



DATASHEET: Casting Gemstones in place by Ajit Menon

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Introduction:

Gem-Stone castings have been practised in some jewellery industries in the US for the past 10 years. The labour costs for setting gemstones in the US are approximately 10 to 15 times more than the cost compared to eastern countries. The process of setting stones in wax, if done appropriately, reduces labour costs. Initially this process was practised very discreetly solely because of its tremendous economic benefits and an edge over the competitors. Gem Stone castings can be done only to a few natural stones and there is a limitation to the type of finishing procedures like tumbling. Due to these limitations, the process has not gained a widespread popularity. The quality of jewellery and the quality of settings have been a controversial debate since the beginning.

The earliest publication on this process was some time during the year 1988. Since then, more publications and references have been made regarding this process. The ease of setting stones in wax with no damage to the stones while setting accounts for most of the major savings in labour costs. However this process also involves the risks of tremendous loss of Gem Stones, if the casting procedures are not followed meticulously.

Designing the model:

As always, model-making is the first and very important step. for Gem Stone settings in wax, the model requires strict dimensional control. Improvements in the manufacturing technologies such as CAD/CAM provide the accuracy and ease of maintaining such tolerances. All shrinkage factors have to be accounted for, prior to dimensioning the size of the model. The model is finished and electro-plated if applicable. The model may have to be sprued differently to change the orientation of the model within the mould so that the mould parting line is not running directly over the Gem Stones. They are then moulded using the conventional rubber moulding technique. Gem Stones may be placed in the cavities within the mould and wax injected into them.

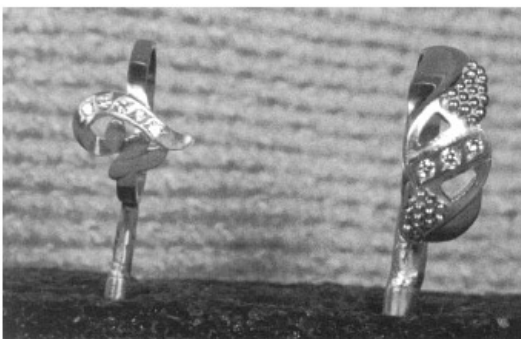


Figure: 1 The wax patterns will now have the Gem Stones already set in them.



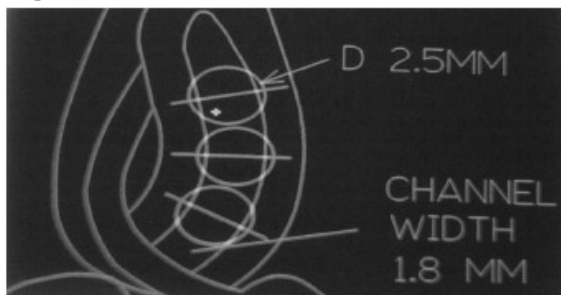
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RTV moulds may also be used for this process. The transparent kind seems to have an advantage for making moulds for those models, having the Gem Stones already installed in them. The transparency of the mould helps to view the orientation of the Gem Stone and the filling of wax within the mould. Sometimes minor adjustment may be needed to correct the orientation, and wax flashings over the Gem Stone. Gem Stones set in this manner are rigid and are tightly set within the wax.

Gem Stones setting in wax:

The most important aspect of Gem Stones setting in wax is the dimensional tolerances. Models are to be made with the correct dimension to accommodate the Gem Stones, so the Gem Stones also need to be within the correct dimensions. For e.g. diamonds that need to be set in wax channels need to have very close tolerances in their girdle diameter so that there is enough wax on each side of the table to hold the diamond in place.

Figure: 2



Even though diamonds may be of the same size (for e.g. 1 pt. or 2 pt.) , they may still vary in their girdle diameter. A sieve plate should be used to make sure that the diamonds are of the same dimension.

Prong settings:

Gem Stones may be directly installed in the model and moulded as usual, either using rubber vulcanisation method or RTV . Gem Stones may be placed within the mould and oriented in such a way that the opening or parting line of the mould is not directly over the settings. The Gem Stone in the wax pattern may need some adjustment or realigning. For Gem Stone setting within the wax pattern, the prongs may be bent over the stone by using a wax pen.

The prongs may be cleaned and smoothed with an applicator. soaked in a wax solvent such as lighter. fluid.





DATASHEET: Casting Gemstones in place by Ajit Menon

Channel Settings:

Diamonds for the channels can also be preset into the model provided there is some space between them. Figure: 2. This is necessary for the rubber to hold the stones. If the stones are very close or touching each other., then there is nothing to hold the stones in the rubber. mould. Stone setters develop their own techniques for installing diamonds or gemstones in channels. Diamonds can be set in wax within the channels by touching the top of the diamond with a slightly heated wax pen. The top of the channel may have to be rebuilt and cleaned using a wax solvent and applicator. Wider channels may just be squeezed together to hold the diamonds in place. Diamonds may also be set from beneath the channel. A groove along the inside of the channel provides a socket for the girdle of the diamond. The edges might need some cleaning and rebuilding of wax. This process leaves the outside top of the channel clean.

Alternate Bead Setting:

Diamonds may be pre-set in the model to appear as a tube set or a bead set. The model would need the appearance of the tube around the seat or have graver cuts to accent like a bead cut. Brilliance holes under the diamond are very important for the investment to hold diamond securely in place. Depending on the design of the model, a side sprue and core mould may be an advantage during setting diamonds in the mould.

Bead set gem stones in wax: is less time consuming and strenuous.

Wax cleaning and inspection:

Cleaning the wax: is a necessary step. The quality of stones in the metal reflect the quality of stones in the wax. All excess wax: around the stone and within the channel needs to be cleaned out. The top of the channel may be smoothed. The stones may be cleaned to insure that there is no wax: film over them. Some channels have a seat for the diamond. Make sure that the seats are cleaned. For prong setting, the tips of the prongs may be cleaned and smoothed out.

Proper inspection of the wax: needs to be done to insure proper alignment, orientation and quality. Gem stones with inclusions often turn milky or crack during the burnout / casting process. For alternate bead settings, the brilliance hole needs to be checked for melted wax: and cleaned with a sharp pin point wire.



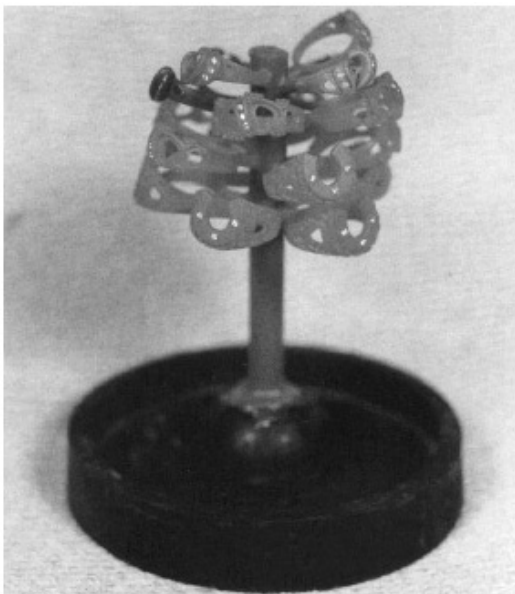


DATASHEET: Casting Gemstones in place by Ajit Menon

Treeing Waxes:

Waxes with Gem Stones may be set in a tree of any suitable length. For taller trees (greater than 6 inches), the metal force may cause some flashing on the castings at the extreme top of the tree. It is advisable to have wax: patterns without Gem Stones in the first two layers and the last two layers, with waxes containing Gem Stones in the middle. Waxes very close to the bottom of the tree (near the button) do not have as much metal force and sometimes might lead to some non fills for a vacuum assist type of casting. Treeing up the waxes in the above mentioned way eliminates the possibility of any such situations. Waxes may be set at an angle to facilitate smooth filling of the metal.

Figure: 3



Investing & Flask Burnout:

Investing is done in the normal way for either the automatic vacuum mix and pour or for the bowl- bell jar type of investing. All water -powder ratios and mixing & vacuuming times may be as normal.





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The flasks may be loaded and placed in the oven in the same way as for regular casting. Temperature of the oven may not exceed 900°F. A longer holding time (10 to 14 hrs) at this maximum temperature is recommended for proper burnout. A typical burnout cycle is shown below.

This low flask temperature often leads to casting defects such as non-fills of fine filigree castings and shrinkage porosity. For diamond castings, it has been claimed that when 2% by weight of boric acid is added to the investment powder while investing, the flasks may be heated in a oven temperature of 1350°F and still have good diamonds. No research is known to be documented for this process but theoretical explanation for this phenomena would be that the boric acid and investment mixture envelopes the diamonds and reduces the effect of oxidation and therefore the Gem Stones can withstand higher temperatures. Boric acid, upon heating will turn glassy and will help keep the oxidising atmosphere from being in contact with the diamonds. Boric acid solution mixtures are supplied by various vendors to prevent oxidation of jewellery during soldering and brazing process. It is a known fact, that even though diamonds burn and turn milky at temperatures above 1000°F in the burnout oven in an oxidising atmosphere, they can go through a reducing atmosphere brazing oven at 1400°F and still maintain their sparkle. This explains the effect of the surrounding atmosphere on diamonds when heated.

Casting:

There is no restriction as to the type of casting process for using this technique. Excessive metal pressure sometimes leads to flashing over the gemstones which often can be removed with a metal brush wheel. A wide range of yellow gold and silver alloys can be used. A reducing gas may also be used to prevent oxidation of the metal. In fact all parameters such as metal temperatures, fluxing, cover gas, used and new metal mixtures, etc. may all used as normal for a conventional casting method. Overheating the metal is not recommended, but a superheat of about 100 to 150°F above the liquidus temperature should be sufficient to give a good casting for a majority of the alloys.

Figure: 4





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Divesting (Investment Removal) Procedure:

The divesting procedure for Gem Stone Castings is very different than the normal procedure. Gem Stones often crack or shatter due to thermal contraction, stresses, and possibly metal contraction, if quenched immediately from high temperatures. The flask containing the Gem Stones has to be cooled in air, in a properly ventilated area for at least 3 hours prior to quenching. After the flask has cooled for 3 hours in air, tap on the button and the side of flask with a rubber mallet to knock off most of the investment. Removing the investment is a bit more difficult when it is cold than when it is hot. Remove the casting from the flask and quench the button only in water. for about 10 minutes to bring the whole casting to room temperature. The casting can now be sprayed as normal and soaked in hydrofluoric acid solution and/ or pickled as normal.

It is advisable to perform the divesting process in a separate container or a sieve to catch loose Gem Stones that have fallen off or have dislodged during the investing and casting process. If a particular ring did not fill properly, then all the gemstones would be left embedded in the investment.

Finishing Procedure:

Castings may be clipped as normal and checked for any loose stones. They may also be tightened at this stage. Grinding is done as normal. Tumbling in a abrasive media sometimes will scratch certain stones and the best way is to first test them. Diamonds are not damaged by any type of tumbling procedures. Steel shot burnishing may also damage certain kinds of stones but diamonds are not damaged by this process.

Hand soldering may be done safely as long as there is no direct heat applied to the stone. Again, quenching after hand soldering may crack or shatter certain Gem Stones. Oven Brazing at about 1450°F has been found to be safe for diamonds, rubies and garnets. Genuine Sapphires may darken. Jewellery with a majority of Cubic Zircon's' and synthetic gem stones also may be oven brazed.

Usually , a wide variety of ultrasonic cleaning solutions, heated in the range of 100°F to 150°F, do not seem to affect the Gemstones. Cyanide solutions do not affect diamonds, rubies, garnets, sapphires and a wide range of synthetic and lab created Gem Stones. Hand polishing of the jewellery may be successfully performed without any damage to the Gem Stones.

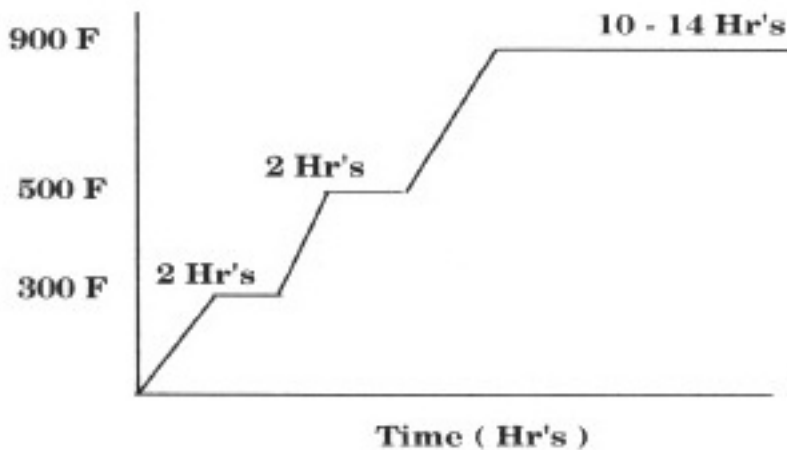




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Jewellery with Gem Stones cast in place can be of high quality and can save a substantial amount of labour costs.

Figure: 5



Gem Stone Casting has its own limitations. Only certain Gem Stones can be cast, and there is a limitation to the type of finishing process also. The advantages are savings in labour costs, ease of setting, low expenditure on tools and ease on the hands of the stone setters. The best way to determine the feasibility of a certain Gem Stone is to test a particular jewellery with the Gem Stone through the finishing process.

Reference:

Jack Weinraub

Casting With Gemstones, American Jewelry Manufacturer, June 1993, p 53 -66.

Arthur Altman

Cut Costs! Set Stones in Wax, American Jewelry Manufacturer, August 1988, p 43- 45.

