Quick Facts

Industry
Air Separation

Challenge
Modernize a helium vaporizer to meet extreme -452°F cryogenic conditions and stringent ASME weld qualifications.

Solution
Reverse engineer a custom stainless steel heat exchanger while qualifying a specialized welding team to meet liquid helium requirements

Solving Cryogenic Challenges Others Avoided

API Heat Transfer Delivers Alternative Helium Vaporization Solution

Recently, one of the world's leading diversified air separation companies sought to modernize a helium vaporizer nearing the end of its service life. The existing unit, a shell-and-tube design, was manufactured in 1988 by a company no longer in business.

The original unit measured 7 feet in length and 18 inches in diameter. The company solicited bids from several heat exchanger manufacturers; however, the cryogenic requirements for liquid helium posed challenges.

Cryogenic Design Challenges

1. *Ultra-low temperature requirement*. The helium vaporizer must operate reliably at a temperature of -452°F. At this condition, material behavior changes dramatically, particularly at weld joints, where brittleness and microscopic defects can lead to failure.

2. *Welding qualification barrier*. Meeting the stringent weld qualifications for cryogenics under the American Society of Material Engineers (ASME) Section VIII, Division 1 and Section IX standards presented another hurdle for heat exchanger manufacturers. Testing requires a specialized lab capable of validating weld performance at extreme cryogenic temperatures.

While multiple manufacturers were invited to bid, only API Heat Transfer could meet the rigorous weld qualifications. Beyond this, API engineers demonstrated broad technical expertise and proven results across a range of industries. They showed they could reverse engineer the unit, working closely with the customer to deliver a solution precisely tailored to their needs.

Custom-Engineered Integration

The project demanded a sophisticated mechanical design. The customer specified a TEMA Class B BEU heat exchanger featuring a bonnet head, one-pass shell, and U-tube bundle. This configuration is ideal for high thermal shock and differential expansion, but it also introduced manufacturing complexity. The unit had to be cut and assembled in stages to match the internal geometry and required additional welds on the front head.

Material selection was critical. To handle extreme thermal differentials while maintaining structural integrity, API engineers recommended a fully stainless-steel design: 304L stainless on the tube side and 304 stainless on the shell side. This ensures resistance to low-temperature brittleness and corrosion over the next 30-plus years of operation. To meet cryogenic welding requirements, API qualified a team

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of welders to work at -452°F. They produced test coupons from stainless steel, which were sent to a third-party certified lab for impact testing and metallurgical validation. Microscopic analysis ensured the absence of inclusions and structural weaknesses.

Following successful validation, API delivered a highly engineered helium vaporizer that integrated seamlessly into the customer's existing system. Designed with maintenance efficiency in mind, the unit features a removeable tube bundle.

Trusted Partnership

The customer praised API's collaborative partnership with their process engineers. They also commended the team's responsiveness to complex challenges and dedication to outstanding service.

As a testament to performance and confidence in API, the customer ordered four additional units. In a highly customized market with decades-long equipment lifespans, repeat orders of this scale are rare and a strong indicator of performance and customer trust.

To learn more about our products or review other case studies, **contact us:**

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