such as electrical equipment or connections.

G10/G11 with Viton/Spring Energized Gaskets

a. Characteristics

- G10 or G11 layers provide electrical insulation while adding Viton or a spring-energized component enhances the sealing capabilities.
- The spring-energized design ensures a constant force for improved sealing.

b. Applications

- They are used when electrical insulation and dynamic sealing are required, such as in flange connections with variable loads or movement.



Choosing the appropriate type of insulation gasket depends on pressure, temperature, fluid compatibility, and the application's specific requirements. Each kind has unique advantages, making it crucial to match the gasket type with the system's demands to ensure optimal performance and reliability.

Insulation Gasket Materials

Insulation gasket materials play a crucial role in determining the performance and effectiveness of insulation gaskets in various industrial applications. The choice of material depends on factors such as the application's specific needs, environmental conditions, and the type of insulation required. Here is an overview of some common insulation gasket materials and their characteristics

Rubber (e.g., Neoprene)

a. Characteristics

- Resilient and flexible.
- Good electrical insulation properties.
- Moderate temperature resistance.

b. Applications

- Suitable for general-purpose insulation in low to moderate-temperature environments.

Phenolic

a. Characteristics

- High-temperature resistance.
- Excellent electrical insulating capabilities.
- Resistant to chemicals

b. Applications

- Ideal for high-temperature and corrosive environments, commonly used in the oil and gas industry.

G-10 (Glass-Reinforced Epoxy)

a. Characteristics

- Strong electrical insulating properties.
- Excellent mechanical strength.
- Good chemical resistance.

b. Applications

- Suitable for applications requiring a combination of electrical insulation and mechanical strength, such as in electrical equipment.

PTFE (Polytetrafluoroethylene)

a. Characteristics

- Exceptional chemical resistance.
- Low friction
- Wide temperature range.

b. Applications

- Ideal for harsh environments where chemical resistance and a broad temperature range are critical.

Viton (Fluoroelastomer)

a. Characteristics

- Excellent chemical resistance
- High-temperature resistance
- Resilient and durable

b. Applications

- It is commonly used in applications requiring resistance to extreme temperatures and chemical exposure, such as in the oil and gas industry.

G11 (High-Temperature Epoxy)

a. Characteristics

- High-temperature resistance
- Good electrical insulating properties
- Chemical resistance

b. Applications

- Suitable for high-temperature applications where electrical insulation is crucial, such as in electrical equipment

Metal Core (e.g., Stainless Steel)

a. Characteristics

- Provides structural integrity
- Enhances stability
- They are typically used with insulating layers.

b. Applications

- Ideal for applications where both mechanical strength and electrical insulation is required.

The selection of insulation gasket materials involves considering the system's specific requirements, including temperature, pressure, chemical exposure, and electrical considerations.

Industry Standards and ANSI B16.5 Specifications

Insulation gasket kits adhere to industry standards, with ANSI B16.5 being a prominent specification governing flange dimensions and materials. These standards ensure compatibility and reliability in various applications. Insulation gaskets and kits are available in sizes up to 60", catering to various industrial needs.

Selection Criteria

The right insulation gasket is critical for a system's performance, safety, and longevity. Several criteria should be considered during the selection process:

Gasket Style

- The choice of gasket style depends on the application's specific requirements. Consider whether a full-face gasket, ring-type gasket, sleeve-type gasket, or insulating set is more suitable for the flange connection.

Nominal Flange Size or Pipe Size

- The nominal pipe size, or flange size, refers to the size of the opening or bore, corresponding to the size of the pipe the flange is designed to connect. Select insulation gaskets that match the nominal pipe size to ensure a proper fit and effective sealing.

Pressure & Temperature of Service

- Understand the system's operating conditions, including the pressure and temperature. Different insulation gasket materials and styles are designed to handle specific pressure and temperature ranges. Ensure that the selected gasket can withstand the conditions it will be exposed to during service.

Preferred Material for Construction

- The material of the insulation gasket is a crucial consideration. Depending on the application, materials such as rubber, phenolic, G-10/FR4, PTFE, Viton, G11, or metal cores may be suitable. The material should align with the chemical compatibility, temperature resistance, and electrical properties required for the specific environment.

Chemical Compatibility

- Consider the fluids or gasses the system will handle. The insulation gasket material should resist corrosion and chemical degradation to ensure long-term reliability and prevent material deterioration.

Electrical Insulation Properties

 Select a gasket material with appropriate dielectric strength and insulating properties for applications where electrical insulation is crucial. This is particularly important in systems where electrical currents must be isolated to prevent safety hazards or equipment damage.

Installation of Insulation Gaskets

During the installation of insulation gaskets, it is customary to manufacture the gasket ID (inside diameter) slightly smaller than the flange ID. When installing, it is imperative to ensure that the gasket is accurately centered over the bore. This precautionary measure prevents the accumulation of foreign materials between the flange faces during pigging operations.

For underground flanges, it is recommended to utilize single-washer insulating sets. These sets should be installed on the unprotected side of the flange, providing cathodic protection for both the studs and the nuts. On the other hand, double washers are suggested for above-ground flanges, facilitating ease in testing procedures. Using alignment pins is always advisable to enhance the alignment of flanges and gaskets. Each pin should have a minimum size of 3/32 (2.38 mm) larger than the bolt, ensuring proper alignment during installation. Following these guidelines helps guarantee an effective and durable installation of insulation gaskets.

In conclusion, insulation gaskets are indispensable components in industrial settings, providing thermal, electrical, and fluidic insulation to ensure system longevity, safety, and efficiency. Understanding their functions, types, materials, and installation practices is crucial for selecting the right gasket and maintaining optimal performance in diverse applications.





Registered Office ASIAN SEALING PRODUCTS PVT. LTD.

A3(2), SIPCOT INDUSTRIAL PARK, PILLAIPAKKAM, SRIPERUMBUDUR -602105 TAMIL NADU, INDIA PHONE: +91 75400 75400 Email: info@asiansealing.in

Our Distributor in USA HTX Products LLC

333-A Northpark Central Drive Houston, Texas 77073, USA PHONE: +1(281)571-7005 EMAIL: sales@htxproducts.com www.htxproducts.com

www.asiansealing.in