TECHNOLOGY DATA SHEET · PERMANENT MOLD CASTING

Aluminum permanent mold casting

We pour molten aluminum alloy by gravity into a reusable metal mold – a permanent mold made of cast iron or structural steel. The mold lasts for the entire production run, so castings have repeatable dimensions and a smooth surface, and require less finishing than castings from a sand mold. We design and manufacture permanent molds in-house.

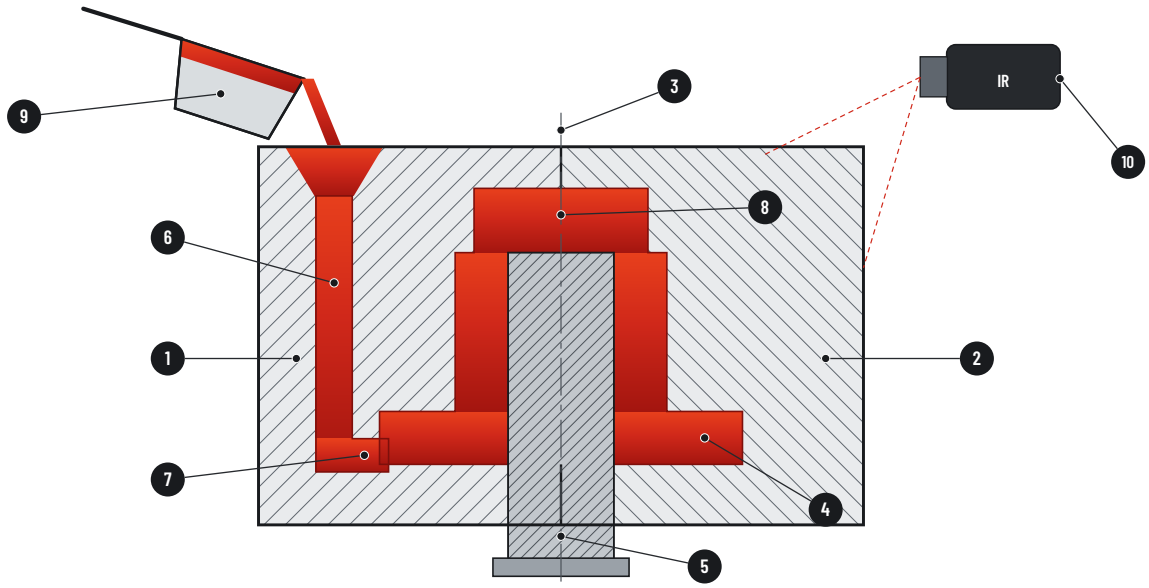
0.1–50 kg
casting weight – from small parts to larger components

1400 × 1200 × 750 mm
maximum mold size on permanent mold casting machines

250–600 kg
charge capacity of electric foundry furnaces

PN-EN 1706
aluminum alloys, including EN AC-42000, 46200, 47100

SCHEMATIC DIAGRAM · NOT TO SCALE



1. Mold half – cast iron or structural steel
2. Second mold half (reusable mold)
3. Mold parting plane
4. Mold cavity filled with alloy – casting (example: flanged bushing)
5. Metal core forming the bore; hardened cores are also used
6. Pouring basin and sprue
7. Runner feeding the alloy into the cavity
8. Riser feeding the casting during solidification
9. Casting ladle – gravity pouring: manual (short runs) or in an automatic cycle (series)
10. Thermal imaging camera – mold temperature check before pouring

Fig. 1. Permanent mold casting – cross-section of the mold with mold cavity, metal core and gating system.

01 · Technical parameters

Material	aluminum alloys per PN-EN 1706, including EN AC-42000, 46200, 46500, 47100, 51300
Casting weight	from 0.1 to 50 kg
Mold size	permanent mold casting machines – molds up to 1400 × 1200 × 750 mm; casting units – molds up to 300 × 300 × 300 mm
Non-standard molds	permanent molds not limited by the standard working area of permanent mold casting machines – on a unit with a screw mechanism
Remelting	electric holding furnaces with a capacity of 250–600 kg of charge; alloy refining and modification
Pouring	in an automatic cycle for series production; manually for short runs
Molds and cores	permanent molds made of cast iron or structural steel; integrated metal cores and hardened cores; CAD design and manufacture on in-house CNC machines
Process control	mold temperature measured with a thermal imaging camera; control of alloy chemical composition, melting and pouring temperatures, and quality of finished castings
Production runs	series production; short runs and prototypes – upon consultation
Mold lead time	depends on size and complexity – stated in the quotation

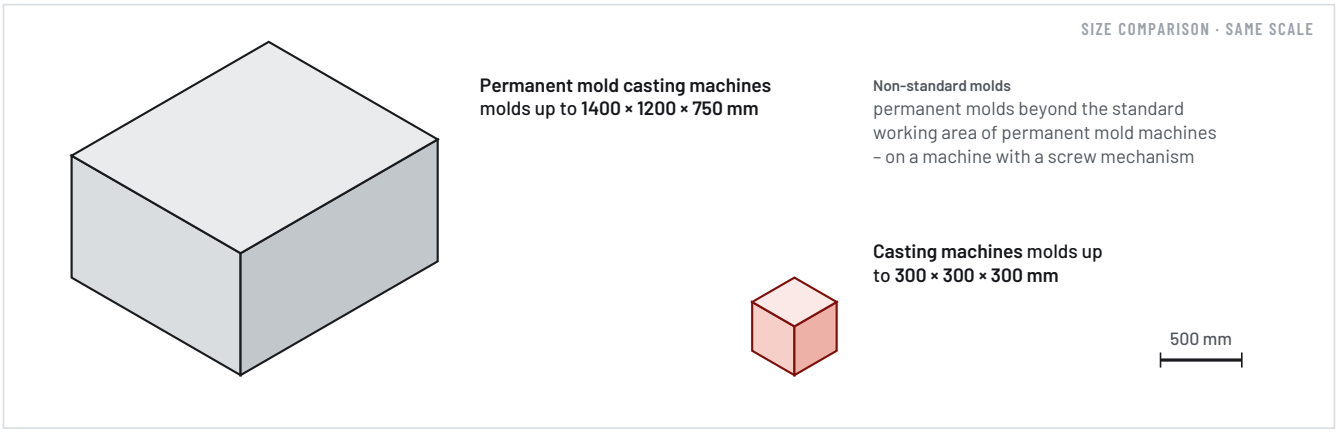


Fig. 2. Maximum mold dimensions – permanent mold machines and casting machines drawn to the same scale.

02 · Material and melting

We use certified charge material whose chemical composition almost fully matches the customer's requirements; alloying additions are dosed when the customer specifies particular technical parameters. We do not use aluminum scrap from external sources – as an exception, for process economy, we introduce selected in-house scrap (rejects and gating systems) with a composition conforming to the required standard. Refining removes gases and inclusions, and modification improves the crystalline structure of the alloy.

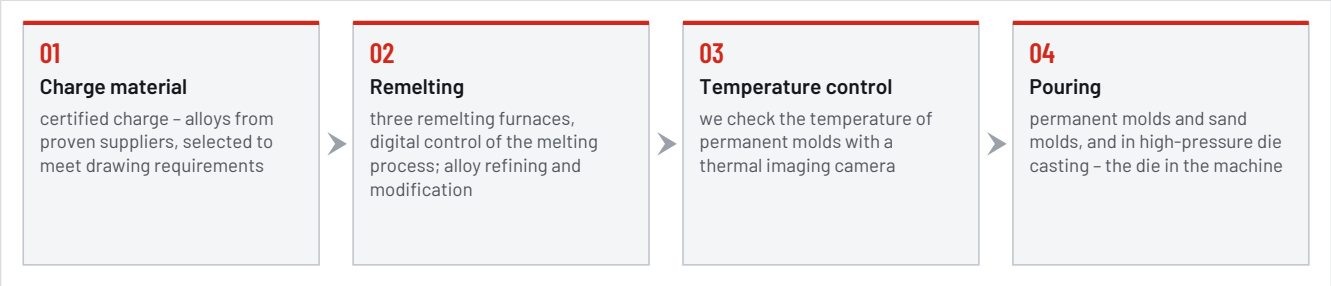


Fig. 3. From raw material to casting – four controlled melting steps.

Designation	Symbol	Main alloying elements*	Properties	Typical applications
EN AC-42000	AlSi7Mg	Si 6.5–7.5 % Mg 0.2–0.65 %	good castability and corrosion resistance, high strength after heat treatment (T6)	automotive parts, engine housings, machine parts
EN AC-46200	AlSi8Cu3	Si 7.5–9.5 % Cu 2.0–3.5 %	high strength, good castability, limited corrosion resistance	engine housings, structural components, fittings
EN AC-46500	AlSi9Cu3(Fe)(Zn)	Si 8–11% Cu 2–4% Zn up to 3%	very good castability and machinability, limited corrosion resistance	electronics housings, automotive parts, household appliances
EN AC-47100	AlSi12Cu1(Fe)	Si 10.5–13.5 % Cu 0.7–1.2 %	very good castability – also in thin walls, good leak tightness	automotive parts, engine components, electrical equipment
EN AC-51300	AlMg5	Mg 4.5–6.5 %	very good corrosion resistance, including in marine environments; polishes and anodizes well	marine hardware, decorative elements, structural parts

* Chemical composition ranges (wt. %) are given for guidance only – the composition according to PN-EN 1706 and the material certificate is binding. Alloy details: Material Data Sheet "Aluminum alloys according to PN-EN 1706".

03 · When to choose permanent mold casting

Permanent mold casting works well for production runs where repeatable dimensions and a smooth casting surface matter. For prototypes, short runs, and large or complex castings, choose sand casting; for large runs of parts with complex shapes and tight tolerances, choose high-pressure die casting.

Feature	Permanent mold casting	Sand casting	High-pressure die casting
Mold	metal (cast iron or steel), reusable	sand, single-use, made on a pattern	die casting mold made of tool steel
Pouring	gravity pouring – in an automatic cycle or manually	gravity die casting	high-pressure die casting
Best suited for	series with repeatable dimensions	prototypes, short runs, large and complex castings	large series of parts with complex shapes
Dimensions and surface	stable dimensions, smooth surface	depends on the molding material; usually with a machining allowance	very good surface finish, tolerances often ±0.1 mm
Mold cost	medium	lowest	highest
Offer data	castings 0.1–50 kg; molds up to 1400 × 1200 × 750 mm	castings 1–100 kg; flasks up to 1000 mm	tolerances often ±0.1 mm – depending on part geometry

04 · Applications and ordering

Permanent mold castings go to the automotive, aerospace, electronics and construction industries, and to machinery and equipment manufacturing – including engines, electronics housings, industrial fittings, hardware, and decorative and structural components. We deliver the casting ready for assembly – after CNC machining, grinding and polishing, or powder coating.

Data for quotation

- 2D drawing in PDF or 3D model in STEP format
- aluminum alloy and casting weight
- number of pieces per run and per year
- machining and coating requirements

In response, we will send a technology proposal and a quotation for the castings together with the mold. We prepare the mold concept already at the quotation stage.

Contact and quotation

FOUNDRY
Mikołaj Kosicki
tel. +48 531 541 171
m.kosicki@adjatech.pl
permanent mold, sand and high-pressure die castings, patterns and molds

OFFICE · MON–FRI 8:30–16:30
Odlewnia Poznań
tel. +48 61 662 43 37
odlewnia@adjatech.pl
requests for quotation, orders and documents

MACHINING
Rafał Wojtkowiak
tel. +48 531 541 003
r.wojtkowiak@adjatech.pl
CNC milling and turning, machining of castings – series and one-off production

Plant and office: ul. Gnieźnieńska 26, Janikowo, 62-006 Kobylnica (near Poznań) · Registered office: ul. Piotra Ściegiennego 139, 60-304 Poznań

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