SETTING THE STANDARD

DATASHEET:
Casting with gemstones set in wax by United PMR

No Guarantees are made for the following methods, which are provided as information for United customers.

GEMSTONE SET IN WAX CASTING has evolved over the past 10 years from a secret process used by a few. manufacturers to a commonly used method. Many new products are now available to make gemstone in place casting a more reliable process. United VHF alloys are formulated for the high fluidity required for gemstone in place casting. United also has special de-oxidised Sterling Silver Alloys that give excellent results when casting gemstones in place with Sterling Silver. A number of investment manufacturers have specially formulated investment powders to protect gemstones from heat during burn-out and casting. Supply houses carry various proprietary investment additives that can be added to regular investment to protect the gemstones from heat. Boric Acid is the main ingredient in investment additives along with retarding agents to counteract the rapid set up times caused by the Boric Acid.

GEMSTONES SUCCESSFULLY CAST IN PLACE ARE: Diamond, Ruby, Sapphire, Garnet, Cubic Zirconia and Various lab grown coloured gemstones.

GEMSTONES NOT RECOMMENDED ARE: Emerald, Opal, Jade, Amethyst, Topaz, Peridot, Coral, Aquamarine, Tourmaline, Topaz, Pearl, Lapis Lazuli, Turquoise and Onyx as these gemstones may bum, crack or discolour when exposed to high heat.

GEMSTONES SELECTED FOR CASTING IN PLACE should be high quality, dimensionally accurate, free of flaws and inclusions that can turn milky, frosty or crack when heated.

DESIGNS SELECTED FOR CASTING IN PLACE must allow support in at least 2 places by the surrounding investment. The gemstones need to be held in place securely to withstand investing, burn out and casting without coming loose.

MODELS SHOULD BE DESIGNED FOR CASTING IN PLACE. Model makers must make allowances for shrinkage factors in rubber moulds and waxes. The settings should have pre-knotched prongs and/or channel seats to allow the stones to be snapped into place and hold them securely. Using existing Models for. gemstone in place casting often results in loose fitting gemstones and till problems due to inadequate sprues.

LARGER SPRUES ARE NEEDED for casting gemstones in place. The gemstones will chill molten metal during the cast and a well thought out sprue system is necessary to avoid shrinkage in stone set areas. Often a multiple sprue system will be needed to properly feed molten metal to the casting. A 10, 2 & 6 O'clock sprue system may be needed on certain designs to provide adequate fill of the casting

Specialist Refractory Services Limited, Amber Business Centre, Riddings, Derbyshire, DE55 4BR, England.
Tel: +44 (0)1773 608969 | Fax +44 (0)1773 540105 | www.srs-ltd.co.uk | sales@srs-ltd.co.uk

DATASHEET:
Casting with gemstones set in wax by United PMR

WAXES USED FOR CASTING GEMSTONES in place should have a good shape memory and the ability to snap back in place after the stone is set in the wax mounting. A mixture of 50% Kerr Aqua Flake and 50% Blue Plastowax works well for wax setting. Some suppliers carry special wax formulations for gemstone in place casting that have a good shape memory.

WAXES SHOULD BE CAREFULLY INSPECTED after injection. All parting lines and flashing should be removed before attempting to set the gemstones. Pay close attention to mounting areas, edges of prongs and seating areas in the wax pattern as these areas are very difficult to clean up after casting in metal.

HELPFUL TOOLS FOR SETTING GEMSTONES IN WAX are Vacuum tweezers, Sharp pointed tweezers, Small rounded and pointed spatulas, Electric wax pen and a small alcohol or bunsen burner to heat the spatulas.

SETTING GEMSTONES IN THE WAX PATTERNS can be aided by the use of Vacuum Tweezers to pick up and hold smaller stones while a gentle pressure is used to insert them into the mountings. This is where the type of wax being used is important as the stones will snap into place using the correct wax mix. For larger stones, hand tweezers can be used assisted by pointed spatulas. A heated wax pen can be applied to larger stones, warming them up and softening the wax slightly to allow easier insertion into the settings.

SETTING GEMSTONES IN THE RUBBER MOULD may be accomplished on certain channel set designs. The models are set with stones before making the rubber moulds, this leaves recesses in the mould allowing stones to be set in the rubber mould and wax injected around then. Proper alignment is crucial and more flashing is experienced with this process. This method is not very popular due to the wax flashing coating the gemstones and alignment problems.

CHANNEL SET BAGUETTES IN WAX require close attention to spacing. A small space should be allowed between the closely set stones to prevent the stones from touching. Failure to leave a space can result in cracked stones. The molten metal will shrink as it solidifies compressing the channel set baguettes. If no space is allowed between the stones for metal shrinkage, the gemstones can crack from compression. A small feeler gauge is often helpful in this process -.001 " to .005" depending on stone size and number of stones in the channel.

GEM SET WAX, PATTERNS SHOULD BE CARBFULLY INSPECTED before assembling trees. The alignment and fit of gemstones may need a slight adjustment before committing to casting. Check the table height on the gems and make any needed adjustments with a heated wax pen. It is much easier to make adjustments in the waxes than it is after casting in metal.

Specialist Refractory Services Limited, Amber Business Centre, Riddings, Derbyshire, DE55 4BR, England.
Tel: +44 (0)1773 608969 | Fax +44 (0)1773 540105 | www.srs-ltd.co.uk | sales@srs-ltd.co.uk

DATASHEET:
Casting with gemstones set in wax by United PMR

WAX PATTERNS SHOULD BE MOUNTED ON A TREE rather than on a sprue base. The size of the tree is dependent on the burn out, flask temperature used and the casting procedure used. For Vacuum casting a 6" flask can be used for the lower temperature method and up to a 10" flask can be used with the higher flask temperatures possible with the special gemstone casting investments. For Centrifugal casting a standard size flask can be used for both higher and lower flask temperatures. Be sure to leave a one inch space between the sprue base and the first row of waxes, this will avojd the main shrinkage area on the tree.

INVESTING IS DONE ACCORDING TO THE MANUFACTURERS INSTRUCTIONS. If you are using the special gemstone casting investment be sure to read and follow the recommended investing procedures. Mixing instructions may differ between investment manufacturers.

MAKE SURE THE INVESTED FLASKS HAVE SUFFICENT VACUUM TIME to get rid of air bubbles. Any air bubbles trapped under or near the stone set areas will create metal nodules in the castings that are difficult to remove. A very small amount of liquid dishwashing detergent added to the water used for investing will aid the wetting properties of the investment to prevent trapped air bubbles.

A**LLOW INVESTED FLASKS TO SET FOR 1 TO 1 1/2 HOURS.** If steam de-waxing is used allow a 2 hour set up time before beginning the de-waxing cycle. Inadequate set up time can cause investment breakdown during the steam de-waxing process from hydration of partially set investment.

STEAM DE-WAXING IS HELPFUL for gemstone set in wax casting. Due to the somewhat lower burnout temperatures used in this process, steam de-waxing is helpful in removing wax from the invested flasks. Allow a 2 hour set up time after investing the flasks before putting into a preheated steam de-waxer. The steam dewax cycle should be limited to 1 hour maximum followed by immediate transfer to a preheated bum out oven set at 275 to 300 degrees F. Leaving flasks in a steam dewaxer longer than 1 hour can result in water marks on the castings or investment breakdown. Do not allow flasks to cool down once the de-wax cycle has started.

BURN OUT OVENS NEED ACCURATE CALIBRATION for gemstone in place casting. Incorrect temperature read outs can cause burning or discoloration of gemstones if overheating occurs. Be aware of any hot spots in the burn out oven that may cause uneven heating of the flasks.

BURN OUT OVENS USED IN THIS PROCESS, require adequate air inlet and exhaust The bottom plate in the burn out oven should have grooves in it to allow proper air flow into the flasks. If the oven does not have grooves in the bottom plate some ceramic supports should be used to slightly elevate the flasks to allow better air flow into the main sprue area.

Specialist Refractory Services Limited, Amber Business Centre, Riddings, Derbyshire, DE55 4BR, England.
Tel: +44 (0)1773 608969 | Fax +44 (0)1773 540105 | www.srs-ltd.co.uk | sales@srs-ltd.co.uk

DATASHEET:
Casting with gemstones set in wax by United PMR

BURN OUT PROCEDURES FOR GEMSTONE IN WAX CASTING. There are 2 methods commonly used for gemstone in place casting, a low temperature method using regular investment and a higher temperature method using special investments or investment additives. Most manufacturers now use the higher temperature method with the special stone casting investments to protect the gemstones from heat.

BURN OUT CYCLE FOR THE LOW TEMPERATURE METHOD using regular investment mixes that do not contain additives to protect the stones;

- STEAM DE-WAX 1 HOUR
- 300°F 2 HOURS
- 500°F 2 HOURS
- 750 to 800°F 10 HOURS
- DON'T EXCEED 850°F
- DO NOT QUENCH THE FLASKS AFTER CASTING
- Air cool flasks 2 to 3 hours before breaking out investment

BURN OUT CYCLES USING SPECIAL INVESTMENTS WITH ADDITIVES to protect the gemstones from heat damage during burn out and casting. Two investment manufacturers SRS and Ransom & Randolph have special formulations designed for casting gemstones set in wax. The following burn out cycles are recommended by the respective manufacturers.

SRS STONECAST

- Recommends 2 to 3 hour set up time.
- Steam De-wax –3/4 to 1 hour
- 356°F -3 hours
- 428°F -3 hours
- 707°F -3 hours
- 1022°I; -2 hours
- 1166°F ~ 6 to 9 hours
- Do not quench flasks after casting.
- Air cool flasks to room temperature.

R & R SOLITARE

- Recommends 2 hour set up time.
- Steam De-Wax -Optional
- 302°F -4 hours
- 707°F -2 hours
- 1247 dcg. F -3 hours
- Cast Temp. ~ 3 hours
- Burn out temperature can vary depending on type and quality of gemstone
- Do not quench flasks after casting, cool to room temp.

Specialist Refractory Services Limited, Amber Business Centre, Riddings, Derbyshire, DE55 4BR, England.
Tel: +44 (0)1773 608969 | Fax +44 (0)1773 540105 | www.srs-ltd.co.uk | sales@srs-ltd.co.uk

DATASHEET:
Casting with gemstones set in wax by United PMR

CHECK WITH YOUR SUPPLY HOUSE as various investment manufacturers have come out with new mixes for casting gemstones in place. There are also proprietary investment additives available from various supply houses that are mixed with regular investment to protect the gemstones from heat. Be sure to follow the recommended mixing and burn out procedures.

INVESTMENT ADDITIVE FORMULAS used by a few manufacturers to prevent the burning of the gemstones during bum out and casting are mainly boric acid added to regular investment powder. The draw backs to the boric acid additive is a rapid set up time, usually 5 to 6 minutes and the extreme hardness of the investment after bum out. The additives are as follows:

For each kilogram of investment add:

- 20 to 30 Grams of Boric Acid powder
- 420 to 450 ML of water (some prefer deionised)

Or

- For each kilogram of investment add:
- 28.5 Grams of Boric Acid powder
- 1.5 Grams of Borax 10 Mol. Powder
- 450 ML of water (some prefer deionised)

Weigh and measure all materials. Heat water to boiling, add Boric Acid or Boric Acid and Borax. Stir well until Boric Acid and Borax is completely dissolved in water.. Allow the water and Boric Acid solution to cool to room temperature. Add investment powder and mix in the usual way. Work very quickly as the investment will begin to set up in about 5 to 6 minutes. Some of the normal procedures will need to be shortened due to the faster set up time. Let flasks set up for 2 hours before starting the de- waxing cycle. Steam de-waxing is helpful A slow ramp of temperatures is advisable during burn out, beginning at 275 to 300°F. A safe top burn out temperature is 1050 to 1100 degrees F for about 6 hours. Do not quench flasks, air cool 2 to 3 hours after casting before breaking out flasks. Investment will be very hard and somewhat difficult to remove.

USE GREAT CARE WITH MARGINAL QUALITY DIAMONDS, a lower temperature bum out may be advisable to prevent breakage or discolouring of stones with inclusions. It is usually best to use good quality diamonds for casting in place.

BURNOUTS FOR GEMSTONE SET IN WAX CASTING are often less complete than standard burn out procedures due to the lower top end temperatures used. Defects from unburned carbon residues may be: experienced from time to time. Results are usually better using the special investments or investment additives that allow somewhat higher burn out temperatures to be: used.

Specialist Refractory Services Limited, Amber Business Centre, Riddings, Derbyshire, DE55 4BR, England.
Tel: +44 (0)1773 608969 | Fax +44 (0)1773 540105 | www.srs-ltd.co.uk | sales@srs-ltd.co.uk

DATASHEET:
Casting with gemstones set in wax by United PMR

ALTERNATIVE METHOD FOR CUBIC ZIRCONIA
and some laboratory grown synthetic gemstones. Top quality Cubic Zirconia such as Swarogem CZ's have been cast in regular investment using close to regular burn out and flask temperatures without damage to the stones. The flasks should not be quenched after casting and a 2 to 3 hour air cooling is required before breaking out of the flasks. It is best to run a few test casts to determine the resistance of your CZ's to discoloration on your existing equipment.

CASTING MAYBE DONE BY VACUUM OR CENTRIFUGAL METHODS. Vacuum casting is more popular for gemstone in place casting due to less turbulence being developed during the cast that could dislodge gemstones. However, excellent results have been obtained from centrifugal casting. The most successful metals for gemstone set in wax casting are 8 to 14 karat yellow gold and sterling silver.

THE GREATEST SUCCESS HAS BEEN OBTAINED with modern casting machines with accurate temperature controls and a strong vacuum. Many excellent casting machines are available today, some even have overpressure in conjunction with vacuum to assist in getting an excellent fill at lower casting temperatures. Most major manufacturers use casting machines for gemstone in place casting.

UNITED V H F ALLOYS GIVE EXCELLENT RESULTS with gemstone set in wax casting in 10 and 14 karat yellow gold due to higher fluidity and lower casting temperatures. The V H F alloys are available in 5 popular yellow colours. United deoxidized Sterling Silver alloys will give excellent results with gemstone set in wax casting coming out of the flask white and free of fire scale.

NICKEL WHITE GOLD ALLOYS ARE MORE PROBLEMATIC when casting gemstones set in wax. Due to the high casting temperatures and more rapid solidification characteristics of nickel white gold alloys, more casting problems are encountered. The nickel white gold alloys can have adverse reactions with the unburned wax residues in the flask due to the lower top end bum out temperatures causing porosity in the castings. Shrinkage porosity due to rapid chilling in the stone set areas is more common in white gold. The long air cooling time of the flasks used in gemstone set in wax casting can create excessive hardness in white gold alloys due to prolonged periods in the 500 to 800 degree F range which acts as a heat treatment that hardens the white gold. The lower nickel content white gold alloys usually work better for gemstone set in wax casting although they may have a slight yellowish tint. Somewhat smaller size trees are more successful with white gold Occasional cracking of channel set CZ's has been a problem in white gold that does not occur with diamonds, it seems to be due to the hardness of the white gold and the slightly higher rate of shrinkage on solidification. Check with your United representative for alloy recommendations.

Specialist Refractory Services Limited, Amber Business Centre, Riddings, Derbyshire, DE55 4BR, England.
Tel: +44 (0)1773 608969 | Fax +44 (0)1773 540105 | www.srs-ltd.co.uk | sales@srs-ltd.co.uk

DATASHEET:
Casting with gemstones set in wax by United PMR

8 KT TO 14 KT YELLOW, GREEN. RED, PINK AND WHITE GOLD have been successfully used for casting gemstones in place in high production environments.

18 KARAT YELLOW, GREEN AND WHITE GOLD have been successfully used for casting gemstones set in wax. Somewhat smaller trees are normally used due to the more rapid solidification of the higher gold content alloys. Avoid using 18 karat pink or red gold alloys for casting gemstones in place, the long cooling times in the flask cause cracking and brittleness in these alloys.

20KT TO 22KT YELLOW GOLD has been used for casting gemstones set in wax casting. Centrifugal casting has been more successful with the high karat gold alloys than vacuum casting. The high flask temperatures used for vacuum casting high karat gold alloys are much to hot for the gemstones. The lower flask temperatures used for centrifugal casting are more compatible with the gemstones in this process.

STERLING SILVER is very successful for gemstone set in wax casting. It is normally used with Cubic Zirconia and various lower cost synthetic gemstones. United deoxidised Sterling Silver alloys give excellent results when casting gemstones in place and casts with greatly reduced porosity without firescale.

ALLOW FLASKS TO AIR COOL AFTER CASTING, do not quench. This will prevent cracking of the gemstones from thermal shock. Most casters allow a 2 to 3 hour air cooling before breaking out of the flasks.

BREAK OUT FLASKS OVER A SEPARATE CONTAINER to catch any gemstones that may have come loose during the investing or casting process.

THE NEWER GEMSTONE CASTING INVESTMENTS will be harder than standard investment and somewhat more difficult to remove. A hammer may be required to remove the investment from the flask. A high pressure water gun is very helpful in removing the investment from the castings. A good de-vesting chemical is very useful in removing the investment De-vesting tanks with ultrasonic power are now available which are very useful in investment removal. Avoid using Hydrochloric acid as a de-vesting chemical on gold alloys under 18 karat. Check the chemical resistance of the gemstones being used before placing gem set castings in devesting solutions.

MAGNETIC PIN TUMBLERS ARE VERY USEFUL in shining up hard to reach areas of the casting. Use great care if castings are bombed in cyanide, it may attack delicate prong areas of the casting causing the gemstones to come loose.

Specialist Refractory Services Limited, Amber Business Centre, Riddings, Derbyshire, DE55 4BR, England.
Tel: +44 (0)1773 608969 | Fax +44 (0)1773 540105 | www.srs-ltd.co.uk | sales@srs-ltd.co.uk

DATASHEET:
Casting with gemstones set in wax by United PMR

INSPECT GEMSTONE SET CASTINGS for misalignment and loose stones before beginning the finishing process. If any missing stones are noticed, check the container the flasks were broken out over to retrieve any missing gemstones.

USE GREATER CARE IN FINISHING GEM SET CASTINGS. Check the media used in mass finishing to make sure it won't scratch or damage: the gemstones. Be careful finishing the prong areas of the gem set castings to avoid polishing away the prongs.

KEEP THE GOLD SCRAP FROM CASTING GEMSTONES IN PLACE SEPARATE from scrap generated in regular casting. Due to the lower bum out temperatures used in casting gemstones set in wax the gold alloys may become contaminated faster from the unburned residues in the flasks. The gold alloy from gemstone set in wax casting may need refining sooner than the scrap from regular casting.

MANUFACTURERS OF SPECIAL GEMSTONE CASTING INVESTMENTS:

SRS STONECAST INVESTMENT
Specialist Refractory Services Ltd.
Amber Business Centre,
Riddings,
Derbyshire,
DE55 4BR
England
Phone (44) 1773-608969
Fax (44) 1773-540105

CHECK WITH YOUR SUPPLIER, other manufacturers are now supplying gemstone casting investments and proprietary investment additives.

GEMSTONE SET IN WAX CASTING is an evolving technology with new materials, equipment and methods being developed each year. Excellent articles have been published in trade publications and lectures on the subject have been given at various trade shows. Several papers have been given at the Santa Fe Symposium on casting gemstones set in wax. More information becomes available each year on this subject.

DATASHEET:
Casting with gemstones set in wax by United PMR

ARTICLES PUBLISHED ON GEMSTONE SET IN WAX CASTING:

- Casting with Gemstones Myth or Reality .By Jack Weinraub American Jewellery Manufacturer. June 1993
- Getting the best from wax setting. By Editor Jewellery News Asia -February 1997
- Casting Stones By Ajit Menon American Jewehy Manufacturer -March 1997
- Setting Pretty By Andre Janiszewski American Jewellry Manufacturer -March 1998

BOOKLET AVAILABLE:

- Casting in Place with Cubic Zirconia, Synthetic and Natural Gemstones.

Available from:
SWAROGEM
98 San Jacinto Blvd.
Suite 1420
Austin TX 78701 U.S.A.
Phone (512) 478 8911
Fax (512) 482 9480
Other offices World Wide