

The plunger tip is a critical element of aluminum die casting process. Its' successful operation depends on a number of factors. The most important factor is its' efficient interaction with a round, straight, thermally and therefore dimensionally stable shot sleeve.

Castool's plunger tips were developed a number of years ago by Allper of Switzerland. The plunger materials have been developed jointly between Allper and SCHMELZMETALL over the last 30 years particularly for die-casting. All the copper alloys are refined from virgin materials, heated and casted in high vacuum to avoid oxides, forged and thermally precipitated. The alloy combines high fatigue, high hardness, high resistance to heat and high thermal conductivity.

## PURPOSE

- Prevent alloy from penetrating between the shot sleeve and plunger, prolonging tooling life
- Move smoothly and consistently, with a minimum of lubrication, through the shot sleeve bore increasing casting properties
- Maintain a secure seal with the shot sleeve wall necessary for an effective vacuum to be drawn reducing porosity
- Cool the biscuit quickly to reduce cycle times

## FUNCTION

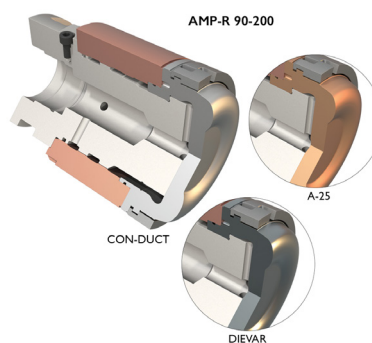
The function of the plunger tip is the extension of the plunger rod, which pushes the molten alloy into the mold. There are a number of functions that must be satisfied by an effective plunger tip.

- To repeatedly transmit the force of the plunger rod, at high temperature, to the alloy.
- To maintain a seal with the shot sleeve wall during the shot, eliminating flash or blow-by and preventing air from being drawn into the alloy when using a vacuum.
- To remain thermally and therefore dimensionally stable throughout the shot allowing consistent and repeatable shot velocities.
- Since the tip is dimensionally stable, and the gap controllable, steel wear rings can be attached to the plunger tip body to provide a guarantee that the seal is maintained.

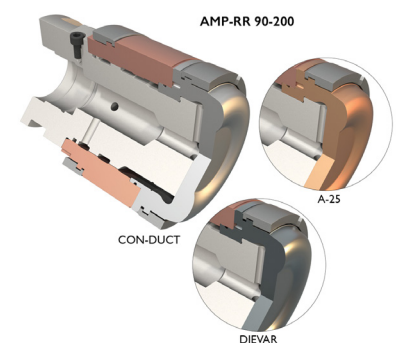
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## The AMP Plunger

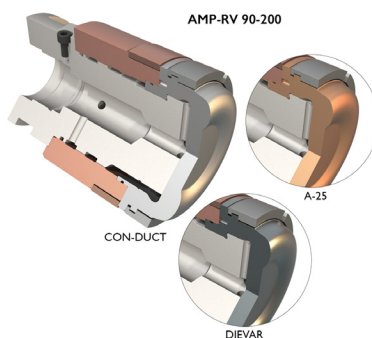
The AMP is excellent for large machine from 100 mm up to 200 mm diameter. The demands on the plunger tip, particularly in strength and stability, outgrew the Allper Ring Plunger ARP. This led to the development of the Allper Modular Plunger AMP. The plunger head can be made from Con-Duct or a special A25 ultra high strength copper alloy. The Con-Duct has a 1127 MPa tensile strength minimum and 42 W/mK thermal conductivity and A25 alloy has a 950 MPa tensile strength minimum and 180 W/mK thermal conductivity. These specific combinations of properties leads to thermal and mechanical stability of plunger head. The body of the AMP is made of A45 copper alloy. The A45 has the high thermal conductivity 240 W/mK, which assists the plunger thermally stable. A 45 copper body with A25 head is fastened to a stainless steel holder with a quick release bayonet coupling. The heat transfer to the coolant is more effective than with the ARP. The tip is more thermally and therefore dimensionally stable, allowing it to be used on today's very large castings.



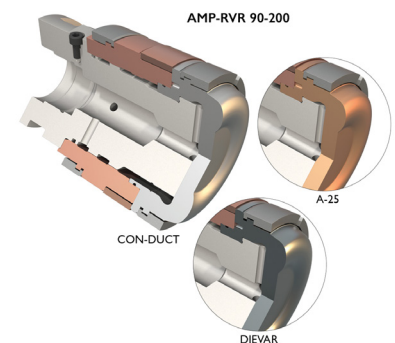
**AMP-R:** A nitride H-13 (1,2344) steel ring rests freely in a groove machined near the front of the AMP plunger tip. It is split, and expands against the inside wall of the shot sleeve to maintain a better seal. The cost of consumables is reduced.



**AMP-RR:** Similar to the AMP-R, but has two expanding wear rings instead of one, specifically for large, convoluted close-tolerance castings.

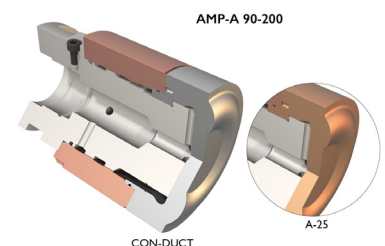


**AMP-RV:** The RV incorporates a forged beryllium copper bushing around the copper body, between the 2 rings. A more positive seal is achieved.



**AMP-RVR:** The RVR incorporates a forged beryllium copper bushing around the copper body, between the 2 rings. A more positive seal is achieved.

**AMP-A:** In some cases, because of the die or shot sleeve configuration, it is difficult to use the split ring. In these cases, a forged ultra high strength Con-Duct steel or beryllium copper head is attached to the AMP stainless steel holder and copper body.



FUNCTION continued...

- Because the ring is flexible, it makes continuous contact with the inside of the shot sleeve. Flash, which is a major cause of wear, is essentially eliminated. Shot speeds are consistent.
- Since the expanding wear ring ensures a secure seal between the plunger and the shot sleeve, a better vacuum can be drawn.
- An additional advantage is that the face of these is considerably cooler than that of other plunger tips. This cools the biscuit much faster, and reduces the cycle time significantly.

## BENEFITS of the Allper Plunger Tip

- Reduce cost per shot
- Increase plunger life
- Increase shot sleeve life
- Improve vacuum seal
- Reduce flash
- Reduce scrap rate
- Reduce downtime

With the Allper Plunger Tip, Castool again sets a new standard of excellence in the die cast industry.

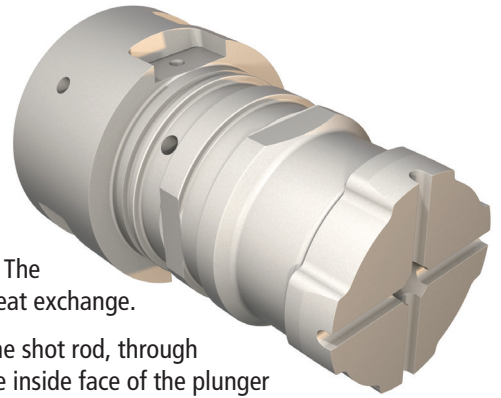
Results may vary depending on individual press characteristics and setup.



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### AMP (Holder)

The AMP stainless steel tip holder is screwed onto the shot rod, and the head is securely fastened to it with a quick release bayonet type connector. The front of the steel holder lies in full contact with the inside face of the plunger tip and absorbs the total pressure of the shot. The face can then be very thin for better heat exchange.

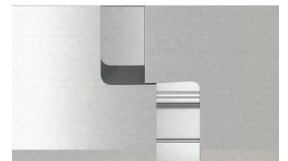


The water flow is from the center of the shot rod, through the stainless holder, and directly to the inside face of the plunger tip where a turbulent flow is generated to maximize the heat transfer. It then goes through four channels to the circular external coolant return passage.

Approximately 20 to 60 l/min. of water flow are necessary to use this system depending on plunger diameter.

### AMP (Ring)

Replaceable wear ring creates a superior seal for vacuum applications and reduces cost. The internal radius has been increased by 8 times, reducing the stress concentration factor by 1/3. The overlap length has also been reduced. The total effective stress from the reduced overlap and increased radius reduces the stress to at least 1/5 of the original milled ring.



Two pin hoods are now being machined into most rings. The split is kept away from the pour spout and also erosion prone area of the shot sleeve, under the pour spout. The ring complies to the ID of the shot sleeve better than with a single hood opposite the split. It is also easier for the operator to access the split for removing and installing a new ring.



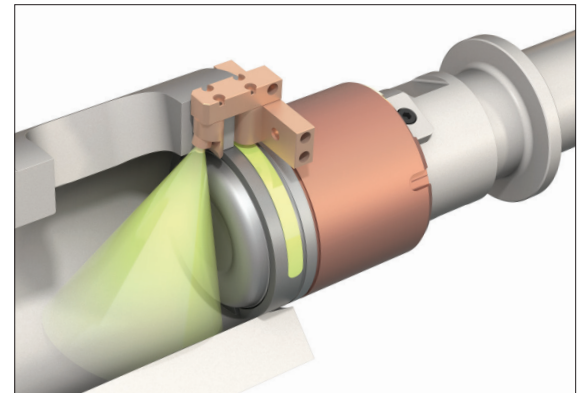
### Shot Sleeve

The sleeve should be straight and round under production temperature. If it is not the case, aluminum will penetrate between the clearance of the plunger tip and sleeve.

In most cases these shot sleeve require thermo regulation with oil or water.

### Lubrication Combi-Lube

For larger and longer shot sleeves, it is difficult to adequately lubricate the complete interior of the shot sleeve. This can be accomplished with the ACL system. Lubricant is delivered directly on top of the plunger or split ring and sprayed onto the bore under the pour spout.



**SCHMELZMETALL**



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