PRECISE DIMENSIONAL ACCURACY VIA NOBAKE CASTING

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CASTING PROFILE

Component:
Header front casting for water heater.

Material:
Aluminum bronze.

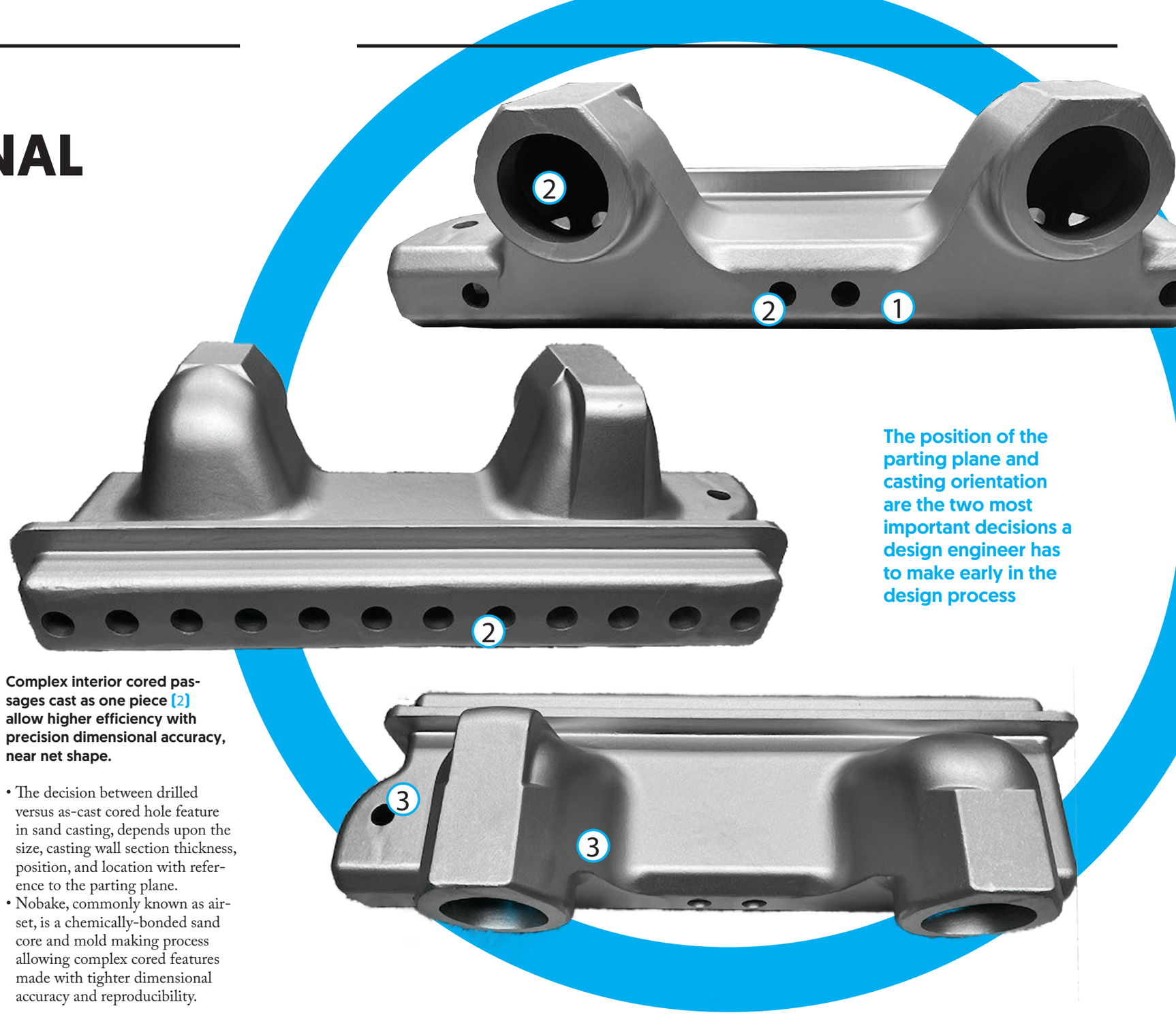
Weight:
55 lbs.

Dimensions:
22 x 10 x 8 in.

Process:
Nobake/airset sand casting.

Jiten Shah is president of Product Development & Analysis (PDA) LLC (www.pda-llc.com), a 35-year casting design and manufacturing veteran, and recipient of 2022 William J Grede Award. He is proactive in the areas of Industry 4.0, AI/ML driven metamodeling, additive manufacturing, and various advanced research projects.

A new product for a high efficiency water heater was designed for manufacturability at an affordable cost and produced by Alu-Bra Foundry (Bensenville, Illinois). The complex internal structure was produced with an internal core and the nobake sand casting process, which produced a dimensionally accurate part that met the customer's 100% hydro-pressure test performance requirement.



Off-set parting (1) is used for the ease of core print location and core placement in the mold.

- The position of the parting plane and casting orientation are the two most important decisions a design engineer has to make early in the design process, before detail design starts.
- Typically, core prints, which are required to support the core that makes the interior of the casting, are located at the parting plane. A simple split parting plane would not have been possible in this example. The rigging elements' (risering and gating) location and access need to be facilitated and typically are designed such that they can be mounted on the parting plane.

Complex interior cored passages cast as one piece (2) allow higher efficiency with precision dimensional accuracy, near net shape.

- The decision between drilled versus as-cast cored hole feature in sand casting, depends upon the size, casting wall section thickness, position, and location with reference to the parting plane.
- Nobake, commonly known as airset, is a chemically-bonded sand core and mold making process allowing complex cored features made with tighter dimensional accuracy and reproducibility.

Use of generous fillet, radii, and transitions (3) create a better cast component.

- Complex castings require generous fillet and radii for smoother transitions. Smooth transitions and generous fillet and radii offer better flow of liquid metal into the mold cavity with least turbulence and dross resulting in a better-quality casting without inclusions.
- Due to greater complexity and stringent requirements, the casting process modeling of the mold flow, solidification, residual stress, and porosity predictions are more valuable, as opposed to traditional "pour and pray" methods to validate the design of casting configuration and rigging and to optimize the process parameters for cost-effective solutions.
- Collaborative engineering among the OEM, foundry, pattern shop, and engineering firm is key to success. CS

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