



Die Castings

Technology at work for you



Goudsmit UK is part of the Goudsmit Group of companies based in Eindhoven, the Netherlands. Founded in 1960 the group manufactures and supplies a range of products from components through to capital equipment. The group has subsidiary companies across Europe and into Asia.

Goudsmit UK was founded in 1998 and specialises in the design, industrialisation and manufacture of custom industrial components. The company can also design and sub-contract manufacture entire products and offers a comprehensive and global logistics service.

TS16949 and ISO9001 qualified the company works in a wide range of market segments including Automotive, Oil and Gas, Aerospace, Medical Devices and Green Technology.

Logistics

Designing, industrialising and manufacturing components are only some of the issues which face us and our clients. Just as important is getting the correct number of components to the correct place at the right time. To do this we have a refined and complex logistics network which operates throughout the globe. Key capabilities of this network are:

- Demand planning system to predict and manufacture client requirements
- Frame contracts with multiple drops spanning up to 2 years
- Warehouses in Holland / USA / UK to allow ex stock delivery
- Buffer stock held locally to offer 3 day delivery
- Consignment stock capabilities
- JIT delivery for automotive volumes
- KANBAN delivery for regular use items
- Global tracking system to monitor orders and parts through production and shipping

We have adapted our logistics network to match the dispersed and global nature of our clients operations and can offer whatever service our clients require.

For further information please refer to our logistics brochure.

Quality Assurance

What our clients want are parts which are correct first time and every time. We endeavour to provide this and our QA aim is zero defects on deliveries and continual improvement in all our processes. In order to achieve this we have become TS16949 and ISO9001 certified and are constantly tightening our processes and QA controls to better control our final product. A short summary of the QA tools and documentation we use and can provide is shown below:

- Samples with ISIR submission
- Design and Process FMEA
- PPAP on pre-production parts
- APQP
- Inspection reports with all deliveries
- Hardness testing
- Tensile strength tests
- Destructive testing
- Environmental testing

We are happy to provide any custom QA structure our clients require right up to zero defect by measurement.

For further information please refer to our Quality Assurance brochure.

Die Castings



Pressure die casting is a very powerful method of making net shape metal parts without machining. Molten metal is injected into a die (or tool) and then ejected as it has begun to cool leaving a xerox of the cavity from which it came. The process is limited to materials which are molten at low temperatures, with zinc and aluminium being the most common materials to be cast. The process can be very cost effective for complex forms and the parts can be extensively post treated to provide cosmetic and high tolerance components for a range of industries from Aerospace to Medical to Automotive. Goudsmit UK has been supplying die castings for over 10 years and has a wide range of experience in die design and the processing of die cast products.

DESIGN

Design is absolutely crucial for die casting, however with so few dedicated professionals about most engineers are designing without any in-depth knowledge of the process and what it can do. Unfortunately many designers apply the same rules as they would to injection mouldings and although the two processes share many similarities they are also quite different.

As design is so crucial Goudsmit UK will work with you to try and define some of the following areas:

- Wall thicknesses and the likely effects on die fill
- The cosmetic finish likely on parts due to the gate, floods and split lines
- The issues concerning flash and how best to avoid it in visual areas

Many of our clients do not have a full design capability so we are also happy to carry out the following for them:

- Produce 3D models, 2D tolerance drawings, analysis of fits, addition of assembly features, draft angles and tool finish
- Location of splits, ejector pins, gate position, flood positions, date wheels and part number

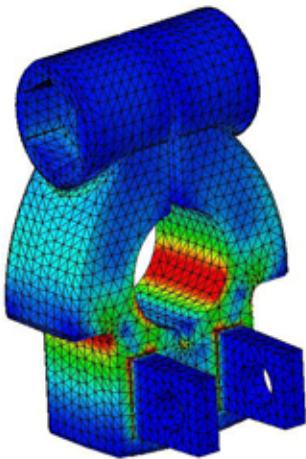


FEA ANALYSIS

Of the many products that Goudsmit UK work with, this is the one that merits finite element analysis the most. The two specific areas are:

- Die fill - This is difficult to predict, if the design is wrong it can lead to cold welds, air pockets and cold castings
- Mechanical performance vs Ease of casting - It is often a trade-off between these two issues when designing a die casting. Pure FEA for mechanical strength may be undone by casting flaws which have not been predicted

In this area Goudsmit UK are happy to help any client who wishes to end up with a casting which not only performs as it should mechanically but also has the correct tolerances and cosmetic finish.



ALL TOOLED UP

Pressure die casting tooling is more complex than injection moulding and is absolutely crucial to the performance of the product. They are made from hardened steel and are subject to extremes of both temperature and pressure. Due to the range of temperatures they are more likely to undergo non-linear expansion and features such as core-pins will have more open fits than on injection mould tools. Getting both the design and tool right first time is absolutely crucial as the tools are not easy to modify and any modification's feasibility is subject to the constraints of injection pressure in the tool.

HOW DOES IT ALL WORK?

To make a die casting the first requirement is a 3D model of the component. If only 2D drawings exist a 3D model will have to be generated and Goudsmit UK can do this for the client. From the model we can establish the location of the gates, vents, split lines, moving cores and ejector pins etc. Feedback will also be given on expected surface finish as well as details such as cavity numbers, date wheels and part number. Once the die has been made it will be run in the tool for the first time.

At this stage molten metal is placed in the barrel of the machine and this is then injected into the die by a hydraulic ram. The molten metal solidifies in the tool and as the tool opens the part is ejected by the pins. These first-off parts will be checked and some modifications will be made to the tool. The tool will then be re-run and the parts again analysed for dimension and any casting flaws such as cold casting or porosity. If everything is OK the tool will then be run again and the parts which come from it will be submitted as samples and will come with all the necessary QA documentation.

Provided these pass, we will then proceed with a pre-production batch and finally the first production batch. Approved samples can take anything from 8-14 weeks depending on the complexity of the casting and its cooling profile.

ALLOY ALLOY

Goudsmit UK manufacture only zinc and aluminium die castings however there are also magnesium and brass alloys which exist. Raw material theory is complex but they are normally binary or ternary alloys with the addition of other materials to improve mechanical properties or to avoid undesirable casting characteristics.

Material choices are complex and although designers choose alloys for their mechanical properties it should be remembered that these may not be suitable for casting into the desired shape. We would advise that you contact us as early as possible to discuss alloy choice for each application.

A non-exhaustive list of the alloys we cast:

- Aluminium zinc
- Alloy 3
- Alloy 5
- Alloy 7
- ZA-12
- A360
- 380
- A380
- ZA-8



Finishing

This is one of the main areas which is misunderstood by designers and can sometimes lead to disappointment in the product they receive despite guidance. For cosmetic purposes it should always be remembered that we have to get the metal in and the air out of the die and so witnesses of this will be left on the part. Other witness marks will also be left behind such as ejector pin witness and flash and these cannot be avoided. Finishing can be looked at in four sections.

DIE FEED SYSTEM

This needs to be worked on with us from the beginning. Normally there is quite a lot of metal which must be removed from the part after casting and it has an effect on cost. The amount of gating and venting will depend on the complexity of the part and any hard to cast features. This part is thin walled and has to be gated in 4 positions plus have multiple vents and floods to get it to be well cast. It also has quite a lot of flash from die blow.



CLIPPING

The clipping tool will remove all excess metal from the part and is either mechanical or hydraulic. The tool will try and remove the feed and vent system as cleanly as possible, however this is not always the case and is dependent on the geometry of the part. Also the alloys have a crystalline structure and so do not break as cleanly as say mild steel would, so there will be witness left. A solution is to leave some witness on the part after clipping and then CNC the part to optimise removal. Some witness of the clipping can be seen on the part.

PRIMARY FINISHING

At this point we can begin to cover up some of the evidence left by the process up until now. Some of the residual flash can be removed as can the evidence of split lines and ejector pin marks. Although not removed completely they can be much reduced. Shot blasting, bead blasting and vibratory tumbling are common techniques Goudsmit UK employs to modify the finish of the casting post cast.



SURFACE FINISHING

This can be a number of different coatings from metal to organic. Our front cover shows a polished chrome casting which is difficult to do but which is clearly achievable, although it needs to be engineered from the outset. Other forms of plating such as nickel are common. Generally die castings do not anodise well but chromate conversions can be applied. As you can see on the attached part, powder coat can form a very good cosmetic finish changing both colour and hiding some of the process witness. Finally, die castings do age with time and can become darker due to oxidation, therefore it is important to opt for a cosmetic finish of some description.



Products



NEAR NET SHAPE

Technically die casting is about the quickest known route of getting metal to a given form. However it is not always possible to get the product to perform as desired mechanically and also to not require any post cast modification. As such we offer a range of options to give you exactly what you need.

POST CAST MACHINING

The dies used to make the castings are extremely complex and also heavily constrained by cooling rates and flow patterns. Some shapes are better not to be cast but to be machined post casting. Features such as this include; holes which are neither parallel nor perpendicular to the split line, features with parallel sides (remember we need draft to get the part out of the tool), both internal and external threads (especially for external threads when the axis is not along the split line) and finally undercuts in the line of draw. In order to get around these issues we have a range of multi-axis CNC milling centres and also a range of CNC lathes. These enable us to achieve what cannot be cast and in some cases simply tight tolerances that the casting process cannot achieve. Virtually all our post cast machining is now done by CNC as it provides better repeatability than normal manual machining.

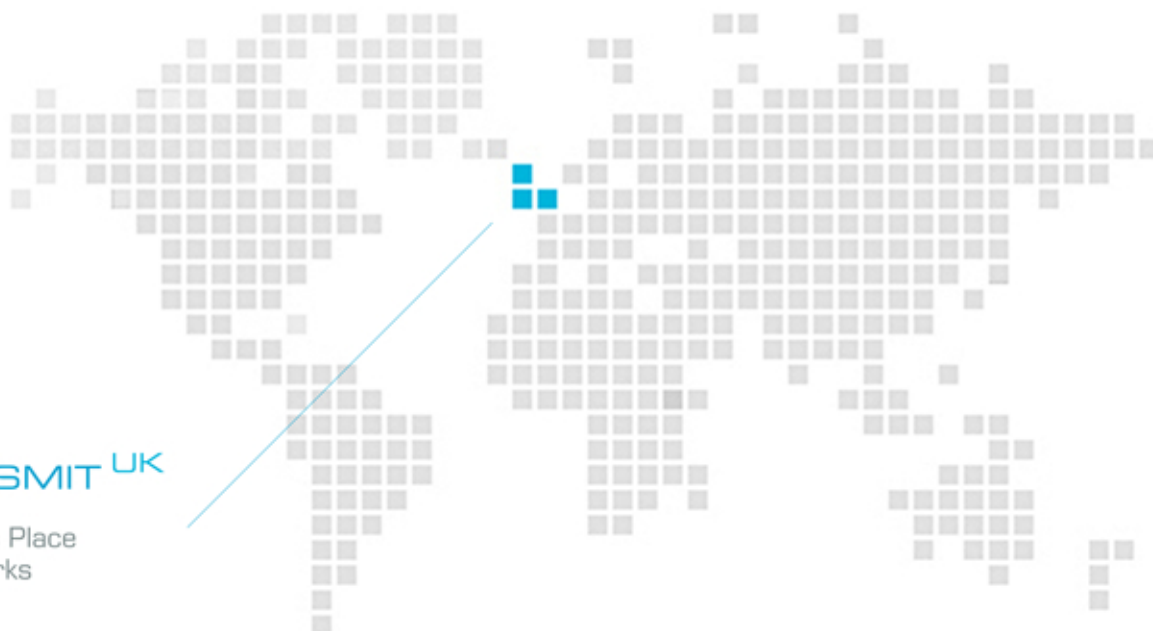
INSERTS

Die cast alloys undergo rapid solidification to form a fine dense grain structure which is what inherently provides their mechanical properties. The skin (that being the surface which is in contact with the die and cools rapidly) is particularly strong, however the interior of the casting may have an inferior grain structure due to longer cooling. When designs call for a high torque and thus a heavily bossed, tapped zone, sometimes it is preferable to press fit a stainless steel insert. Press fitting outside the tool is preferable to inserting within the tool and casting around the insert. Some features will not cast but can be added into the tool and cast around. An example of this would be a motor shaft.

Fundamentally die casting is a flexible and very effective manufacturing technology. What can be achieved is often surprising and depends as much on the imagination of the designer as it does on the process itself.

Worldwide Service

- Goudsmit UK is part of the Goudsmit Group of companies. With two production facilities in China, one in the Czech Republic and two in Holland, the company has the reach to supply from Asia to Europe and on into the USA.



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