High-Temperature Pump-Motor Assembly

A high-temperature pump-motor assembly has been developed for pumping liquid sodium-potassium (NaK) eutectic at a temperature of 950°K (1250°F) for up to 20,000 hours without maintenance or adjusting radiation environments; (5) reliability and long life without maintenance; and (6) ability to seal high static pressures.

These features qualify the assembly for pumping high-temperature, dangerous, corrosive and/or valuable liquids; liquids sensitive to contact with the atmosphere; or liquids at extremely high or low absolute pressures. In addition, the assembly could be used for pumping hard-to-seal liquids; liquids which might be contaminated by conventional lubricants; or liquids containing a higher degree of contaminants or solids than can normally be tolerated.
ated in bearings or seals. The maintenance-free capability makes the system particularly suitable for use in remote or restricted locations.

On one shaft, the pump-motor assembly (PMA) has a centrifugal pump, a sealed drive motor, an internal process fluid lubricant/coolant circulating pump, and process fluid lubricated hydrodynamic bearings. A thermal barrier between the pump and motor allows the motor and bearings to run at a cooler temperature (approx. 620°K = 650°F) than the pump (approx. 900°K = 1160°F). A recirculation system filters and cools the process fluid that is circulated through the motor and bearings for lubrication and cooling. No static or dynamic shaft seals are used. The general design is similar to that of conventional zero-leakage pumps. However, this PMA includes innovations such as the new-design thrust and journal bearings, a high-temperature motor, and a method for connecting the pump and motor housings which minimizes heat transfer, yet allows thermal expansion without high stress, binding, or distortion.

A 10,000-hour design-life endurance run of the PMA, including over 800 stops and starts, was completed with no significant wear. A 20,000-hour minimum operating life is predicted.