

## You Build, We Protect!

# NEWSLETTER HEGGEL<sup>®</sup> Fix 831

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## Flanges: Critical Connectors in High-Risk Oil and Gas Operations

Flanges are foundational components in the Oil and Gas industry, especially in high-risk settings like gas refineries, offshore platforms, petrochemical plants, and extensive pipeline networks. By securely connecting pipes, valves, pumps, and other equipment, flanges create a reliable seal that contains hazardous substances. sustains critical pressure levels, and enables efficient assembly and disassembly of components. Their design and durability are essential in ensuring safety, minimizing leakage risks, and supporting seamless maintenance in environments where operational integrity is paramount.



Gas refineries rely heavily on the secure sealing capabilities of flanges to prevent leaks that could lead to severe safety risks, such as explosions and fires. These flanges are designed to withstand the high pressures and temperatures typical in gas refining, necessitating durable materials and precise installation to avoid potential seal failures. Additionally, given the corrosive nature of gases, refinery flanges are often crafted from or coated with corrosion-resistant materials, like stainless steel or advanced alloys, to ensure longevity. Flanges also simplify inspection and maintenance processes, which are critical in refineries to prevent system failures and support a safe, uninterrupted operational lifespan.





Offshore platforms face unique challenges due to continuous exposure to saltwater and high humidity, making corrosion-resistant flanges essential to prevent structural damage and leaks. These platforms also endure harsh environmental forces, including high winds, waves, and storms, which place additional stress on flange connections. In these high-risk conditions, secure flange fastening is critical to maintaining operational stability and preventing breakdowns. Furthermore, the modular design of offshore platforms benefits greatly from flanges, as they enable quick assembly and disassembly, simplifying maintenance and repairs in remote oceanic settings where timely upkeep is vital.



Petrochemical plants require flanges with exceptional chemical resistance due to the presence of hazardous substances in many of their processes. The materials and coatings used for these flanges must withstand aggressive chemicals to prevent degradation long-lasting and ensure performance. Additionally, flanges in petrochemical settings endure extreme temperature fluctuations, demanding materials that can expand and contract without compromising the integrity of the seal. Effective sealing is also essential for containing toxic gases and liquids, as it protects against environmental contamination and safeguards worker safety in these high-risk environments.





Pipelines, both onshore and subsea, depend on flanges to maintain consistent pressure over long distances, as any flange failure could result in pressure drops, blockages, or leaks. These flanges face significant environmental stresses: onshore pipelines are exposed to soil moisture and temperature fluctuations, while subsea pipelines endure intense deep-sea pressures. Flanges are strategically placed along pipelines to provide access points for essential repairs, which is particularly crucial in lengthy systems that traverse remote or environmentally sensitive areas. accessibility simplifies maintenance This and enhances the operational reliability of extensive pipeline networks.



## Key Corrosion Types Threatening Flange Integrity

Flanges in industrial applications are exposed to several corrosion types, each presenting unique risks to their functionality and longevity.





**Uniform Corrosion** affects the entire surface evenly, often due to constant exposure to corrosive environments like moist or acidic conditions in petrochemical plants. Although predictable, it gradually reduces flange strength over time. **Pitting Corrosion** creates deep, localized pits on the flange surface, typically from chloride exposure, as seen in offshore platforms and subsea pipelines. This form of corrosion is challenging to detect and can lead to leaks from weakened structural integrity.

**Crevice Corrosion** occurs in areas where moisture, chemicals, or contaminants become trapped, such as gaps in flanged connections. Common in pipelines and gas refineries, this type can compromise seal effectiveness, leading to leaks and pressure drops. **Galvanic Corrosion** develops when dissimilar metals come into contact in an electrolyte, accelerating corrosion at the anodic metal. Often found in mixed-metal flange assemblies in offshore platforms, this type can weaken the metal and result in flange failure.

**Stress Corrosion Cracking (SCC)** combines tensile stress with a corrosive environment, leading to cracking, especially in stainless steel flanges in high-temperature, high-pressure settings like gas refineries. These cracks can quickly spread, causing sudden and potentially catastrophic failures. Lastly, **Erosion Corrosion** results from the flow of corrosive fluids at high velocities, which physically erodes the flange surface while corroding it. This type, common in pipelines, can thin the flange and lead to seal failure and leaks.





Understanding these corrosion types is essential for selecting appropriate materials and implementing preventive measures to maintain flange integrity in high-risk industrial environments.

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## Critical Flange Damage Types Affecting Industrial Reliability

In industrial applications, flanges are subjected to various stresses and corrosive elements that can lead to physical damage and corrosion, compromising their structural integrity and sealing effectiveness.

Understanding the common types of flange damage is essential to maintaining reliable, leak-proof connections in high-stakes environments.



#### **Mechanical Damage**

Mechanical damage in flanges results from physical impacts, vibrations, or improper installation, which can cause dents, gouges, or surface deformations. These issues may misalign flange connections, compromising seal integrity and heightening the risk of leaks.

#### **Thermal Damage**

Frequent thermal cycling, typical in environments like refineries and petrochemical plants, can cause flanges to warp, expand, and develop material fatigue. This thermal stress disrupts alignment and reduces sealing effectiveness, increasing the likelihood of joint failure over time.

#### Gasket Damage

within Gaskets flange assemblies are vulnerable to degradation from high temperatures, pressures, or exposure to incompatible chemicals. Damaged gaskets reduce the flange's sealing capacity, leading to leaks, pressure loss, and potentially hazardous emissions. especially in gas processing environments.

#### Wear and Abrasion

In abrasive conditions, such as pipelines transporting sand-laden fluids, wear can gradually erode flange surfaces, thinning the material and weakening the connection. This reduction in thickness can critically compromise the flange's structural stability and its ability to maintain a secure seal.

By recognizing these damage types, operators can implement targeted maintenance and material selection strategies to enhance flange durability and system reliability in industrial operations.



## Consequences of Corrosion and Damage

consequences of flange The corrosion and damage are significant in industries such as Oil and Gas, where flanges play a critical role in connecting piping systems, valves, and equipment. Compromised seals lead to leakage and hazardous emissions, posing serious risks in gas refineries and petrochemical plants. Flange weaknesses can result in pressure drops, reducing operational efficiency, while unexpected failures cause costly shutdowns and repairs. Furthermore, structural degradation raises safety hazards, increasing the risk of fires, explosions, and contamination. As a result, maintenance costs escalate due to the need for frequent inspections, preventive treatments, and the use of corrosion-resistant materials.



## Flange Face Corrosion: A Critical Focus

Among the various forms of flange damage, flange face corrosion is particularly detrimental due to its direct impact on sealing surfaces. This type of corrosion often begins as small pits or crevices or through the accumulation of corrosive fluids in holes and cracks, gradually spreading and compromising the seal's integrity. Additionally, when flanges and gaskets are made from dissimilar materials, galvanic corrosion can occur, accelerating damage. Structural issues in the flange face further exacerbate corrosion, leading to leaks. operational inefficiencies, emissions, and

which demand urgent attention in high-risk environments.

Despite robust designs and careful material selection, flange faces remain inherently vulnerable to environmental and chemical stresses, highlighting the critical importance of proactive maintenance and protective measures. To mitigate these risks, a protective anti-corrosion layer is often applied even to new flange faces, effectively preventing potential damage and extending their service life.



Meanwhile, effectively addressing these challenges is crucial to maintaining the integrity, safety, and operational efficiency of flange systems in demanding industrial environments.

To confront these problems, **HEGGEL Fix 831** provides a state-of-the-art solution for effectively combating flange face corrosion. By employing modern protective technologies, this highperformance composite repair system not only restores damaged flange faces to their original integrity but also ensures long-term resistance to future corrosion. This advanced solution bolsters the durability and reliability of flange systems, significantly reducing maintenance costs and preventing operational disruptions.

The accompanying before-and-after images offer a compelling visual testament to the remarkable transformation achieved through these innovative techniques.

## High Abrasion Metal-Buildings Repair Filler

**HEGGEL Fix 831** is a powerful, multi-purpose metal repair compound, specially formulated to repair and rebuild machinery and equipment affected by severe wear, erosion, and corrosion. Designed for applications involving steel and iron, **HEGGEL Fix 831** offers outstanding abrasion and corrosion resistance, forming a protective barrier that guards surfaces against damage from both impacting particles and corrosive elements. For applications in particularly harsh environments, **HEGGEL Fix 831** can be topcoated with HEGGEL Corr products to further extend the lifespan of flanges and other critical components. This self-priming compound, with 100% solids content, can be applied by hand to a Dry Film Thickness (DFT) of up to 15 mm, delivering reliable defense against abrasive, erosive, and corrosive forces.





Renowned for its superior mechanical strength, **HEGGEL Fix 831** adheres robustly to materials such as stainless steel, cast iron, copper, bronze, aluminum, various alloys, and concrete, providing versatile protection across a wide range of industrial settings.

Its user-friendly application, extended working time, and rapid curing allow for minimal downtime, ensuring a swift return to operation. By integrating **HEGGEL Fix 831**, industries can effectively combat wear, erosion, and corrosion, reinforcing the structural integrity and extending the lifespan of critical flange systems, even in the most demanding environments.

### **Chemical Resistance**

- Crude oil (sweet or sour), kerosene
- Acetone
- Sulphuric acid 50%
- Hydrochloric acid 35%
- Demineralised water
- Nitric acid 15%

- Acetic acid 30%
- Diethanolamine, diglycolamine
- Sodium hydroxide 50%
- Sodium hypochlorite 15%
- Methanol

| Technical Data   |                          | Value       | Unit              |
|--|--------------------------|-------------|-------------------|
| Abrasion Resistance<br>ASTM D4060<br>(Taber CS-17/1kg/1000 cycles) |                          | 12          | mg<br>weight loss |
| Compressive Strength<br>BS6319 Part 2 1983                         |                          | 79.83       | MPa               |
| Adhesion Strength<br>(Cohesive failure)<br>ASTM D4541              |                          | 23.04       | MPa               |
| Barcol Hardness<br>ASTM D2583                                      |                          | 52          | -                 |
| <b>Tensile Strength</b><br>BS 6319 Part 7 1985                     |                          | 34.32       | MPa               |
| Temperature Resistance<br>NACE TM0174                              | Immersed<br>Non-Immersed | +90<br>+150 | °C                |