GRS®
GOODWIN REFRACTORY SERVICES LTD

# INJECTION WAXES

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# INTRODUCTION

Goodwin Refractory Services Ltd (GRS), based in the UK, is a company renowned worldwide for its high quality investment powders, injection waxes and range of Castaldo products. GRS have been manufacturing injection waxes for many years alongside their investment powders and have come to understand each customers' particular requirements.

Using their technical expertise and knowledge they have developed a comprehensive range of waxes suited to all applications. GRS waxes are used to reproduce high quality wax pieces or patterns efficiently, with the best surface finish demanded by the industry. Using only the highest quality materials. GRS injection waxes will give you the following benefits:

Better reproduction of rubber mould details and suitable for filigree work, intricate detail and stone-in-place wax setting

Excellent surface finish resulting in better casting results and lesser metal loss at finishing

Higher flexibility as low cost waxes tend to be brittle

Zero ash content meaning lower chance of residue in castings

Minimal shrinkage

Waxes that are suitable for hot climates

Several different flow, viscosity and hardness characteristics adapted for every application

HIGH QUALITY & THE BEST SURFACE FINISH DEMANDED BY THE JEWELLERY INDUSTRY

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# GRS PREMIUM INJECTION WAXES

GRS® PREMIUM IS A BRAND OF SPECIALITY INJECTION WAXES MANUFACTURED IN STOKE-ON-TRENT, ENGLAND USING THE HIGHEST QUALITY RAW MATERIALS TO PRODUCE A CONSISTENTLY HIGH PERFORMANCE PRODUCT.

Thanks to constant R&D and investment, our specialised team of experts have developed a range of injection waxes suitable for the widest ranging needs.

Within the GRS® Premium range you will find a wax with the optimum viscosity, hardness, flexibility, memory and shrinkage to meet all of your requirements.


...OUR AIM IS TO PROVIDE THE BEST CHOICE OF PRODUCTS FOR THE JEWELLERY MANUFACTURER AT THE HIGHEST QUALITY

### *Flexi Blue - R34WF*

Flexi Blue is the most flexible wax in the GRS® Premium range. This wax has high plasticity giving the wax exceptional memory and durability. Flexi Blue is a very durable wax widely used for stone in place and will withstand rough handling and removal from very complex moulds.

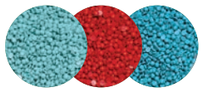
### *Sturdy Green - R35WF*

Sturdy Green is the hardest and most durable wax in the range. This wax is perfect for use in metal moulds or where the patterns have sharp detail or where a high degree of accuracy is needed. It has a high flexibility and low shrinkage and is therefore easy to remove and easy to read.

### *Finest Filigree - R36WF*

Finest Filigree is specifically designed for injecting fine detailed filigree pieces and providing a wax that is flexible and strong enough to enable removal from the mould without damage. Finest filigree is also recommended for stone in place setting.

### *General Purpose - R37WF*



General Purpose wax is a formulation which is suitable for most jewellery designs. This product has a balanced set of characteristics for the most demanding wax applications, with good flow, low shrinkage and easy to read. This wax is available in aqua, burgundy and turquoise.

### *R863 - Pink*

R863 Pink wax is a Premium Grade injection wax, specifically designed for injecting detailed patterns and providing a wax that is flexible and strong enough to enable removal from the mould without damage. R863 is a good general purpose wax with high flexibility, low shrinkage and gives an extremely smooth surface finish.

### *R864 - Red*

R864 is a Premium Grade Injection Wax, designed to be used for a wide vary of applications due to its easy flow giving high level of surface finish and detailed reproduction.

### *R865 - Green*

R865 is a Premium Grade injection wax, developed with high flexibility, easy flow and low hardness. These waxes will hold sharp details and is an ideal wax for most wax patterns produced in the modern wax room.

### *R866 - Blue*

R866 is a Premium Grade Injection Wax. It is the most robust wax from our range, used for all applications in a demanding wax room from fine filigree to stone setting to heavier items.

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# GRS PREMIUM INJECTION WAXES

| | R34WF | R35WF | R36WF | R37WF | R863 | R864 | R865 | R866 |
|---|---|---|---|---|---|---|---|---|
| *VISCOSITY (cPs) | 390 | 600 | 330 | 200 | 210 | 175 | 200 | 200 |
| **HARDNESS (N) | 170 | 180 | 205 | 220 | 190 | 165 | 150 | 150 |
| FLEXIBILITY (N) | Medium | Medium | Low | Low | Medium | Medium | Medium | Medium |
| ***SOLIDIFICATION TIME | Medium | Medium | Medium | Medium | Fast | Fast | Fast | Fast |
| LINEAR SHRINKAGE (%) | 2.00 | 2.78 | 2.99 | 1.70 | 1.70 | 2.00 | 2.00 | 2.00 |
| INJECTION TEMP (°C/°F) | 65-70/ 149-158 | 70-75/ 158-167 | 65-70/ 149-158 | 65-70/ 149-158 | 65-70/ 149-158 | 65-70/ 149-158 | 65-70/ 149-158 | 65-70/ 149-158 |

* Viscosity: The lower the value, the thinner the wax. Therefore the easier and quicker the flow at injection temperature. R35WF is generally used as a pouring wax or for injecting into metal moulds and for large, flat pieces.

** The higher the number the harder the wax. A lower value means the wax is softer and more easily handled

*** Solidification time is dependent on item size and thickness, mould temperature, room temperature etc.

## EVERYDAY CONSUMABLE GOODS IN RELATION TO GENERAL PRODUCT VISCOSITY IN CENTIPOISE

| | |
|---|---|
| Water @ 21°C/ 70°F | 1 |
| Blood or Kerosene | 10 |
| Ethylene Glycol or Anti-Freeze | 15 |
| Motor Oil (SAE 10) | 50 |
| Corn Oil | 65 |
| Maple Syrup or Motor Oil (SAE 30) | 150 - 200 |
| Castor Oil or Motor Oil (SAE 40) | 250 - 500 |
| Glycerin or Motor Oil (SAE 60) | 1,000 - 2,000 |
| Honey or Corn Syrup | 2,000 - 3,000 |
| Molasses | 5,000 - 10,000 |
| Chocolate Syrup | 10,000 - 25,000 |
| Pourable Silicone Rubber | 14,000 - 40,000 |
| Ketchup or Mustard | 50,000 - 70,000 |
| Brushable Silicone Rubber | 100,000 - 150,000 |
| Peanut Butter or Tomato Paste | 150,000 - 250,000 |
| Lard or Crisco Shortening | 1,000,000 - 2,000,000 |
| Caulking Compound | 5,000,000 - 10,000,000 |
| Window Putty | 100,000,000 |

# GRS UNIVERSAL INJECTION WAXES

GOLD STAR POWDERS

SRS

Whip Mix

HYDRACAST INVESTMENT POWDER

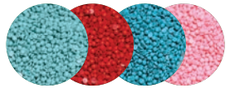
castaldo

OUR UNIVERSAL RANGE OF WAXES ARE MANUFACTURED IN STOKE-ON-TRENT, ENGLAND, USING ONLY RAW MATERIALS OF CONSISTENTLY GOOD QUALITY.

Using our very best knowledge of jewellery production we have an exhaustive understanding of what is required from the wax. Our R&D team, having gained a fully comprehensive set of skills gained through the production of GRS injection waxes, have produced a range suitable for the most demanding of injection circumstances.

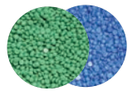

...OUR AIM IS TO PROVIDE THE BEST CHOICE OF PRODUCTS FOR THE JEWELLERY MANUFACTURER AT THE HIGHEST QUALITY

### *R1/GS110/Omni 010*



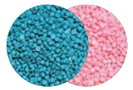
A high quality, economic, all-purpose wax that covers a variety of applications. R1 is formulated to produce wax patterns with a high level of surface finish and detail reproduction across a wide range of item cross sections and designs.

### *R3/GS210*



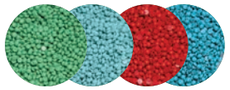
Specifically developed for the production of large patterns and statues. It's accurate and durable, yet flexible characteristics combined with a slow cooling time and high viscosity make it ideal for larger pieces.

### *R25/XR2025/Omni 025*



Medium hardness wax, ideal for filigree work and stone setting with high flexibility properties and easy flow into the mould.

### *R28/XR2028*



Perfect for larger, intricate pieces and patterns. It is very flexible which makes it very easy to remove from the rubber mould without damage.

# GRS UNIVERSAL INJECTION WAXES





| | GS110/R1 /Omni 010 | GS210 /R3 | XR2025/R25 / Omni 25 | XR2028/ R28 |
|---|---|---|---|---|
| *VISCOSITY (cPs) | 160 | 280 | 110 | 210 |
| **HARDNESS (N) | 175 | 165 | 190 | 190 |
| FLEXIBILITY (N) | Medium | High | Low | Medium |
| ***SOLIDIFICATION TIME | Medium | Medium | Fast | Fast |
| LINEAR SHRINKAGE (%) | <1 | <1 | 1.57 | 2.61 |
| INJECTION TEMP (°C/°F) | 65-70/ 149-158 | 65-70/ 149-158 | 65-70/ 149-158 | 65-70/ 149-158 |

* Viscosity: The lower the value, the thinner the wax. Therefore the easier and quicker the flow at injection temperature.

** The higher the number the harder the wax. A lower value means the wax is softer and more easily handled

*** Solidification time is dependent on item size and thickness, mould temperature, room temperature etc.

GOLD STAR POWDERS · SRS · Whip Mix · HYDRACAST INVESTMENT POWDER · castaldo

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| Caulking Compound | 5,000,000 - 10,000,000 |
| Window Putty | 100,000,000 |

# INJECTION WAX PROPERTIES

## HIGH QUALITY WAXES

- Better reproduction of rubber mould details
- Excellent surface results - therefore less metal loss at finishing
- Easier removal from the mould thanks to high quality materials
- Higher flexibility - low cost waxes tend to be brittle
- Low ash content - lowering the chance of residue in casting

## EQUIPMENT PREPARATION

- Air filters should be installed on the air lines to the wax pot
- A moisture trap should be installed before the pot
- Set the temperature on the wax pot according to the manufacturers recommendations
- Store wax in a sealed bag or container to avoid contamination
- Check wax for signs of contamination or air bubbles when refilling the pot
- Periodically clean the wax pot

# INJECTION WAX MANUFACTURING PROPERTIES & PARAMETERS

## VISCOSITY
The viscosity level determines the level of fluid consistency when the wax is at injection temperature. The lower the value, the thinner the wax and therefore the quicker the flow when injecting.

## HARDNESS
This measures the pressure force it takes in newtons to penetrate the wax. The higher the number the harder the wax. A lower value means the wax is softer and more easily handled.

## FLEXIBILITY
The number represents the pressure force required to bend the wax. The lower the value, the more flexible the wax is, enabling easy mould retrieval and handling.

## SHRINKAGE
Area Shrinkage Difference is a measurement of the injected bar piece compared to the mould length and width.

## CONGEALING POINT
Congealing Point is the temperature at which the wax has congealed to the point where it stops flowing.

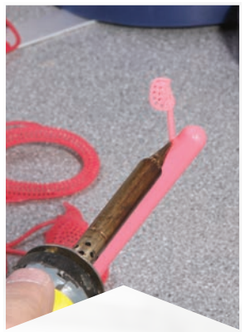
## INJECTION TEMPERATURE
Optimal temperature at which the wax is ready to be injected into the mould. A range of 5°C is standard and acceptable for most waxes.
N.B: Use a maximum temperature of 90°C to melt the wax in the wax pot and reduce to injection temperature for at least an hour for the wax to stabilise before injecting.

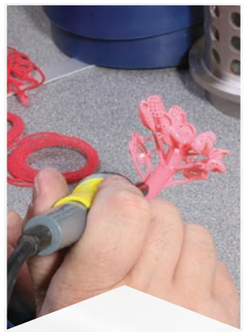
## SOLIDIFICATION TIME
The approximate amount of time the wax needs to stand for, after being injected into a specific mould, before it can be removed without any imperfections. Solidification time is dependent on item size and thickness, mould temperature, room temperature etc..

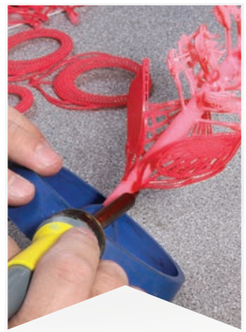
# SPRUEING TECHNIQUE

During casting, the metal should be able to enter the mould cavity quickly and easily without restrictions. To enable this to happen and in order to obtain good casting results good sprueing techniques are essential. Follow these below hints and tips:

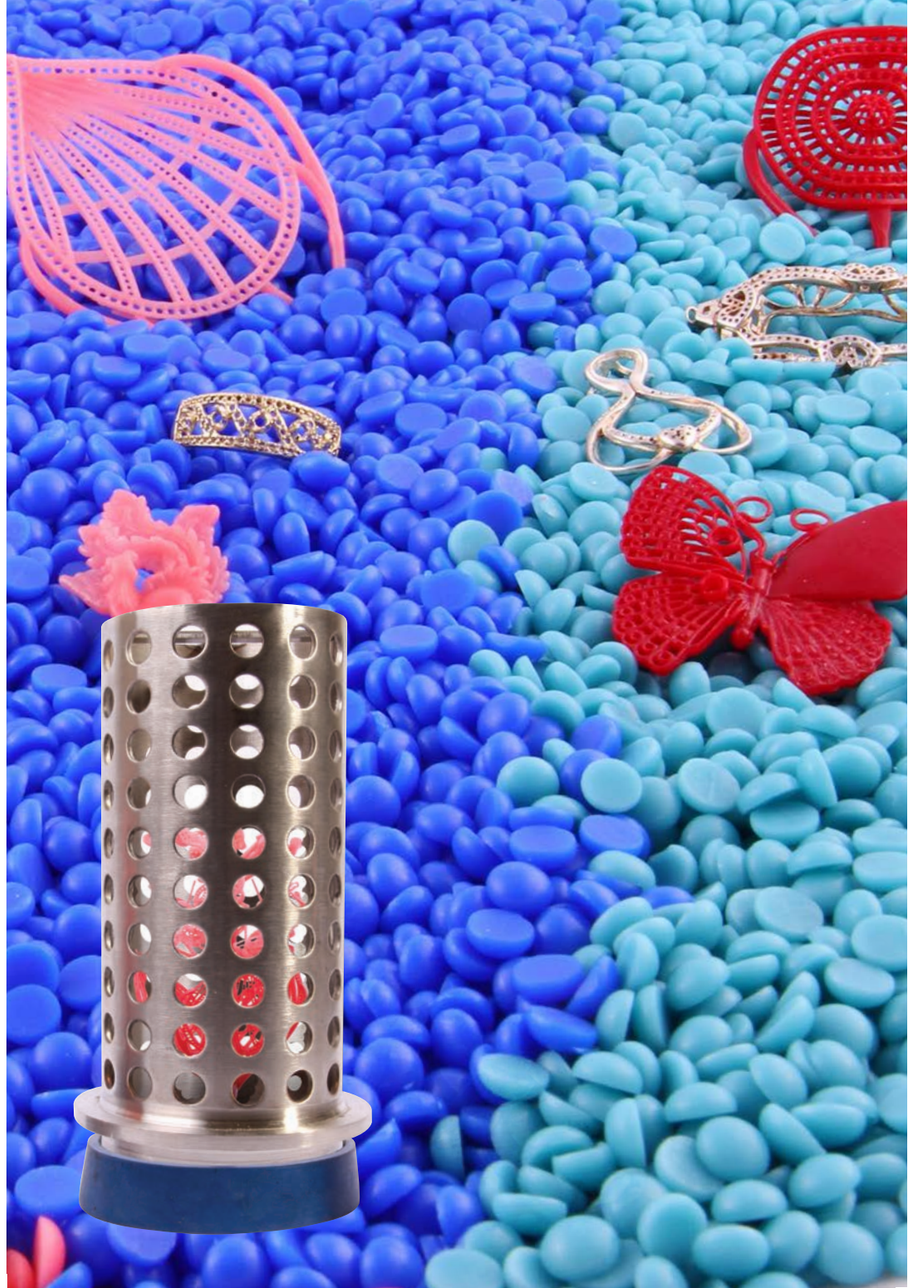
- Sprue size should be proportionate to the casting and round sprues flared at the casting are the most affective.
- Attach sprue to the heaviest area of the casting as the thinest areas will solidify first. This allows the heavy area to draw molten metal from the sprue as it solidifies.
- Multiple sprues may be needed on the more complex castings to obtain the best results.
- Avoid sharp bends as any restrictions can cause turbulence in the metal flow causing mould erosion and porosity from entrapped mould gases.



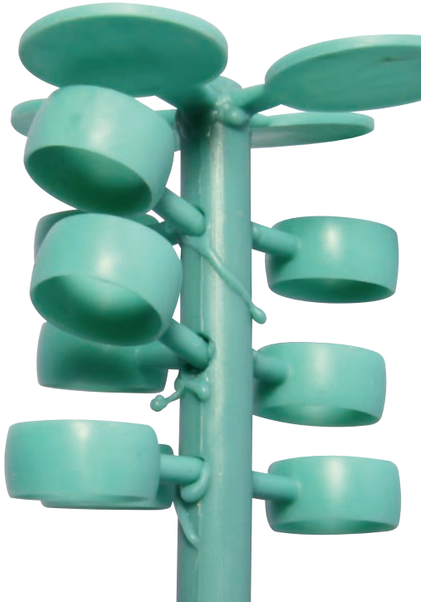








- For the main sprue always use a wax with lower melting temperature than the wax patterns. This will allow the wax to flow out of the mould cavity without boiling inside the mould thus reducing mould erosion.
- Avoid mixing light and heavy wax patterns on the same tree. If you need to mix place the big pieces close to the base and the small pieces at the top.
- The wax patterns should be angled at 45° upwards to the main sprue this allows the wax to flow out and the molten metal to flow in without restrictions.
- Care should be taken attaching the wax patterns to the main sprue. Avoid leaving molten wax or depressions on the sprues as they cause protrusions of investment powder that could break off during casting and cause inclusions in the metal.
- Allow enough space 1cm between the flask wall and the wax patterns for investment to fill around and 2.5cm at top of the tree to the top of the flask.
- Leave 1cm space between the button and the first row of the wax patterns.



# ACHIEVING THE BEST RESULTS FROM GRS WAX

## YOUR WAX POT

- Wax pots should be drained and cleaned on a regular basis
- Fill your wax pot at the end of the day
- Allow your GRS wax time to reach the correct injection temperature
- If you have to refill the wax pot during the day use the following procedure:
  1. Increase the pot temperature to 90°C to fast melt the wax
  2. Stir the added wax to eliminate bubbles and to distribute the heat
  3. Take a temperature reading to ensure correct injection pressure
  4. Before re-use allow the pot to settle and recheck the injection pressure
  5. Pull vacuum on the wax pot to ensure there is no air trapped

## OPERATION

- Keep the pot on continuously at the injection temperature to keep the wax at an even temperature

## WAX TEMPERATURE

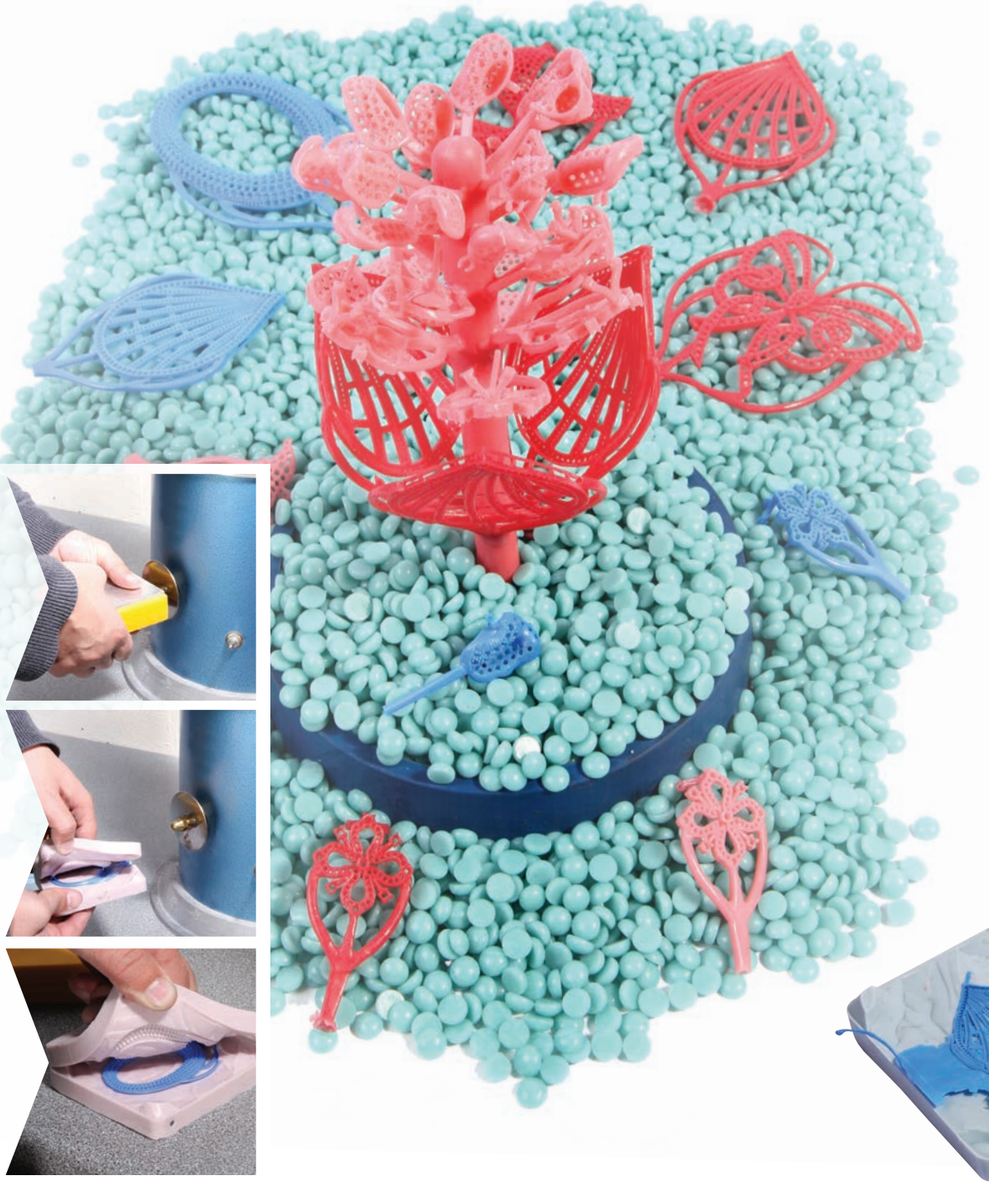
- Use the recommended wax injection temperature
- Use a calibrated thermometer exclusively for your wax pot
- Immerse the thermometer into the wax to get an accurate reading

## INJECTION PRESSURE

- To get the best results set the pressure at the lowest pressure setting
- Always clean the nozzle before daily use

## SHUTTING DOWN NIGHT

- Release the air pressure
- Refill the wax pot
- Ensure wax pot is left switched on









# INJECTION WAX TROUBLE SHOOTING

## SHRINKAGE TOO HIGH

- Wax too hot
- Sprue too narrow
- Injection pressure too low

## WAX DOES NOT FILL

- Wax too cold
- Pressure too low
- Sprue too narrow

## MOULD OVERFLOW / FILL

- Wax too hot
- Too much pressure
- Mould not clamped well enough during injection
- Poor cut mould
- Injection dwell time too long
- Lack of vents within the mould

## DISTORTED WAX PATTERNS

- Poor master pieces
- Damage when cleaning flash off with a knife

## AIR BUBBLES

- Wax temperature incorrect (too hot/cold)
- Not enough wax in the pot
- Too much injection pressure or pressure too low
- Moisture in the wax or airlines
- Wax at a low level in wax pot

## INCOMPLETE WAX PATTERNS

- Wax temperature too low
- Injection pressure too low
- Overheating of the wax
- Low wax level in the wax pot

## DISTORTED WAX PATTERNS

- Opening mould too soon

## ROUGH WAX PATTERNS

- Excess talc or release agent on the moulds

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***GOODWIN REFRACTORY SERVICES LTD.***
Spencroft Road,
Newcastle-under-Lyme,
England,
ST5 9JE

info@grscastingpowders.com

+44 (0)1782 663600


WWW.**GRSCASTINGPOWDERS**.COM