

CORE MATERIALS

For Low-Expansion Ceramic Shell Systems

C-1 CORE MIX & 50/50 CORE MIX

R&R designed these core materials for making preformed cores and for hand packing cores to be used with ceramic shell. They are used primarily by ferrous casters. C-1 core mix is the stronger of the two and is used for preformed cores, while 50/50 core mix is used to hand pack cores. Both can be used for either process, depending on the size and type of core needed.

Application/Mixing Instructions

Mixing Ratio/Properties	C-1 Core Mix	50/50 Core Mix
Water/Powder Ratio by Weight	14/100	16-18/100
Working Time*	5 to 5-1/2 minutes	5 to 6 minutes
Setting Time	10 minutes maximum	6-1/2 to 10 minutes

*NOTE: By using cold water or cold water and chilled core material you can lengthen the working time.

These core materials give off heat when setting, which, in most cases, prevents them from being used in direct contact with wax patterns. If you are making small cores, such as golf club hozzles, you can form the core against the wax pattern without damage to the wax.

To improve the strength of these core materials, replace a portion of the water with Core Hardener 2000™ binder. Flow characteristics are reduced when using higher percentages of the Core Hardener 2000 binder. It is recommended you use 2 parts water to 1 part Core Hardener 2000 binder by volume.

The powder should be added to the water in the proper proportions and mixed by hand or mechanically to take a smooth consistency. This should take 1 to 1-1/2 minutes. The mix can then be poured or vibrated into the ceramic shell, rubber or plastic mold.

These core materials will bond to most metallic objects unless their surfaces are heavily lubricated. Core material can be vacuumed after mixing to remove excess air. This process will help increase core strength.

After the preformed core molds are poured, they should be allowed to set until they have sufficient strength to permit separation. This time is best determined by experimentation and will vary depending on the size and type of the mold. Adding external heat will accelerate the hardening process.

Preformed cores should be air dried 3 to 4 hours, then baked at a minimum of 1200F (650C) for 3 to 4 hours before use. If a metal mold reaction occurs, the baking temperature should be increased until the reaction is eliminated. In some cases it may be necessary to bake the cores in a kiln at 2300F to 2500F (1260-1271C). In such cases, the cores should be supported so they don't sag or distort.

For cores hand packed into a ceramic shell mold, follow the same mixing instructions. After the core has been packed, allow one hour for the core material to set before proceeding with the remaining shell coating. Ceramic shells containing these core materials should be processed as normal. After autoclaving, dry for 4 hours. This allows the excess water to evaporate prior to firing, preventing the core from exploding.

Where autoclave dewaxing is used to remove the pattern, the pressure must be released very slowly to prevent destruction of the core material.

When making preformed cores or coring directly into the wax, a core extension is needed. The shell is built around the core extension to hold the core in place. The core extension should be at least 1/4" long or longer, depending on the core size. When hand packing cores, a core extension may be necessary depending on the core size and configuration. If making a core extension is not possible, a fused quartz tube can be inserted into the core material before it sets.



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CORE HARDENER 2000™ BINDER

This water-based colloidal silica binder is used to strengthen the ceramic shell in small holes, slots, and hard-to-reach openings. It helps prevent metal penetration by strengthening the shell which is usually thin in these areas. The product is easy to use following the seven step application process.

Application Instructions

1. Apply usual primary coat of slurry and stucco, dry in the usual manner.
2. Apply Core Hardener 2000 binder by dipping, by syringe or by spraying, and allow to dry completely.
3. Apply Core Hardener instead of usual Pre-Wet and drain well.
4. Apply second coat of slurry and stucco and dry in usual manner.
5. Repeat step 2.
6. Repeat step 3.
7. Continue with the third and subsequential coats and dry in usual manner without further use of Core Hardener 2000 binder.

Core Hardener 2000 binder can also be used to strengthen R&R's ferrous (C-1 Core Mix and 50/50 Core Mix) and non-ferrous (910 Investment) core materials.

910 INVESTMENT

910 is a calcium sulfate bonded investment used for cores. It is used with non-ferrous alloys which do not exceed temperatures of 2200F (1200C). 910 investment has good green strength, good thermal shock resistance, is easily removed after casting and can be used directly in contact with the wax pattern.

Application/Mixing Instructions

Mixing Ratio/Properties

Water/Powder Ratio	28/100 by weight
Working Time	10 to 11 minutes
Setting Time	12 to 14 minutes

Calcium sulfate bonded core materials require core pins to hold them in place. Place core pins through the wax until they protrude at least 1/2 inch into the cavity to be cored. This distance will vary depending on the size of the core. They should extend about 1/2 inch outside the wax so the shell can be built around them.

Add the measured powder to the water and mix thoroughly by hand or mechanically. To strengthen the core material, you can replace a portion of the water with Core Hardener 2000™ binder.

Pour the core material into the cavity. Some vibration may be used to help fill the core easier and remove entrapped air. Allow the completed core to set 3 or 4 hours before further processing.

It is important to remember that when a complete-fill core material is used, you must allow extra time during dewaxing and burnout to completely dry and burn out the core. Failure to burn out the core completely may lead to outgassing when metal is poured.

If an autoclave is used to remove the wax pattern, the pressure must be released very slowly to prevent destruction of the core material.

Placing vents into the cores to help in drying and eliminating gases during casting is recommended.

NOTE: Date of manufacture is indicated by first 6 digits of lot number (MM/DD/YY). Ransom & Randolph recommends using C-1 and 50/50 core materials within 6 months of manufacture date. Core Hardener 2000 and 910 investment within 12 months.



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KWIK-CORE™ MATERIAL

Ransom & Randolph's Kwik-Core material is a powder and binder system that is designed for hand packing cores to be used with ceramic shell. Kwik-Core material is for use primarily with ferrous castings. Kwik-Core material can be poured directly into the cavity of the wax due to its low exothermal reaction.

- Low-exothermic reaction - can be applied against most wax patterns.
- Pourable for easy application.
- Eliminates need for extra shell drying time on complicated parts.
- An alternative to shelling narrow slots and passageways.

APPLICATION

Kwik-Core powder must be mixed with Kwik-Core binder to be effective. Recommended binder to powder ratio is 32-35 parts binder to 100 parts powder by weight. In general, the higher the ratio of binder to powder, the better the material's fluidity and the longer the working time, but the weaker the core.

The following properties are based on a 32/100 binder to powder ratio:

Binder/Powder Ratio:	32/100 by weight (or 29 ml of binder per 100 g of powder)
Pouring Time:	12-15 minutes
Setting Time:	50-60 minutes
2-hour Green Strength:	120 psi
1600oF Fired Strength:	400 psi
Binder Density:	1.11 g/ml
Volume of Mix:	18.7 cubic inches per 1 lb of powder, or 675 cubic centimeters per 1 kg of powder

WAX PATTERN PREPARATION

1. Wash, rinse, and dry individual wax patterns to be packed. We recommend R&R® Wash-N-Etch pattern cleaner.
2. If the core in the wax pattern has multiple openings, seal all but one with pieces of masking tape.

CORE MIX PREPARATION AND APPLICATION

1. Weigh or measure the required amounts of powder and binder separately. **NOTE:** You will have about 10 minutes of working time before the mix loses its fluidity, so make sure the total amount of the mix can be used up within the working time. Multiple patterns can be filled with one mix.
2. Add the preweighed powder into a mixing container that contains the premeasured binder.
3. Wet out the powder by hand with a mixing paddle, wire whip, or whisk. This should take no more than 45 seconds.
4. Mechanically mix the investment at a moderate speed for about 1.5 minutes. If the total amount of the mix is manageable, you can do the entire mixing by hand.
5. Place the mixing container on a vacuum table and apply full vacuum until the investment rises in the bowl and collapses. Alternatively, you can place the container on the top of a vibratory table and vibrate for a while to get rid of air bubbles.
6. Pour the mix down the side of the core so that no air bubbles will be trapped within. To make the pouring easier, you might want to use a rubber or paper pouring cup. You may also pipe the material in with a syringe, pipette or a pastry bag.



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7. Vibrate the filled pattern to let possible entrapped air bubbles escape.
8. If core pins are necessary (depending on core configuration), insert pieces of ceramic rods into the mix at about the 20 minute mark (counting from step 1).
9. Leave the patterns undisturbed for at least 2 hours.
10. After 2 hours, peel off the masking tape (if any), and the filled patterns are ready to be assembled.

NOTE: Do not wash the assembled trees, since the patterns have been previously washed.

NOTE: If dust-like particles are visible at the surface of the core at this point, it should be brushed or blown off prior to shelling. This is a product of the core mix reaction and may be visible depending on core size or core configuration.

DEWAXING TIPS

For autoclave dewaxing it is important to release the pressure in the autoclave slowly to avoid rupturing the core. We recommend a minimum of 2 minutes from peak pressure to atmospheric pressure.

BURN OUT TIPS

It is important to remember that when a complete-fill core material is used, you must allow extra time during burn out for the core to be completely burned out. Failure to burn out the core completely may lead to outgassing when metal is poured.



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