

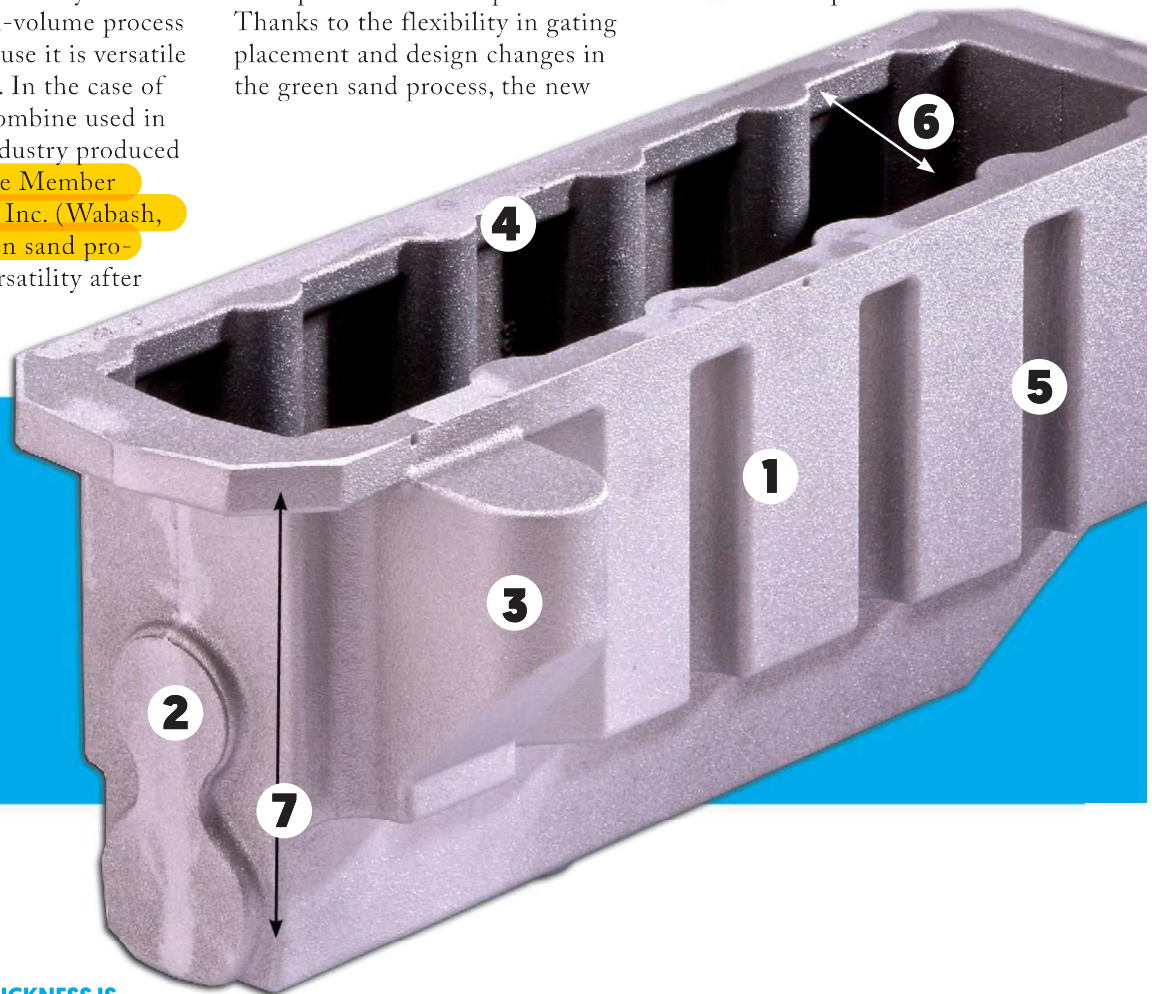
CORE DESIGN KEY TO SUCCESSFUL CASTING

JITEN SHAH, PRODUCT DEVELOPMENT & ANALYSIS (NAPERVILLE, ILLINOIS)

The green sand casting process is the most widely used high-volume process because it is versatile and cost effective. In the case of an oil pan for a combine used in the agriculture industry produced by AFS Corporate Member Wabash Castings Inc. (Wabash, Indiana), the green sand process proved its versatility after

eliminating some issues in the old design, which was cast in the semi-permanent mold process. Thanks to the flexibility in gating placement and design changes in the green sand process, the new

casting reduced cost by using a common core for two cavities inside the part.



CRITICAL WALL THICKNESS IS MAINTAINED REPEATEDLY WITH HORIZONTALLY-PARTED GREEN SAND MOLDING USING A RUGGED COMMON CORE FOR TWO MOLD CAVITIES.

- Critical wall section thickness **(1)** in the oil pan is controlled with a massive common core that is well supported at the core print. The main body core has an overhang, like a cantilever, and if not

- designed carefully, it could sag or deform, resulting in uneven wall thickness. This could potentially lead to shrinkage porosities and non-uniform mechanical properties due to uneven cooling rates of thinner and thicker sections within the same casting.
- The most important and key decision at the conceptual stage while designing a casting is the

parting plane location **(2)** and orientation of the casting with respect to gravity. If the casting is parted properly, the access to the key features requiring desired soundness can be achieved with the facilitation of the attachment and placement of the gating and risering system.

CASTING PROFILE

Cast Component:

Oil pan

Process:

Green sand casting

Material:

Aluminum

Dimensions:

21 x 8 x 9 in.

Weight:

15.64 lbs.

Application:

Agriculture industry

ACCESS TO THE HEAVY BOSS IN THE COPE AIDS FEEDING TO AVOID POTENTIAL SHRINKAGE POROSITY.

- The heavy mass on one side of the casting **(3)**, if not fed properly, will lead to shrinkage porosity. By positioning it in the cope, it is easily accessible for riser connection to feed during solidification.
- Casting process modeling validates the design of casting and rigging as well as process parameters. These tools simulate mold filling, solidification and cooling, microstructure and mechanical properties predictions locally, in addition to shrinkage porosities.

SMOOTH TRANSITIONS ARE AIDED BY GENEROUS FILLETS AND RADII.

- Casting design with smooth transitions with generous fillets **(4)**, radii **(5)** and thick-to-thin

features are very important to achieve sound quality castings. Smooth transitions also eliminate sudden change in cross sections, eliminate or reduce the stress concentration, and provide better fatigue life performance in highly structural applications with repeated loadings.

BODY CORE OPENING AND DEPTH ARE BALANCED.

- The body core's opening **(6)** and depth **(7)** are critical to its strength and stability. If the opening is too thin with a depth that is too large, it could lead to core breakage and/or distortion, uneven wall section thickness, potential porosities and non-uniform properties. **CS**



Jiten Shah is president of Product Development & Analysis (PDA) LLC (www.pda-llc.com), and a 30-year casting design and manufacturing veteran.

Thanks to the flexibility in gating placement and design changes in the green sand process, the new casting reduced cost by using a common core for two cavities inside the part.