TOOLCRAFT PLASTICS'

INJECTION MOULDING FOR BUYERS GUIDE

Toolcraft Plastics (Swindon) Ltd

1 & 5 Argyle Commercial Centre

Argyle Street

Swindon, SN1 4DB

01793 641040

www.toolcraft.co.uk

help @ toolcraft.co.uk

Introduction

This guide is intended for people who are looking to source plastic mouldings. It gives a much needed insight into all that is involved with creating plastic parts, from the mould tool required to the moulding process itself. It also explores what to look out for when obtaining quotes and comparing them. If you want to explore further, the guide covers types of mould tools, as well as special finishing processes such as colours & plating. Words that are underlined can be found in the glossary in the appendix.

Once you've read the guide, we hope you're armed with the knowledge to enable you to make an informed decision of where to place your moulding work. We'll start with explaining the advantages of injection moulding.

Part I : Moulding: The Basics

The Advantages of Injection Moulding

Plastic injection moulding is a very precise process that offers several advantages over other plastic processing methods. Here are just 5 benefits:

1. Precision

Plastic injection moulding is perfect for very intricate parts. Compared to other techniques, moulding allows you to incorporate more features at very small tolerances. Have a look at the image to the right. You can hold this moulding in the palm of your hand and it has bosses, ribs, metal inserts, side cores and holes, made with a sliding shut off feature in the mould tool. That's an awful lot of features on a small part!

2. Material choice

There's a vast amount of materials available for plastic injection moulding. A range of standard materials, but also things like antistatic plastic, thermoplastic rubber, chemical resistant plastics, infrared, biocompostable...and with colour compounding or masterbatch colouring you have an endless choice of colours as well. The moulding above is just black, but it's made out of PPO which is an extremely rigid and flame-retardant material.

3. Low cost per part

Whilst there is an initial high investment for the plastic injection moulding tool, after that the cost per part is very low. Other plastic processing techniques may require multiple operations, like polishing, but injection moulding can do it all at once. If you chose to CNC machine the part above, it would cost hundreds of pounds per part. If you're looking to go into full production, injection moulding is the way to go.

4. Fast

Cycle times can be as low as 10 seconds. Combine that with a multi-impression injection moulding tool and you get a LOT of products very quickly. That part above takes a bit longer as it's a specialist material and has a lot of features to be moulded correctly, but at about 50 seconds you'd still get 70 parts per cavity per hour. CNC machining a one-off would take half a day - 3D printing it even longer!

5. And for the green-minded: little waste

Part repeatability is very high for injection moulding. Even the sprues and runners (the leftover bits of plastic created by the 'tunnels' through which the plastic material reaches the actual mould) can be reground and the material reused.

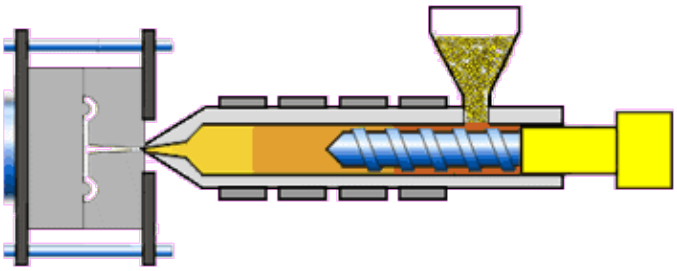
Now you know all the good things, we'll have a look at the injection moulding process.

The Injection Moulding Process

The injection moulding process involves heating & injecting plastic material under pressure into a closed metal mould tool. The molten plastic cools & hardens into the shape inside the mould tool, which then opens to allow the mouldings to be ejected or removed for inspection, delivery or secondary operations.

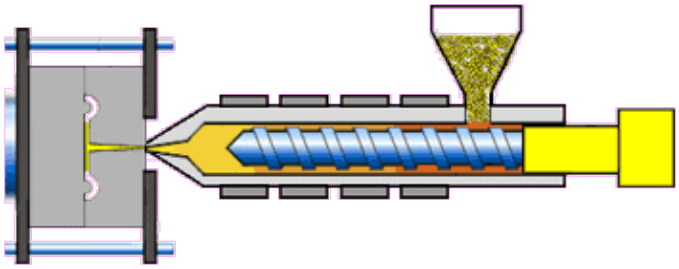
Stage 1

Material granules from the hopper feed into the heated barrel & rotating screw.
Material melted by heat, friction & shear force is forced through a check valve to the front by the rotating screw.



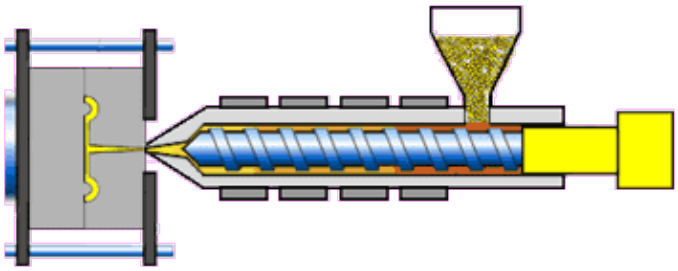
Stage 2

Having been moved backwards by the shot of material at the front, the screw is forced forward by a hydraulic ram. This action **injects** material into the mould cavity of the closed mould tool.



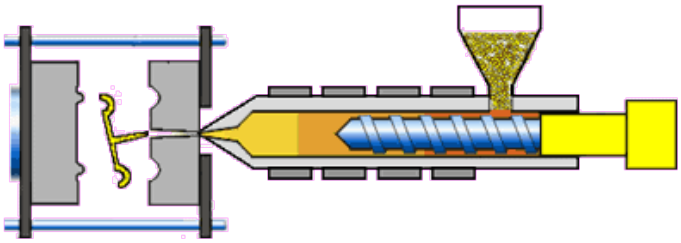
Stage 3

The tool is held closed under pressure until the plastic material cools & sets hard in the mould tool cavity. This is often the longest part of the injection moulding process.



Stage 4

The screw starts to move back for the next moulding. The tool then opens & the finished plastic part is ejected. The tool is closed and the injection moulding process starts again at **1**.



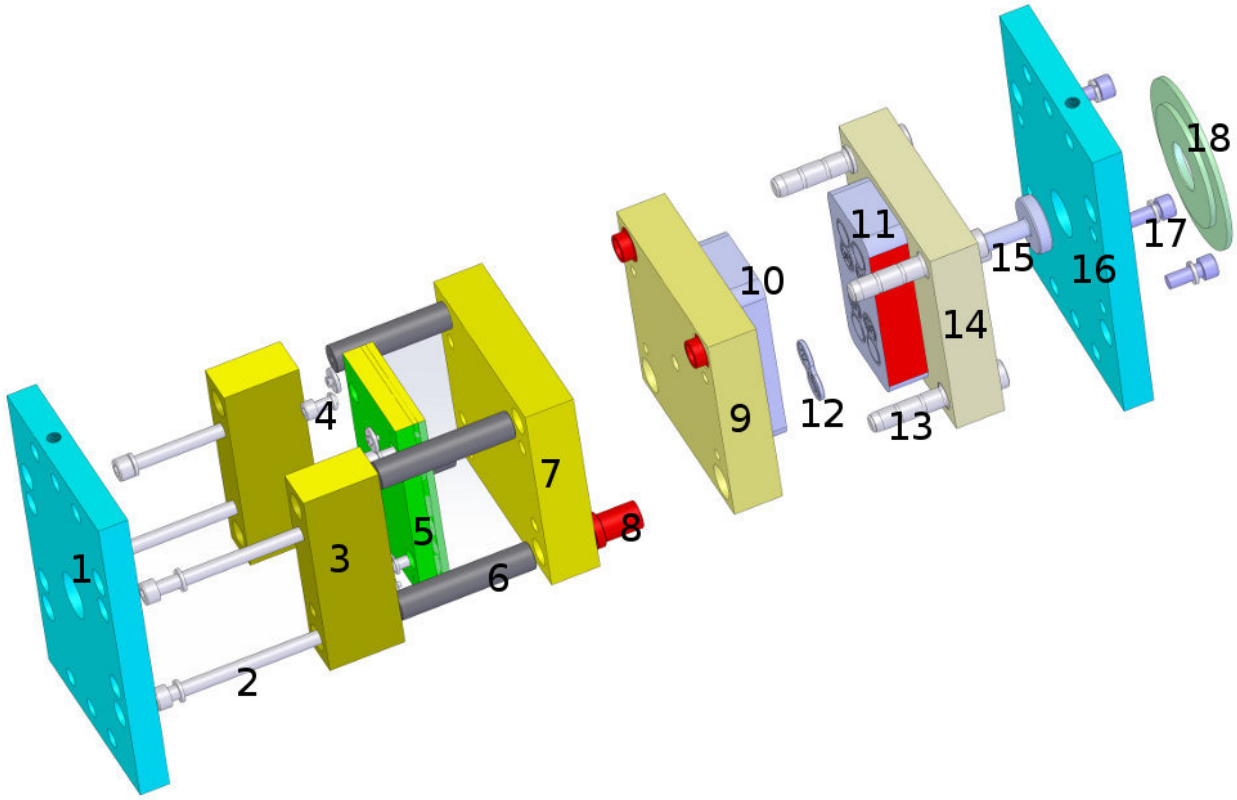
Good results depend on injection speed, material temperature & type, tool material, cooling time etc. The mould cavity of the mould tool is what gives the product its shape. The mould tool is essentially what you're buying when you're sourcing a completely new plastic product, so carry on reading for an explanation of the components of a mould tool.

A Look Inside a Mould Tool

The **core & cavity design** of the plastic injection mould tool is what gives the final product its shape, but there are several other functions of the tool that are crucial for the correct formation of the end product.

The tool places a large role in the correct cooling down rate of the moulded plastic part. If a plastic material sets at the wrong speed, distortion and stress may occur. The material of the tool should be chosen to keep cooling down rate in mind. Some plastic materials may even need to be moulded in a water cooled tool.

Below you'll see a tool with a detailed explanation of all its components and their function in the injection moulding process.



1. Moving half back plate. Fits the moving platen of the injection moulding machine and provides the framework for the core or cavity to be mounted on. When open, the moulded part can be ejected.

2. Bolts

3. Risers. Provide space for the ejector plate to move.

4. Ejector plate feet. These create a small gap between the fixed plate and the ejector plate to prevent the accumulation of dirt.

5. Ejector locating plate & ejector plate retainer. The locating plate guides the ejector pins to the correct place and the retainer prevents the ejector pins from pushing back too far.

6. Bolster sleeves. These keep all the elements of the bolster together, square and aligned.

7. Moving half support plate. Fits the moving part of the injection moulding machine and provides the framework for the core or cavity to be mounted on. When open, the moulded part can be ejected.

8. Guide bushes. Provide a bearing surface for the guide pins, protecting the core plate from wear.

13. Guide pins. These are the pins on one half on the tool that slide into the holes in the other half. Guide pins ensure the two halves of the tool are correctly aligned so that the product is correctly formed.

9. Core retaining plate. The core can be mounted on top or recessed into this.

10. Mould core & 11. Mould cavity. The core & cavity are the shaped sections in either half of the mould tool which give the plastic product its final shape. The hot molten material is injected into the core & cavity and then sets hard into shape. The design of the core & cavity is essential in the correct formation of the product.

Essential elements of the core & cavity are -

Gate: This is the point between the runner and the core & cavity. Often it is designed to be slightly narrower than the runner, so that the plastic there is thinner when it sets, forming a natural weak point for easier removal of the runners. The tool needs to be designed carefully so that gates are in the right place to ensure correct filling of the core & cavity. As the placement of gates always remains visible on the moulded part, the tool also needs to be designed in such a way that the gates don't detract from the aesthetics of the finished product.

Runner: Runners allow the passage of the molten plastic materials to the core & cavity. Runners can also be hot or cold. Hot runners are more expensive but provide much greater flexibility for the positioning of gates (because they allow a gate to be much smaller) and they also reduce wastage because the plastic inside the runner stays hot and is used for the next part.

12. THE MOULDED PART !!

14. Cavity retaining plate. The core can be mounted on top or recessed into this.

15. Sprue bush. This is the point of the tool where the plastic material is first injected into the cavity. Sprue bushes can be hot tip or cold tip. Cold tip sprue bushes are less costly to make but use more material; hot tips use less material and give greater moulding flexibility.

16. Fixed half back plate. Fits the fixed platen of the injection moulding machine and provides the framework for the core or cavity to be mounted on.

17. Bolts

18. Locating ring. This fits in a location hole on the fixed half platen of the injection moulding machine to ensure correct alignment of the tool and the machine.

Now you know what a mould tool consists of. But what can you expect for your money ?

Mould Tool Life: What to Expect ?

Mould Tools cost a lot of money. When you're sourcing them, you'll have noticed that a lot of mould makers advertise 'lifetime guarantees' for their moulds. Before you jump to the conclusion that you'll be able to get perfect products from that mould tool for the next 50 years or more, 'lifetime' means the life of the mould, not yours. **Injection Mould Tool Life** stands for the number of moulding cycles a mould can make before it needs to be replaced or repaired.

Which factors affect tool life ?

Any injection mould will be subject to wear. Wear will occur particularly to ejectors, gates, slides & other moving parts of the tool. Surface finishes such as high polish or sparked finish will also become less defined over time. The following factors affect how quickly wear takes place:

1. **The material the mould is made of.** Soft aluminium moulds will incur much more wear from the plastic material than hard steel moulds. Steel moulds should last for millions of mouldings, but not when certain plastic materials are used - see the next point.
2. **The material the mouldings are made of.** Certain materials can be very abrasive, such as glass filled nylon for example. Other materials are very corrosive and will rust normal steel moulds, so aluminium alloy or stainless steel moulds should be used, or the steel mould should be stainless steel or aluminium alloy plated.
3. **Mould setter skill.** Moulds need to be set up to work in the injection moulding machine correctly. Overlocking, poor tool alignment, excessive ejector stroke, overpressurisation of the plastic material, not enough lubricant on the ejectors are all examples of poor setting which wear any mould down much more quickly than necessary.
4. **Mould maintenance.** A regular bit of TLC goes a long way to prolong mould tool life !

Mould tool life guarantees

So, when you're sourcing an injection mould tool, make sure you check the exact guarantees the mould maker has in place. As a guideline, **w**e're very happy to guarantee every tool made by us, **when injection moulded by us**, as follows:

1. Moulds made of **P20 steel** - guaranteed to **300,000** mouldings
2. Moulds made of **H13 steel** - guaranteed to **500,000** mouldings
3. Moulds made of **7000** series **Aluminium** - guaranteed to **30,000** mouldings (but this will reduce for aluminium mould tools with mechanical moving parts and those where metal inserts are loaded in and out of the tool).

Does that mean the mould has to go in the bin when these numbers are reached? Of course not. A well-made tool may last many times its original guaranteed lifetime, just like your washing machine might now be 10 years past its 1-year guarantee. Repairs may be needed, or parts may need to be reinforced, but the mould tool is likely to serve for many more years.

Now you know how plastic moulding works and what you should expect from your injection mould tool, it's time to get some quotes.

Part II : Comparing Quotes & Moulders

How to Get an Accurate Quote on First Attempt

Getting an accurate quote for a new plastic moulding can be complicated. Small changes may have an unexpected large impact on the projected costs. For a fast and accurate plastic moulding & mould tool quote, tell your plastic moulder the following:

1. How big it is !

Make sure your drawings have the correct product sizes. Prevent a game of e-mail ping-pong by giving your moulder a good idea of the size of the plastic moulding - it determines:

- the cost of material for the plastic moulding tool
- the machining time & labour costs for the mould tool
- the size of the injection moulding machine required (bigger=more energy=more expensive)
- and simply the amount of plastic material required to make the product.

2. How many you need.

Doubling of the quantity does not simply mean halving the price per moulding. You might make extra savings by having a multi-impression mould tool made. This is a larger initial investment but results in large savings per part for long runs. Also, plastic material is much cheaper when bought in larger batches. Your plastic moulder needs to rework the prices for each quantity, so try to be as realistic as possible to get your quote faster.

3. The plastic material it needs to be made of.

UV resistant? Conductive? Functional at high or low temperatures? Fire retardant? A specific colour or transparency?

Special properties increase the material price, but they can also affect the price of the mould tool, as some materials can only be injection moulded in a steel mould tool. Are the special properties you've specified absolutely necessary? Don't select a more complicated material than is necessary for the plastic part to do its job, as this can increase the moulding cost exponentially. To get a good idea of commonly available materials and their properties, have a look at our online plastic moulding material guide.

4. Was the product designed for the injection moulding process?

The design of a plastic product is not the same as the design of a plastic mould tool. Design agencies are very good at designing products, but less good at planning how the product will be manufactured. Plastic mould tool design needs draft angles and radii and it shouldn't have locked-in features. If the design isn't right, the quote may be badly wrong and the work very expensive ! You can read up on common design pitfalls here.

Assuming you now have several quotes, you'll need to compare them in a meaningful way. The next pages provide a guideline.

How To Compare Moulding Quotes

When you've obtained a number of quotes from different plastic injection moulders, it can be hard to compare them effectively through different quote layouts and small print. These are the core things to look out for:

Price comparison

To ensure the other quotes are really like for like, check :-

Which material will the moulders use for the injection mould tool ?

There are 3 main types: Cast aluminium tools that aren't meant to last more than a few hundred mouldings; Aluminium Alloy tools (QC7 or equivalent) are marginally more expensive but should last for at least 30,000 mouldings; Steel tools are the most expensive, but should last between 300,000 and a million mouldings, depending on the project.

How many mouldings-per-shot will the injection mould tool make ?

A mould tool that makes more mouldings per shot (also called the number of impressions, or cavities) will be more expensive, but the moulding costs will be much cheaper. Make sure each quote is based on the same number of impressions.

What plastic material will the mouldings be made from ?

Different plastic materials can result in very different quotes, so make very sure all moulders have quoted the same, or if they haven't, find out why – they may have selected a cheaper comparable material.

Small print comparison !

To avoid costly surprises, check :-

If your quote includes a mould tool, will you own the tool once it is made ?

You should own the tooling outright, otherwise the plastic moulder may be able to mould from your tool for a different customer. Some moulders quote for an insert-only mould tool without telling you. Insert-only tools are a good way of saving cost at the outset of a moulding project, but if you want to take the mould tool to another moulder, the tool will need to be adapted. They should tell you clearly what they've quoted for.

Does the moulder tie you in to a minimum yearly order quantity, or charge for tool storage ?

Some overseas plastic injection moulders insist on a minimum quantity and will dispose of your tooling if you don't order that. They may also charge for tool storage. Make sure your tool is treated with protective spray before storage and that it's stored with a unique ID so it doesn't go missing. Your moulder should also advice you in good time if any toolwork is needed to avoid delays when the product is next run.

Does the moulder offer a stock holding facility ?

If the moulder offers a stock holding facility, you're able to take advantage of cost-savings on polymers and setup costs, by ordering a year's worth of stock and calling it up in batches.

Moulding Company Comparison

Now you've compared the quotes and made sure they're like for like, make sure you compare the moulders. A good supplier should be a strategic business partner. Before you select your plastic injection moulder based on price only, think about some other things.

Does the injection moulder offer quality standards & guarantees ?

Look for at least BS EN ISO 9001:2008 and check the mould tool guarantees they provide as well.

What moulding experience do they have ?

Have they worked with the material you require before ? Do they have experience with the process you need – i.e. insert & outsert moulding, overmoulding, threaded mouldings ? Do they have experienced setters who will treat your mould tool with the respect it deserves ?

Can they ensure production continuity ?

Look out for on-site toolmaking & maintenance facilities, as well as experienced designers, who can get your tool back into action quickly if any issues arise.

Does the plastic moulder offer finishing services ?

Mouldings may need several secondary operations like CNC machining & ultrasonic welding; assembly & packaging; pad & hot foil printing; electroplating & painting. Having a moulder who offers all of those reduces manufacturing time & takes all the arrangements off your hands.

Do they still speak English if something goes wrong?

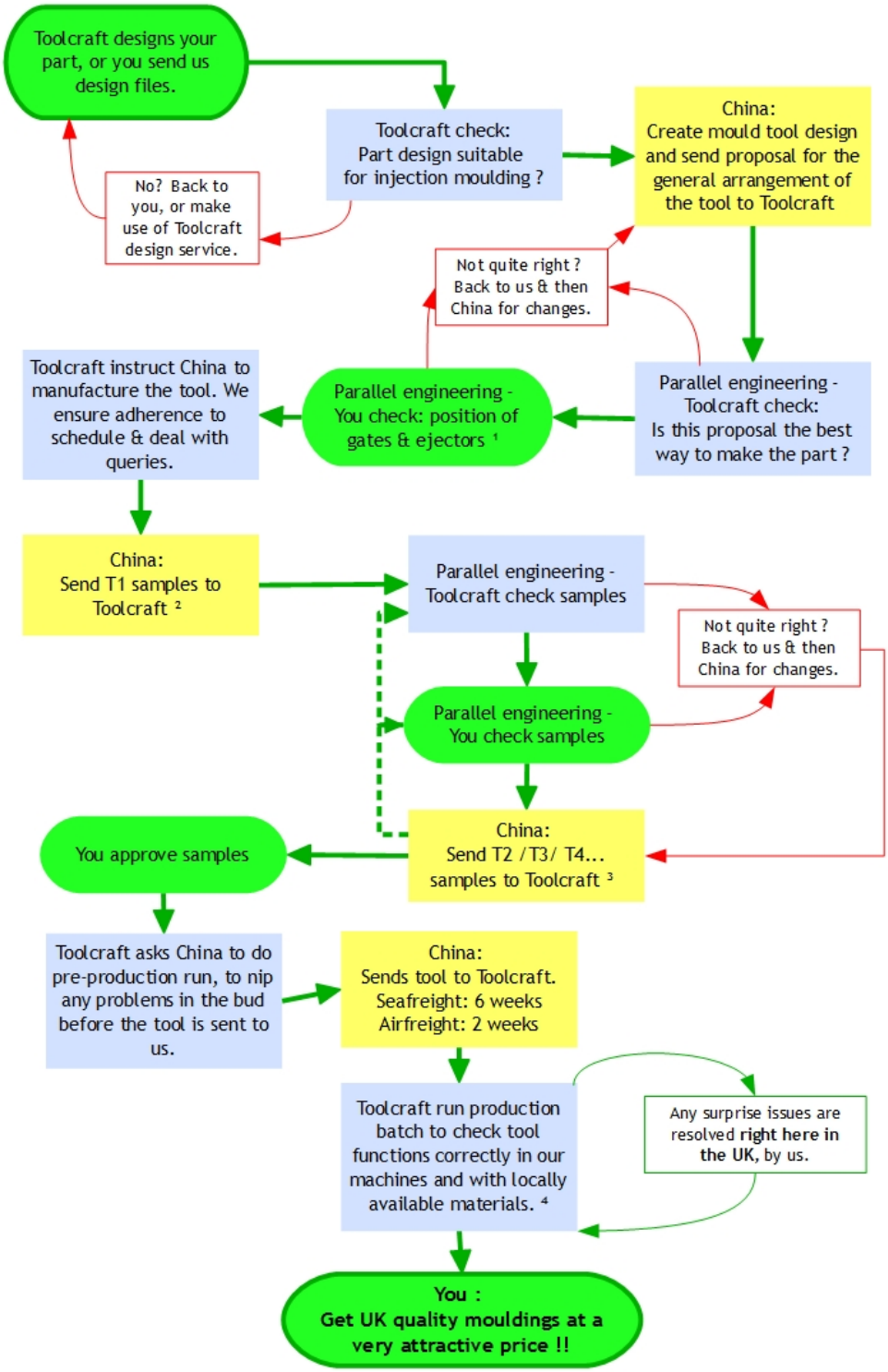
Far Eastern pricing can be very tempting, but if things go wrong it can be a lengthy and costly process to get them put right. Using a moulder based in England with existing ties to a Far Eastern company may be a safer option, while still offering cost-savings.

The first part of this guide was intended as an overall introduction to the moulding process and what's involved in sourcing tooling. Read on to find out more about Chinese tooling programmes, the different kinds of tooling that exist, and the finishing options for mouldings.

Part III: Beyond the Basics – Tooling Options

Chinese Mould Tool Manufacture Step by Step

Manufacturing in China can save you a lot of cost, but it can come with problems such as delivery delays, miscommunications, inferior quality and the paperwork surrounding importation. Using a UK moulder with existing ties to China can remove the risk and still result in cost-saving. Here's how it works at Toolcraft :



Notes:

1. If you're planning to mould from the tool yourself, you must check if it fits your moulding machine !

2. T1 samples are intended for dimensional checking only and do not have any surface finish yet.

3. T2 samples include the surface finish. All being well, no further sample rounds should be needed.

4. If you wish to produce the mouldings yourself later, we still run a batch to ensure the tool is in good working order.

Advantages of Insert-Only Mould Tools

Apart from sourcing tooling in China, insert only mould tools are also a great way of cutting tooling cost. The 'insert' is the core & cavity of the mould tool, which is the part of the tool that gives the plastic product its shape – the mould tool diagram on p5 explains this.

By manufacturing a core & cavity insert to fit inside a standard mould tool 'bolster', it's possible to save the cost of the bolster, as well as the time needed to make the bolster.

So, if you're in a hurry and on a tight budget, insert-only tooling can save you between £500 and £1500 on your overall tooling cost.

An Insert only mould tool means that you only **pay for** and **own** the **tool insert.** If you should decide later on that you wish to change moulder, then you'll need to pay either your old or new moulder to make an **outer tool bolster** to accept your cavity & core tool insert.

Insert-only mould tools **are a good choice for you** if you need to be in production very fast and at low cost, because :-

- you only pay for the insert & insert change-over
- you save manufacturing time

An insert-only mould tool is something different from an insert moulding tool, which is a tool which allows metal inserts to be placed inside a moulding. You can find a complete list of mould tool types and their uses in the appendix.

Part IV : Beyond the Basics – Mouldings

Colour Options Explained

Colour compounding and masterbatch are the two main options of colouring plastic mouldings, while special effect dyes can also be used to good effect. Here they are explained.

Colour Compounding

With colour compounding, the material supplier mixes the colour with the base material when it is being made and delivers the plastic granules to us ready-coloured. Materials can be matched to your company colours. This method results in the **most consistent colouring** run after run and is sometimes the only way to colour materials with a dense base colour such as fire retardant ABS. Compounding is most suitable for long run plastic mouldings as **small quantities of the material are expensive** and sometimes unobtainable.

Masterbatch – standard colours or colourmatched

When we use masterbatch colours, the masterbatch dye is added to the base material on-site. It can be **more difficult to get good colour consistency** with masterbatch than with compounding, but a good moulding company should use electronic dye dosers on their plastic moulding machines. It's possible to have the masterbatch colour-matched to your company colours exactly. For **small batches of coloured mouldings** it's more cost-effective to select from the range of 200 or so standard colours – they are available in quantities as low as 250g.

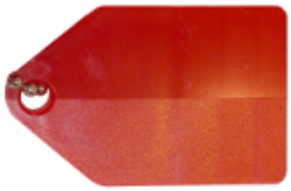
Special effect dyes

By adding aluminum impregnated dyes to a base material, it is possible to achieve a sparkling finish on plastic mouldings, like this cosmetics container. Other special effects available are pearlescent, fluorescent and metallic, all achievable economically by using masterbatch.

Factors that affect colour

If your product has a textured surface, the colour really can look significantly different from that of a smooth surface. The thickness of the plastic can also impact on the colour. To minimise this effect, it's essential to control the tool design & manufacture carefully.

Masterbatch swatch showing effect of material thickness on the colour
Thick = dark and Thin = light



Masterbatch swatch showing effect of material surface on the colour
Smooth = dark and Textured = light

Printing Methods Explained

It makes sense to put your name & logo on your products. The following printing methods are very suitable for printing on plastics – we explain the benefits of each.

Hot foil printing

This is the technique used for things like embossed effects on wedding invitations. But there's more to it than that :-

- it's a very cost cost-effective method which makes it justifiable for your short run products
- it's very long-lasting and hard wearing
- there's a great range of colours available, with metallic, gloss, matt and holographic finishes

If you're considering this method, remember that :-

- the printing colours can't be matched to specific colours
- the surface you want to print must be flat(ish)

Pad printing

Pad printing is used to print just about anything from golf balls to washing machines. It's extremely versatile because :-

- you can print on curved, convex, concave & recessed surfaces
- you can have wraparound printing on three-dimensional objects
- edges are sharply defined and the printing is very high resolution

There are pad printing inks available with very high resistance against mechanical abrasion or chemicals, or that etch into the plastic material which makes them very long lasting. Pad printing inks can also be colour matched to your company colours.

However, as the inks are more expensive and it takes longer to set up and clean up than hot foil printing, it's most likely to be suitable for long run or high spec products.

Screen printing

Screen printing is the method used for most printed promotional T-shirts. It's very suitable for large or long designs, with blocks of colour and large fonts, and slightly curved surfaces. It's also very suitable for printing the conductive lines on circuit boards as it can print thick layers of ink. Again, it's fairly expensive to set up.

Is printing not for you ?

Don't forget that logos and other text can also be engraved or embossed in the injection moulding or vacuum forming tool.

Coating & Plating Explained

Coatings are used in **special applications** such as EMI/RFI shielding, but also simply to **improve the appearance** of a plastic moulding, e.g. soft feel decorative painting and chrome electroplating.

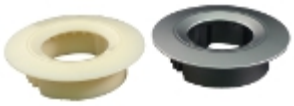
EMI / RFI Shielding

EMI / RFI shielding can be achieved by the application of Conductive paint, or by Electroplating.

Conductive paints have a **smooth and very hard durable surface**. Paints can be chosen that are compatible with solvent sensitive plastics, heat sensitive plastics as well as flexible plastics. They're not designed to function as external coatings, but they can be overpainted with aesthetic finishes. A strong advantage is that the paint can be **applied selectively**.

Electroplating EMI/RFI coatings combine **very high levels of shielding** with wear and corrosion resistance and aesthetic appeal. It's perfect for parts that can be coated all over, as it's more difficult to mask areas. The coating is scratch resistant and lightweight. The main plastic materials that can be electroplated are ABS and PC/ABS, but there's now also a selection of specialist polymers available that can be plated. For the best quality finish 'plating grade' materials must be used.

Chrome Plating



A superior metallic effect can be achieved by electroplating chrome finishes onto injection mouldings. **Bright chrome, gold, satin chrome and black pearl** are popular choices, but bright tinted lacquers and antique finishes are also available.

Painting

A variety of paints exists, such as **solid or metallic colours**; pearlescent or two-tone finishes, luxurious **soft feel and textured coatings**; low friction or dry lubricant coatings, as well as special coatings e.g. a paint that changes colour with heat.

Injection Moulding for the coating process

Most injection moulding polymers can be coated, however, it is important to remember that coating will not hide defects such as sink, flow and weld line & scratches - it's more likely to highlight them ! Even the moulding design affects its ability to be electroplated, as a wrong design can lead to excessive metal build up, or prevent plating in certain areas. To find out more, have a look at Toolcraft's coating mouldings best results guide.

Part V : Beyond the Basics: Special Moulding Techniques

Insert Moulding – How to Achieve the Best Results

Insert moulding is the process where a plastic material is moulded over, around or even inside a metal insert. Examples are the soft-grip rubber handle on a pair of scissors or the plastic covering on a pc connector. It's easy to forget that these day-to-day items are produced by a pretty specialised plastic injection moulding process.

Inserts can be put inside plastic mouldings during or after the plastic injection moulding process. Mouldings can also be created inside metal parts, a process known as outsert moulding.

The insert moulding process can be completely automatised, with the insert loading robotically into the plastic injection moulding machines. This can mean significant cost-savings for mass products, but the very high investment required for machinery makes this method unviable for shorter run products.

What makes insert moulding special ?

Your injection moulder needs to know how the insert and the plastic material will respond to the moulding process, otherwise the results can be very poor indeed. These are some of the most important considerations to get a good quality insert moulding:

1. Plastic injection pressure

If the injection pressure is too high, the insert will get damaged. If it's set too low, the plastic material might not form a cohesive bond with the insert and will start coming loose when the part is in use – for example the handle coming off that knife from the bargain shop.

2. Plastic material temperature

If the injection temperature is too high the insert might be distorted or damaged. If it's too low, the plastic material will flow too slowly and the part will not get completely encapsulated, or the plastic will be so hard that it can displace the insert.

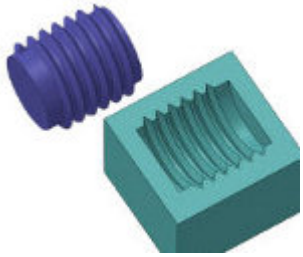
3. Injection mould tool design

The mould tool needs to be designed for a good result. Air vents need to be carefully designed to avoid air bubbles which will prevent adhesion. And thin layers of plastic material may give an acceptable result at first, but can easily start peeling off later.

Threaded mouldings

Moulding threaded plastic injection mouldings is a specialised part of the plastic injection moulding process. The main challenge with threaded mouldings is removing the moulding from the moulding tool.

Mouldings with thread on the outside



Mouldings with thread on the outside can generally be made by making a mould tool with half of the thread in the core and half of the thread in the cavity. That way, the moulding can be removed from the tool without problem. A very thin joining line will be visible on the thread where the two halves of the tool met.

Mouldings with thread on the inside

However, to obtain a plastic moulding with the thread on the inside, or a moulding with the thread on the outside where no join lines should be visible, a different process is needed. For these mouldings, a removable threaded core (or cavity, if the thread is on the outside of the moulding) is placed inside the mould tool. The polymer is injected into the mould tool and sets to create the thread. The core and the moulded part are then removed from the mould tool and the core must then be removed from the moulded part in one of the following ways:

1. Operator-based

In this process, the threaded core is manually placed inside the mould tool and once the part is moulded, the moulding with the core still inside is removed from the moulding machine. The operator then removes the core from the threaded moulding, often with a power tool. There will most likely be 2 threaded cores, so that the machine can carry on moulding with one core while the operator removes the other core from the part. This technique is more labour intensive and therefore the cost per part will be high, but cost of the mould tool will be average. This method is therefore very suitable for low run products.

2. Fully automated

In a fully automated process the unscrewing of the core from the moulding is completely automated and takes place within the machine. This is a fast way of making the parts and the price per part will be low, but the cost of the mould tool will be very high. This method is therefore most suitable for high & long run products.

3. CNC - Machining

Another way of achieving a threaded moulding is to mould the part without any thread and CNC machine the thread afterwards. The advantage is that no threaded insert is needed at all; the same part can be machined with different sized threads; and it's possible to use the same mould for different polymers.

Part VI : Why Buy From Toolcraft

Thank you for reading this guide, we hope it will be useful to you. Of course, we think that the best place for you to source your mouldings is Toolcraft Plastics (Swindon) Ltd.

Why ?

We're an established plastic moulding company in the UK. Our complete in-house service includes 3d plastic product design, mould toolmaking, precision plastic moulding, vacuum forming and a range of finishing services including printing, coating and assembly. We provide a number of benefits to our customers:

- By developing unique techniques, we create your **bespoke plastic products in good lead times & excellent quality** - using ISO9001:2008 quality procedures.
- We have great expertise in moulding less common **technical and specialist** plastic materials, enabling us to give accurate materials advice to our customers.
- We can help you justify **low run & short life** mouldings - even for specialised processes - and we're able to economically produce lower runs in our technical and specialist materials too.
- Our strong relationship with our Chinese tooling partner enables us to offer very economical Chinese mould tools, while we take care of all import & communication issues. We guarantee the mould tools and because we have **experienced mould toolmakers** in house, any problems can be rectified quickly.
- Toolcraft remains a family company. Our personal involvement enables us to adapt our services to meet **your specific needs** and to provide you with a high level of service.

ToolcraftPlastics
Moulding Your Ideas...

Toolcraft Plastics (Swindon) Ltd

1 & 5 Argyle Commercial Centre

Argyle Street

Swindon, SN1 4DB

01793 641040

www.toolcraft.co.uk

help @ toolcraft.co.uk

Appendix

Mould Tool Types Explained

Tool Type	Definition	Suitability / Comments
Core Pulling (Manual)	Makes parts with side holes & features, but needs machine operator to manually remove tool parts to get finished part	Low - medium quantities of more complex parts. Lower tool cost than automatic cp tool, higher moulding costs
Core Pulling (Automatic)	Contains mechanism to automatically produce holes & features in parts which otherwise could not be released from tool	Medium - high quantities of more complex parts. Higher tool cost than manual cp tool - moulding costs lower, larger amounts made quicker
Family	Makes several different shaped & sized parts to produce a set made in same material & colour	Low - medium quantities of kit type parts e.g. knife, fork & spoon set
Hot Runner	Uses heated tool parts so standard cavity feed not needed & only parts (no waste) are made	Medium - high quantities of parts needing lower costs. Higher tool cost than standard tool
Insert (Manual)	Makes parts with feature holes which enable metal inserts to be e.g. pushed in afterwards	Low - medium quantities. Cost benefits or losses depend on job
Insert (Semi-Auto)	Moulds around inserts put in tool by machine operator to make parts inc. metal inserts	Low - medium quantities. Cost benefits or losses depend on job
Multi Impression	Makes several identical parts	Medium - large quantities, higher tool cost than single impression, moulding costs lower, larger amounts made quicker
Overmould	Moulds around parts put in tool by machine operator to make final part e.g. shaver plug	Low - medium quantities of parts needing encapsulation
Single Impression	Makes one part only	Low quantities, tool cost lower than multi impression, higher moulding costs
Thread manual unscrewing	Makes parts with screw thread/s, but machine operator needed to manually unscrew tool inserts to get finished parts	Low - medium quantities of screw threaded parts. Lower tool cost than automatic unscrewing tool, higher moulding costs
Thread automatic unscrewing	Contains mechanism to automatically make & unscrew parts with screw threads	Medium - high quantities of screw threaded parts. Higher tool cost than manual unscrewing tool - moulding costs lower, larger amounts made quicker
Universal	Gate position offset or moved to enable parts to be made in e.g. small machine & split position	All moulding quantities. Part & tool costs lower than standard due to machine efficiency
Upgradeable	Larger than if made to make e.g. just 1 part, only 1 or more impressions produce parts, with others blank, but upgradeable in future	Good for if moulding quantities are likely to increase in the future. Higher tool cost than if tool made to make e.g. just 1 part

Glossary

Boss	On a moulded part, an upright column which can take a metal insert or a screw for example.
Cavity	The part of an injection mould tool that gives the plastic product its shape, that does the actual moulding of the plastic. Also see mould tool chapter on pages 5 and 6 for all terms associated with the mould tool
Cycle time	The time it takes for a mould cycle to be completed, i.e. from material feed & melting; material injection; cooling time and ejection to the re-closing of the mould tool ready for the next cycle.
Draft angles	The walls of a moulded part should be slightly tapered in the direction in which the part is ejected from the mould tool, to allow the part to be ejected easily. This angle at which they are tapered is called the draft angle.
Ejector stroke	The pushing out of ejector pins to eject the moulded part from the mould tool. Ejector stroke speed, length and timing needs to be carefully controlled to prevent damage to the ejectors and mould tool, but at the same time make the moulding cycle as short as possible.
High polish	A special finish on the cavity of the mould tool which ensures the plastic part is super smooth
Locked-in features	Features on a plastic part design that would make the plastic part impossible to remove from the mould tool, or that would cause the mould tool to need expensive mechanisms to be able to remove the part.
Overlocking	When a mould tool has been set into a moulding machine incorrectly, causing the tool to shut too hard and so damaging the mould tool
Part repeatability	The ability to create identical plastic parts time after time
Radii	Perfectly straight corners are impossible to eject from the mould tool. A slight radius should be added to any straight corners.
Ribs	When a plastic part has thin walls, ribs are added to the design to make the thin walls stronger
Side cores	Side action which produces a feature on a moulded part, at an opposing angle to the normal opening direction of the mould tool. The side core needs to be able to retract as the plastic part cannot be ejected otherwise.
Sparked finish	A special finish on the cavity of the mould tool which ensures the plastic part has a slightly gritty texture – think about some car dashboards, keyboards, computer frames for example
Tolerance	The margin by which a moulded part is allowed to deviate from the sizes specified on the drawing
Tool bolster	A near complete standard mould tool which can take a core and cavity insert.
Walls	The sides of a moulded part