The Challenge

Testing components to be used in a liquid metal system such as Lead-Bismuth, Lead-Lithium, Sodium, NaK, or similar liquid metals can be very difficult. The customer needed a safe, reliable, robust system to handle molten liquid metals at temperatures ranging from 150 to over 400 degrees C. A large test section was necessary for testing the first item, but the system needed to be flexible for a wide range of future test articles that could include heat exchangers, traps, and more. All components in the system must operate in an inert gas environment, to preserve the chemical purity of the liquid metal alloy and prevent oxidation. The system needed variable temperature control, in-place filtering, and variable pump flow control. Large system shipment and installation in Asia with startup assistance was also a requirement.

The Solution

The test loop was designed and built by Creative Engineers, Inc. (CEI). The system has 23 zones of single-phase and three-phase temperature control for piping, tanks, and instrumentation. The control system safely distributes hundreds of amps of current throughout the system. It features the CEI flat linear-induction pump (FLIP) which moves fluid throughout the system. A CEI Electro-Magnetic flow meter is used to measure the liquid metal flow rate, which is displayed on the control panel along with approximately 20 other critical process parameters. The sump tank and expansion tank have multiple level switches to guide the operator during charging, filling, and draining operations of the loop. At these temperatures, very careful selection of all materials of construction is imperative, as is piping, structural, and vessel design to accommodate expansion and contraction of the system. The complete design was modular to allow shipping in multiple sea-going containers and assembly at the customer’s final location.