

Shot Sleeve and Plunger Tip Materials for Die Casting

In a cold chamber machine the melt meets the shot sleeve and the plunger before it reaches the die, and the two are chosen on opposite principles, one as hard as the process allows and the other deliberately softer. The tables below give the materials and hardness of both, the properties of the plunger tip alloys, and the machine parts around them.

Reference only. This is a reference summary of a published source and it is not a specification of ours. The values are reproduced from the source, which gives them as nominal analyses and property values for named commercial materials. What a particular die or machine reaches depends on the design, the alloy being cast and the cycle. Final specification is confirmed on the job.

The two parts that meet the melt first

The shot sleeve is a nitrided steel part

Why the sleeve and the tip must not match in hardness

Plunger tip materials and their properties

Plunger tip material	Thermal conductivity (CGS units)	Coefficient of thermal expansion (per C, x 10 ⁻⁶)	Tensile strength at room temperature (N/mm ²)	Hardness, Brinell	Hardness, Rockwell C
Nitrided steel	0.12	11.5	1000	780	70
2 percent beryllium copper, heat treated (83-20)	0.30	17.0	1170	370	40
Copper with 0.5 percent Be, 1 percent Co and 1 percent Ni, heat treated (91-20)	0.45	17.8	650	210	17
Copper-silicon-nickel-chromium alloy (940)	0.45	17.5	630	180	16
Copper with 0.6 percent Be, 1.5 percent Ni and 0.8 percent Co, heat treated (BB1-MOD)	0.50	17.8	760	230	20

Materials used for cold chamber plunger tips with the relevant properties, as published in the source. Thermal conductivity is given in CGS units, so the column is comparable within the table rather than against a table in SI units.

Clearance and the thermal expansion of copper

How the rest of the machine is built

Part description	1938 EMB 12	1981 EMB 12 B and C
Base	Cast iron	Mild steel fabrication
Metal container	Chromium cast iron	Meehanite
Fixed platen	Mild steel	0.4 percent carbon steel
Moving platen	Semi steel	Cast steel 0.25 percent C
Tie bars	0.4 percent carbon steel	EN 24 nickel chromium molybdenum steel
Toggle links	Semi steel	Cast steel 0.25 percent C
Toggle bracket	Semi steel	Cast steel 0.25 percent C
Toggle pins	Case hardened steel	0.5 percent carbon steel, hardened
Bush and plungers	Nitralloy	EN 41a steel, nitrided

Machine part materials for a medium sized hot chamber machine as built in 1938 and in 1981, as published in the source.

The pair in one view

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Part	Normal material and condition	Hardness	Why it is chosen this way
Shot sleeve, cold chamber machine	Steel, nitrided to a case depth of about 0.25 mm	Up to about 70 HRC at the surface	To resist attack by the molten aluminium and the sliding of the tip inside the bore
Plunger tip	Nitrided steel, Meehanite or a copper alloy	Copper alloys run up to about 40 HRC	To stay softer than the sleeve so the pair cannot seize or gall, and to take the shock, fatigue and wear that the tip sees

The shot sleeve and the plunger tip, their usual material and condition, and the reason each is chosen that way.

Where to go next

Aobo Steel, tool steel supplier

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Source, Die Casting Metallurgy, A. Kaye and A. Street, Butterworths Monographs in Materials, 1982.

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