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Alloy Engineering’s Science and Art: the ‘Fountain-of-Youth’ for Continuous Furnace Muffles

BEREA, OHIO—Alloy Engineering muffles exhibit unprecedented levels of performance and life in spite of the extremely hostile, high-temperature sintering and heat-treating furnace environments to which they are exposed. This performance is the result of a unique combination of sophisticated design techniques, superior alloy fabrication expertise, and an experienced-based understanding of furnace dynamics.

The Alloy Engineering Company designs and manufactures muffles in a wide range of configurations from a variety of high-temperature and corrosion-resistant alloys. Alloy Engineering muffles are not off-the-shelf designs; each is specifically designed for optimum performance and life in its intended application.

“Our approach to muffle design begins with a thorough understanding of application parameters including furnace characteristics, process requirements, and product criteria,” explains Glenn Jackson, Alloy Engineering chief engineer. “We analyze and evaluate the many factors affecting muffle life including the furnace chamber and support structure, product work package, process atmosphere and temperature, alloy temperature-dependent characteristics, and forming and welding concerns. Although much depends on specific application parameters, an

Alloy Engineering muffle will typically provide two to three times the life of the muffle it is replacing.”

Alloy engineers utilize advanced and sophisticated CAD (computer aided design) software with solid-modeling and FEA (finite-element analysis) capabilities. “With these tools we can study the physical and thermal responses of critical muffle features to operational conditions and optimize the design to maximize life,” says Mr. Jackson. “We can analyze such factors as stress, frequency, displacement, buckling, steady-state and transient thermal patterns, shape optimization, dynamic response, fluid-flow dynamics, fatigue characteristics, and perform assembly contact and gap checks.”

Whenever possible, Alloy designers incorporate a unique catenary arch cross section in their muffles. This design equalizes stress throughout the section to provide the highest strength and life at temperature. Drawings for the infinitely changing radius of a catenary curve, time consuming and difficult to manually generate, can be quickly developed in the solid-modeling program. “Another important benefit of our CAD system is that we can seamlessly integrate our product designs with customer system specifications,” notes Mr. Jackson.

For almost 60 years, The Alloy Engineering Company has pioneered the design and manufacture of a wide range of alloy products for high-temperature furnace and corrosive applications throughout the automotive, aerospace, petrochemical, pulp & paper, primary metals, and general manufacturing industries.

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