Cracking and Flashing in Jewelry Molds

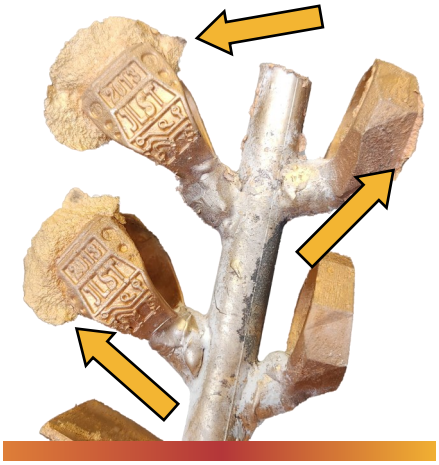
TECH TIPS

One of the most common issues investment casters face is mold cracking and flashing defects on jewelry castings. However, understanding the science behind jewelry investments and the process may help you to overcome these defects.

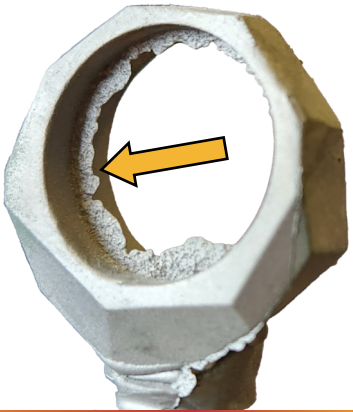
What is Flashing?

Flashing, also known as finning, presents as sharp metal fins that appear perpendicular to the surface of the casting. These defects vary in severity from superficial (about 1 mm high) to heavy (several mm high). This happens when the mold cracks, allowing the metal to overfill some areas of the casting.

Heavy flashing defects



Superficial flashing defect



Understanding Jewelry Investments

Ingredients

Jewelry investments are a mixture of three main ingredients: a binder, refractories, and controlling chemicals.

- Binder – For casting precious and other low temperature alloys, this is typically gypsum. Gypsum will shrink during burnout.
- Refractories – Typically some form of silica which can not only standup to the burnout and alloy temperature, but can also expand during burnout to counteract the shrinkage of the gypsum.
- Controlling chemicals – These ingredients control working time, set time, and the fluidity of the mixed investment.

Process

The jewelry investment is added to water and mixed well before pouring into the flask, investing it. This is followed by a bench cure, burnout, then casting. Cracking and flashing defects can be a result of many factors in this process such as improper water to powder ratio, improper bench curing, and issues within the burnout cycle. By reviewing these few areas of your process you may be able to eliminate any mold cracking and flashing defects.

Potential Causes of Cracking and Flashing Defects

Improper Water to Powder Ratio

If too much water is used, the binder (gypsum) becomes diluted, resulting in a weaker mold. To avoid this, follow the recommended water to powder ratio for the investment you are using. When a range is given for water to powder ratio, remember that the less water used, the stronger the mold will be.

Improper Bench Curing

Bench curing is defined as the time a mold sets undisturbed after the investing process is complete. Immediately after investing, while the investment is still fluid, the mold should be transferred to vibration free setting where it can remain undisturbed for a minimum of 2 hours. This time is essential in allowing the gypsum to develop to its maximum green strength. A high green strength allows for the mold to withstand base removal, mold preparation, and other essential tasks before burnout.

Burnout Cycle

Improper burnout is the most common cause of mold cracking and flashing defects. There are three distinct segments of a burnout cycle: drying, thermal transition, and pattern burnout. The first two segments of the cycle can greatly impact cracking and flashing defects.

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Drying Segment

Jewelry molds contain water and need to be completely dried in the first segment of the burnout cycle. Proper drying can be accomplished by placing the mold in an oven, such as R&R's Vulcan® burnout furnace, and heating to 300°F (150°C) and holding the temperature until the mold is completely dry. Hold times vary depending on the investment you are using, but typically range from 1-3 hours. Proper hold times for various sized flasks are listed on the applications instructions for R&R's jewelry investments. There is no downside to holding at 300°F (150°C) for longer than the recommended time. The objective of this segment is for the mold to be completely dry before the next phase of the burnout cycle begins. If the mold is not completely dry before moving forward, mold cracking and flashing defects may occur.

Thermal Transition

In this stage of the burnout cycle, when the temperature ranges from 300–700°F (150-370°C), a lot is happening in the mold. The gypsum is shrinking and the refractories are expanding to compensate for the shrinkage. If the molds are not completely dry before entering this segment, the heating of the mold will be inconsistent. The wet parts of the mold will not heat past 212°F (100°C) until they are dry. Meanwhile, the parts of the mold that were dry are heating at the same temperature as the oven. This difference in temperature will cause different parts of the mold to expand at different times, leading to mold cracking and flashing. However, even if the mold is completely dry before entering this segment, cracking and flashing can still result if you raise the oven temperature too quickly. Be sure to follow the proper rate of temperature increase as indicated on the appropriate R&R product's application instructions.

Need Additional Assistance?

R&R's technical team of experts support customers with a focus on constant improvement. If you have any questions regarding application, troubleshooting, feedback, or tips, do not hesitate to contact our technical team by calling 800-800-7496 (US) or by emailing technical@ ransom-randolph.com.

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