

# Platinum Casting Problems and Solutions

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The first thing for all of us to remember is that Platinum, just like all other metals, has its own list of characteristics in all phases of manufacturing that must be professionally addressed. The following guide is designed as an easy to use list of Platinum manufacturing related problems, questions, or suggestions that we have come across in the past. The guide is intended to get you looking at ways to improve your operation or reduce your costs to manufacture. Model and design limitations in this guide will not be addressed.

## SECTION I.

### 1. WHAT CAUSES FINS ON MY CASTINGS?

#### A. Poor quality investment

##### *Corrective Action:*

In general, a phosphoric acid investment will set up harder and better than non phosphoric based investments. "Finning" is usually caused by internal fractures in your investment flask in to which the metal will flow. There are a couple of high grade investments

on the market led by Romanoff's "J" formula Platinum investment.

#### B. Flask put into hot oven.

##### *Corrective Action:*

Oven should be at room temperature when flasks are first put into the oven. (J Formula)

#### C. Wrong absorbent paper used.

##### *Corrective Action:*

Use only the absorbent paper from your supplier of investment. The engineered rate of absorbency varies greatly from brand to brand. Do not use paper towels, hair dryers, napkins or any other such things.

#### D. Rough handling of flasks prior to burnout.

##### *Corrective Action:*

Flasks should be gently moved from location to location prior to burnout. It is best if the flask is moved directly from the vacuum table to the hearth plate of the room temperature burn-out oven.

#### E. Too much moisture still in investment when oven temperature reaches 212° F, 100°C (boiling point of water.)

##### *Corrective Action:*

Reduce amount of investment from the top of your highest piece to the top of the flask to no more than 1" (25mm) (for J Formula). Also flask must be accurately held at 190°F to 200°F, for the first hour of burnout.

#### F. Centrifugal speed on your casting machine is too high.

##### *Corrective Action:*

Reduce settings to lowest acceptable level to fill your thinnest pieces.

#### G. Improper powder to liquid ratio.

##### *Corrective Action:*

Instructions for proper mixing ratios must be followed accurately. Keep in mind that Platinum investment as well as gold investment is hygroscopic in nature and will be affected by humidity in your area. Be aware of vast seasonal changes and track humidity on a day to day basis to detect corresponding problems with finning. You must keep the bags tightly sealed when not in use and unused investment should not be opened until needed. The shelf life is indefinite as long as you follow these basic procedures. A water to powder ratio change of up to 2% might be appropriate depending on your exact humidity conditions.

#### General Statement.

Most "investment related problems" reported by customers using all types of investment are called in as the seasons change, Winter (*low humidity*) to Summer (*high humidity*). Do not underestimate this phenomena. Track humidity when you run in to problems.

#### H. Absorbent paper has absorbed atmospheric moisture and therefore has lost some of the absorbency it is capable of.

##### *Corrective Action:*

1) Always store the paper in plastic bags that are tightly sealed. Re-seal after each use.

2) If this is suspected you can "dry out" the paper by placing on the top of a warm oven for a few minutes prior to use.

#### I. Wax not eliminated completely before the boiling temperature of

the wax is reached. The wax boils and breaks down the adjacent investment surface.

*Corrective Action:*

Cut a hole which is approximately ½" (12mm) diameter in the center of the paper base directly under the wax cone to which the pieces are sprued.

## 2. WHY DO I GET A ROUGH SHANK SURFACE ON MY CASTING?

### A. Improper spruing.

*Corrective Action:*

Increase diameter of your sprue.

**General Statement:**

For Platinum pieces, sprues are generally larger and shorter than other metals. Do not use molds designed for use with other metals without some sprue modification.

### B. Improper sprue wax used.

*Corrective Action:*

Use only lower temperature sprue wax for your buttons and sprue.

**General Statement:**

This ensures complete flow of your investment wax from your pieces resulting in smoother surfaces.

### C. Poor quality wax used.

*Corrective Action:*

Use only waxes with very low ash content. Certain brand waxes are very high in ash content which will leave a deposit on your shanks (especially on larger pieces).

## 3. WHAT ARE THE BASIC CAUSES OF ROUGH SURFACES ON CASTING?

### A. Generally from metal temperature too high.

*Corrective Action:*

- 1) Check with your metal supplier for proper melting and casting temperatures.
- 2) If melting with temperature sensing, set your machines accordingly to avoid overshooting temperature.
- 3) If melting with a torch, cast no more than three seconds after metal puddles.

**General Statement:**

If your pieces do not fill with the correct casting temperature, it is a sign of something else wrong. Raising temperatures to higher levels to fill will only lead to other issues such as porosity or roughness or investment breakdown etc. Use this guide to try and determine the root cause of the original problem.

### B. Burnout temperature too high. Overheating of investment will result in deterioration of the investment.

*Corrective Action:*

- 1) Follow burnout directions from the manufacturer.
- 2) Do not exceed 1600°F, 904°C.
- 3) Check your oven controller for proper calibration at both the high and low range of the cycle.

### C. Poor original model and/or wax.

*Corrective Action:*

- 1) Examine your casting carefully and compare it to your waxes and model for repeat roughness. Correct the defect as needed.
- 2) Powder on the wax which is not cleaned off will show up on the surface of the castings.

### D. Poor quality investment.

*Corrective Action:*

In general nonphosphoric acid based investments will give a poor surface finish with much higher reject rate. Romanoff Brand "J" Formula is a quick setting (six hours from investing to casting) investment that will provide you with a smoother and higher luster surface. This much smoother surface will save you time and money in finishing labor and supplies.

### E. Improper mixing of investment which may leave powder "lumps" in the mix.

*Corrective Action:*

Use an electric mixer to thoroughly mix your batch of investment. Follow investment directions carefully.

### F. Cross contamination from gold or silver investing process.

*Corrective Action:*

Ideally, Platinum should be processed 100% separately from gold/silver and other metals. If this is impossible due to budget or site constraints you must take extraordinary measures to clean equipment for mixing/investing. At the very least invest in a separate mixer and all of the basic accessories. Keep your investing areas and equipment spotless as a general rule, at all times.

### G. Premature breakdown of your crucible which results in particles from the crucible mixing with the Platinum.

*Corrective Action:*

Some casters like to coat their crucibles with a zirconium oxide paint which reduces contamination from your crucible in succes-

sive castings. Zirconium oxide can be brushed or sprayed on.

#### **General Statement:**

This Zirconium oxide will not extend the life of your crucible.

#### **4. WHAT CAUSES MY PIECES NOT TO FILL DURING CASTING?**

##### **A. Improper spruing.**

###### *Corrective Action:*

Platinum sprues should be a larger diameter and shorter than for other metals. Do not use molds designed for other metals for Platinum pieces.

##### **B. Centrifugal casting speed too slow.**

###### *Corrective Action:*

Increase speed gradually for the type tree and pieces being cast.

##### **C. Poor design of piece.**

###### *Corrective Action:*

Check your model design for applicable improved sprue techniques or design modifications for easier flow of the metal.

##### **D. Flask temperature too low.**

###### *Corrective Action:*

- 1) Follow burnout cycle suggested by your supplier.
- 2) Check oven calibration.
- 3) Shorten the time elapsed between removal of the flask from the oven and the actual time to cast.
- 4) Raise oven temperature but avoid exceeding 1600°F, 904°C.

##### **E. Cast temperature too low.**

###### *Corrective Action:*

- 1) Check with your metal supplier for proper melting and casting temperatures.

- 2) Adjust your casting temperature accordingly.

#### **5. WHY DOES MY CAST PIECE GET DISTORTED?**

##### **A. Excess centrifugal speed.**

###### *Corrective Action:*

Reduce centrifugal speed setting of your casting machine.

##### **B. Rough handling of castings while still hot after removal of investment.**

###### *Corrective Action:*

Allow the castings to cool completely before cutting them off the base.

##### **C. Excessive rough handling of wet investment.**

###### *Corrective Action:*

Move flasks gently and directly from vacuum table onto the room temperature oven hearth plate.

#### **6. SINCE I ONLY MIX SMALL AMOUNTS OF PLATINUM INVESTMENT AT A TIME DO I NEED TO WEAR A MASK?**

You must definitely use an OSHA approved dust mask/respirator for both investment mixing, cleanup and investment removal.

#### **7. MY PLATINUM MELTING BY TORCH IS TAKING A VERY LONG TIME. WHY IS THIS?**

Wrong combination of gas being used.

###### *Corrective Action:*

Use hydrogen or natural gas only with a high grade Platinum designed to handle the high heat required. A popular usage is hydrogen with 40 pounds of oxygen.

#### **8. MY PLATINUM METAL CONTAINS DARK "INCLUSIONS" AFTER CASTING?**

Generally this is caused by Acetylene gas usage in metal (for torch melting).

###### *Corrective Action:*

Use hydrogen or natural gas with your torch system.

#### **9. MY PIECES HAVE A "CRAZED" LOOK TO THEM. WHAT CAUSES THIS PROBLEM?**

Generally this is caused by excessive centrifugal speed in your casting machine.

###### *Corrective Action:*

Remember the fastest acceleration is not right for all pieces. Learn your spruing, piece and tree requirements to set your speed correctly. Remember, also that speed in casting consists of both initial acceleration (up to 850 RPM in less than  $\frac{3}{10}$  of a second) and also running RPM during cool-down.

#### **10. I DON'T WANT TO USE DANGEROUS HYDRO-FLUORIC ACID IN MY FACTORY DUE TO SAFETY CONSIDERATIONS. WHAT ALTERNATIVES ARE THERE?**

###### *Corrective Action:*

Remove the Platinum investment with a safer substitute. Follow these steps:

Step #1: Quench the flask after casting in water.

Step #2: Use high powered pressure blaster to remove most of the remaining investment.

Step #3: Soak the tree in material such as Romanoff's "J" Break Platinum Investment Remover.

This product is a safe substitute for hydrofluoric acid. Be sure to follow the instructions carefully.

### 11. WHAT CAUSES THE INVESTMENT ON THE TOP OF MY FLASK TO BLOW OFF IN THE BURNOUT CYCLE?

Too much investment on top of the pieces.

#### *Corrective Action:*

- 1) Reduce amount of investment over the top of the piece to no more than 1" from the top of the flask.
- 2) Check your water to powder ratio.
- 3) Ensure that all moisture is out of the investment prior to taking the cycle over 212°F (J Formula).

### 12. WHAT IS THE BASIC CAUSE OF POROSITY IN MY CASTING OF PLATINUM?

Improper sprucing of the pieces and overheating of the metal.

#### *Corrective Action:*

- 1) Sprues should be attached to the thickest part of the casting and should have at least a diameter 1.5 times the thickness of the section it is attached to.
- 2) Find out and use the recommended metal and flask temperatures from your metal supplier.

### 13. WHY DOES THE QUALITY OF MY CASTING VARY FROM FLASK TO FLASK?

Casting is an exact science. If you vary the casting conditions so will the quality of the castings. Use advanced casting equipment which is capable of repeating good results such as precise temperature control.

### 14. CAN PHOSPHATE BASED MATERIALS SUCH AS "J FORMULA" BE INVESTED IN THE DAY AND BURNED OUT OVERNIGHT?

While this is generally not recommended you can do this only if you follow the proper cycle after investing beginning one hour after you invest. At the end of the cycle you can reduce the temperature to hold during the night and then bring back up to casting temperature in the morning. Your absolute best results will be to invest in the morning, burnout during the day, and cast in the afternoon.

### 15. WHAT TYPE OF EYE PROTECTION IS NEEDED FOR MELTING OF PLATINUM?

A Minimum Grade 9 eye filter is required for melting of Platinum. The excessive heat generated can cause much higher levels of ultra-violet and white radiation than ordinary light. Never, ever melt without the proper grade of filter. Sunglasses are not good and will cause permanent damage to your eyes. A #11 lens is recommended for close up melting of Platinum and is the preferred safety level for casting also.

### 16. I HEAR THAT HOUSE CLEANING IS ESPECIALLY IMPORTANT WHEN DEALING WITH PLATINUM. WHY IS THIS?

Platinum picks up cross contamination very easily. This contamination can be from lead solders, silicone investment, charcoal, metal filings, oil, grease, lubricants on work surfaces etc. Take the time to keep your operation looking like a laboratory and you will save a lot of money in the long run.

### 17. WHY DOES MY BUTTON SOMETIMES FLOW OUT OF MY CAST FLASK INTO MY CENTRIFUGAL CASTING SYSTEM?

Temperature of the metal is too hot for the centrifugal cycle that you have on your casting machine.

#### *Corrective Action*

Lower the temperature or increase the centrifugal cycle time.

### 18. CAN I RE-HEAT A PARTIALLY CURED FLASK?

Unless you are desperate to save the piece the most prudent answer is no. You will have a generally poor surface and probably size distortion. You need to decide cost effectiveness here versus your business decision/customer needs.

### 19. WHAT ARE THE MELTING POINTS, SPECIFIC GRAVITY, AND TROY OUNCES PER CUBIC INCH OF PLATINUM AND PLATINUM RELATED ITEMS?

Metal	Melt. Point	Spec. Gravity	Troy oz per cu. in.
Platinum	3214°F 1768°C	21.45	11.301
Palladium	2829°F 1554°C	12.02	6.333
Ruthenium	4190°F 2310°C	12.45	6.559
Iridium	4429°F 2443°C	22.65	11.933

## SECTION II.

### Questions Relating to Polishing/Finishing Operations

#### 1. WHAT ARE THE BASIC STEPS FOR FINISHING PLATINUM PIECES BY HAND?

- 1) Sand sprues flush with a 270 grit paper. Follow cross directional patterns.

- 2) Use a lightly applied rotary file for the insides of the rings.
- 3) Sand insides of rings using 280 grit and 320 grit paper.
- 4) Rubber wheel outside surfaces with coarse and fine grit wheels in succession. Use cross diagonal, overlapping passes.
- 5) For any flat surfaces use 250 grit and 320 grit paper in succession. Cross diagonal and overlap passes.
- 6) Use #400, 500, and 600 grit deburring next. Cross diagonal and overlap passes.
- 7) Inside rings can be polished with white cutting compounds.
- 8) White compounds in the 800, 4500, 4000, and 8000 grit range should be used for final finish levels as desired.

## 2. CAN I BATCH FINISH MY PLATINUM AND GOLD PIECES IN A TUMBLER?

Never mix Platinum with other metals. One or both will contaminate and/or scratch the other.

## 3. CAN I USE TITANIUM TIPPED TWEEZERS FOR PLATINUM?

Tungsten tipped tweezers and picks are the best for handling Platinum. Titanium should never be used due to contamination. Also never use the same tools for different metals.

## 4. HOW DO I BEST APPLY POLISHING COMPOUNDS FOR PLATINUM?

In general, you can use hard muslin buffs and rock hard split laps.

## 5. WHAT GRIT ALUMINUM OXIDE EMERY PAPER IS BEST FOR PLATINUM?

Generally, grits from 220 to 300 will work best on Platinum.

## 6. CAN I USE MY EMERY PAPERS AND/OR POLISHING WHEELS FOR PLATINUM AND GOLD?

Never use Platinum tools, compounds or other supplies with other metals. Contamination will occur.

## 7. IF MY SURFACE IS CONTAMINATED IS THERE ANYTHING THAT CAN SAVE THE PIECE?

- 1) Cut out and weld in new, clean alloy.
- 2) Pickle in a hot 10% Nitric Acid.

## 8. HOW OFTEN SHOULD I DRESS MY BUFFS DURING THE POLISHING PROCESS?

To be safe you should re-charge your buff after each dressing/use. Unlike gold, Platinum papers and buffs will cause scratches without proper dressing.

## SECTION III.

### General Questions on Automation of the Casting Process.

#### 1. I DO TORCH MELTING AND WANT TO AUTOMATE. WHERE DO I BEGIN?

This section could probably be a book itself. The following is a basic breakdown of the equipment on the market today. Some machines are converted "gold machines" that may get you somewhat automated, some machines are automated spinners but do not provide 100% repeatability due to lack of optical pyrometer and or controlled casting cycles etc. If you wish to automate anything, you should look only to the system that is 100% automatic that

gives you the best possible product from the best available technology. Most equipment is leased in today's world which is just a fancy way of financing your purchase and paying for it tomorrow with today's profit. The difference between a \$50,000 lease or a \$25,000 lease is insignificant if one is producing pieces that reduce your rework costs by one or two people or significantly increases your output with the same people that you now have.

### THE BASIC DIFFERENCES IN CASTING MACHINES IS AS FOLLOWS:

#### Casting Machine Type #1

Tabletop units. Basic cost approximately \$11,000 - \$12,000. Generally little more than motorized spin casters. You will get more infinitely adjustable spin settings and better repeatability than with the basic spin casters. Induction melting is generally better than with a torch but most of these units still melt "by eye" and cast based on your expertise. Usually small metal and flask capacity.

#### Casting Machine Type #2

This range of machine is by far the most glutted segment of the market. The stripped models sell in the high teens with the optical pyrometer laden semi-automatic units priced in the mid \$30,000 range. A suggestion in this market is to do your homework well and check reliability, parts availability, technical support, references and determine the true value of upgrading to these lower end units.

#### Casting Machine Type #3

This type of machine is the fully automated system that is computer controlled and just about

foolproof. These units are offered with or without vacuum and will run from the \$50,000 range for a fully automated unit without vacuum to the \$60,000-\$70,000 range for the units with a vacuum.

These units are made exclusively for Platinum only and prevent temperature overshoot of any sort in order to optimize your quality output.

*Generalization:*

Your search for a machine as important as this should look at price as your very, very last consideration. Just do not get confused with oddball arguments about machines with huge capacities that you can never use with Platinum anyway or with

the broken arm - straight arm argument. All machines can be retrofit with either arm and the arguments are mute when excellent castings are consistently achieved.

In all cases, check carefully with professional references, invest a couple of hundred dollars and fly or drive to a customer to see the unit in operation. Your supplier should be able to help make these arrangements with you.

Do a complete cost analysis based on facts, yields, scrap rates, finishing labor saved, re-casting costs, re-treeing costs, etc. Only then do you let the actual cost get into question. Then the decision is easy.

## 2. HOW DO I RESOLVE THE STRAIGHT ARM VERSUS BENT ARM CASTING QUESTION THAT I HEAR PEOPLE ASKING NOW?

You can begin by acknowledging that both sides of this argument are correct and both sides are wrong at the same time. Proper design of both the arm and machine will make either arm work equally well. On the other hand, a poorly engineered machine will still be a bad choice whether it has a straight or broken arm if it doesn't work reliably, economically, and consistently. The only suggestion is to use the arm that the machine was engineered for; the results are what counts...not people's opinions.