

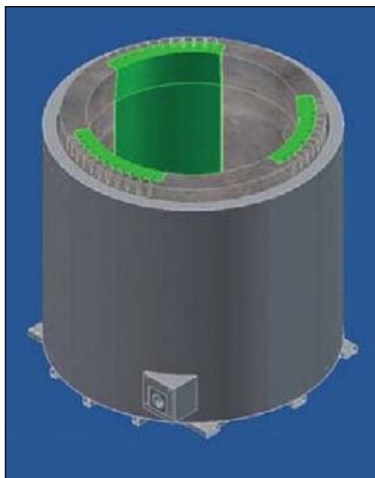
Case Study

Apogee Technology Develops Transportable Electric Ladle

Apogee Technology, Verona, Pa., has developed an electric ladle for molten metal transport. The internally heated, transportable electric ladles are kept at controlled temperatures, avoiding changes in metal composition or degradation of quality. Because the ladles can transport molten metal from other locations, in-plant melting can be avoided or reduced.

The transportable electric ladle is a shell-contained refractory crucible comprised of modular baffle or side pocket panels in which high-intensity electric resistance heating elements are embedded (Figs. 1 and 2). Power for over-the-road and rail transport is provided by small, efficient generators or, in the case of in-plant transport, by existing power. Ladle designs exist for 1,000-lb. fork truck liftable ladles and up to 30,000-lb. interplant transport.

Some existing unheated ladles rely on high temperature refractory preheating and super-heated metal for successful over-the-road delivery and have distance limitations. Apogee's transportable electric ladles include heating, temperature maintenance and control in a U.S. Department of Transportation-



Figs. 1 and 2. Apogee's transportable electric ladle features baffle or side pocket panels with embedded high-intensity electric resistance elements.



approved design. A 22,000-lb. capacity transportable electric ladle consumes 80,900 BTU/hour (Fig. 3), versus an estimated preheating input of a 2-3 million BTU for an unheated transfer ladle, which after charging loses 0.75F/minute. Excessive and inefficient metal and refractory preheating negatively impacts cleaning costs and refractory

life, while transient element composition also is affected. The demonstrated, transportable electric ladle temperature control is +/-5F at conventional holding and pouring temperatures.

The ladles may be used as an alternative to conventional holding furnaces; the use of baffle or side pocket panels has been adapted from Apogee's diecasting holding furnace design. Capacities can be consistent with operating requirements, and holding energy has been measured as low as 3.9 BTU/lb.-hour compared to an existing energy benchmark for gas-fired holders of 44 BTU/lb.-hour.

Most ladles are emptied by either cascade or tap-hole. Cascading is turbulent and can result in excessive melt loss, hydrogen adsorption and increases in entrained oxides. During tap-hole transfer, metallostatic heads of 7-10 ft. result in uncontrolled, initially high velocity, then variably turbulent flow. Transportable electric ladles can be equipped with a controlled negative pressure system (power modulated dispensation), which allows the flow of metal without turbulence at controlled rates.

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Fig. 3. The ladles come in a range of sizes and designs, including this 22,000-lb.-capacity ladle for road transport.