

Ransom & Randolph

Ceramic Shell Investment Casting

An Introduction

Investing with Innovation™

Glossary of Terms

- **Binder** - colloidal silica binder is a suspension of solid amorphous silicon dioxide (SiO_2) particles (25%-30%) in water (70%-75%).
- **Binder Solids** - SiO_2, as well as other ingredients, in high performance binders that bond together refractory and sand to form a shell.
- **Refractory** - a fine, powder-like, heat resistant ceramic material.
- **Stucco** - a sand applied to an investment mold after it has been freshly dipped in a slurry and drained.
- **Slurry** - a combination of binder and flour materials.
- **Primary Slurry** - slurry used to apply the initial coat(s) to the pattern. These coat(s) determine the surface finish of the cast metal.
- **Backup Slurry** - slurry used to apply shell coats after the primary(ies) to build up a shell with adequate strength and thickness to withstand the stresses in the process.
- **Viscosity** - the resistance of a substance to flow.

Binders

For the new investment caster, R&R recommends using SuspendaSlurry® materials.

SUSPENDASLURRY materials are pre-mixed, chemically suspended and ready-to-use ceramic shell slurries designed to simplify slurry make-up and maintenance and eliminate continuous slurry mixing; while offering proven casting performance.

SUSPENDASLURRY materials can be remixed in minutes, often by hand, and used immediately upon opening.

SUSPENDASLURRY materials are available for non-ferrous and ferrous metal casting.

- Non-ferrous metals: SUSPENDASLURRY FS material is recommended for both initial and backup coats.
- Ferrous metals: SUSPENDASLURRY ZR material is recommended for initial coats; for backup coats, use SUSPENDASLURRY FS material.

SUSPENDASLURRY material package sizes:

- SUSPENDASLURRY FS material is available in 60 pound (5 gallon) and 400 pound (30 gallon) slurries.
- SUSPENDASLURRY ZR is packaged in 100 pound pails (5 gallons) and 600 pound drums (30 gallons).

Refractories

The refractory powder used depends on the alloy chosen. For ferrous alloys, zircon is used on primary coats. For non-ferrous alloys, fused silica flour is used. Therefore; depending on the alloy cast, the formula for five gallons (18,9 liters) of slurry is:

Non-Ferrous

SUSPENDASLURRY FS material 60 pounds (27,2 kg)

Ferrous

SUSPENDASLURRY ZR material 100 pounds (45,4 kg)

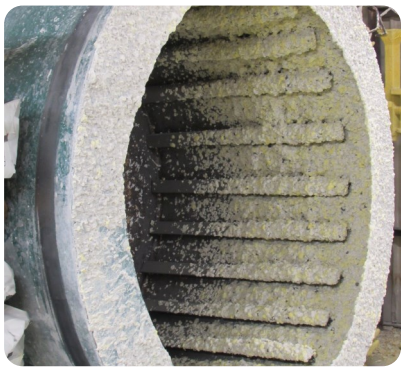
Note: SUSPENDASLURRY materials contain refractory.

Preparing the Slurry

- Remix the SUSPENDASLURRY material prior to use to ensure a homogeneous blend of material. Remixing time will vary with the size of the slurry, but should take minutes. Small slurries may be remixed by hand, larger slurries may require a propeller mixer. Remix until the liquid at the top of the slurry is blended and the mixture is creamy in appearance.
- Remove the propeller mixer from the tank after initial remixing.
- Patterns must be clean and free from silicones or other contaminants before dipping.
- It is not usually necessary to use a prewet between coats. If a prewet is needed, use deionized water only. Drain the pattern before dipping into the slurry.
- **Once finished dipping shells, replace slurry tank lid to prevent evaporation.**
- When using SUSPENDASLURRY material again, remix to a creamy consistency prior to dipping if there is a visual separation of liquid at the top of the tank. If there is no separation visible, dip without remixing.
- Measure viscosity and add water.

Stucco

The normal dipping sequence is to immerse the cleaned pattern in the slurry, drain until a uniform coat is formed with no dripping, and then apply stucco sand.



- Non-ferrous metals: Use a fine sand, such as RANCO-SIL A fused silica, on the first coat. For backup coats, use a coarser sand. We recommend RANCO-SIL B fused silica.
- Ferrous metals: A fine zircon sand should be used on the first coat, while RANCO-SIL B fused silica is still recommended for backup coats.

Stucco sand is normally applied using one of the following methods:

1. **Rainfall Sanding** - sifting or sprinkling sand over a freshly dipped and drained pattern.
2. **Fluidized Bed** - compressed air passes through a porous stone or plate evenly distributing air through a bed of sand allowing a pattern or mold to be immersed into it.
3. **Cat Box Method** - placing the freshly dipped and drained mold on an open bed of sand with moderate side walls and flipping sand by hand onto the mold.

Common Materials

Item No.	Non-Ferrous	
64160	SUSPENDASLURRY FS material (60 pound [27,2 kg])	Pre-mixed 5 gallon (18,9 liter) slurry + corresponding stuccos
63102	RANCO-SIL A fused silica (1 bag)	
63103	RANCO-SIL B fused silica (2 bags)	

Item No.	Non-Ferrous	
64165	SUSPENDASLURRY FS material (400 pound [181,4 kg])	Pre-mixed 30 gallon (113,6 liter) slurry + corresponding stuccos
63102	RANCO-SIL A fused silica (3 bags)	
63103	RANCO-SIL B fused silica (9 bags)	

Item No.	Ferrous	
64170	SUSPENDASLURRY ZR material (100 pound [45,4 kg])	Pre-mixed 5 gallon (18,9 liter) slurry + corresponding stuccos
69808	Zircon sand (1 bag)	

Item No.	Ferrous	
64175	SUSPENDASLURRY ZR material (600 pound [272,2 kg])	Pre-mixed 30 gallon (113,6 liter) slurry + corresponding stuccos
69808	Zircon sand (3 bags)	

Equipment, Information & Testing

Foundry Equipment Suppliers

Ransom & Randolph (800.253.4502)

- Fluidized Bed Sanders
- Barrel Rain Sanders
- Slurry Mixers
- Burnout Furnaces
- FlashFire Dewax Systems
- Wax Injection Machines
- Zahn Cups (Viscosity)

Hints & Tips

Refer to SUSPENDASLURRY materials Application Instructions for proper storage and control of the slurry. Viscosity testing is required to ensure sufficient water is present in the slurry; it must be replaced occasionally due to evaporation.

It is important to tightly cover the SUSPENDASLURRY materials when not in use. If allowed to sit covered, unused for longer than one month at a time, open and gently remix the SUSPENDASLURRY materials monthly.

SUSPENDASLURRY materials are ideal for new or small foundries, providing excellent benefits in the shell room. Established foundries with more complicated process requirements should contact Ransom & Randolph to discuss technical needs and to schedule a process audit to determine what slurry solutions will work best for your individual needs.

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