



Why Alloy 625 is the Top Choice for Extreme Oil and Gas Environments

Properties and Applications of Alloy 625



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Introduction

The oil and gas industry, particularly in regions such as the Middle East, the North Sea and the Gulf of Mexico, faces unique challenges due to extreme temperatures, volatile environments and changing composition of oil and gas. As oil reservoirs become deeper and more complex to extract, companies require materials that can withstand harsher conditions. One such material gaining popularity is Alloy 625 (UNS N06625). This white paper will explore the properties of Alloy 625 that make it an ideal choice for the oil and gas industry in extreme environments, highlighting Parker's expertise in supplying small bore instrumentation components in this material.



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Properties of Alloy 625

Alloy 625 (UNS N06625) is a nickel-based alloy known for its superior corrosion-resistant properties, metallurgical stability, and high mechanical and thermal performance. High levels of nickel, chromium, and molybdenum, along with small additions of niobium, aluminium and titanium, are responsible for the superior performance of this alloy. Originally developed during the 1950s as a replacement for stainless steel 316 in critical steam applications, Alloy 625 has been successfully and extensively used in oil and gas, chemical and petrochemical, medical and aerospace applications.

Advantages of Alloy 625 in the Oil and Gas Industry

As the more geographically accessible oil reservoirs approach their maturity or exhaustion cycle, oil and gas companies are facing more complex and deeper locations for oil extraction. And the deeper companies need to drill, the harsher the conditions. There is a proportional relationship between the drilling depth and the pressure required to extract oil.

In addition to increasing pressure, the oil well depth also increases temperature, reaching more than 150°C in many cases. The unique balance of strength, corrosion resistance and thermal stability makes Alloy 625 an optimum choice for preventing the premature

failure of pressure-retaining equipment expected to operate in hostile environments, transferring corrosive media or bearing high temperature long-term exposure.

Alloy 625's strength, corrosion resistance, and thermal properties

1. Strength:

The combination of niobium and molybdenum on the nickel-chromium matrix gives Alloy 625 superior tensile, creep, fatigue and thermal-fatigue strength. These properties make Alloy 625 suitable for use in applications where high strength is required at elevated temperatures, such as downhole tubing, offshore pipelines and process piping.

2. Corrosion Resistance:

Sulphur, chlorides, hydrogen sulphide or carbon dioxide are some of the most common chemicals present in oil rigs and are highly corrosive to many metals, including stainless steels such as 316. Alloy 625's broad resistance to many corrosive substances and outstanding performance against crevice and pitting corrosion, stress corrosion cracking, oxidization, and carburization, even at high concentrations and temperatures, makes it an ideal material for piping, tubing, and other instrumentation components. For many decades, Alloy 625 has been the material of choice for sour gas and is listed in the NACE MR0175/ISO 15156 standard.



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3. Thermal Properties:

Alloy 625 can endure high temperatures while retaining good mechanical properties and a stable microstructure without suffering from oxidation or scaling. Its outstanding thermal fatigue strength makes this material ideal for oil and gas extraction and processing, particularly when extreme environments and operating conditions are required. It has a high melting point of 1350°C, making it suitable for use in extreme temperature conditions. Its thermal conductivity is excellent, which also contributes to its suitability for use in high-temperature applications. Alloy 625 also has excellent weldability. Examples of Alloy 625 usage on high-temperature applications include separation, extraction, and transfer lines in process systems, natural gas production or jet engines.

Customers and Applications

The superior properties of Alloy 625 make it an ideal choice for a range of applications in the oil and gas industry, especially offshore, marine engineering and nuclear power production. For example, it is commonly used in sour gas service, engine exhaust systems, fuel and hydraulic lines, distillation columns and chemical transfer lines, nuclear water reactors and chemical processing equipment. Its ability to withstand extreme temperatures and corrosive

environments with high H₂S concentrations makes it an essential material for oil and gas extraction in harsh environments.

However, it is essential to note that proper material selection is crucial for ensuring the safety and longevity of equipment and personnel in the oil and gas industry. While Alloy 625 is an excellent choice for many applications, it may not be the best option for every situation. End-users must

carefully consider all design and operating parameters before selecting the right material for their application. Selecting the wrong material to cut costs at the early stages of a project could end up costing the end-user a significant amount in the long term. Choosing an unsuitable material for the intended use may lead to problems such as corrosion, cracks, leaks, and other maintenance and operational issues, resulting in downtime and revenue loss.

Why Parker?

As the world's first instrumentation manufacturer to develop a full range of Alloy 625 solutions, Parker Instrumentation Products Division, Europe, holds a leadership position in this field globally. Our dedication to quality and durability is demonstrated by our successful history of projects involving the use of Alloy 625 material in extreme environments.

With a comprehensive range of Alloy 625 products including fittings, valves, and manifolds, we ensure our customers find the components best suited to their specific applications. We prioritise safety and quality by providing heat code traceability to track and verify the production history of the material.

With our extensive supply chain, Parker is well-positioned to provide a reliable source of Alloy 625 material, as well as other corrosion-resistant materials to customers around the world. Additionally, our machining capabilities allow us to supply large quantities of materials promptly.

Our technical support team and global engineering network are always available to assist and guide customers through all stages of projects, from design to installation and maintenance. Finally, our team of experienced material experts is ready to provide professional advice to our customers.

We understand that material selection is just one part of the equation, and proper

installation is also critical. That is why we offer Small Bore Expert (SBEx) training to ensure our clients have the knowledge and skills required to install our products safely and effectively.



Parker Autoclave Engineers range of valves, fittings and tubing for applications up to 150,000 psi (10,350 bar).



Parker provides specialised Small Bore Expert (SBEx) safety training to ensure the correct installation of small bore tubing systems. Faulty installations can lead to reduced productivity and, more critically, pose risks to personnel, even when using top-quality materials.

Conclusion

In conclusion, Alloy 625's strength, corrosion resistance and thermal properties make it an excellent material for extreme oil and gas environments. Its ability to withstand harsh conditions and high concentrations of corrosive substances makes it suitable for oil and gas extraction, especially in offshore sites and marine industries. However, it is crucial to remember that the material selection responsibility ultimately falls on the customer, who must carefully consider all design and operating parameters to

select the suitable material for their application.

Parker Hannifin's Instrumentation Products Division boasts over 40 years of experience in providing the highest quality corrosion-resistant alloys (CRA). Our expertise and knowledge have been continuously tested and proven over time, allowing us to adapt to the fast-paced development of CRAs and to meet the ever-changing and demanding market needs. With this extensive experience, we have become the go-to partner

for customers looking for corrosion-resistant alloys. Trust us to provide you with the highest quality products and the expertise to ensure that your projects are successful, even in the harshest environments.

Reach out to your local Parker representative today to discover more about how we can supply small bore fittings, tubing and valves in the appropriate material for your project.



Phastite® non-weld push-fit connectors are suitable for pressures up to 22,500 psi (1,550 bar) and depths of 10,000 feet (3,050 m).



Parker's unique corrosion-resistant Supercase™ treatment is applied to a rear ferrule of A-LOK® tube fittings to ensure durability in harsh environments.

Contact Our Global Specification Team Today

Parker's global specification team of experts works closely with end-users and EPCs to understand their specific application requirements and provide professional guidance on material selection to ensure durability and safety. Reach out to your local Parker representative to learn more.



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