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NEWSLETTER

HEGGEL® Corr 290

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Corrosion Protection Against Exposure To Nitric Acid

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Nitric Acid

Nitric Acid is an indispensable chemical in numerous industrial applications due to its powerful oxidizing nature and ability to react with a wide array of substances. It is a strong mineral acid commonly used in a variety of industrial processes, including in oil and gas industry.

It plays a key role in the manufacture of fertilizers, particularly ammonium nitrate, supporting the global agricultural sector's growth and food production. Nitric acid is also extensively used in the production of explosives and propellants, supporting sectors like construction, mining, and defense. In the metal industry, it is used for pickling and etching of metals, which aids in purifying and preparing metals for further use. Additionally, nitric acid is employed in the production of various chemicals, polymers, and dyes, highlighting its central role in the chemical industry. Moreover, its use extends to water treatment, where it assists in pH regulation and the treatment of waste products.

Despite its corrosive and hazardous nature, nitric acid's multifaceted applications underscore its pivotal role in modern industry; its application in acidizing wells, industrial cleaning and maintenance purposes, etc. are among significant applications of this inorganic compound.

Industrial Exposures

Nitric acid plays a critical role in various industries, and certain components within these industrial applications are exposed to this substance due to its necessity in processes or operations.

Equipment in manufacturing plants that produce fertilizers, dyes, explosives, and other chemicals; pipelines, distillation columns, reactors, heat exchangers and vessels in oil and gas industry and refineries; process equipment in metal processing; various parts of the water treatment system; waste management facilities, storage tanks, etc. are often come into contact with nitric acid.

Moreover, pumps, storage tanks, secondary containments used across all industries are directly exposed to nitric acid.

Both nitric acid and various oxygenating chemicals can contribute to corrosion in industrial applications. Therefore, in each of these industries and applications, the equipment and components subjected to nitric acid require stringent safety measures, routine inspections, and regular maintenance due to the harsh and hazardous nature of these chemicals. This underlines the importance of appropriate design and upkeep of these components in industrial settings.

Corrosion by Nitric Acid

Corrosion by nitric acid is a common challenge faced by various industries, especially those where the acid is widely used, such as the oil and gas, chemical, and metallurgical industries. Acid interaction with metallic surfaces can lead to corrosion, which is a chemical or electrochemical reaction degrading the material over time. This can compromise the structural integrity of the equipment or infrastructure, posing potential safety risks and operational inefficiencies.

For example, in oil and gas applications, equipment such as pipelines, storage tanks, and secondary containment systems can be susceptible to nitric acid corrosion, leading to potential leaks, system failure, or even environmental contamination. Similarly, in the chemical industry, reactors, heat exchangers, and other process equipment may face similar challenges.

The corrosive effects of nitric acid on metal surfaces varies based on factors such as acid concentration, the presence of other impurities, temperature, and the type of metal.

Corrosion by nitric acid can manifest in several forms, including:

Uniform or General Corrosion:

In the oil and gas industry, pipelines and storage tanks are typically exposed to nitric acid and can suffer uniform corrosion over time. Similarly, in the fertilizer industry, reaction vessels where nitric acid is used may also experience this type of corrosion.

Pitting Corrosion:

In metal processing industries, equipment such as stainless-steel tanks used for pickling processes could suffer from pitting corrosion due to concentrated nitric acid exposure. Similarly, oil and gas pipelines may develop pits if protective coatings are damaged or worn out.

Crevice Corrosion:

Flanges, seals, gaskets, bolts, and riveted joints in pipelines or storage tanks in oil and gas industries could develop crevice corrosion if nitric acid gets trapped in these narrow spaces. This is also a concern for heat exchangers in chemical industries.

Galvanic Corrosion:

An example would be offshore oil and gas platforms, where different metals come in contact with each other in the presence of nitric acid and seawater, leading to accelerated corrosion of less noble metals.

Stress Corrosion Cracking (SCC):

High-pressure equipment like oil and gas pipelines, boilers in power plants, and pressure vessels in chemical plants could be susceptible to SCC due to the combined action of tensile stress and corrosive environment created by nitric acid.

Despite its challenges, nitric acid remains an inseparable part of many industrial processes due to its unique chemical properties.

With its widespread implications, protecting against nitric acid corrosion is of great importance; the aim is to ensure that the equipment can perform its intended function over its design life without failure or excessive maintenance.

Corrosion Protection

The importance of corrosion protection against nitric acid in industrial applications, particularly within the oil and gas industry, is critical due to several reasons; maintaining structural Integrity of the infrastructures involved in various industrial procedures, ensuring operational efficiency, preventing environmental catastrophes, avoiding financial loss, etc. are among reasons describing the significance of protection against corrosion defects in this regard.

There are several corrosion protection key methods utilized in industrial applications to safeguard equipment and infrastructure against deteriorating effects of nitric acid and oxygenating chemicals;

Material Selection is a fundamental method of corrosion protection, as choosing a material that can resist the corrosive effects of destructive chemicals significantly impacts the overall strength and stability of industrial structural components to some extent.

Corrosion Inhibitors are effective in decreasing the corrosion rate; forming a thin, protective film on the surface of the metal that prevents the acid from reacting with it. However, regular monitoring is required to ensure its correct concentration and performance within different environmental conditions.

Cathodic Protection is often used to protect underground or submerged structures, such as pipelines or storage tanks. Although this technique significantly slows down the corrosion process, it does require a power source and monitoring, and it's not typically applicable for general structural protection in an industrial plant.

Proper Design, Control of Operating Conditions, Regular Maintenance and Inspection are also vital approaches minimizing the risk of corrosion. In addition to significant costs, extra functional requirements and practical limitations, these methods are more about managing corrosion rather than preventing it in the first place; moreover, some types of damages may not be easily detectable until significant corrosion has already occurred.

Protective Coatings are widely used in various industries for corrosion prevention, and offer several advantages compared to other methods; versatility of application to a wide variety of surfaces and structures, barrier protection capability blocking the corrosive substances from directly contacting and reacting with the substrates, being cost effective while high-performing protection, easy application and repair, etc. are some of the benefits of protective coatings as part of a comprehensive corrosion protection strategy.

HEGGEL® Corr 290

Advanced Phenolic Hybrid Lining

Implementing advanced polymer technology, **HEGGEL Corr 290** is an advanced modified phenolic hybrid coating system specifically engineered to protect components exposed to nitric acid and oxygenating chemicals, both at ambient and elevated temperatures. The maximum operating temperature may vary depending on the specific chemical involved.

With semi-gloss finish, **HEGGEL Corr 290** reduce friction and improve the flow of liquids in pipelines, improving operational efficiency.

HEGGEL Corr 290 is an ideal coating with strong adhesion to the substrate ensuring the long-lasting and effective corrosion protection. This innovative product with its self-priming feature, offers an impermeable protective layer in a single coat application, eliminating the need for a primer during installation.

The solvent-free microstructure of **HEGGEL Corr 290** greatly impact the performance of the coating and adds to the environmental friendliness features of the coating.

Ambient curing characteristic of **HEGGEL Corr 290** helps its easy application, results in reduced downtimes and enhanced safety, providing significant economic benefits.

Easy repair or touch-up when necessary is another advantage of **HEGGEL Corr 290** minimizing operational disruptions and costs associated with maintenance.

Chemical Resistance

- 70% Nitric acid
- 37% Hydrochloric acid
- 100% Glacial acetic
- 84% Phosphoric acid
- 30% Chromic acid

Application Areas

- Storage tanks
- Pickling tanks
- Process vessels
- Secondary containments (including concrete walls/floors)
- Pipes
- Pumps
- Internal coating of the equipment exposed to nitric acid

Characteristics

- Solvent-free
- Ultra-high chemical resistance to oxygenating chemicals and full-strength nitric acid / concentrated organic acids
- Ambient curing
- Application to both metallic and concrete surfaces
- Temperature resistance up to 100ºC, and up to 180ºC in acid vapours

Technical Data	
Abrasion Resistance ASTM D4060 (Taber CS-17/1kg/1000 cycles)	65 mg weight loss
Impact Resistance ASTM G14	Forward: 6 Joules Reverse: 3 Joules
Adhesives Strength ASTM D4541	19.0 MPa (cohesive failure)
Elongation to Break BS 6319 Part 7 1985	1.0%
Temperature Resistance NACE TM0174	+100ºC Immersed +180ºC Non-Immersed