Processes.

Conventional aluminum die casting.
Magnesium die casting.
Vacuum casting process.
Squeeze casting.

Standard die casting processes.
Standard die casting processes.
Rugged and economic.

Regardless of whether you are planning to cast standard components, magnesium components, weldable or pressure-tight components – you will find Bühler to be your ideal partner for paving the way for achieving efficient die casting.

**Vast experience**
The vast experience of Bühler guarantees smooth project handling. A team with globally leading experts are available to you as problem solvers for the following processes:

- Conventional aluminum die casting
- Magnesium die casting
- Vacuum casting process
- Squeeze casting
Conventional aluminum die casting.

**Productive and economic**
The most productive and economic process is still classic die casting of molten aluminum alloys. Therefore, aluminum is still the most widely processed metal in the field of die casting.

**Aluminum remains future-oriented**
Industry and especially automotive engineering are increasingly demanding lighter components. In conjunction with the reasons mentioned above, aluminum therefore remains an indispensable engineering material. The raw material from which aluminum is made – bauxite – is available in abundant quantities. This offers us the assurance that we will be able to use aluminum in future-oriented and innovative ways for a long time to come.

**Features and advantages**
– Aluminum is comparably easy to cast.
– The metal is recyclable – an important environmental consideration.

**Your benefits**
– Shorter production starts thanks to our services.
– Increased productivity thanks to a larger number of accept components per time unit.
– Reduced testing requirements thanks to reproducible quality level.
Magnesium die casting.

**Why magnesium die casting?**
The assured availability and the combination of positive properties of high-purity magnesium alloys make this lightest of all metallic engineering materials an attractive option for numerous applications such as:
- Light-weight components in automotive engineering
- Casings of office machines, notebooks, cell phone handsets, loudspeakers
- Power tools, etc.

**Advantages of magnesium die casting using Buhler SC machines**
The powerful shot unit allows fast die cavity filling. This high dynamism can be mastered by braking the plunger at the end of the die filling phase. The feared dynamic pressure peak possibly caused by die opening is eliminated. Thus, the conditions for achieving a casting process that is gentle on the die and that can be automated are fulfilled.

**Features and advantages of the process**
- The excellent flow characteristics enable components to be cast with even thinner wall sections or higher complexity than with aluminum die casting.
- New applications in the electrical engineering industry thanks to the good thermal conductivity and the electromagnetic screening of the metal.
- Higher strength and better thermal conductivity are achieved than with plastics.
- Magnesium supplies are all but inexhaustible.
- The return scrap can be readily recycled.
- High-purity magnesium alloys are not prone to corrosion.
- Good soundproofing properties.
- Weight reduction compared with aluminum about 30%.
Your benefits
- Lower fixed costs through the application of the standard SC machines equipped with magnesium options.
- Faster achievement of accept components thanks to solid training in magnesium by Buhler.
- High capabilities in the field of magnesium thanks to process development in the Buhler Technology Center.

The die casting process
Following are the main steps in the magnesium die casting process:
The ingots are heated to about 150 °C. This is required because the melting and ladling furnaces must only be charged with dry ingots. Then the ingots are introduced into the ladling furnace and melted. An inert gas atmosphere prevents oxidation of the bath surface. The molten metal is maintained at the prescribed temperature until fed to the shot sleeve.

1. The required weight to be cast is conveyed to the shot sleeve by positive pressure or a conveying device with feed pipe.
2. The low heat content of the molten magnesium requires a fast first injection phase.
3. Die cavity filling is faster than with aluminum.
4. After a very brief solidification time, the die can be opened and the cast component can be extracted.
Vacuum casting process.

Why vacuum casting?
Structural automotive components with thin to medium wall sections are expected to meet high requirements such as
– good welding characteristics
– high mechanical strength
– low production scatter
To satisfy them, a high structural quality is required.

Vacuum casting creates good conditions for decisively reducing gas porosity, since air is evacuated from the die cavity. Depending on the alloy used, the required values may be achieved in vacuum casting even without additional heat treatment. But if such treatment is necessary, it will produce surface flaws in the presence of even minor gas porosity, which cannot be tolerated on the end product.
Casting process requirements
Following are the requirements for an optimal vacuum casting process:
– The vacuum equipment must offer high performance, and the die and shot assembly must be tightly sealed to ensure high process reliability.
– It must be possible to control the velocity and pressure profiles with high precision and high reproducibility and in real time – which can be taken for granted with Buhler SC machines.
– Additional influencing factors such as molten metal feed, die temperature control, plunger lubrication, and die spraying are also optimized to an extent crucial to quality.

Optimized vacuum casting process
The casting process assisted by high vacuum will satisfy the above requirements with a high degree of certainty. Each individual step is optimized, especially in order to further reduce the gas porosity compared with previous vacuum applications.

The process takes place as follows:

1. Pure and degassed metal is filled with low turbulence into the shot sleeve.

2. When the plunger has passed over the filling hole, this will trigger evacuation of the shot sleeve and die.

3. Even before the fast shot phase, high negative pressures are generated in the die.

4. Prefilling and die filling are carried out on the basis of an injection profile matched to the specific component.

5. The vacuum shut-off valve integrated in the die closes independently of the metal feed rate, tripped by a metal pulse at the very last moment of filling, allowing total gas removal. The process is completed by the pressure intensification phase, which again is matched to the specific component.
Squeeze Casting.

Squeeze casting on Buhler horizontal machines
The process is suitable for components with relatively thick wall sections with high mechanical properties, as for example required of safety components in automotive engineering. The cast components can be welded and heat-treated, and they can be produced with near net shape. Aluminum alloys can be used which are difficult or impossible to produce by standard die casting.
Buhler selectively utilizes the advantages of the horizontal shot sleeve system.

Advantages using Buhler machines
– The velocity and pressure intensification profile matched to the component geometry can be programmed in very many discrete steps. Real time control maintains these parameters constant.
– Depending on the type of shot unit selected, it is possible to generate high pressure intensification values during the solidification phase.

Your benefits
– Low capital investment, as no special-purpose machines are required.
– Entering of future-oriented market segments using existing SC machines.
– Low maintenance and training requirements thanks to unified machine and die ranges.
1. The thermally optimized shot sleeve is filled with low turbulence with specially pretreated and high-grade molten metal.

2. A calculated velocity profile for the first injection phase allows all the air to be removed from the shot sleeve.

3. A special gating and venting system design in conjunction with a velocity profile matched to the die geometry helps produce castings without air entrapments.

4. The matched pressure intensification profile of the plunger, possibly in combination with partial final compression, produces very dense and homogeneous structures with oriented solidification.