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Counter-Pressure Casting System Eases Aluminum Pouring for High Integrity Components

Metalcasters who work with molten aluminum are familiar with turbulence. The process of pouring the touchy alloy can be stressful due to its need to follow a slow, tranquil path into the mold. Too much turbulence while pouring leads to inclusions and defects.

To avoid this problem, many metalcasting facilities have opted to defy gravity and employ the use of counter-gravity casting technology. In an effort to help relieve some of the pressure, Counter Pressure Casting, Inc., Laguna Hills, Calif., offers a variety of counter-gravity casting machines that focus their efforts on using pressure instead of vacuums for slow, tranquil mold fill.

In this casting technique, the machines are designed to provide simplicity and convenience in operation and maintenance. CPC offers four machines in its line—CPC 601, CPC 1103, CPC 1303 and CPC 1400. The medium range CPC 1103 is the most widely used, standing 19 ft tall (5780 mm) with a floor width of 13 ft (4000 mm) and a floor length of 11 ft (3500 mm). The machine weighs in at 3748 lb (1700 kg) and has a furnace with a metal capacity of 1102 lb (500 kg).

The aluminum furnace housing the heaters and crucible are located below the permanent mold chamber. As a result, the aluminum is fed into the mold through a riser tube. The upward movement of the molten aluminum working against pressurizing gas (coming from the top of the mold) provides the controlled pour needed to eliminate many of the problems associated with working with molten aluminum. Cast components produced in the counter-pressure machines meet high requirements in strength, density, surface smoothness and dimensional accuracy when using aluminum alloys in a variety of different molds (Table 1).

Table 1. Comparison of Typical Mechanical Properties Achieved for Aluminum Components Produced in Various Casting Processes

Process	Ultimate Tensile Strength (ksi)	Yield Strength (ksi)	Elongation (%)
Sand Cast	49	38	10
Vacuum Pressure Cast	46.9	35	11.3
Squeeze Cast	45.3	35	11
CPC	48.5	35	14.3

To further ease the process, CPC's line of machines can automatically transfer furnaces or molds by way of a shuttle system. The furnace transfer system keeps the metal in the crucible after the pouring process so degassing occurs in the same place and keeps the metal constant. Only the furnace is moved. The transfer process takes only 1-2 min. and can be done concurrently with the solidification process. With some jobs, the furnace can be switched out while the cast component is solidifying, meaning the temperature of the mold is not lost and consequently, no time is lost between pours.

The machine also can be fitted with a mold transfer system, which gives a metalcasting facility the freedom to quickly swap out molds to keep the pouring process moving efficiently. And depending on production needs, the unit also can be equipped with a casting unloader and core pull assemblies.

The machines were designed using a four tiebar vertical construction with an integrated holding furnace. The system delivers dimensional stability and accuracy in guiding and positioning moving parts. They can be used in three modes—setting, separate operations and semiautomatic.

The free-standing control cabinet allows for monitoring and automatic control of the machine's technological parameters. The display panel shows all steps of the casting cycle, including: real time indication of the pressurization trend graph, the diagnostic menu and temperatures of the molten metal and mold. The control cabinet also manages all movements of the machine in every mode of operation and the movements of the transfer systems.

For safety measures, the machine's sides are electromechanically protected with movable working platforms and safety doors. Infra-red optronic machine guarding also is available upon request. **MC**



This A356 aluminum steering knuckle was made using the Counter-Pressure Casting process. It replaced an iron design at a 50% weight savings while maintaining critical safety and performance characteristics.