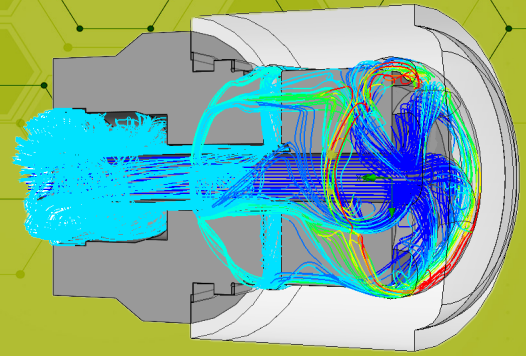


GIGA PRESS

Tooling System

THAILAND • CANADA • MOROCCO



GIGA PRESSES

The approach to using giant casting machines, nicknamed Giga Presses, to make car bodies with just a few massive casted parts is catching on in the auto industry. One Giga Press manufacturer says that they work with about half a dozen automakers taking the same approach.

Over the last few years, several automakers have invested heavily in casting and alloy technology to enable larger casted parts that can significantly simplify manufacturing. In some cases, a single body piece can replace 70 or more different parts in the vehicle.

The strategy to reduce the number of pieces to make a car body results in a massive reduction in the complexity of the body line and the capital needed to build the production line. It also brings weight advantage to the vehicle itself, which can improve efficiency.

BIGGER CASTINGS = BIGGER PROBLEMS

Automotive is an extremely demanding industry. Automakers insist on 100% guaranteed quality, with just-in-time delivery. The enormity of their long-term orders allows them to negotiate very low prices. The potential volume of business is undoubtedly attractive to a die caster, but their productivity must be outstanding to profit from it. Several problems arise - such as uncontrolled thermal expansion, lubrication, and porosity due to incomplete air evacuation which can be easily resolved in smaller machines but seriously magnified when producing large castings. Possible solutions to these large-alloy casting production problems will be addressed.

SHOT-END SYSTEM

Attaining maximum productivity and maximum operating life for both the shot sleeve and the plunger tip requires the plunger to move smoothly and at a constant speed through a perfectly round, straight shot sleeve. The clearance between the plunger and the shot sleeve cannot exceed 0.004" (0.10 mm). If the clearance becomes more than this, the alloy can penetrate as "flash" or blow-by. This will cause excessive wear.

The problem is that when metal is heated, it expands. The amount by which each metal will expand or contract with temperature changes is expressed in terms of its coefficient of thermal expansion. For example, plunger tips are commonly copper and shot sleeves H-13 steel or its equivalent. H-13 expands at the rate of 0.0000061/F° (0.000011/C°) and copper at 0.0000094/F° (0.000017/C°).

The clearance between the plunger and shot sleeve never remains constant. At the start of the casting cycle, the sleeve is very hot, while the plunger tip is quite cool at the pour end. As the plunger moves forward toward the die end, the tip becomes hotter. At the end of the stroke, the sleeve dissipates heat to the platen and the die, and it cools. The tip then expands while the shot sleeve contracts. If the initial clearance at the pour end is small enough to prevent penetration of alloy past the tip of the plunger, the plunger may seize in the sleeve before reaching the end of the stroke. The chance of this happening increases with the length of the shot sleeve.

CAPACITIES/CAPABILITIES



DEW Deutsche Edelstahlwerke, a Swiss Steel International mill in Germany, is Castool's main supplier of all hot work tool steels.



Heat Treatment is done mainly in Ipsen vacuum ovens with all shot sleeves receiving three draws to promote better structure.



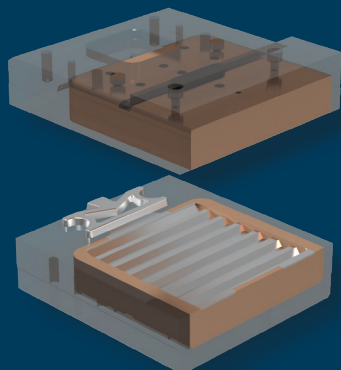
Nitriding is done mainly in Nitrex vacuum ovens to control the nitride layers.

CNC Turning:	30" (762 mm) X 180" (4572 mm)
Drilling:	20" (508 mm) Ø X 70" (1778 mm)
Horizontal Milling:	80" (2032 mm) X 80" (2032 mm) X 100" (2540 mm)
Honing:	20" (508 mm) Ø X 100" (2540 mm)
Heat Treatment:	60" (1524 mm) Ø X 84" (2134 mm)
Nitration:	61" (1550 mm) Ø X 98.5" (2502 mm)

VENTING

When producing large castings for the automotive industry, a conventional venting system in the die is no longer adequate. Porosity and poor surface finish are unacceptable. Superior quality is demanded in this market sector, and the price level is such that any appreciable scrap loss will make the die caster uncompetitive. Almost all the air from the die cavity and the shot sleeve can be extracted using a modern chill vent. Effective air removal by chill vent technology is essential when producing high-quality large castings.

Castool recommends InterGuss chill vents for Giga-Presses



InterGuss
Chill Vent Technology GmbH



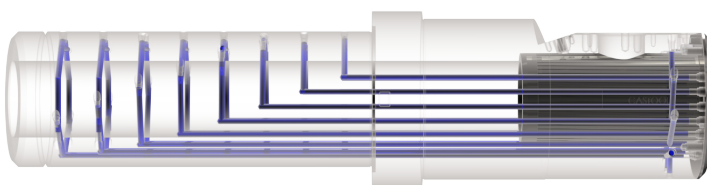
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SHOT SLEEVE WITH INSERT



Castool recommends a gun-drilled shot sleeve with replaceable wear inserts for Giga Presses. Most often, the cross-drilling is done using 5-axis machining to promote conformal cooling and to help solidify the biscuit to better manage reducing cycle time.

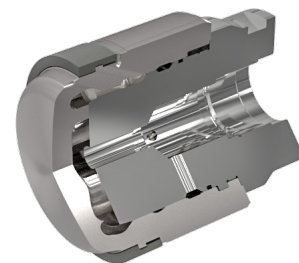
PLUNGER TIP

Unless the plunger tip is adequately cooled as it moves forward, it will expand much more rapidly than the sleeve. Binding may result. When satisfactorily cooling a plunger tip, most problems result from an inefficient heat transfer to the cooling water. There is often simply an insufficient flow of water.

The Castool Ring Plunger (CRP) is a steel tip with very good conductivity and ductility supported by a stainless-steel holder which lies in full contact with the inside face of the plunger and absorbs the total shot pressure. This allows the face wall of the plunger to have highly efficient heat exchange.

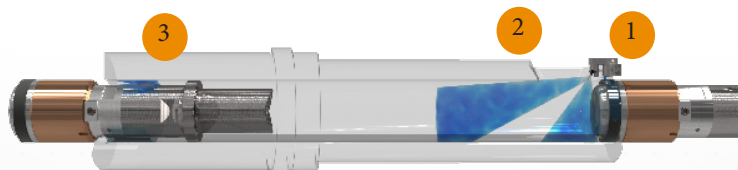
This exchange is assisted by cooling channels in the tip face. These channels are designed so that the flow of coolant becomes turbulent. This turbulence prevents filming or stratification, thus improving heat transfer to the coolant. The flow of water is introduced directly to the inside face of the plunger through the centre bore. It is then distributed via several channels to the circular external channel. For large casting machines, effective cooling of the plunger is essential.

To further ensure a consistent seal between the plunger and shot sleeve, a plunger may have a replaceable expanding wear ring mounted near the front of the tip. This wide ring, made of tool steel with a wear-resistant coating, is split using wire EDM so that it can be easily and quickly installed and replaced. Because of its flexibility, the ring automatically adjusts to the sleeve's inside diameter during the shot. It will also compensate for some ovality of the sleeve.



Castool recommends its CRP plunger tip with wide expanding wear rings for Giga-Presses

LUBRICATION



To get maximum production from any cold chamber die casting machine, effective lubrication of the shot sleeve and plunger/plunger ring is necessary. Insufficient lubrication will result in inconsistent shot velocity, premature sleeve and plunger tip wear, and unnecessary scrap.

Large, long sleeves require sufficient lubricant to coat the entire bore. The problem is that the most commonly used lubricants (such as powder, wax, or oil) are quite satisfactory in smaller machines but are often inadequately applied when the shot sleeve is large and long. The lubricant itself may be effective, but if a 9-12" diameter (22-30 cm) sleeve is longer than 65-80" (165-203 cm), the lubrication is often gone by the time the plunger has travelled about 35" (90 cm).

Castool recommends CLS-200, a low viscosity, biodegradable lubricant with a high flash point applied by Combi-Lube and Rod-Lube for Giga-Presses.

BETTER CASTINGS FASTER