# The Jewellers Toolkit

## a guide to manufacturing

## Acknowledgements

Jewellery Connections was led by Camden Council in partnership with Holts Academy of Jewellery and CENTA Business Services. The project was part funded by the European Regional Development Fund (ERDF).

With thanks to the participants and consultants from the Jewellery Connections Project.

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London Borough of Camden.

Designed and produced by benchpeg creative consultancy.

## Partner logos

*With benchpeg's extensive experience of the trade, we have designed and written this toolkit as a series of dynamic and interactive fact sheets which we hope you will enjoy using.*

*We welcome any feedback and hope you will find this toolkit useful for your business.*



Front cover image: Jewellery Connections

# The Jewellers Toolkit
## a guide to manufacturing


## Introduction

Welcome to the Jewellers Toolkit.

This Toolkit was conceived as a direct outcome of the successful delivery of the Jewellery Connections project in 2011. The Jewellery Connections Project took place across London and was designed to encourage collaboration and innovation within the jewellery sector. The aim of the project was to bring together designers and manufacturers, and by introduction, create new and exciting products and services through innovation, education and collaboration.

The project was open to jewellery designers, jewellers, designer/makers, manufacturers and related trades who were based in and around London's Hatton Garden. The project brought many facets of the industry together in a collaboration, which resulted in new ways of working for both designers and manufacturers.

The Jewellery Connections Project ended in September 2011, after seeing 90 participants make positive collaborations and forge new working relationships with exciting results.

This Toolkit is aimed at being a legacy of the project.

## The benefit of experience

The Jewellery Connections Project recognised the gap in knowledge between manufacturers and designers. Each specialism owns its expertise and the project was aimed at marrying technical and manufacturing knowledge with the creative aspect of design in order to support the development of new product lines. As a result, product development issues were resolved and support was provided to form the creation of new services and processes for the jewellery sector.

After working with over 90 jewellery businesses which all spanned these different areas of industry, it became apparent that the Project should record what its participants had learnt from these collaborations throughout the year in which the project ran, for the benefit of the wider trade and industry as a legacy.

## Why a toolkit?

The aim of this document is to provide the reader with an easy to use guide for how to approach outsourcing your business' manufacturing requirements in relation to business requirements.

This Toolkit sets down the different areas of specific technical needs, which a modern jewellery business will deal with on a day-to-day basis.

This toolkit will give the jeweller the tools and information to understand and consider their manufacturing needs, and also help them prepare for and understand the process involved in commissioning someone else to produce their work.

## About this toolkit

The Toolkit is made up of 10 fact sheets to guide you through specific manufacturing processes, which incorporate traditional manufacturing processes, but also more hi-tech solutions which use technology and computer aided design and manufacture. These include:

**01 Getting your work made**
An explanation of the decisions you might have to make in order to start outsourcing, the pros and cons of doing so, and guidance on which method is best to use

**02 Approaching a manufacturer**
This fact sheet tells you how to go about the commissioning process, what questions you should ask, and importantly what you should know before you go along to disuss your requirements

**03 Bench jeweller**
The tool kit guides you through why you should consider using someone else to help manufacture your work. In this fact sheet you willl earn the pros and cons

**04 Master pattern making**
A small run, batch production or mass manufacture? Confused? The toolkit explains what is best for your needs

**05 Wax carving**
Why use a wax carver? The toolkit explains the process

**06 Lost wax casting**
Confused about the casting process? Read this fact sheet which will demystify the process

**07 Engraving**
Engraving can add value to your work. This factsheet explains how

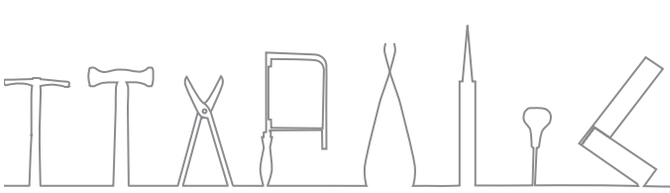
**08 CAD**
There are many perceived difficulties in using CAD, this fact sheet simplifies the process into understandable language

**09 Rapid prototyping**
If you are using CAD CAM, RP is an option for manufacture. Read more to learn how to use it as a resource in your toolkit

**10 Laser welding**
Laser welding can revolutionise working practices. The Tooklit explains more

**11 Technical drawing**
This fact sheet gives you an example of a simple way of laying out a technical drawing for a manufacturer

**12 Purchase order form**
This fact sheet contains a form that will give you a template you can customise for your own business



## How to use this toolkit

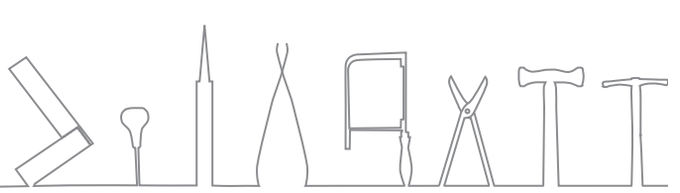
The toolkit has been designed to be used in two different ways.

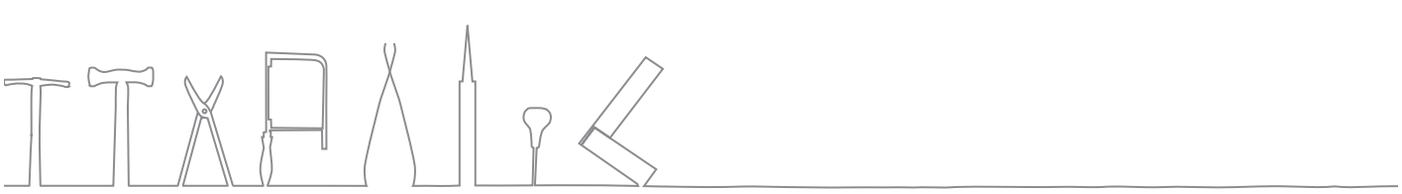
The first, as a complete guide to sourcing, commmissioning and using a specialist manufacturer. The toolkit will equip you with the understanding of what to expect during the process of getting work manufactured through the outsourcing process.

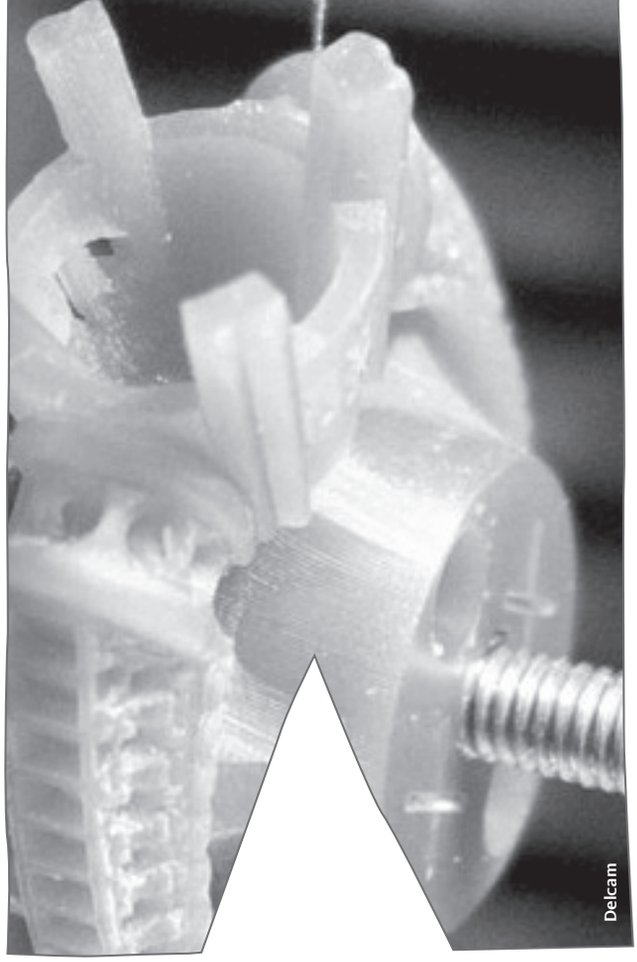
The second, as a series of individual factsheets which can be used independently as a specialist fact sheet on a single manufacturing subject, according to the readers' needs.

The toolkit has embedded links throughout the fact sheets. If you want to refer to a process mentioned in one fact sheet which is detailed in another simply use the dynamic links to take you there.

*"I was not aware of how much value I can add to my products and how much time I can save by working with others"*








# Fact Sheet 01: getting your work made

## Manufacturing options - the production process

The decision to get your work made by someone else can be a daunting prospect to begin with. Most start-up businesses tend to manufacture their work in-house, but as your business grows, you may want to consider outsourcing some of the key processes in the manufacture of your work or even consider the prospect of the entire process being taken out of your hands. This enables you to free up your time for other important aspects in running your business. As far as manufacture is concerned, your job becomes one of overseeing the production process to ensure it maintains the quality and cost that you require and is completed in the time frame you have allowed.

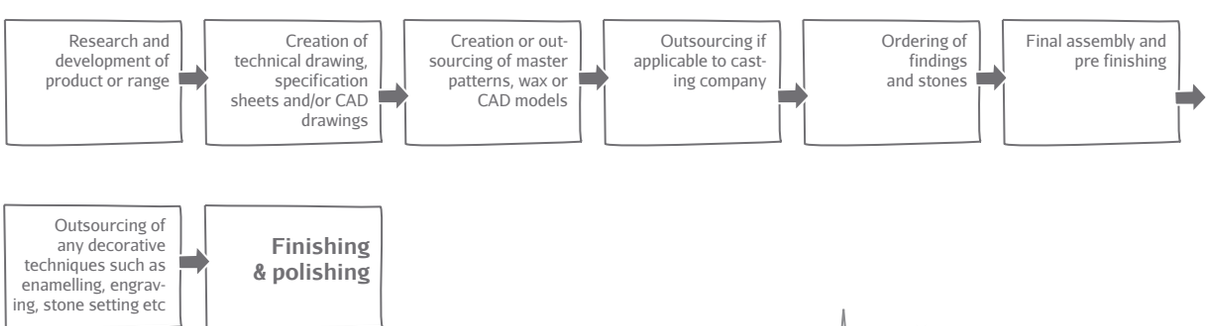
**Advantages of in-house manufacturing**

* Control over the process and quality
* No extra external labour costs to consider
* No need for any travel or shipping considerations

**Disadvantages of in-house manufacture**

* Only small quantities can be produced
* Less time available for other aspects of your business such as admin, PR, selling etc
* Responsible for sourcing findings and materials yourself

Although the type of product you have designed will largely determine the production process, the following flowchart shows the key stages of production:



## Outsourcing

Finding a manufacturer you trust to make up your designs to the quality you require and the cost you are aiming for can be hard but once you have built up your contacts, the rest of the process is relatively simple. There are a myriad of specialist skilled workers in the industry working behind the scenes. Most of these craftsmen and women have built up skills over years and even decades and can provide an invaluable service to enhance your product. Remember, you have the control over how much of this process you want to keep in-house and which elements you want to outsource.

How to approach a manufacturer is covered in more detail in **Fact Sheet 02: approaching a manufacturer**, but for example, you can outsource work in any or all of the following areas of manufacture:

* Mounting and setting of stones
* **Engraving** of patterns and letters/words
* Chasing and repoussé work
* Polishing and finishing
* Engineering of components
* Cleaning up of castings
* General repairs
* Restoration
* **Casting**
* Decorative techniques such as chasing, enamelling, photo-etching etc
* **Laser welding**
* **CAD**
* **Wax model/pattern making**
* Spinning
* Die sinking and stamping

**Advantages of outsourcing**

* Labour costs may be smaller than in-house costs due to speed.
* Ability to incorporate skill areas that you might not have.
* Ability to produce larger numbers of pieces.
* Responsibility for sourcing findings and materials taken away from you

**Disadvantages of outsourcing**

* Less control over quality
* Lead-times – need to allow for extra time
* Potential travel and shipping costs

## Where to source materials

The UK jewellery industry is primarily focused around the centres of Hatton Garden in London, the Jewellery Quarter in Birmingham, Sheffield and in the city of Edinburgh. These areas, now seen as the traditional areas of manufacture, were based around the regional Assay Offices where once thriving industry took place. Most of the main findings and bullion companies tend to be centred around these areas and you can find out names and addresses on any of the databases listed at the end of each fact sheet.

Most findings and bullion companies will ask for identification and set you up with a customer reference number or code and you can either go in person or order on line.

You can also find a large variety of findings, chain and gemstone dealers at the key industry trade shows in the UK and Europe. If you can't travel to any of these, most have an online catalogue of exhibitors you can access throughout the year:

BaselWorld, Basel, Switzerland
**www.baselworld.com**

Inhorgenta, Munich, Germany
**www.inhorgenta.com**

Vicenza Fair, Vicenza, Italy
**www.vicenzafiera.it**

Spring & Autumn Fair, Birmingham, UK
**www.springfair.com**

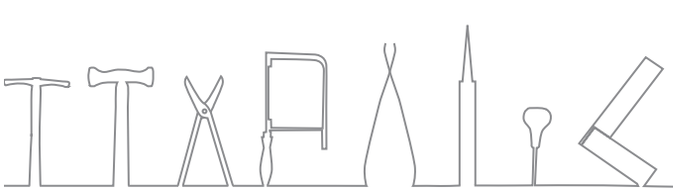
International Jewellery London, Earl's Court, UK
**www.jewellerylondon.com**

**Jewellery alloys**

Before you embark on putting your work in to production, it is worth taking some time to understand the materials you are working with. For the newcomer to the industry, an easy mistake to make is to assume that the sheet or wire you buy from the bullion dealer will work in every situation and that is not necessarily the case.

Silver, gold and platinum in their pure form, are all very soft, very ductile metals and are not very practical for jewellery application. They all have very low (HV) in the annealed condition, which is very low when compared to many other metals and alloys.

There fore, it is necessary to alloy the pure metal with another metal. As a consequence, their wear and scratch resistance is better, they have higher strength and hardness, allowing better dent and damage resistance.



Gold is alloyed typically, with silver and copper to give the carat golds, platinum with a number of alloying metals to give a range of 950 or other fineness alloys, silver with copper to give Britannia silver, sterling silver and other lower finenesses. However, not all alloys are equal when it comes to fitness for purpose. An issue commonly seen with platinum jewellery is that the incorrect alloy is used which can result in denting. For example, 950 standard platinum rings supplied to the UK market but manufactured in SE Asia and the Far East are often fabricated from a platinum 5% palladium alloy. This has a hardness of only about 60HV. Because of this, the alloy is relatively soft and easily damaged during normal wear. In contrast, platinum/cobalt, platinum/ruthenium and platinum/copper alloys have annealed or cast hardnesses in the range 120-135HV and these are much more resistant to wear and tear.

**Ethics & sustainability**

Though some manufacturers build their entire business model around a single ethical or sustainablity premise, for most jewellers ethics and sustainability are best considered as aspects that inform their activities. There are no standard guidelines for what constitutes 'ethical practice' and sustainability has been measured by very different criteria. Current definitions for both are heavily influenced by activists and campaigners, who are promoting their own specific agendas. The word ethical has been used to cover: supporting fair trade initiatives, helping protect indigenous communities, responding to environmental and ecological concerns, reducing resource use and using recycled materials. Professional jewellers need to develop their own personal position that can be put into practice through their business. They also increasingly need to be able to clearly describe and be prepared to defend this position in public and media debates as well as to their clients.

In-house manufacturers have more direct control over processes and how to ensure these meet their chosen ethical and sustainable criteria. Outsourcing brings additional issues. There is a need to identify if suppliers have a complimentary ethical perspective and the extent to which these ideals are manifested in their day-to-day practical actions. All manufacturers have some external suppliers. These include tools and equipment, energy supply and secondary production materials (e.g. pickling acids or polishing compounds), as well as precious metals, gemstones and other raw materials and packaging.

There are currently a range of ethical initiatives in the jewellery sector. The most high-profile are the Kimberley Process, Fairtrade and Fairmined Gold, and the Responsible Jewellery Council accreditation programme. Jewellers should be familiar with these and their strengths and limitations. Some manufacturers have chosen to develop their own, independent ethical sourcing systems, working with specific communities in the developing world. Involvement in any of these activities is often used as part of a company's promotional strategy.

Many companies highlight their ethical and sustainable position on their website and in promotional literature. It is worth noting that some suppliers or outsourcing companies, whilst being more low-key regarding ethics, may respond positively to specific proposals with an ethical or sustainable dimension depending on the nature of the work.

The Kimberley Process
**www.kimberleyprocess.com**

Fairtrade and Fairmined Gold
**www.fairtrade.org.uk/gold**

Responsible Jewellery Council
**www.responsiblejewellery.com**

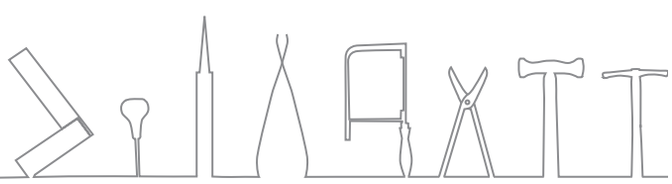
**Contracts**

Although it is not usual to use contracts in our industry for small outsourcing jobs, these may be necessary if you start manufacturing in large quantities and it is certainly good practice to keep a paper trail of all your conversations and orders. The British Jewellers' Association offers sample contracts in areas such as design, IP and also offers help with pricing, guidance on writing terms and conditions and has a legal help line for its members. It offers a free student graduate newsletter from its website: **www.bja.org.uk**

## Production management

**Lead times and time management**

An easy mistake for a newcomer to make is to assume that when they have their piece ready to be worked on by an outworker such as a **bench jeweller**, that the person will be available to get on with the job straight away. Bench jewellers are very experienced craftspeople and as a result are highly sought after. You need to allow sufficient lead times and book your work in ahead of time with your chosen craftsman and integrate it into your production management plan. Each one will vary but lead times can be 4-6 weeks. If you are using more than one craftsman, this needs to be thought about in advance and checked at every stage.



**Hallmarking**
When working in precious metals, consideration also needs to be given within your production plan for hallmarking your work. The Hallmarking Act 1973 requires that all precious metal articles offered for sale in the UK have a hallmark applied by an independent assay office to guarantee the precious metal content of the item.

Therefore, if you are using gold, silver, platinum or palladium alloys, it is a legal requirement to have your items tested to ensure they conform to the legal standards. Each assay office offers a number of different testing or assaying methods at the end of which process; your hallmark is applied either by the traditional hand marking process or by the latest laser marking technology. The former can be applied to unfinished work and may need a degree of re-finishing but is widely accepted as the most aesthetically pleasing method of hallmarking. However, laser marks can be applied after the product has been finished and also can be applied to very small items with thin gauges of metal. In terms of your production, you need to factor in an extra day or two to have your work hallmarked. You can get it done very quickly but you pay a premium for this service and should limit it to urgent jobs only. Also, sending multiples of items will reduce costs – check with your assay office for a breakdown.

To find out more about hallmarking, visit the websites of one of the four UK assay offices or the Hallmarking Council.

The Hallmarking Council
**www.bis.gov.uk/britishhallmarkingcounci**l

Assay Office London
**www.assayofficelondon.co.uk**

Birmingham Assay Office
**www.theassayoffice.co.uk**

Edinburgh Assay Office
**www.edinburghassayoffice.co.uk**

Sheffield Assay Office
**www.assayoffice.co.uk**

**Ordering**
When taking goods to be outsourced, it is good practice to complete a **purchase order** with the date, item, quantity, weight and description of the goods delivered to the outworker or manufacturer. The purchase order will normally contain information that confirms what has been discussed verbally and include any items that are being handed over for the outworker to use.

Try and get a signature that the items have been received if you are delivering in person, or have three copies, two of which you send along with the package, asking the outworker to return one signed copy as acknowledgment of the safe arrival of the goods.

## Getting your work made FAQ

**Q: What is a sponsor's mark?**

A: A sponsor's mark forms part of a hallmark and consists of the initials of the person or company registered for that mark surrounded by a shield design. To obtain one you need to register with one of the UK assay offices.

**Q: What's the best platinum alloy to ask for when casting jewellery?**

A: The recommended alloy is 950 platinum/cobalt which has good casting properties. It does have a slight bluish tinge when compared with other platinum alloys and it is also slightly magnetic due to the cobalt content. Platinum/ruthenium is sometimes used for casting but casters vary in their views on its castability. Platinum/copper is not suitable for casting but is a general purpose alloy recommended when working with sheet, wire, etc.

**Q: What is a lead time and why is it important?**

A: It is the time a jeweller or other service gives as the time after which they can begin on your work. Therefore it is always a good idea to book ahead if you know when you will be ready to have the piece worked on. It gains importance when you are relying on more than one outworker as it impacts on your production time.

## Glossary

**Assay**
Testing of jewellery alloys to establish precious metal content

**CAD**
Computer Aided Design

**Hallmarking**
Mark struck on a precious metal object; the full traditional mark usually consists of a sponsor's mark, traditional fineness mark, millesimal fineness mark, assay office mark and date letter mark

**HV**
Hardness Value

**IP**
Intellectual Property

**Master pattern**
A model of a piece of work that is to be put in to production – commonly made out of sterling silver or wax.

## Databases of industry specific trade services

The following websites hold information about trade services, equipment suppliers, products and educational courses:

**benchpeg: www.benchpeg.com**
The jewellery industry's leading creative and digital communications network

**British Jewellers' Association Trade Product Search: www.bja.org.uk**
A membership organisation that represents the jewellery industry

**Ganoksin: www.ganoksin.com**
An international online resource for the jewellery industry

**The Goldsmiths' Company Technical Portal: www.thegoldsmiths.co.uk**
A supplier database of trade-to-trade services and suppliers

## Further reading

Introduction to Precious Metals – Metallurgy for Jewellers and Silversmiths, Mark Grimwade, Publ A&C Black 2009, ISBN: 978-0-7136-8758-3

Jewelry Concepts and Technology, Oppi Untracht, Publ Robert Hale Ltd, ISBN 0-7091-9616-4

## Technical sources of information

Ganoksin
**www.ganoksin.com**

Johnson Matthey
**www.jmny.com**

MJSA
**www.mjsa.org**

The Goldsmiths' Company
**www.thegoldsmiths.co.uk**

The World Gold Council
**www.gold.org**

## Sources of training

Birmingham Institute of Art & Design
**www.schoolofjewellery.co.uk**

City Lit
**www.citylit.ac.uk**

The Goldsmiths' Institute
**www.goldsmiths-centre.org.uk**

Holts Academy
**www.holtsacademy.com**

London Metropolitan University
**www.londonmet.ac.uk**

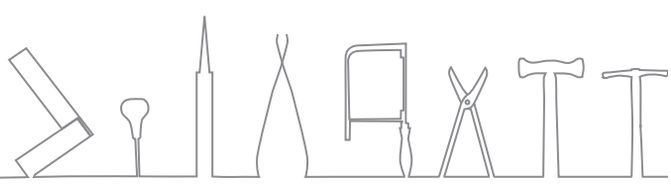
London Jewellery School
**www.londonjewelleryschool.co.uk**

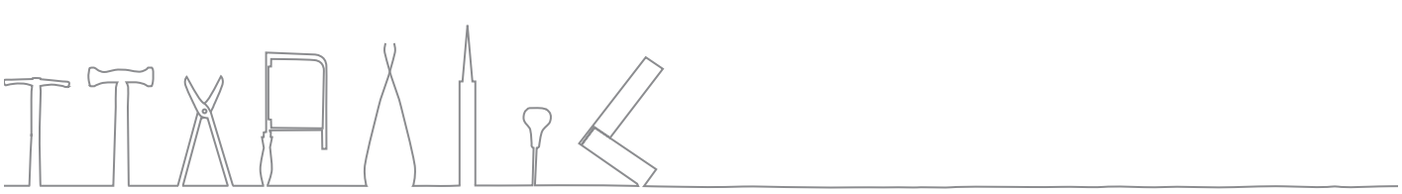
Morley College
**www.morleycollege.ac.uk**

West Dean College
**www.westdean.org.uk**

Also look at the Jewellery & Allied Industries Training Council for training information **www.jaitc.org.uk**

For other courses, check local and national art colleges for information.





# Fact Sheet 02: approaching a manufacturer


## Manufacturing

When considering outsourcing your work to someone else, first consider the nature of the work you want to produce. If you want to create multiples of a component, for example for a jewellery item you want to sell through many different stores, you may want to consider having a master model made so you can have copies cast. However, if you just want to make a one-off bespoke piece or low batch production items, you may want to consider going to a **bench jeweller** who will be able to undertake the work for you and set stones and engrave the piece. There is no wrong or right answer and indeed you may end up using both. You just have to find the right path for you.

As your business progresses you will build up an address book of manufacturers and bench jewellers that you can call upon to realise your designs.

The list opposite is a broad outline of the sorts of manufacturing processes available to you. Research the method you are planning to use in advance so you understand the process as much as you can before approaching a manufacturer as this will save time for both sides

**Production techniques**
Casting
Electroforming
Machining & tooling
Photo etching
Stamping & die sinking
Laser cutting
Water jet cutting
Laser marking

**Traditional workshop production**
Chasing
Diamond mounting
Stone setting
Enamelling
Repairs & restoration
Stone carving & lapidary
Wax model/pattern making
Engraving/engine turning
Polishing & finishing
Spinning

## Finding a manufacturer

It is relatively simple to find a manufacturer for production, just go online to one of the trade databases listed at the end of this fact sheet. You can also try websites such as **www.alibaba.com** to help with worldwide sourcing of manufacturers. The industry trade shows are also great places to find manufacturers and materials suppliers. See the list at the end of this fact sheet.

Finding an experienced workshop bench jeweller isn't quite as straightforward. These tend to be self-employed and don't always advertise. Make yourself active in the industry – it is a small close-knit community and work often is by word of

mouth and recommendation so attend networking events and any industry seminars. Also, keep an eye out for business cards in the tool shops and findings companies around the main jewellery centres and you can also try contacting one of the industry associations.

## Terms, conditions, contracts and negotiation

It is not usual in our industry to have contracts but nevertheless it is important to agree terms and conditions in advance of ordering, preferably via email rather than verbally. Industry associations such as the BJA (**www.bja.org.uk**) can supply sample design contracts, intellectual property (IP) contracts, non-disclosure agreements (NDA's), guidance on writing terms and conditions and other useful documents. You need to be a member to access this service.

**Order quantity**
You may be able to negotiate prices depending on how many of a component or piece you are making. Ask the supplier if they offer any discounts for multiple orders (break points) and also find out if they have minimum order quantities.

**Production costs**
Most manufacturers should give you an estimate of the cost based on your drawings, then a final price once samples have been made. Remember to ask whether this price includes materials, VAT, shipping and hallmarking and if you have a maximum budget, make sure this is explicit in your instructions.

**Insurance**
Whether a limited company or a sole trader you will need to have some insurance in place. Firstly, you will need *Public Liability* insurance - for example if you walk into a workshop and damage something, you can be sued as, you are representing your business.

You may also need to consider *Products Liability*, in case you supply a product that then damages the wearer. Protecting your stock and tools, within the workshop and out of it. And finally, in a business, the biggest asset is you so you can take out cover to protect you and your family in the event of getting ill. You can also get *Entrustment* cover, which will protect your stock while entrusted to for example, a setter or other outworker.

## Quality and finish

Agree in advance and stipulate on your design the type of finish and level of finish you require. For example, make it clear that you want a perfect mirror finish or whether you want areas sandblasted or gold plated in your design.

## Lead times and delivery dates

Lead times are something that should be taken in to account when planning your production. Most bench jewellers are busy and won't be able to take on and complete your work straight away. Once you know the process, book in the work ahead of time with the jeweller so they know you will be coming as some jewellers may have a lead time of up to 4-6 weeks.

## Reliability and reputation

It is very important that you as a client are as reliable as you expect your manufacturer to be. Prompt payment will help your relationship for future orders. In the beginning when you are starting out, you may not be as lucrative a client so always be professional and keep them informed of any press coverage you get from your work. Remember, both parties are handling precious goods and reputation and trust needs to be garnered on both sides. Make sure the manufacturer you choose is also reliable; they can meet deadlines and make the pieces to the quality you require. There is no easy way to establish this but word of mouth is always a good place to start.

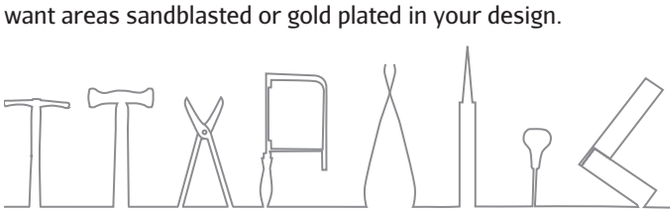
## Sampling

Often ahead of a big order, samples will be produced for you. This is so that you can sign off the product and accept the design, weight, finish etc. In short production runs, you will be expected to pay for this service but in larger runs in the 100's or above, it may be free if you agree to order a certain amount of units. You will also need to agree in advance what the process will be for getting the sample right if it is not to your satisfaction.

## Preparation for approaching a manufacturer

The general rule of thumb is to prepare as much as you can in the way of visual material for approaching a manufacturer. **Accurate technical drawings** or CAD models with dimensions, details on any decorative techniques you are intending to use, dimensions and type of stones, materials, any final weight allowances etc. Manufacturers are used to receiving designs in different formats and will usually scrutinise your proposals and ask questions about areas they may not be clear on.

Don't forget to include your contact details so theyknow where to ship the final pieces to and how to contact you if they have a question.



## Costing and pricing:

Costing is the term used to describe the process of calculating how much your work costs to create. You should never sell your work for under this amount. To work out your cost price you should take into account your workshop/ business overheads – the cost of running your business, labour costs – what you want to earn, external costs for outsourcing elements of your work, material costs which can be worked out by simply weighing the piece and multiplying this by its cost per gram and other costs such as hallmarking. For more detail about how to calculate this, the Crafts Council has published a very useful chapter on costing in its book *Running a Workshop*.

## Manufacturing FAQ

**Q: What is a sample?**

A: A sample is a piece of jewellery or object that is produced as an example of the quality of the production pieces. To proceed with production you normally have to view and approve a sample.

**Q: How do I find a manufacturer?**

A: Ask for recommendations, go to industry networking events and seminars, look for business cards in jewellery toolshops and scour trade databases.

*"One participant was put in contact with enamellers and stone setters which she believed would improve the competitiveness of her company as finding good quality and dependable contacts was difficult and time consuming."*

## Databases of industry specific trade services

The following websites hold information about trade services, equipment suppliers, products and educational courses:

**benchpeg: www.benchpeg.com**
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**British Jewellers' Association Trade Product Search: www.bja.org.uk**
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An international online resource for the jewellery industry

**The Goldsmiths' Company Technical Portal: www.thegoldsmiths.co.uk**
A supplier database of trade-to-trade services and suppliers

## Trade Shows

The online catalogues for these shows are rich pickings for suppliers of findings, chains, manufacturing equipment, packaging and stones or you could visit in person. The following are the primary trade shows for our industry:

Baselworld, Switzerland
**www.baselworld.com**

Inhorgenta, Munich
**www.inhorgenta.com**

International Jewellery London, Earls Court
**www.jewellerylondon.com**

The Spring Fair, Birmingham
**www.springfair.com**

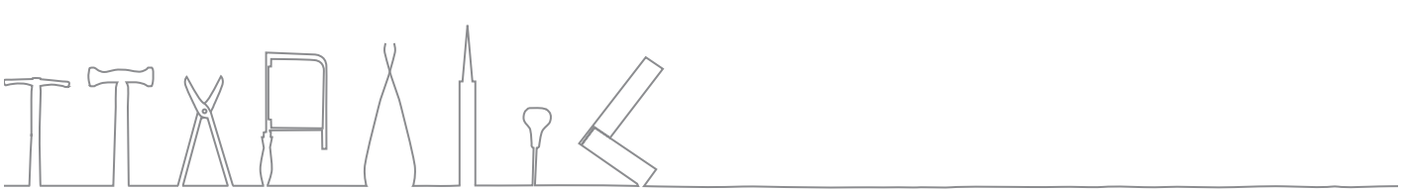
Vicenza Fair, Italy
**www.vicenzafiera.it**

## Further information

Running a Workshop - basic business for craftspeople.
Publ Crafts Council 2000. ISBN 1 870145 73 9

## Acknowledgements:

Mark Smith, Director TH March Insurance Ltd
**www.thmarch.co.uk**



# Fact Sheet 03:
## bench jeweller


## Introduction

A bench jeweller is the umbrella trade name for a highly skilled craftsman who can undertake the manufacture of jewellery. Bench jewellers may also have knowledge of several different skills as well as making, including stone setting or engraving and are highly regarded within the industry for their technical expertise, often having learned these through a traditional apprenticeship. A bench jeweller has the technical skill to take your design and turn it into a real piece of top quality jewellery. Bench jewellers are either employed in-house or are self-employed and undertake work for a variety of clients including Bond Street jewellers. Often the sort of work undertaken is short production, high value specialist pieces with diamonds or gemstones, and perhaps incorporating some other decorative work.

**Bench jeweller:**
Bespoke jewellery maker
Goldsmith
**Master pattern maker**
Diamond mounter
Stone setter
Polisher
Specialist repairs
and restoration

**Jobbing jeweller:**
General production work
Repairs
Sizing
Assembly

## Finding a bench jeweller

Bench jewellers are highly sought after craftsmen and don't all necessarily advertise their businesses, working quietly behind the scenes and getting work mainly via word of mouth. This is because their skills are very desirable in the industry and usually there is no shortage of work for them. So you will need to do some investigating – ask around and get recommendations. Go and visit the sort of suppliers that a bench jeweller might frequent like findings and tools shops in the jewellery centres and look on their notice boards. In London, the Assay Office notice boards in Greville Street and the Goldsmiths' Company are another good source of bench jewellers. Also check online trade databases.

## Preparing your design for a professional bench jeweller

As with the rest of your production, you can choose which aspect of the manufacture of your work you are interested in outsourcing. It could be that you just want the jeweller to add a joint or clasp to your work, or you may want to effectively hand over the entire design or assembly to them.

If you want them to do the latter, you need to supply as many details as you can about your design, including accurate measurements. Bench jewellers often use your drawing as a template for creating the piece so an accurately drawn to

scale drawing is ideal. Make sure you indicate where stones will be placed and any findings. Be prepared for them to scrutinise your drawing so don't overcomplicate your design. Bench jewellers are very experienced and will be able to spot any potential issues and suggest alternative solutions. Remember to fill out a **purchase order form** and include a description of what you have given them, along with materials and your contact details.

## Costing and pricing

A bench jeweller usually charges by the hour or by the piece in the case of setting. They should be able to supply you with an estimate for how long the job will take up front so you have an idea. And there may be other costs such as materials, findings, VAT and shipping to consider. If you have a budget, don't forget to discuss this at this initial meeting.

## Bench jeweller FAQ

**Q: What is a bench jeweller – I keep hearing lots of terms about outworkers**

A: Quite simply, the word bench jeweller is an umbrella term for skilled craftsmen that work at the (jeweller's) bench and encompasses a wide variety of specialist skills.

**Q: How do I know if I am being quoted the going rate for the work I am commissioning?**

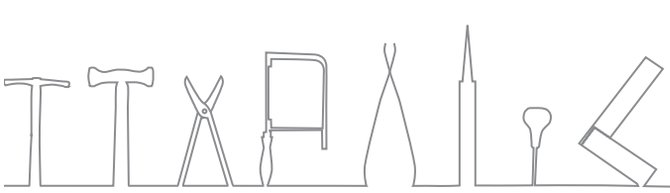
A: The jewellery industry is a very small, close knit community so you are not likely to be overcharged, but if you are concerned and want to make sure, you can get more than one quote and compare the difference.

**Q: How do I find a bench jeweller, they don't seem to advertise?**

A: Try asking other jewellers, look on tool shop noticeboards, trade databases, assay office noticeboards and business cards in findings shops.

**Q: If the bench jeweller loses or damages my work or that of my customer, who is liable?**

A: This depends on the trading terms and conditions of the jeweller you are working with. It is always best to find this out beforehand, particularly if you are dealing with high value goods. You can also take out 'entrustment cover' through your insurer. See **Fact Sheet 02: approaching a manufacturer**.



*"I learned that there are opportunities out there and I need to check my emails. Before I would just sit at the bench, I know now you have to get involved and the benefit is that you get to be seen, share your knowledge. Otherwise you sit on your own and no-one knows you."*

## Glossary

**Assembly**
Fixing together by soldering or other means of multiple components to form a complete piece of jewellery

**Diamond mounter**
The skilled craftsman who makes the framework of the piece of jewellery, ready to have stones set usually by hand

**Master pattern**
A model of a piece of work that is to be put in to production – commonly made out of sterling silver or wax.

**Sizing**
The process of reducing or increasing circumference of a ring to the correct size

## Databases of industry specific trade services

The following websites hold information about trade services, equipment suppliers, products and educational courses:

**benchpeg: www.benchpeg.com**
The jewellery industry's leading creative and digital communications network

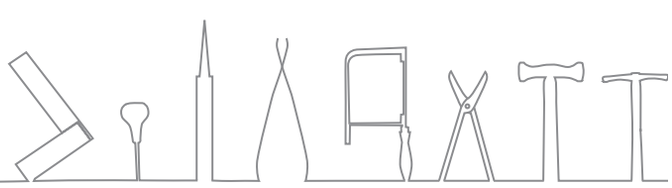
**British Jewellers' Association Trade Product Search: www.bja.org.uk**
A membership organisation that represents the jewellery industry

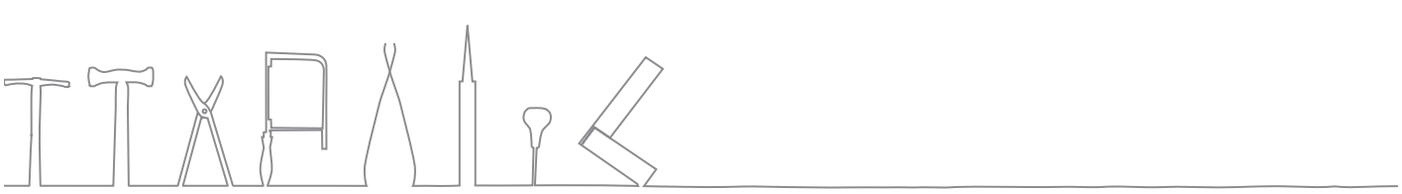
**Ganoksin: www.ganoksin.com**
An international online resource for the jewellery industry

**The Goldsmiths' Company Technical Portal: www.thegoldsmiths.co.uk**
A supplier database of trade-to-trade services and suppliers

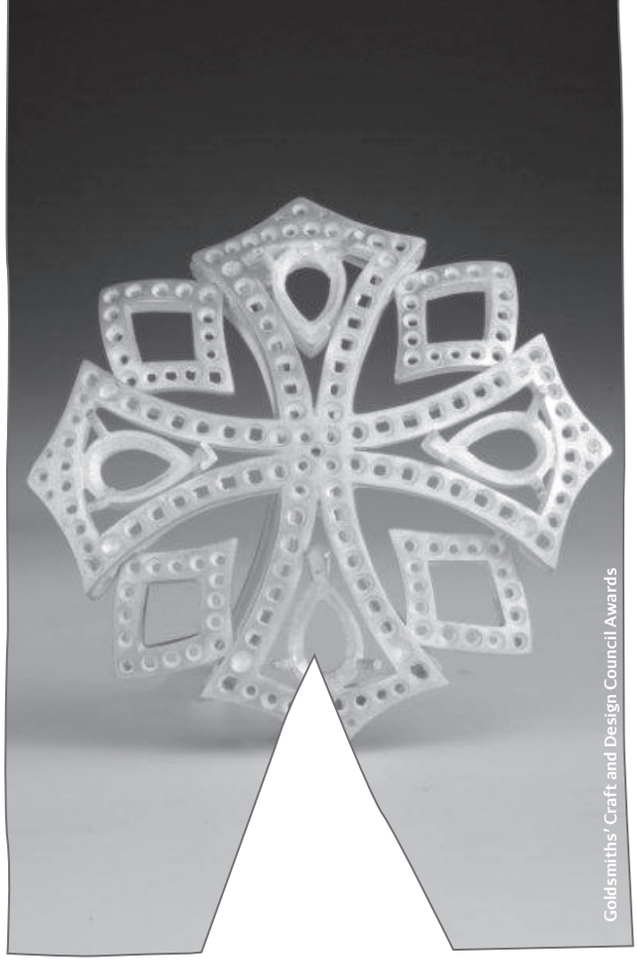
## Acknowledgements

Justin Wilson, Designer and Manufacturer
**www.jwjewellery.net**





# Fact Sheet 4: master pattern making




## Introduction

A master pattern maker is a professional and highly skilled craftsman who specialises in the production of a master model for a client which will typically go on to be cast and put in to production. Regarded as one of the most technically skilled bench jewellers in the trade, the master pattern maker has usually had training as an apprentice and lots of experience making models for major jewellery houses, bespoke and production pieces and small businesses alike.

You would approach a master pattern maker to make you a metal model of a piece you want to put in to production. Models are commonly made using sterling silver and the pattern maker will take a lot of time making and refining the model to the highest possible standards. This is because the quality of the resulting castings will depend entirely on the quality of the original model. They will also make the piece slightly larger than if it were being made to be worn straight away. This is because the model needs to compensate for the shrinkage that occurs during the casting process so bear this in mind when discussing your designs and make sure you make it clear that the final casting should be to your design measurements.

## Finding a professional master pattern maker

As with all bench jewellers, master pattern makers can be hard to find as generally speaking, they are not short of work and don't always advertise. Ask for recommendations; look at the trade databases listed at the end of this fact sheet and on notice boards in the areas a bench jeweller might frequent such as tool shops in the jewellery centres around the country.

## How to prepare your design for master pattern making

Try and have as much information to hand as possible on your design, including accurate measurements. Your drawing may be used as a template to create the work so supplying a drawing to scale is always helpful.

It is good practice to provide the master pattern maker with any elements or components that are integral to the success of the piece. For example, if you are designing a pendant, a chain sample is useful to the model maker so he can check the dimensions of the hole. Make sure you indicate where stones are going to be positioned and ideally send the stones along with the design so the model maker can see the dimensions of the stone for themselves. Make sure you include all these items and any precious metal on your purchase order so there is a record for both parties.

Be prepared for your drawing to be scrutinised. Model makers

have lots of experience and may ask you questions about how you want the piece to work. A good craftsman will do their homework about the job first so they can be sure they understand what is being presented and can be true to your design.

Don't forget to clearly mark the package you give to the master pattern maker with your business details, a contact telephone number and the address the pattern should be returned to if you can't collect it in person.

More information about dealing with manufacturers can be found on **Fact Sheet 02: approaching a manufacturer.**

## Costing and pricing

A master pattern maker usually charges by the hour. Bear in mind when you approach a maker that they have to spend a lot of time making sure the model is correct. They will usually estimate how long the job will take up front so you have an idea and other costs to consider will be metal costs, findings and any other extra processes you would like included.

## Master pattern making FAQ

**Q: What sort of finish should I leave or expect on a metal master pattern?**

A: A master model is made to the highest possible standards – the quality of it will dictate the quality of the resulting castings so any scratches or imperfections, however small will be replicated.

**Q: Will the master pattern maker be able to tell me if my design won't work?**

A: Usually yes, they usually have many years' experience and will be able to spot potential issues at the design stage and help you make alterations. Your casting company should also be able to advise you on any potential issues with your design from a casting perspective.

**Q: Will the model maker place the sprue on my piece?**

A: Usually yes, but make sure you confirm this in your initial meeting. Otherwise you can add yourself or ask your caster to do it for you, although they will charge for this service.

*"We thought we had to do everything ourselves, but were linked up with people and it feels easier to do it now."*

## Glossary

**Master pattern**
A model of a piece of work that is to be put in to production – commonly made out of sterling silver or wax.

**Wax pattern**
Wax replica of a master model, produced by injecting molten wax into a rubber mould.

## Further reading

Handbook on Investment Casting – the lost wax casting process for carat gold jewellery manufacture, Publ World Gold Council 2003, Valerio Faccenda

## Databases of industry specific trade services

The following websites hold information about trade services, equipment suppliers, products and educational courses:

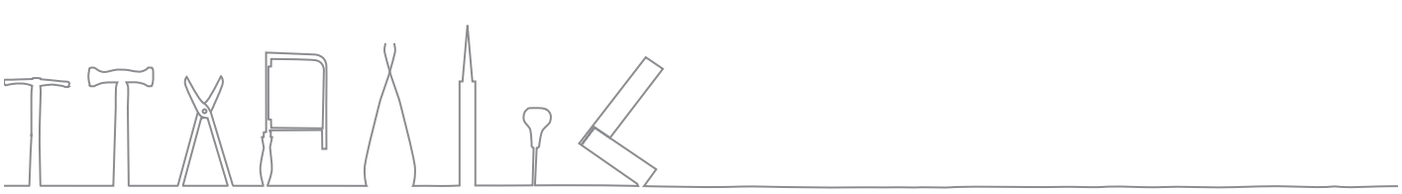
**benchpeg: www.benchpeg.com**
The jewellery industry's leading creative and digital communications network

**British Jewellers' Association Trade Product Search: www.bja.org.uk**
A membership organisation that represents the jewellery industry

**Ganoksin: www.ganoksin.com**
An international online resource for the jewellery industry

**The Goldsmiths' Company Technical Portal: www.thegoldsmiths.co.uk**
A supplier database of trade-to-trade services and suppliers

*"It is easy to say you want to outsource but it's a huge step change in reality. You need to present someone with detailed instruction, simplify the making process, the communication has to be spot on and intellectual property issues need to be in place. There are very few role models to look at in terms of the design and production route and it is very difficult and challenging to make the jump."*




# Fact Sheet 05:
# wax carving

## Introduction

Wax carving is another specialism within the jewellery industry. A wax model or carving provides the starting point either for a one-off bespoke piece or a production line.

Often referred to as model makers, wax carvers use a variety of waxes and other carving materials in order to achieve the final product. These are used alone or sometimes in combination with other materials. Many models must be carved in more than one piece and will require assembly once in metal to achieve the final product. The carving process for each model is different every time and can require considerable planning and preparation.

## Approaching a professional wax carver

Professional wax carvers are particularly sought after within the industry and it is not always easy to find one. Ask around frequent places where wax modellers might go to get supplies and look on notice boards. Some model makers are also listed on the trade online directories listed at the end of this fact sheet.

When preparing your design for the wax carver, remember that, as with any other outworker, they are charging for their time. So the more you can do at this stage to put across your idea clearly, the better, as reworking of models will cost time and money.

For example, provide as much visual material as possible that puts across your idea. **Technical drawings** are ideal, showing the front, side and plan elevations and a perspective version of the piece you want made. Ideally provide these to scale as quite often wax carvers take measurements directly from your drawings. Add notes to the drawings that indicate what the item is, indicating positioning of any final features or findings for orientation. Make sure you include any other additional information that you think would help the modeller interpret your drawings. This would include detailed dimensions, final weight allowance, whether the piece is destined to be a one-off or if you want multiples produced, indicate where you want stones to go and how these are to be set and the size of the gemstones.

This isn't always possible with for example animals or other organic forms but you can provide overall dimensions and final weights etc.

As with other subcontractors, the wax carver's time is booked in advance, so planning ahead and indicating your time-scale is important. Small jobs can sometimes be fitted into tight schedules but you cannot depend on this.

Generally, the wax carver will sit down with you to discuss the job and resolve any design issues.

## Costing and pricing

As with other bench jewellers, wax carvers charge for their time so having as much information available about your proposed design will cut down on the time you have to commission. Other on costs from the wax model will be casting costs and material costs – more of this in **Fact Sheet 06: lost wax casting**.

Most wax carvers will give you an estimate of the time your piece will take and give you a confirmed price once the piece is complete.

## Wax carving FAQ

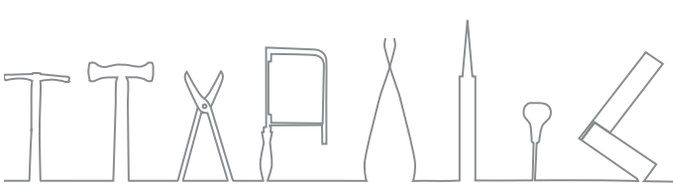
**Q: What are the measurements I should supply on my drawing?**

A: Length, width, height, and also gemstone sizes so positioning can be allowed for. Ideally send the stones in with the designs so the carver can see the proportions for themselves.

**Q: Should I include shrinkage allowances on my drawing?**

A: Not necessarily, the wax carver should be able to supply you with a model that will withstand shrinkage but discuss this at your initial meeting to make sure. You can also show your drawing to a caster to find out what they estimate shrinkage will be.

*"Because the project provided a learning curve, I felt that I did not understand the process/what was required from me at various stages of the project. For example, I drew designs to be made into 3D CAD files, without understanding the process of the 3D printing. As a result, I wasted some of my 20 hours having components designed on CAD, which it would be uneconomical to have printed in 3D, and from the outset, it would have made more sense to make these components by hand. If I'd had the opportunity to talk through the process/have it explained to me, I wouldn't have made this mistake.*



## Glossary

**Visual research**
A collection of images that inspire a design and help the wax carver to understand the feel of the originating idea.

**Design**
The actual drawing of the piece to be created in wax, which shows visually its dimensions to scale from top, side and bottom.

**Wax carving/model**
The final representation in wax or other carving material of the design

**Master**
Once the wax has been cast and cleaned up, it is ready to have a mould taken from it. It is important to keep the master in a safe place in case the mould is lost or deteriorates over time.

**Mould**
An impression of the master taken in rubber; it is used by the caster to produce multiple waxes for production.

## Databases of industry specific trade services

The following websites hold information about trade services, equipment suppliers, products and educational courses:

**benchpeg: www.benchpeg.com**
The jewellery industry's leading creative and digital communications network

**British Jewellers' Association Trade Product Search: www.bja.org.uk**
A membership organisation that represents the jewellery industry

**Ganoksin: www.ganoksin.com**
An international online resource for the jewellery industry

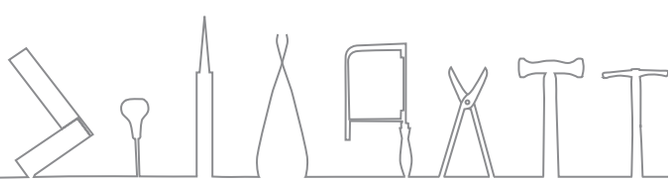
**The Goldsmiths' Company Technical Portal: www.thegoldsmiths.co.uk**
A supplier database of trade-to-trade services and suppliers

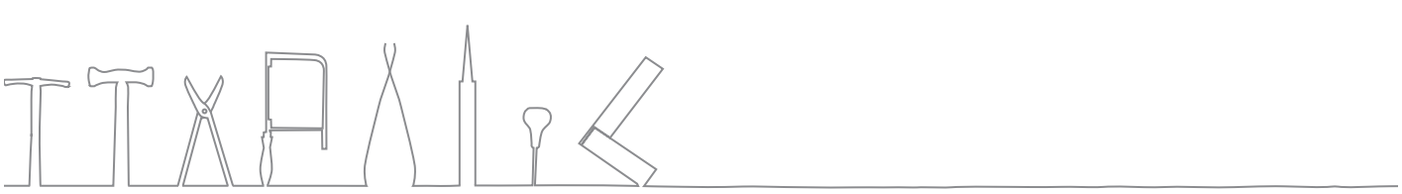
*"Two participants learned about the production process and learned how pieces could be too large, too heavy, clasps not function the way they were intended and pieces too intricate to produce even for CAD designers."*


## Acknowledgements

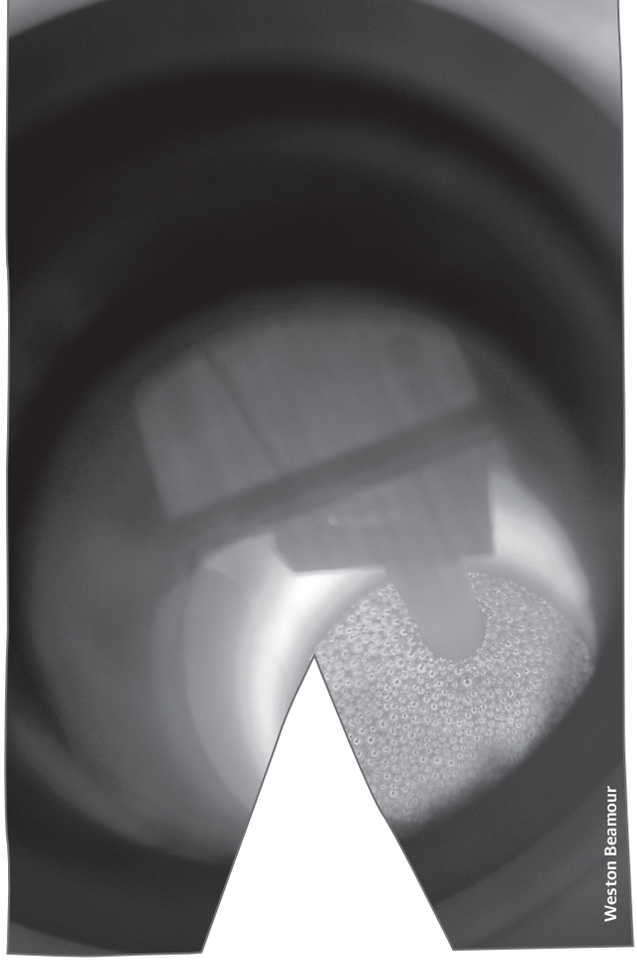
Danila Tarcinale and Russell Lownsbrough, Wax Carvers
**www.waxcarving.co.uk**

Martin Baker, Bepoke Wax Carver
**www.martinbaker.net**



# Fact Sheet 06:
# lost wax casting




## Introduction to lost wax casting

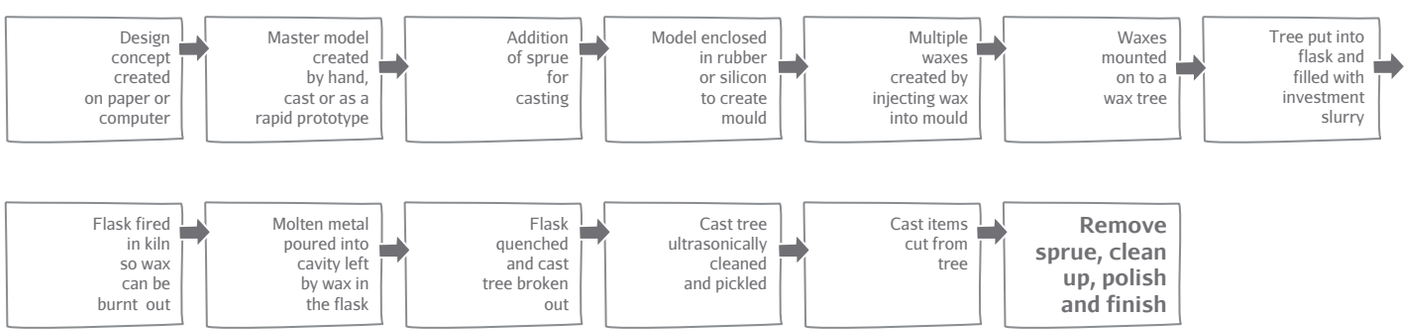
Lost wax casting is the most common type of casting used in the jewellery industry for production. Casting gives the jeweller or silversmith the ability to produce repeat patterns over and over again, which can substantially save on time and labour costs.

Silver and gold alloys are generally vacuum cast, while platinum and palladium use centrifugal casting which requires higher temperatures, is a more difficult process and therefore can be more expensive.

## Preparing your design for casting

To begin with you need to make a suitable model either in metal or in modelling wax. Modelling wax can be bought at most reputable tool shops or ordered on line and comes in block, sheet, tube or rod form. At this stage you could also outsource the making of the model to a professional **master pattern maker** or **wax carver**.

Remember that the model needs to be as perfect as you can get it because any imperfections at this stage will be replicated in each casting you produce. In creating your model, consideration needs to be given to the final weight of the item and therefore you should avoid any unnecessary thickness in the metal while also paying attention to not making areas too thin either - for example claw thicknesses. If you are planning to use stones in the resulting piece, these should also be planned out in advance.



## A word on shrinkage

Due to shrinkage on solidification, and the polishing and finishing process, your final casting will be slightly smaller by about 1-3% so you need to allow for this in your master pattern. And remember, if you make a wax model and cast a metal master pattern from that, you need to allow for shrinkage to occur twice. Knowledge of shrinkage is information picked up through experience as models don't necessarily shrink uniformly. Remember that it is always easier to take metal away than to have to add it later so erring on the side of caution is advisable. For example, for a ring, you could make it slightly smaller so you can size it once it comes back from casting if the design lends itself to doing that.

Again, a master model maker or wax model maker will have in-depth practical knowledge of this process and can advise you. You can also liaise with your casting company who should be able to estimate likely shrinkage based on your design.

## Sprues

Most casting houses can add sprues to your wax masters for you and if you have little experience in this area, it is probably a good idea to let them do it for you as they understand how metal flows and fills the mould. However, if you send a metal master pattern with no sprue, bear in mind in this case there will usually be a cost involved.

## Approaching a casting company

Casting companies now accept models in many forms, including wax models, rapid prototypes, metal master patterns, or even a small plastic component or other natural object that can be cold moulded. Many can now create **rapid prototyped** models for you from your **CAD** design. And many casting companies now offer a complete jewellery manufacturing service where you can end up with a finished and polished piece at the end of the process. It all comes down to which aspect of the processes you want to outwork or do yourself and obviously cost.

When you send your work in to the casting company, make sure that you stipulate the following:

* If you have sent a hand carved model, state whether you want the item to be cast directly or whether they should make a mould of it first. This is important as if they cast it directly, you will lose the wax model in the process.
* In which metal would you like the piece to be cast? For example, if you want it made in platinum, be aware that there are different alloys of platinum and that you should research their suitability for the piece you are making. See **Fact Sheet 01: getting your work made** regarding choosing the correct alloy for your work.
* How many pieces you would like produced
* The correct shipping address and your contact details clearly marked on your **purchase order**.

Other things to note are that you should always ask for an estimated cost prior to giving the go ahead – fluctuating precious metal prices could give you a surprise and if the cost is too high you still have time to modify the model so it uses less precious material.

As with all outworkers, check on lead times at every stage in the production process. More information about dealing with manufacturers can be found on **Fact Sheet 02: approaching a manufacturer**.

## Cleaning up your castings

When you get your castings back from the casting company, you should first check them for any porosity. There may be slight surface porosity in some of your castings but this should easily be filed off, it is rare to find castings with no porosity at all. Anything greater than that, you may need to consult your casting company and discuss recasting, although most of this should be dealt with during the company's quality control checks.

You will usually receive back your castings bead blasted, which takes off any investment baked and also leaves them with a uniform clean finish.

Once you are happy with the quality of your castings you need to remove the sprue. You can do this quickly by cutting it off with cutters or if necessary, a piercing saw.

Keep all sprues and scrap clearly labelled by alloy so you can reuse or reclaim the scrap value later. You can then go on to finishing and polishing your pieces in the usual way with emery and polishing compounds.

Some companies employ outworkers to clean up castings if they have lots of them, so this is a consideration if you would prefer not to undertake that aspect of your production. You may also find your casting company offers this as a service.

## Costing and pricing

When getting your work cast from a wax, there are usually two charges per casting – the cost for the metal and a casting charge (also sometimes referred to as a fashioning charge), plus VAT plus a shipping charge. Some casting companies offer discounts for multiples so it is worth checking this in advance of your order.

Silver and gold alloys are generally vacuum cast, while platinum and palladium use centrifugal casting which requires higher temperatures,is a more difficult process and therefore more expensive.

If you send a metal master pattern and require it to be moulded, there will be a moulding charge. Bear in mind that the mould belongs to the casting company and is regarded as part of its tooling. Only you will be able to order from that mould and you will retain the IP of the design but ownership generally lies with the casting company.

## Casting FAQ

**Q: Will the casting company own and retain my mould?**

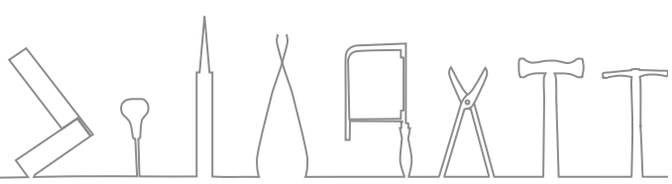
A: Yes, the casting company owns and retains the mould

**Q: Do casters offer FairTrade and Fair Mined metal that I can use for my castings?**

A: This is a hot topic in the jewellery industry and at the time of writing there are only a couple of casters that offer this service although it is hoped this will increase in the future. At present it is only offered in 18ct gold and to those companies and designers who have also received certification from the Fairtrade Foundation to manufacture in the metal[1].

*"For two participants, the fundamental purpose of the project was to outsource production, reduce effective for their clients, without compromising on quality. This they believed was the future of the industry whereby design-based manufacture could make their designs more affordable to a wider clientele. Neither believed their handmade work would cease, but they would be able to broaden their market penetration through enhanced technology design/ production solutions."*

[1] www.westonbeamor.com



## Glossary

**Sprue**
The passage through which molten metal is introduced into the mould to form a cast piece

**Casting**
Manufacturing method by which molten metal is poured into a mould and allowed to solidify to form a component piece of jewellery

**Flask**
Tooling to hold a mould for metal casting

**Rubber mould**
Hollow rubber mould that contains a cavity mould in the shape of the master pattern. Wax is injected into the mould to create wax patterns

## Databases of industry specific trade services

The following websites hold information about trade services, equipment suppliers, products and educational courses:

**benchpeg: www.benchpeg.com**
The jewellery industry's leading creative and digital communications network

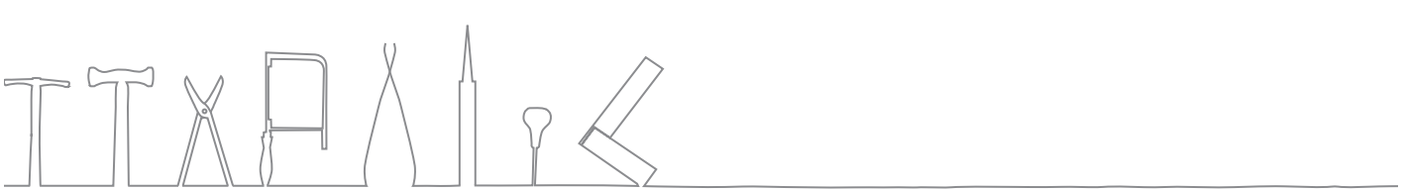
**British Jewellers' Association Trade Product Search: www.bja.org.uk**
A membership organisation that represents the jewellery industry

**Ganoksin: www.ganoksin.com**
An international online resource for the jewellery industry

**The Goldsmiths' Company Technical Portal: www.thegoldsmiths.co.uk**
A supplier database of trade-to-trade services and suppliers

## Acknowledgements

Weston Beamor Ltd
**www.westonbeamor.co.uk**



# Fact Sheet 07:
# engraving


## Introduction

Hand engraving is described by the Hand Engravers Association as the embellishment of precious objects using traditional hand tools. It goes on to say that few people understand the skill and attention to detail involved in the traditional craft of hand engraving. It is a field that requires specialist knowledge, such as tool making and the understanding the behaviour of different metals and other materials, coupled with substantial artistic and calligraphic skill. Even the simplest engraved details – some initials, a date, or just a few decorative lines – can give personality, life and sentiment to an inanimate object.

Hand engraving is a diverse craft with a long history that is intrinsically entwined with human culture. Historically it has been used in both practical and decorative applications; from hunting arms to royal seals, coins and bank notes to jewellery, its influences are all around us.[1]

The term engraving encompasses decorative engraving on jewellery and silverware, seal engraving, heraldry, enamel, champlevé, printing and embossing. Engine turning can also be classed as a form of engraving as can other forms of machine engraving. For the purposes of this fact sheet, we will focus on hand engraving.

## Finding a professional engraver

You can find engravers through the trade databases listed at the end of this fact sheet and also through the Hand Engravers' Association website. You could also have a look at websites such as whoswhoingoldandsilver.com and try approaching a craftsperson that does engraving to see if they do outwork. Ask for recommendations and go to networking events and seminars to build up your address book.

## Preparing your design for engraving

The possibilities for embellishing your jewellery or silverware are endless. Whether you want a beautifully carved inscription or lettering, or whether you want to add some colour to your piece perhaps through the use of enamel techniques, it is really up to your own imagination.

To prepare your work for approaching an engraver, you need to collate any visual reference material you have, along with the piece you have prepared ready to engrave. Prepare to be flexible, engraving is an art form and no two engravers are the same. Once you have your designs ready, sit down with your engraver and discuss your work. Ideally you would discuss your design proposal before going ahead with making it as they might have suggestions  at the design stage that might save you time later on.

[1] Hand Engravers Association website: www.handengravers.co.uk

## Costing and pricing

As with all professional craftspeople, costing is dependent on many variables as each job is different with hand engraving.

Some engravers charge by the letter but most charge by the job. Ask your engraver to estimate a cost and provide a minimum and maximum for you. You can always negotiate depending on your budget.

## Engraving FAQ

**Q: Is there a particular guage metal I should use?**

A: An experienced engraver can engrave on very thin metal but 0.3mm is the recommended minimum.

**Q: Should I finish and polish my piece before submitting it to the engraver?**

A: The more prepared the piece is, the less final finishing there will need to be. It is definitely best to have it finished to a 'prep' polish to prevent excessive wear to the engraving. Liaise with the engraver on this beforehand.

**Q: Should I polish the engraving once I get it back from the engraver?**

A: It shouldn't need much polishing if you have prepared the metal before engraving but it will need a final buff.

*"I learned that there are opportunities out there and I need to check my emails... before I would just sit at the bench, I know now you have to get involved and the benefit is that you get to be seen, share your knowledge... [otherwise] you sit on your own and no-one knows you"*

## Glossary

**Bright cut engraving**
Typical form of engraving which takes advantage of the play of light of shallow slanted cuts on the surface of precious metal

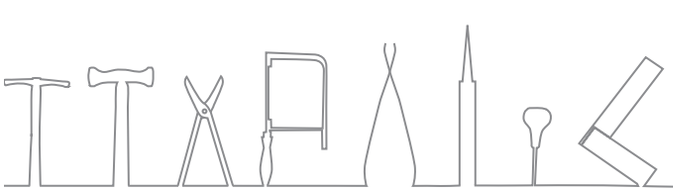
**Intaglio**
Relief engraving on metal

**Basse taille (French: low-cut)**
Form of enamelling where the metal surface is covered with low relief engraving and then enamelled over the top with one colour of transparent enamel. The varying depths of the cuts create depths in the colour

**Champlevé**
A form of enamelling where cells are engraved into the surface of the piece and then enamelled in different colours.

**Graver**
Tool used to engrave line patterns , carve details in intaglio in dies, also for carving inlays

**Seal engraving**
The cutting of metal or stone in such a way as to create a counter-relief negative of the image to imprint – usually a coat of arms or family crest. This item can then be used to produce a finely detailed impression in wax



## Databases of industry specific trade services

The following websites hold information about trade services, equipment suppliers, products and educational courses:

**benchpeg: www.benchpeg.com**
The jewellery industry's leading creative and digital communications network

**British Jewellers' Association Trade Product Search: www.bja.org.uk**
A membership organisation that represents the jewellery industry

**Ganoksin: www.ganoksin.com**
An international online resource for the jewellery industry

**The Goldsmiths' Company Technical Portal: www.thegoldsmiths.co.uk**
A supplier database of trade-to-trade services and suppliers

## Further information

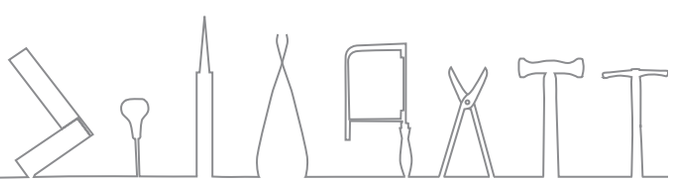
Hand Engravers Association
**www.handengravers.co.uk**

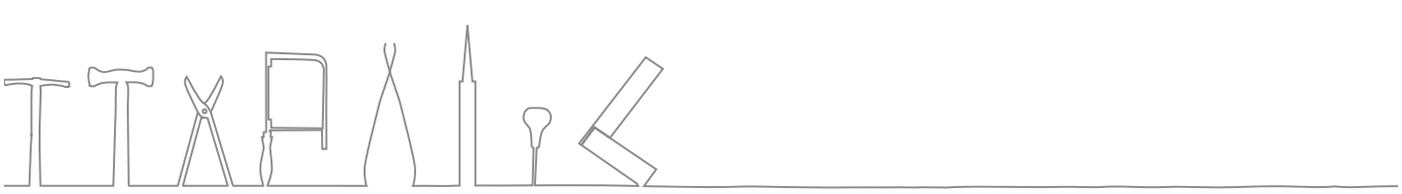
Guild of Enamellers
**www.guildofenamellers.org**

## Acknowledgements

James Neville, Hand Engraver
**www.jamesnevilleengraving.com**

Hand Engravers Association
**www.handengravers.co.uk**





# Fact Sheet 08:
## CAD


## Introduction

Computer Aided Design, or CAD for short, is a term that refers to the use of the computer for the creation of designs. CAD programmes are available in two-dimensional packages (2D) such as Adobe Illustrator or CorelDraw, or three-dimensional (3D) modelling packages such as Matrix or Rhino and CAD is fast becoming standard practice in many businesses in the jewellery and silversmithing industry. Although it shouldn't be regarded as a replacement for traditional skills but rather another tool in the jeweller's toolkit, there are a number of advantages and disadvantages that should be considered about whether to integrate CAD in to your business.

**Advantages**

* Accuracy
* Less time required for modification
* Simple to change stone colour, size etc
* Repeatability
* Ability to send designs easily all over the world
* Ability to render a photo-realistic image of the piece prior to selling
* Jewellery specific software features that automate processes such as pavé setting and provide weight calculations in precious metal
* Ability to create pieces on the computer, then dismantle into component pieces to cast separately which allows new design possibilities
* Ability to display pieces on your website that have yet to be made to show full breadth of designs.

**Disadvantages**

* Training: 3D modelling software packages have complicated looking interfaces with an array of commands and to master a package requires many hours of training and practice.
* Designs can be compromised by lack of knowledge of the software package in question. This can of course be overcome by outsourcing to a CAD bureau.
* Costly to implement
* The choice of which software to buy can be confusing

## The CAD process

The flowchart on the following page illustrates the process of designing using CAD from an initial hand drawn sketch through to a three dimensional CAD model that can be exported to Computer Aided Manufacture (CAM) such as CNC milling machines or rapid prototyping equipment.

1. Initial concept drawings can be created in the traditional way with paper and pencil or even directly into a CAD programme.
2. If on paper, the design can then be scanned and imported into the 3D modelling programme and used as a guide to creating the three dimensional model.
3. The model can then be modified and manipulated until the designer is happy with the outcome. Many iterations of the design can be saved and compared.
4. The design can then be rendered to give it material properties, surface texture, gemstones and other decorative effects. These can be shown to a client or customer to present a photo-realistic interpretation of the piece they will be receiving, and even an animation. Following any feedback, this allows any adjustment of a design to take place before moving on to the more expensive process of manufacture.
5. Once the design has been finalised, it is ready to export.
6. It needs to go through one more process, file checking, which is usually in a separate piece of software. This is in order to check the model is of sufficient quality to go to manufacture, and doesn't have any holes or other problems that might interfere with the creation of the final model. CAD bureaus will usually check your file.
7. The model is ready to be sent for manufacture. Because it is a digital file, this can be sent by email which reduces manufacturing time, and it can also be sent anywhere in the world to be made.

## Approaching a professional CAD designer or bureau

These days, most CAD bureaus offer a complete design service so you can send them your sketches and they will create a 3D CAD model for you that can be exported to Computer Aided Machinery (CAM). Some are even taking over the production of the piece in to precious metal and the lines between casting company and CAD bureau are starting to blur.

Pencil sketches or paper technical drawings can be imported into a CAD programme and used as a guide for producing the model. However, if you are using a CAD designer or bureau, it is useful to supply some extra information such as more detailed technical drawings detailing materials and size and cut of any gemstones etc to ensure you use the minimal time with the CAD designer as they commonly charge by the hour.

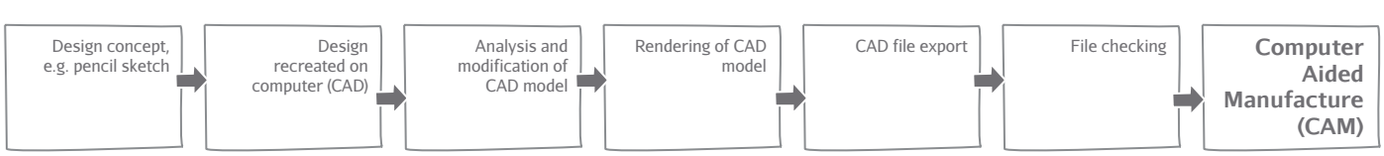
Send as much information as possible about the design you want to create from as many different angles as possible. Include as many measurements as possible – metal thicknesses, dimensions, gemstone sizes etc.

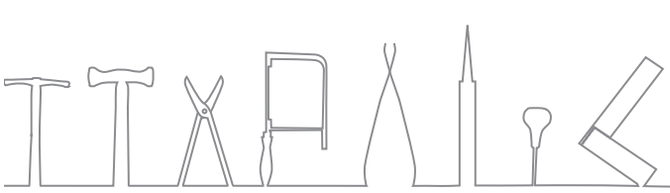
Things to look out for:

* Don't get distracted by the size of your CAD model on the screen, as it can be misleading.
* Keep an eye on wall thicknesses, particularly for channel setting and also claw thickness. As general guidance, claws should be no less than 0.7mm or they will be too fragile.
* A good tip is to keep a vernier gauge by your mouse so you can keep checking dimensions in the real world.

However, a good bureau will double check these measurements and feed back to you if they believe the model will not be fit for purpose.

More general information about dealing with manufacturers can be found on: **Fact Sheet 02: approaching a manufacturer**.



## Costing and pricing

CAD designers usually charge by the hour so ensure you have as much information to hand as possible to avoid them having to contact you for more information. If your intention is for the bureau to not only create a CAD model for you but to also provide you with a finished piece, you will need to discuss the costs involved with them managing this process for you and get an estimate. Alternatively, you can manage this aspect yourself once you have the CAD model and get a range of quotes.

## CAD FAQ

**Q: If I send my CAD drawing by email to a company, is there anything I can do to protect the IP?**

A: You could use a *Non Disclosure Confidentiality Agreement* (NDA) if you were concerned. If you are a member of the BJA, these can be downloaded from its website.

**Q: What is the best programme for creating jewellery on the computer?**

A: This is a very common question and a difficult one to answer. The best solution is to try before you buy. Some programmes, like Rhino offer a free trial download. You can try the software free of charge but saving of models is limited to a number of saves. Others will supply you with a trial version. Go to trade fairs and ask for demonstrations or go on a beginner's course.

**Q: If I get a CAD bureau to create a CAD model for me, who owns the IP?**

A: You own the intellectual property of the design.

*"In one particular case the designer came to the CAD consultant with a brooch design. The CAD consultant worked to devise a new brooch clasp that could be made as one piece instead of two separate components, which the designer had presented initially. This is exactly what CAD can achieve and the result ensured the designer had a more workable piece of jewellery that would cut costs of production as they were creating one piece instead of two."*

## Glossary

**CAD**
Computer Aided Design

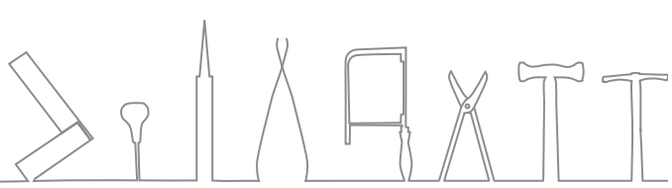
**CAM**
Computer Aided Manufacture

**NDA**
Non Disclosure Confidentiality Agreement – a legal contract between you and a third party not to disclose information that you have shared

**Rapid Prototyping**
Construction of an object from CAD data into a solid object using additive technology

**Rendering**
Creation of a photo-realistic interpretation of a 3D model

**STL**
Stereolithography file format used for exporting to rapid prototyping equipment



## Jewellery specific software

Rhino3D
**www.rhino3D.com**

JewelCAD Pro
**www.jcadcam.com**

Matrix3D
**www.gemvision.com**

ArtCAM JewelSmith
**www.delcam.com**

3Design
**www.3design.com**

## Databases of industry specific trade services

The following websites hold information about trade services, equipment suppliers, products and educational courses:

**benchpeg: www.benchpeg.com**
The jewellery industry's leading creative and digital communications network

**British Jewellers' Association Trade Product Search: www.bja.org.uk**
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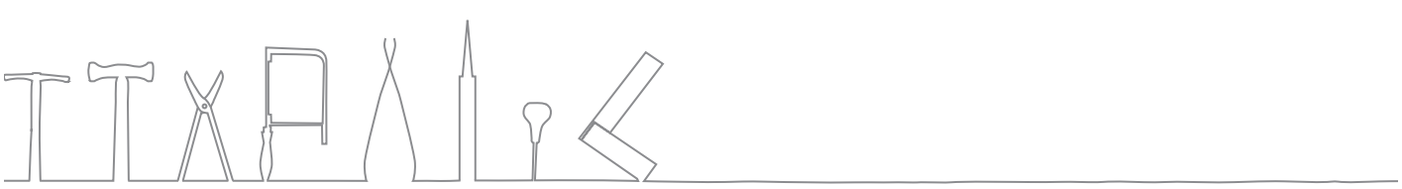
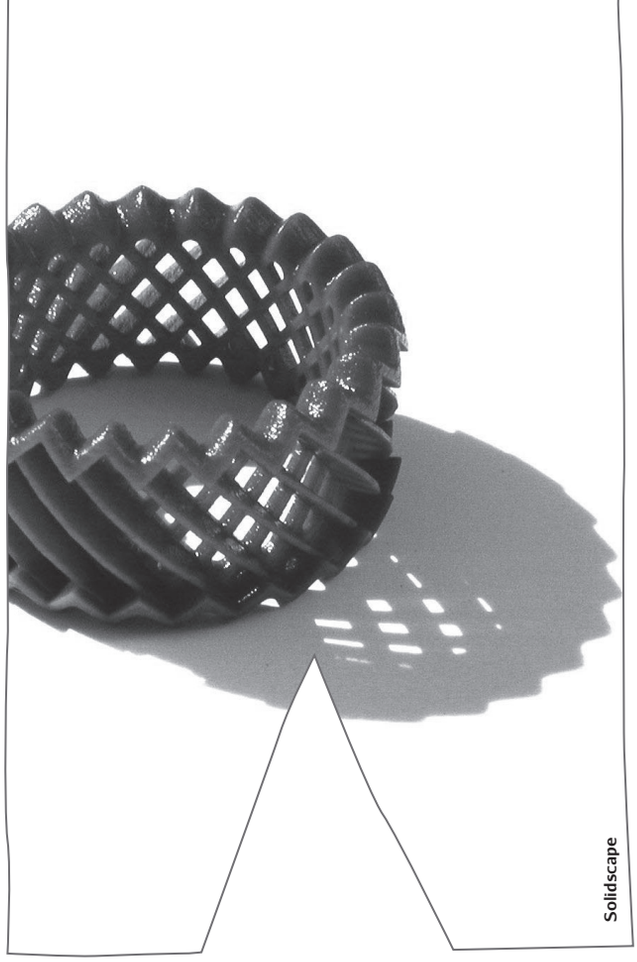
## Acknowledgements

CAD & Rapid Prototyping Bureau, Weston Beamor Ltd
**www.westonbeamor.co.uk**



# Fact Sheet 09:
# rapid prototyping




## Introduction

The term rapid prototyping refers to the creation of a three-dimensional plastic or metal model from 3D CAD generated data. The designed object emerges as a solid, three-dimensional part without the need for tooling. The models can be used to create master patterns and even batch production.

In the jewellery industry, three-dimensional printing is the process most commonly thought of when referring to RP although there are a number of other processes that come under this umbrella term including:

* Three-dimensional printing (3DP)
* Selective laser sintering (SLS)
* Fused deposition modelling (FDM)
* Laminated object manufacturing (LOM)
* Electron beam melting (EBM)

The main advantages of rapid prototyping are widely accepted to be:

The ability to create complex geometric forms, repeatability, scalability, accuracy, speed, and of course, your master CAD model is always available for further use.

## Preparing your design for rapid prototyping

As discussed in **Fact Sheet 08: CAD**, most CAD/RP bureaus now accept designs in many forms, from a pencil sketch to a fully completed 3D model. It all depends on your modelling capability and the price you want to pay. If you are sending a drawing, ensure you have included a detailed technical drawing with as many dimensions as possible.

Assuming you have a CAD model that you have created on a jewellery specific programme, ensure it is completely solid as any 'holes' in the model may interfere with its ability to be built correctly before saving it as an .stl file and emailing it to the CAD/RP bureau for assessment. Most CAD bureaus will double-check your data before proceeding with producing any prototypes and make any minor adjustments but major errors will need to come back to you to alter.

Once your file has been converted to an .stl file and sent to the machine, your model will be built up layer by layer in wax or resin to form a whole part. Waxes don't tend to last very long and are quite brittle so need to be used fairly quickly.

The part can then be used to create a master pattern by moulding or used to cast directly in to precious metal. More information about dealing with manufacturers can be found on **Fact Sheet 02: approaching a manufacturer**.

## Costing and pricing

Once you have sent your .stl file over to the RP bureau, you will be given a price and a production time. Once you have confirmed this, the bureau will print the wax and send it back to you. Some bureaus offer a one-stop shop and will be able to provide you with a finished item.

## Rapid prototyping FAQ

**Q: Can I get multiple castings from one rapid prototype build**

A: Yes a silicon mould can be taken of the rapid prototype model

**Q: Can I get someone to do the file checking for me?**

A: Usually the CAD/RP bureau will check your file prior to printing and make very minor repairs. Any major issues will be referred back to the customer to resolve.

*"I learned about the production process and how pieces could be too large, too heavy, clasps not function the way they were intended and pieces too intricate to produce even for CAD designers."*

## Glossary

**Additive**
RP models built by building layers of material

**CAD**
Computer Aided Design

**CNC**
Computer Numerical Control

**Rapid prototype**
Construction of an object from CAD data into a solid object using additive technology

**SLS**
Selective laser sintering

**STL file**
Industry-standard cross-platform file format used in rapid prototyping. Most jewellery CAD packages will allow you to export in this format

**Subtractive**
RP models built by removal of material, e.g. CNC machining

## Databases of industry specific trade services

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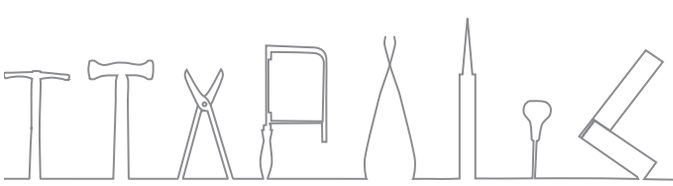


## Further reading

For an in-depth explanation of the rapid prototyping process, the following is an excellent source of information for the jewellery industry:

The current 'state of the art' and future developments for rapid prototyping

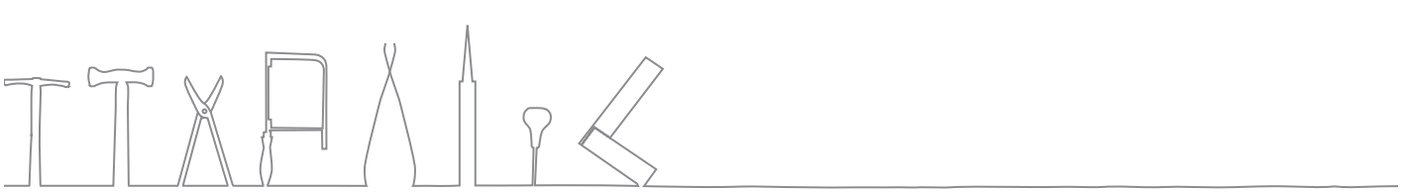
The Goldsmiths' Company Technical Bulletin, Issues 7 & 8, Publ. 2008

To view a video of the rapid prototyping process, visit **www.westonbeamor.co.uk**

## Acknowledgements

CAD-MAN: technology 'one-stop shop' for small and medium-sized jewellery enterprises
**www.cad-man.co.uk**

CAD & Rapid Prototyping Bureau, Weston Beamor Ltd
**www.westonbeamor.co.uk**



# Fact Sheet 10:
# laser welding


## Introduction

The word laser is an acronym for *Light Amplification by Stimulated Emission of Radiation.* Laser spot welding has been a feature of the jewellery industry for the last decade and is fast becoming a staple in larger workshops. Used primarily to solve production problems, its main uses and advantages are:

**Invisible joins**
Invisible joining in platinum, palladium, gold, silver, titanium and other jewellery metals because because when laser welding you can use thin wire in the same alloy as the item being welded as a welding medium

**Sizing of rings**
For the same reason as above, thin wire can be used in the same alloy as the ring and the join welded together with no visible seams.

**Porosity in castings**
Holes can be easily filled with a small piece of wire in the same alloy as the casting, even after polishing.

**Re-tipping of claws**
Because the laser is very accurate (typically 0.2mm beam diameter) and very little heat is generated at the point of welding, you have the ability to repair and re-tip claws on jewellery without the need to remove the stone first.

**Tacking**
It is very to easy tack work together to hold it in place ready for soldering.

**Pre-finishing of pieces**
Use of the laser means you can prepare separate component parts to a finished state and then laser weld them together at the end of the process. This leads to very interesting creative possibilities.

**Multiple welds**
Due to the relatively small amount of heat generated at the weld point, laser spot welding is idea for complex pieces that require multiple joins and will retain the hardness in for example a sprung wire.

In order to understand the technology and its potential in your designs, it helps to learn the basics of laser welding by attending a short course. You should learn enough to be up and running with the technology in a few days and smoothly operate and achieve reasonable results within a few weeks.

## Approaching a laser welding specialist

As with any new technology, the disadvantage of implementing it mainly centres around the cost of the equipment. Although this cost is gradually reducing over time, most laser spot welders cost many thousands of pounds.

If you want to employ laser welding in your work, you have a number of options. Firstly you can invest in a piece of equipment yourself, or you can pay for time on laser spot welders at some of the educational centres in the industry.

Your final option is to outsource to one of the 'jobbing' laser welding companies springing up around the country – these are often very trade-orientated with the majority of work coming from established jewellers, setters, mounting companies and therefore well versed in fixing problems.

## Preparing your work for laser welding

As with conventional soldering, you need to prepare your work. Ensure it is clean and grease free and if wanting a seam welded, ensure edges are touching. If you are unsure, consult the laser welding specialist and they will be able to tell you what is and isn't possible.

The sort of work you could give a laser specialist could be:

* Filling porosity in a casting – particularly useful if you've found it after you've finished and polished the piece.
* Sizing a platinum ring – where you don't want the seam to be visible.
* Repairs – often work that cannot be solved by any other means can be laser welded. For example a pair of opal earrings where the earring post has fallen off – this is an ideal application for the laser as the heat is so localised it won't affect the opal.
* You could create a piece with lots of separate components, polish and finish all of them; set stones and then laser assemble them to create a finished piece.
* Any welding where heat is an issue e.g. through discolouration or effect of heat.
* You are at the final stages of finishing something and it breaks.
* Tacking prior to soldering

## Costing and pricing

As with traditional bench jewellers, the cost will be based on the time spent on the laser and your preparation work can have an effect on how much time the laser specialist has to spend on your work. As a general rule, laser specialists charge by the minute so the more time you can spend preparing your work the less time is spent at the laser. Also, if they have to go to the bench to make an adjustment, there will be a cost involved.

As with all your costing and pricing, this cost needs to be integrated in to the final cost for your piece.

## Laser welding FAQ

**Q: Can you laser weld all metals?**

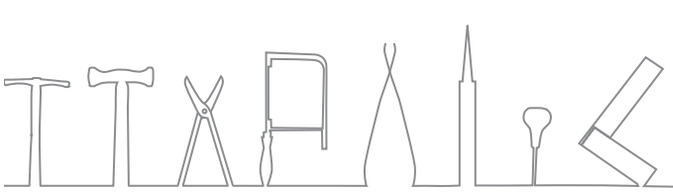
A: Generally, platinum and 18ct gold weld the best, as is stainless steel. Silver and 9ct gold can be problematic as a lot of power is required. Both titanium and palladium need argon. Base metal jewellery, electro plated silver, aluminium, copper, brass can be problematic.

**Q: Can you weld two different metals together.**

A: You can. It depends on the metal but you may have problems as one metal may have a lower melting point than the other.

**Q: Lasers seem to be very expensive, are they worth this cost?**

A: Laser welders are expensive and if you compare this to other tools within our industry, it is indeed at the very top end of this range. However, you have to consider the potential of such technology to pay back its investment within months due to its time saving attributes. The ability to realise designs that could otherwise not be possible using traditional solder techniques is also priceless.



*"Seriously thinking about Fair Trade Gold now whereas before it was a curiosity."*

## Glossary

**Beam diameter (ø)**
Parameter setting that dictates the size of the beam

**Feeder wire**
Wire used to fill weld, usually of same alloy as piece to be welded, drawn down to approximately 0.25mm diameter

**Focal point**
Optimal point at which to hold material for laser welding within the welding chamber

**Frequency (Hz)**
The frequency of the laser pulse

**Laser**
Light Amplification by Stimulated Emission of Radiation

**LSW**
Laser Spot Welder

**Milliseconds (ms)**
Thelaser pulse duration

**Nd YAG**
Crystal used as the lasing medium in laser spot welder (Neodymium-doped Yttrium Aluminium Garnet)

**Welding chamber**
The area in which the piece to be welded is held

**Voltage (V)**
Parameter setting that dictates the power of the laser beam

## Further reading

Laser spot welding: technical guidelines and innovative applications for the jewellery industry, Publ Goldsmiths' Company 2004, ISBN 0140 0541

Introduction to Precious Metals – Metallurgy for Jewellers and Silversmiths, Chapter 13, Mark Grimwade, Publ A&C Black 2009, ISBN: 978-0-7136-8758-3

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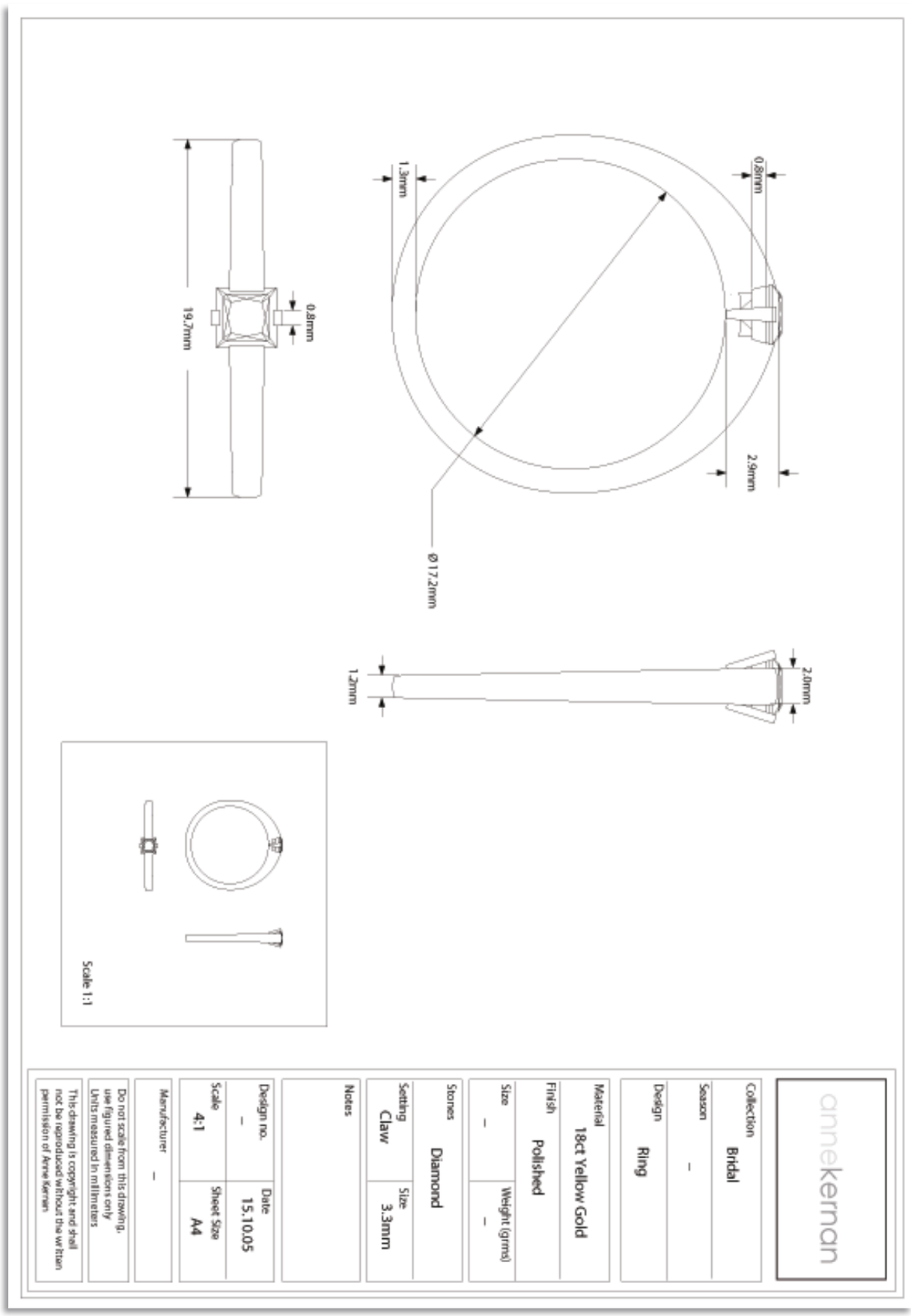
## Acknowledgements

AR Dellow, Laser specialist & Jeweller
**ardellow@hotmail.com**

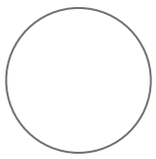
Tom Rucker, International award winning platinum jeweller
**tom.london@tomrucker.co.uk**
**www.facebook.com/tomlaserrucker**

# Fact sheet 11: Technical drawing




This is an example design layout, which could be done in CAD or by hand and given to a manufacturer.

Acknowledgement: **Anne Kernan** – commercial jewellery designer



Your company name and logo

Address
Email
Website
Phone
Mobile
VAT number

| To:<br><br>Address: | **PURCHASE ORDER** |
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**This is an example that you can adapt for your own use or you can buy from any stationery shop.**