

# SHOT SLEEVE SYSTEM

## Thermal Control Reduces Wear

For maximum operating life, the plunger tip must move smoothly through a round, straight shot sleeve, with a clearance of less than .004". If the clearance becomes greater than this, the alloy can penetrate as flash or blow-by. This will immediately cause excessive wear. The problem is to prevent unequal thermal expansion which will distort the sleeve.

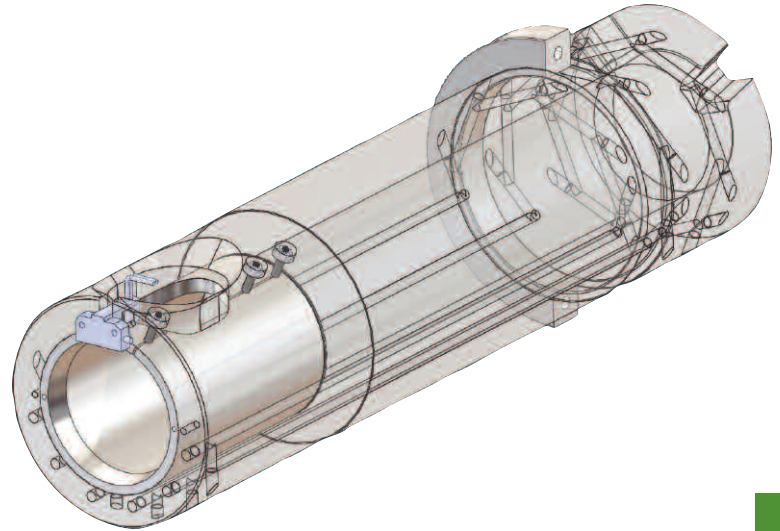
A typical shot sleeve may become 300°F (150°C) hotter at the bottom under the pour hole, than at the top in front of the hole. If the temperature of the sleeve is much higher at the bottom than at the top, unequal expansion will cause it to become oval instead of round. Also, this will cause the sleeve to become slightly bowed instead of straight. Either of these conditions will result in premature wear of both shot sleeve and plunger tip. To avoid this, the temperature at the bottom of the sleeve must be controlled so that the difference in temperature, bottom to top, does not exceed 120°F (50°C).

## When is Temperature Control Necessary?

For small diameter sleeves thermal distortion is usually so small that temperature control is seldom necessary. The flexible ring on the Castool plunger tip will conform to minor variations in the bore.

Medium diameter sleeves may require thermal control. This can be determined by a temperature audit during typical operating conditions. Castool has an effective and economical cooling device which can be re-used when the sleeve is replaced. The Castool Pour End Cooling Jacket puts maximum shot sleeve cooling where it is needed most – beneath the pour spout. Depending on the operating temperature of the alloy being used, the die caster can preset the Castool Cooling Jacket. A thermocouple then activates a controller which increases or reduces the flow of coolant through the jacket as required.

Large diameter sleeves will always benefit from thermal control. A series of gun drilled holes are positioned along the length of the shot sleeve under the pour spout, and are connected to gun drilled holes around the die end of the sleeve. A thermal control unit is used to manage the temperature and the flow rate of the medium (water or oil) to gain control of the shot sleeve temperatures.



## Factors Affecting Amount of Thermal Distortion

- Casting weight
- Alloy temperature
- Fill ratio
- Cycle time
- Thickness of sleeve wall
- Length of sleeve
- Size of pour hole

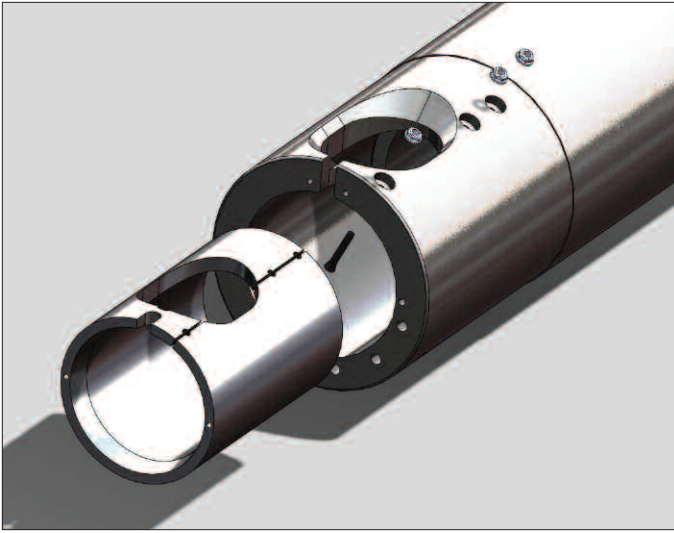
## Shot Sleeve Design Parameters

High shot sleeve temperatures usually result from short cycle times, high filling ratios, and thin sleeve walls. The wall thickness should be at least 1/3 of the inside diameter of the sleeve. The size of the pour spout should be less than 70% of the bore of the sleeve. The unsupported portion of the sleeve should be as short as possible to avoid bending.

## Replaceable Wear Bushing

High temperatures and the velocity of aluminum impacting the sleeve bore under the pour hole causes erosion. Castool recommends the use of replaceable wear bushings. Conical mounting bolts force the split bushing to lock in place, providing good heat transfer. They can be easily replaced, even in the machine when necessary.

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### The Split Collar

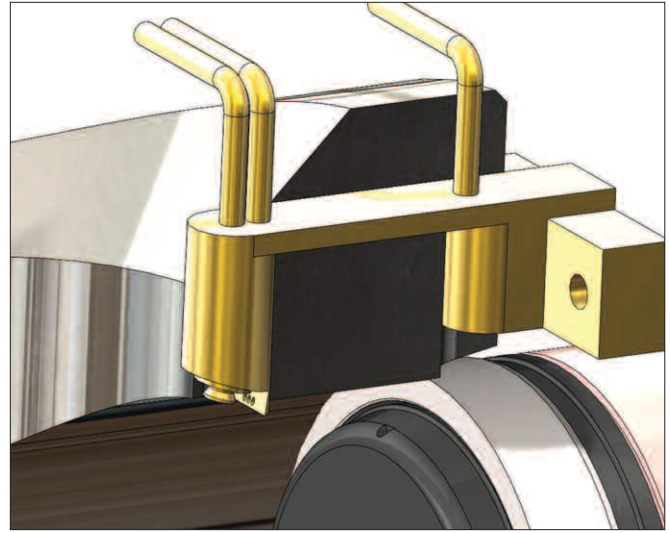
Steel prices have risen dramatically in the last few years. Castool recommends using a split collar that reduces the diameter of steel required to make most shot sleeves. The split collar may also allow the shot sleeve to be used in several dies by having multiple collars.

### Castool Lubrication, Drop and Spray

To get maximum production from any cold chamber die casting machine, effective lubrication of the plunger and shot sleeve is absolutely essential. Insufficient lubrication will result in inconsistent shot velocity, premature sleeve and plunger tip wear, and unnecessary scrap. Too much lubricant can increase porosity. This will also produce costly scrap.

Castool has found it most effective to introduce liquid lubricant by an internal groove at the pour end of the shot sleeve. The lubricant is applied only where it is needed, the surface of the ring or the leading edge of the plunger. This reduces the amount of lubricant used, and therefore reduces cost significantly.

Long, large diameter sleeves require sufficient lubricant to coat the entire bore, especially at the die end where pressure is the greatest. Best results are achieved by using Castool's Combi-Lube system. Lubricant is applied to the surface of the ring and atomizing air and liquid lubrication is sprayed into the sleeve bore.



Castool offers 2 liquid lubricants designed for this application:

ALS192 is a liquid synthetic based boron nitride lubricant, designed for either aluminum or magnesium castings that will be welded, or for which good surface quality is required.

ALS 196 is a mineral oil based lubricant developed specifically for the Castool Lubrication System. It maintains an unusually low coefficient of friction at high temperatures.

### Benefits of Castool System

With the help of Castool to control the temperature of shot sleeves and plunger tips, and with proper lubrication, cold chamber die casters using the Castool Ring Tip Plunger system are getting outstanding results... productivity and cost savings.

