MATCHLESS IN STAINLESS WIRES FOR NASA LIQUID HYDROGEN PRESSURE VESSEL

Customer Didion’s Mechanical asked for a product recommendation and technical assistance with a cryogenic pressure vessel application. As the vessel was used in liquid hydrogen service at -423°F (-253°C) at the John Glenn NASA Research Center, the testing criteria would be extremely stringent: 0.021in (0.53mm) lateral expansion at -320°F (-196°C).

Didion’s Mechanical is a leading pressure vessel fabricator in Ohio, USA, with a reputable industry standing of over 35 years. Didion’s Mechanical has produced over 3,100 A.S.M.E. certified pressure vessels that are registered with the National Board.

With well-established and proven procedures for numerous types of steel, chromes, and exotic alloys, Didion’s Mechanical is a trusted source for the most challenging fabrication jobs. Their operations and methods are continually kept at state-of-the-art levels, including N.D.T. inspection procedures such as in-house industrial radiography.

For their project on a liquid hydrogen vessel at a NASA Research Center and due to the critical nature of this tank and the very strict requirements, Didion’s Mechanical put their trust in Böhler Welding products as well as the expertise of the Böhler Welding Application Engineers.

In the end, Böhler Welding was able to meet all requirements
» min. 0.021in (0.53 mm) lateral expansion at -320°F (-196°C)
» ferrite level of 4-14
» Using FCAW, SMAW, and SAW processes

Due to the working temperature of -423°F (-253°C), higher toughness (0.021in (0.53mm) lateral expansion at -320°F (-196°C)) is required by the ASME Boiler and Pressure Vessel Code.

While the submerged arc and stick welding results were relatively easy to obtain, the biggest issue were the flux
cored wires. It took several procedural changes, including amps, volts, technique and interpass temperature to finally meet the customers needs.

The team of Application Engineers decided to work with the Avesta FCW 308L/MVR Cryo wire as it is designed for welding austenitic stainless steels of EN 1.4301 / ASTM 304 type with very good corrosion resistance and excellent mechanical properties in cryogenic conditions thanks to its controlled ferrite content.

Avesta FCW 308L/MVR Cryo is designed for all-round welding and can be used in all positions without changing the parameter settings. It offers very good slag detachability and almost no spatter formation.

All welding consumables were finally tested and approved, all ASME and NASA requirements were met and all welds were 100% X-rayed, without any defects being detected.

As Böhler Welding is not only a leading supplier of welding consumables but a Full Solution provider, including welding machines, consumables, accessories and technical & application guidance, the company supported the customer without question in every step of the project and guaranteed the attainment of all requirements and targets.

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**MATCHLESS IN STAINLESS WIRES FOR NASA LIQUID HYDROGEN PRESSURE VESSEL**

**PRODUCT SUMMARY**

<table>
<thead>
<tr>
<th>AVESTA FCW 308L/MVR Cryo</th>
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<tbody>
<tr>
<td>EN ISO 17633-A: T 19 9 L P M21/C1</td>
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<tr>
<td>EN ISO 17633-B: TS 308L-F M21/C1</td>
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<tr>
<td>AWS A5.22: E308LT1-4/1</td>
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**Product features**

- Flux-cored wire, high-alloyed
- For welding austenitic stainless steels
- Cryogenic: primarily for use in low temperature applications
- Designed for all-round welding

**Product benefits**

- With very good corrosion resistance under fairly severe conditions, e.g. in oxidizing acids and cold or dilute reducing acids
- Can be used in all positions without changing the parameter settings
- Fast freezing rutile slag

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**CUSTOMER BENEFITS**

- Very good slag detachability
- Almost no spatter formation
- Excellent weldability in all positions
- Fast freezing, easy to remove slag
- High productivity
- Time and cost saving

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**JOIN! voestalpine Böhler Welding**

Why us? Because we have over 100 years of experience, more than 40 offices in 25 countries, 2,300 employees and more than 2,000 distribution partners around the world. This guarantees customer proximity, individual solutions and permanent innovation. In order to meet your requirements and wishes, voestalpine Böhler Welding has developed three specialized product brands. Perfectly coordinated. And as unique as your company.

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