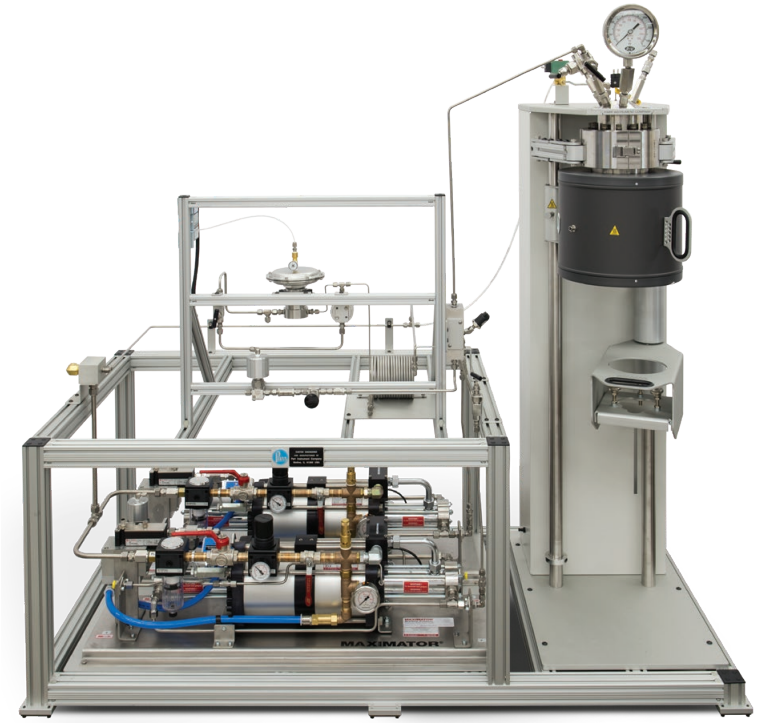
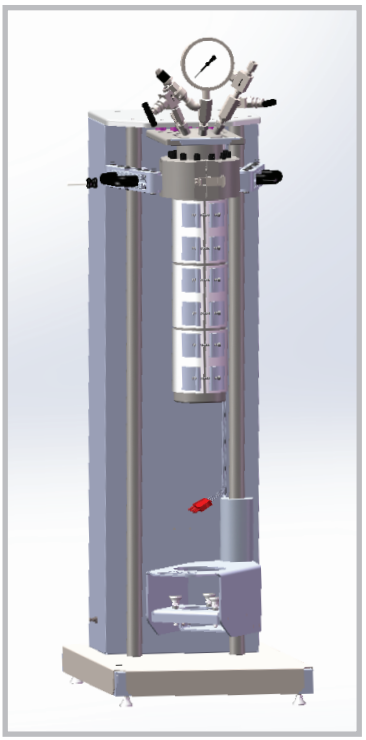


## Disbonding Apparatus for ASTM G146

Parr Instrument Company has developed an automated reactor system for the evaluation of disbonding of bimetallic stainless alloy/steel plate. This hydrogen disbonding reactor system is capable of attaining the conditions necessary for treating samples consisting of bimetallic plate typically used in the refining industry for High Pressure/High Temperature hydrogen gas service. The test temperature and hydrogen gas pressure are selected to simulate those conditions found in refinery hydrogen-containing environments. These typically range from 14 to 20 MPa hydrogen gas pressure and temperature from 300 to 500 °C depending on actual refinery service conditions under consideration. The purpose of this test scheme is to allow for comparison of data among test laboratories on the resistance of bimetallic stainless alloy/steels to hydrogen induced disbonding (HID). This test procedure provides an indication of the resistance or susceptibility, or both, to HID of a metallurgically bonded stainless alloy surface layer on a steel substrate due to exposure to hydrogen-containing gaseous environments under HP/HT conditions. This system can be used over a broad range of pressures, temperatures, cooling rates, and gaseous hydrogen environments where HID could be a significant problem. These tests can be used to assess the effects of material composition, processing methods, fabrication techniques, and heat treatment as well as the effects of hydrogen partial pressure, service temperature, and cooling rate. This testing regime is fully described in ASTM Standard Practice G 146.

The apparatus developed by Parr consists of an HP/HT test cell made from Inconel 625. Two gas booster pumps, one for nitrogen and the other for hydrogen, are used for pressurizing the test cell. The system incorporates an automated back pressure regulator and a variety of automated valves for pressure control. The control system for the apparatus automatically purges the vessel with argon, performs a high pressure leak test with nitrogen and then sequences the main portion of the test. The main test consists of filling the test cell with hydrogen, heating the vessel at a user defined temperature set point for a period of typically 48 hours. After this, the vessel is cooled at a predefined rate, typically 150 °C/hr, until the inside temperature reached 200 °C. The test cell is then automatically vented, purged and cooled further so that the test samples can be safely retrieved. All important test parameters are user adjustable.



## Apparatus for Corrosion Studies

This custom vessel was designed specifically to be used for long term (up to 4000 hours) corrosion testing of zirconium alloy samples in aqueous solutions near the critical point of water.

The vessel illustrated is a non-stirred, fixed head design with a volume of 3.7 liters with a maximum working temperature and pressure of 450 °C and 275 bar, respectively.

The vessel is heated with three clamp-on style band heaters. The system is capable of maintaining a uniform temperature of ± 1 °C over a working zone of 30 cm. Valves are provided on the head of the vessel for purging with inert gas prior the start the test as well as periodic sampling of the contents of the vessel. The controller is equipped to record temperature and pressure data for the duration of the test.

For more information on any of these custom systems please visit www.parrinst.com or contact the Parr Technical Service Department.