



DATASHEET:

Problems, causes and their solutions in stone-in-place casting process: latest developments by Dr Hubert Schuster

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Stone-in-place casting is no longer a novelty in the manufacture of Jewellery, although not until recent years has its use increased considerably and been introduced in many firms throughout the world, in the manufacture of both gold and silver Jewellery. However, it is also true that, notwithstanding their many years of experience, a large number of manufacturers still encounter continual unsolved problems. This article aims at providing some answers to solve the most common problems that occur in stone-in-place casting.



INTRODUCTION

Twelve years ago, during a seminar in Germany for advanced lost wax casting technology, I was able to learn about stone-in-place casting. Although the quality of the results was still not high, the enormous advantages of this technology convinced me to endeavour to learn more about and improve it until it was just as successful as hand setting and, if possible, even more so. Over the subsequent period, I have introduced the stone-in-place casting process to more than 50 firms from various countries. Each time I came across at least one new problem, which I was obliged to find the cause of and, above all, the solution to. It was this challenge that helped me to continually improve my knowledge of the stone-in-place casting process.

WHAT ARE THE ADVANTAGES OF THIS TECHNIQUE?

The most obvious advantage is lower labour costs, with savings ranging from 50-80% depending on the setting, the preparation of the model, the type and quality of cut, and the quality of stones. For example, a ring set pave-style with approximately 40 brilliant cut stones requires two hours of work from an experienced setter; with stone-in-place setting the work takes 10 minutes and can be performed even by worker who does not specialise in setting. In addition, the setting is stronger because the metal cast around the stones shrinks during the cooling phase, forming a tighter fit around the stones. All stones, but especially the smaller ones, look bigger because there is less need for the metal to hold the stones down.





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WHAT ARE THE SETTING METHODS?

There are two principal setting methods for stone-in-place casting. With the first, the stones are positioned in the rubber mould and the wax is injected around them; when the wax is extracted from the mould, the stones are already set. This method can be used only with round stones. With the second method, the stones are set in the wax. This method allows for the setting of any type of cut: round, oval square, marquise, pear, emerald, baguette, tapered baguette and fancy cuts.

WHAT TYPE OF STONE CAN BE CAST IN PLACE?

Almost all types of transparent, natural or synthetic stones can be used: diamond, ruby, sapphire, emerald, aquamarine, garnet, tourmaline, peridot, olivine, tanzanite, etc. It is best not to use stones that change colour with heat, such as amethyst, citrine or blue topaz.

THE STONE-IN-PLACE CASTING PROCESS

To obtain a good result, it's necessary to make some modifications at almost every step of the casting process.

- Correct preparation of the master is essential, and must be performed by someone experienced in stone-in-place casting.
- The type of rubber used for the mold, and how it is cut should be taken into account.
- Only a handful of injection waxes are suitable, and they should be used according to the manufacturer's instruction.
- The right tools must be used to set the stones in wax quickly, precisely and cleanly.
- When calculating the weight of the metal needed for casting, remember to exclude the weight of the stones from that of the whole wax tree.
- The preparation of investment does not require changes, but the addition of a protective liquid (PRO-TECH: D) or the use of SRS STONECAST is necessary when casting with diamonds and gives improved results with all other stones except cubic zirconia.
- Flask dewaxing in a special steam oven is recommended.
- It is necessary to have a fully programmable oven and program it correctly. Choosing the proper master alloys is an important fact.
- It is not necessary to have special equipment, but it helps to obtain a constant high quality. After casting it is important to allow the flask to cool gradually to avoid thermal shock which could damage the stones.
- Finishing and polishing, automated or manual, must be adapted to obtain the best results.





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WHAT ARE THE MOST COMMON PROBLEMS, THEIR CAUSES AND SOLUTIONS?

Problem No.1: The diamonds have lost their shine and become white

Causes:

- 1 Incorrect flask burnout temperature
- 2 Metal melting temperature too high
- 3 Unsuitable investment powder
- 4 No additives in the investment

Solutions:

- 1 Flask burnout must not exceed 630°C and the flask casting temperature must be decreased to about 490°C to 530°C
- 2 The metal temperature must be decreased to that recommended by the manufacturer of the master alloy or alloy supplier
- 3 Use only specific investment for casting with diamonds 4 Better still, add a specific additive for casting with diamonds

Problem No.2: The stones have a black or dark rim after casting

Causes:

- 1 Alloy not suitable for casting with stones
- 2 Metal melting temperature too high

Solutions:

1 Choose an alloy suitable for casting with stones.

There are various alloys suitable for casting with stones:

- Pd white gold
- White gold with low Ni content
- Yellow gold with or without Si
- Red gold with or without Si
- Silver with or without Si

The main specifications of these alloys must be:

- No oxidizing during casting
- Metal soft and not brittle
- Low shrinkage





DATASHEET:

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2 Comply strictly with the melting temperatures recommended by the alloy supplier.

Problem No.3: Some stones have cracked or split entirely

Causes:

- 1 stones are touching one another
- 2 stones are overlapping slightly
- 3 incorrect alloy

Solutions:

- 1 leave a minimum space between stones (round stones) and make sure the corners of the stones are not touching (rectangular stones)
- 2 same as above
- 3 only use alloys suitable for casting with stones

Problem No.4: The color of the stones has changed

Causes:

- 1 Stones not suitable for casting
- 2 Treated stones
- 3 Flask and metal casting temperatures not ideal

Solutions:

- 1 Do not use stones such as amethyst, citrine or blue topaz
- 2 Ask your suppliers for stones that have not been treated
- 3 Adjust the flask and metal casting temperatures to the set stones. If you must use extremely low flask burnout temperatures, use an investment additive as described in the article: Roland Loewen (The effect of additives on the high-temperature chemistry of investment materials) at the SFS in 1999; this may help to prevent carbonaceous residues from being left in the flask.

Problem No.5: Some stones are covered with metal

Causes:

- 1 The rear pre-setting hole is too small
- 2 The rubber mold is not made correctly
- 3 The waxes have not been properly checked
- 4 During setting, the waxes are overheated causing the wax to melt around the stone
- 5 The waxes have accumulated surface tension
- 6 The waxes are positioned incorrectly in relation to the wax tree
- 7 The investment mixture is wrong





DATASHEET:

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Solutions:

- 1 Leave the rear pre-setting hole as large as possible (the hole diameter should be at least 2/3 times the diameter of the stone)
- 2 It is advisable to use silicone rubber and fill the pre-setting holes well before vulcanizing
- 3 Check the waxes well and, if necessary, open the pre-setting holes well
- 4 Do not heat the stones to "set" them in wax; if required, heat them only slightly and make sure the stones are not covered with wax
- 5 Remove surface tension on the wax with an anti-static bath or spray
- 6 Position the wax on the wax tree with the stones facing downward so that no air bubbles can form behind the stones
- 7 Use a more diluted powder to water ratio

Problem No.6: Some stones have moved completely

Causes:

- 1 The majority of causes are identified in problem No.5
- 2 Pre-setting was performed without through hole

Solutions:

- 1 The same solutions as problem No.5
- 2 Each stone requires a through hole in the master piece for investment to hold well and to obtain good results in casting

Problem No.7: The stones are not cast solidly or have dropped out after casting

Causes:

- 1 Incorrect pre-setting of the master piece
- 2 Insufficient sprue feed of the master piece
- 3 Waxes not checked before setting
- 4 Stone setting in the wax is not solid
- 5 Stones not correctly gauged or of the wrong size
- 6 Metal temperature too low
- 7 Insufficient suction/pressure during casting

Solutions:

- 1 Correct the pre-setting of the master piece
- 2 Enlarge the sprues or add others for better metal feed during casting
- 3 Check the waxes well, especially the pre-setting part
- 4 Set the stones solidly and check the hold of the stones by banging the wax lightly
- 5 Only use gauged stones of the correct size





DATASHEET:

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- 6 If necessary, increase the metal temperature to obtain complete castings
- 7 Check the seals and vacuum pump of the casting machine; for extremely fine objects or those with widespread pave, use the "vacuum amplification" system

OTHER LESS-COMMON PROBLEMS:

- Deformed cast objects
- Diamonds with black points
- The level of stones is not even
- Metal between stones opaque or too visible
- Metal stains on the stones
- Porous prongs
- General casting defects; these were described excellently in detail in the article: Characterisation and correction on casting defects, by Dr. Helmut F. Frye Ph.D., of Advanced Casting Technology, LLC at the SFS 1999, Page 413

NEWS ON STONE-IN-PLACE CASTING:

- Stone-in-place casting for high-dollar jewellery
- Diamond-in-place casting with 18-carat Pd white gold
- Invisible setting by casting in silver and any kind of gold alloy, including Pd white gold
- Stone-in-place casting with platinum 950

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