



# **INSTALLATION GUIDE**

## **MIXING AND USING INSTRUCTIONS**



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## HOW TO USE THIS GUIDE\*\*\*

This guide is divided into several sections. Depending upon how you intend to install these materials, only certain sections may apply to you. All the sections that are designated with a "\*\*\*\*" at the beginning of the section are considered "Need To Read" sections and it is important that they be read by everyone regardless of your installation method.

Throughout this guide, we make several references to contacting Stellar Materials for help. As with any technical material, proper installation is the key to a successful application. If at any time or for any reason, you are not clear on any portion of this guide, please do not hesitate to contact us as follows:

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**Website:** [www.thermbond.com](http://www.thermbond.com)

**Remember to *Think Thermbond!*<sup>TM</sup>**

## **SPECIAL THERMBOND® FEATURES\*\*\***

### **THERMBOND® CAN BE INSTALLED WITHOUT CURING**

In many applications, Thermbond's® unique technology allows for installation of the refractory and start-up of the equipment with absolutely no cure-out. This can save significant time and money in both curing time and downtime. See the section titled "CURING AND HEAT-UP SCHEDULE FOR THERMBOND® REFRACTORIES" for specific details.

### **THERMBOND® SETS VERY QUICKLY**

Thermbond's® binder system initiates an exothermic reaction that causes the refractory to set very hard at ambient temperatures very quickly. It is excellent for casting shapes, since molds can be turned over several times per shift. Thus, the number of molds required can be greatly reduced, or the output per mold can be greatly increased. This feature also makes Thermbond® ideal for fast installations and fast repairs. See the sections titled "WORKING TIMES" and "HOT AND COLD WEATHER PLACEMENT" for additional information.

### **THERMBOND® WILL BOND TO ITSELF AND OTHER REFRACTORIES**

Thermbond's® unique technology allows the refractory to bond to itself or most other fired refractories with virtually no cold-joints. This is an important feature which makes Thermbond® very easy to install, making its fast set-times a great advantage. Thermbond® may be slip-formed into place, bonding one panel to the next, with the end result being an essentially monolithic lining. This feature makes it possible to make permanent repairs to existing refractories by simply placing Thermbond® as a veneer. See the section titled "PREPARATION" for detailed procedures to assure a proper bond.

### **THERMBOND® RESISTS THERMAL SHOCK**

Thermbond's® special binder system creates a bonded aggregate system that is very resistant to thermal shock. Even when exposed to extreme thermal cycling, Thermbond® exhibits far less cracking than traditional refractories.

### **THERMBOND® RESISTS PENETRATION**

Thermbond's® binder system forms a pyro-plastic face at temperature that seals tightly, resisting penetration from molten metals, organic materials, and other materials.

## **PRODUCT DESCRIPTION\*\*\***

Thermbond® Refractories are a two-part (dry formulation and Liquid Activator) refractory system. When added together, Thermbond® products exhibit a fast exothermic set. Thermbond® Refractories are available in many different formulations and may be applied using many techniques. There are different types of Thermbond® products for different applications:

#### **THERMBOND® FORMULA SERIES**

Thermbond's® flagship line of refractory products. Formula Series includes an entire line of products with a wide range of alumina contents for most refractory applications.

#### **THERMBOND® THERMBRAKE SERIES**

Thermbond's® insulating refractory products for applications requiring lightweight insulating refractory.

## **PACKAGING**

Thermbond® products are supplied in pre-measured quantities called "Units," with each Thermbond® Unit consisting of a pre-measured amount of dry formulation and a pre-measured amount of Liquid Activator. The dry component is supplied in plastic lined paper bags and the liquid component is supplied in either one-gallon jugs or 55-gallon drums. **SEE THE INDIVIDUAL TECHNICAL DATA SHEET FOR EACH PRODUCT TO DETERMINE ITS PROPER WET-TO-DRY RATIO AND FOR THE PROPER BAG-TO-JUG RATIO.**

## **PRODUCT NAMES AND SUFFIXES**

Thermbond® product names are not meant to convey any particular meaning or characteristic of the product. Please see the individual Technical Data Sheet for a brief product description of each formulation. For additional information, or for help in specifying the correct formulation for your application, please contact Stellar Materials Technical Support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com).

Thermbond® product suffixes, when used, are consistent throughout the product line, and designed to convey certain characteristics of the products. Below is a listing of the suffixes currently in use and their meaning:

"A"	Higher Abrasion Resistance
"B"	Contains poly fibers to facilitate even faster initial firing
"E"	Extended working and setting times specially suitable for pumping applications (even longer than "L" mixes)
"F"	Finer grain sizing
"G"	May be applied by gunning
"J"	More flowable consistency
"L"	Longer working and setting times
"P"	Patch and repair mix may be applied by troweling, hand packing, or casting
"Q"	Super Quick Setting
"W"	Designed to be applied in thin sections as a washcoat

## **ESTIMATING MATERIAL REQUIREMENTS**

Each Thermbond® product has a distinct density and therefore Unit volume. It is important to determine the amount of material required for the application, or equivalently the number of Thermbond® Units required for the application. Refer to **Yield Per Unit** on the specific Technical Data Sheet to determine the number of Units required to fill a specific volume.

## **WORKING TIMES**

In general, Thermbond® products set very quickly and therefore must be mixed and placed quickly. The set is exothermic, and is affected by ambient conditions. Hotter temperatures will result in relatively shorter working times and colder temperatures will result in relatively longer working times. In addition, larger masses will set more quickly than smaller masses. When installing "L" or "E" mixes, larger masses or hotter ambient temperatures may be required in order for the material to set properly. For additional information, or for help in specifying the correct formulation for your application, please contact Stellar Materials Technical Support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com).

More specific information on working times may be found within each product section of this Installation Guide.

## **HOT AND COLD WEATHER PLACEMENT**

The set time of Thermbond® Refractories varies with the ambient temperature and the surface temperature of the area where the material is being placed. Thermbond® Refractories set more quickly at hot temperatures and more slowly at cold temperatures. The optimum ambient installation range for Thermbond® Refractories is from 50°F to 80°F. (10°C to 25°C).

**INSTALLATION AT AMBIENT TEMPERATURES BELOW OPTIMUM RANGE**

Thermbond® Refractories may be placed at ambient temperatures as low as 20°F with no special precautions. The materials, however, will set much more slowly. The setting time can be decreased in applications below the recommended installation temperature "window" by keeping the pre-blended dry component and Liquid Activator in a heated area so that the materials are above 50°F (10°C) and by heating the area that the Thermbond® Refractory is to come in contact with to above 50°F (10°C).

Alternatively, Thermbond® "Q" mixes provide accelerated set times and could be used when ambient temperatures are below 20°F (-5°C). For help in product specification, please contact Stellar Materials at 561.330.9300 or at [support@thermbond.com](mailto:support@thermbond.com).

**INSTALLATION AT AMBIENT TEMPERATURES ABOVE OPTIMUM RANGE**

Thermbond® "L" or "E" mixes provide extended working times and may be used when ambient temperatures are above 80°F (25°C). For help in product specification, please contact Stellar Materials at 561.330.9300 or at [support@thermbond.com](mailto:support@thermbond.com).

Store all dry and liquid materials and all equipment in a cool place out of direct sunlight. If the "L" or "E" mixes still do not provide adequate working time, Thermbond® Refractories may be placed at ambient temperatures above the recommended installation temperature "window" by cooling the pre-blended dry component and Liquid Activator so that the materials are below 80°F (25°C). The pre-blended dry component may be cooled by placing the bags of material in a refrigerated area, by packing dry ice around them, or storing them in an air-conditioned room. Another alternative is to locate a refrigerated truck on the job-site to store the material prior to use. This typically is affordable on larger jobs. If requested in advance, the material can usually be shipped directly to the job site in a refrigerated truck.

**CLEAN-UP AFTER USE**

For final cleaning of equipment, other tools, and areas exposed to the material after the completion of the application, use water before the material sets hard.

**EQUIPMENT DESCRIPTION\*\*\***

Within each product section of this guide, certain equipment is recommended for installing the material. Each section will list the particular equipment recommended and refer back to this section for the detailed description of each piece of equipment. The proper equipment can be critical for a quality installation. Please contact Stellar Materials Technical Support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com) if you have any questions.

**PERSONAL PROTECTION EQUIPMENT**

For a complete listing of required PERSONAL PROTECTION EQUIPMENT when applying Thermbond® products, please contact Stellar Materials Technical Support at 561.330.9300.

**PADDLE MIXER/PAN MIXER**

A mixer is recommended for use when mixing 2 or more units for one job. Ideally the mixer should be positioned as close as possible to the pour site. The mixer should be clean and paddle scrapers should be in good condition and properly aligned to the drum. If using a Pan Mixer, the discharge doors MUST seal tightly to prevent leakage of the Liquid Activator, which is poured in first. If the seal is not tight enough to hold the liquid the following procedure will generally eliminate most leakage from the mixer:

1. Pour enough dry material into to the mixer to completely cover the discharge doors, but no more than half of dry material for any one batch to be mixed.
2. Pour all the liquid for the batch into the mixer and turn on the mixer.
3. Pour the remainder of the dry material into the mixer, mix for the appropriate amount of time, and discharge the mixer.
4. Repeat process until complete.

See "Mixing" section for mixer cleaning and neutralizing instructions. A mortar tray is recommended for keeping the area clean.

### **HOBART-TYPE MIXER**

A Hobart-type mixer is recommended when mixing 1 or less units. It should be used on low speed setting. The mixing blade should be stainless steel and the mixer and blade should be clean. (See "Mixing" section for mixer cleaning and neutralizing instructions).

### **GUNNING MACHINE**

#### **ROTATING BOWL TYPE GUN /ROTARY( ROTATING BARREL) TYPE GUN / FEED-WHEEL(PRESSURE TANK) GUN**

The three basic types of gunite machines we recommend are as follows:-

Rotating bowl - Reed ( LOVA-minimum 21 pocket bowl, SOVA –minimum 16 pocket bowl)

Rotary - Meyco, Piccola, Blastcrete (with minimum 12 hole rotor)

Feedwheel double chamber (Allentown "N" or "S" type with 36 tooth feedwheel).

Other generic manufacturers' machines (where specifications match the above) can be used for the installation of Stellar Materials Incorporated materials. For best results we recommend the maximum output of the Gunning machine be  $<2.7\text{yd}^3/\text{hr}(2\text{M}^3/\text{hr})$ .

For assistance in determining if your equipment meets the above requirements please contact Stellar Materials technical support.

### **GUNNING NOZZLE ASSEMBLY**

A pre-mixing nozzle assembly that is light in weight for easy handling and operation is highly recommended. For specifications, please contact Stellar Materials Technical Support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com).

### **AIR COMPRESSOR**

The Air Compressor must meet or exceed the following specifications:

- A minimum of 450 CFM at 100 psi for Air motor driven Gunning Machines. Electric motor driven Gunning machines require a minimum of 375 CFM at 100 psi
- In-line water trap
- Independent dedicated air port for gunite machine (not to be split with a manifold to run ANY other equipment).
- Independent dedicated air port for the Liquid Activator pump (not to be split with a manifold to run ANY other equipment).
- Dedicated air port for the additional air supply to the nozzle activator body.

If the compressor does not have two independent air ports, then the Liquid Activator pump must be run off of a completely separate compressor or plant air. Plant air is NOT to be used for supplying the gunite machine.

### **LIQUID PUMP**

#### **ARO PUMP MODEL #6661A3-344C (MODIFIED WITH IN-LINE AIR GAUGE AND CUT-OFF VALVE BEHIND AIR GAUGE) OR EQUIVALENT**

Since Thermbond® uses its own Liquid Activator and not water, a special pump system is required. The pump must be an air operated diaphragm pump capable of handling phosphoric acid with a concentration up to 77% and a specific gravity up to 1.6. For longest lasting performance the pumps are fitted with both VITON and TEFLON O-rings, gaskets, diaphragms, and other non-metal fittings.

We recommend that all fittings in contact with the Liquid Activator be high quality stainless steel or brass. The pump and hoses must be capable of operating at 100psi with a minimum safety factor of 3:1.

PRIOR TO THE START OF ANY GUNNING INSTALLATION WE STRONGLY RECOMMEND THAT THE USERS REPLACE ALL THE RUBBER CONNECTION SEALS ON THEIR HOSES THAT ARE UTILISED TO SUPPLY THE LIQUID ACTIVATOR BEFORE HOSES ARE CONNECTED TO THE PUMP AND NOZZLE ASSEMBLY.

This pump may be purchased through Stellar Materials or directly from standard supply houses. Be sure to order two flange fittings for inlet and outlet with stainless steel or brass hardware and acid-resistant gaskets. These are not typically included from supply houses.

### **DRILL MOTOR AND BUCKET**

When mixing individual units or partial units, a 1/2" drive drill motor operating at a minimum of 500 RPM and rated at 3/4 HP. or 7 amps with a Auger type mixer blade (available from Stellar Materials Inc.) or similar can be used with a 5-gallon clean plastic pail for a mixing container.

### **PLACING AND FINISHING TOOLS**

Standard types of tools can be used to place and finish all Thermbond® Castable Refractories. These tools would include power or non-powered screeds, trowels, floats, shovels, rakes, etc. A form vibrator is highly recommended for the best material placement and should be used whenever possible. If using a probe vibrator, a 2" diameter or above is recommended to efficiently move the material. All vibrators should be rated @ 12,000 VPM minimum. BEWARE of probe vibrators since they can generate substantial heat which can accelerate the hardening of Thermbond® products. Extra caution should be taken to avoid leaving "rat holes" in the material.

### **PARTIAL UNIT EQUIPMENT (IF NECESSARY)**

Graduated measuring cylinder with capacity to one (1) gallon (3.785 L) and Scale with capacity to sixty (60) pounds (27.21 kg).

## **PREPARATION\*\*\***

Proper preparation of crews, equipment, forms and vessels is a key to successful Thermbond® installations. Due to the relatively short working times, it is highly recommended that preparation procedures be followed explicitly. Thermbond® Refractories bond to themselves when proper procedures are followed, so cold bonding or lamination is of little concern even if Thermbond® has started to set. If the application is interrupted long enough that the material begins to harden, the surface to be bonded to should be scarified prior to applying Thermbond® to it. If the installation is designed as multiple pours, all joints between pours should be keyed. All required equipment and materials should be staged as close to the casting site as possible before beginning the application.

Please review the published Material Safety Data Sheet for the specific product that you are using for a listing of necessary Personal Protection Equipment, as well as other precautions related to mixing and using Thermbond® products.

### **FORM PREPARATION**

It is necessary that any forming work or form preparation be performed prior to mixing Thermbond® products. Thermbond® materials will bond tenaciously to most non-plastic forming materials. Additionally, Thermbond® will not shrink during setting. Coating steel forms with a paint primer and a mould release agent (e.g. a light coat of vegetable oil or grease) works well for releasing the form when using Thermbond® products. If painting the form is not practical, wrapping the form tightly with 4-mil polyethylene or contact paper and applying a light coat of oil or petroleum jelly will work well. Timber forms can be coated with a mould release agent such as vegetable oil or grease. Alternatively if no mould release agent is available, applying the appropriate Thermbond liquid activator to the timber will aid removal of forms. Coating forms with greases with high sulfur content CANNOT be used as the sulfur can react with the liquid activator contained within the mixed and placed material.

NOTE: Be sure NOT to coat areas on forms that will be in contact with joint sections. Form release in these areas will not allow a proper bonding surface for the subsequent pour.

## **PREPARATION OF EXISTING REFRACTORY SURFACES**

In order to assure a proper bond to an existing refractory surface, the following precautions must be taken:

- The surface being bonded to (if not the same Thermbond® formulation) must have been fired. It cannot be green; otherwise the bond will not last.
- The surface being bonded to must be structurally sound and clean. When repairing an existing lining, make sure that the refractory lining is chipped back to solid, clean refractory. Remove all deteriorated refractory and dust including any refractory penetrated by metals or other foreign matter. If the refractory is not solid, it may then come apart from within, taking the Thermbond® veneer with it. If the refractory is not clean and solid, the veneer may delaminate. Remember the bond is only as good as the surface it is bonding too.
- The surface being bonded to must not be wet. Due to the exothermic reaction of Thermbond® products, form release products can become less viscous and runnier. When slip forming, make sure that no grease or form-release has accumulated on any surface that is to be bonded to. **TIP:** Use The appropriate liquid activator as a form release agent on any forms that are in contact with a surface that is to be bonded to. If it has, scarify it using a appropriate hand tool or grinder prior to attempting to bond to it. If the surface is wet or oily, the joint will delaminate.  
NOTE: We DO NOT recommend pre-dampening the existing refractory surfaces with Liquid Activator prior to installation.
- The surface being bonded to must be rough. When slip-forming, make sure that the surface to be bonded to is not overly smooth. If it appears smooth, or "glassy," then scarify the surface prior to attempting to bond to it. If the surface is too smooth, the strength of the chemical bond may be inhibited by a mechanical bond-plane or it may lack the necessary porosity for a good chemical bond, ultimately causing a lamination. In general the alumina content of the Thermbond material should match the alumina content of the substrate material in order to obtain similar reversible thermal expansion and therefore the best possible bond.

## **PREPARATION FOR LINING VESSELS CARRYING MOLTEN METALS**

Any vessels to be lined with Thermbond® Refractory must have approximately ¼" diameter weep holes spaced no further than twelve inches apart. For location of weep holes, contact Stellar Materials Technical Support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com).

In addition, any vessels to be lined with Thermbond® must be pre-lined with a bond breaker to allow for the different coefficient of expansions between the refractory and the metal shell. A brush coat of Stellar Materials' Thermbreak 402 approximately 1/16" thick serves as an easily applied and excellent bond breaker between the lining and the shell. As an alternative, a high temperature ceramic paper 1/16" to 1/8" thick may be applied tight to the entire inner surface of the vessel and allowed to extend approximately 2" above the vessel. Extending the paper over the top of the shell helps dissipate the moisture through the top of the vessel during initial preheat.

# **THEIRMBOND® INSTALLATION CHECKLIST**

## **MIXER CONDITION**

- Is the mixer located as close to the casting site as possible?
- Is a mortar box required on site?
- Has the mixer been cleaned properly and neutralized?
- Are the rubber paddles properly adjusted to the drum?
- Has the fuel/oil and/or power supply to the mixer been checked?
- Has the mixer been tested to make sure that it runs properly?

## **OTHER EQUIPMENT**

See published MSDS at [www.thermbond.com](http://www.thermbond.com) for a complete listing of required personal protection when applying Thermbond® products.

Have vibrators been checked for good working condition?

NOTE: If using a probe vibrator, a 2" diameter with a minimum of 12,000 VPM is recommended to efficiently move the material. As probe vibrators can generate substantial heat which can accelerate the hardening of Thermbond® products, extra caution should be taken to avoid leaving "rat holes" in the material. Pneumatic probe vibrators are preferred over electric vibrators due to the lower heat generation.

Is the vibrator(s) secured to the form and hooked up to the power/pneumatic supply?

Are all other required tools and equipment on site and operational?

- Dust Masks
- Safety Goggles
- Gloves
- Wheelbarrows / Troughs
- Clock with second hand
- Hammer
- Shovels
- Trowels
- Wrench (to remove vibrator)

## **VESSEL CONDITION**

Is the vessel properly lined with Thermbreak 402 or ceramic paper if necessary?

Are there adequate and clean weep holes (no further than 12" apart) drilled into the walls and bottom of the vessel?

Is the vessel free of loose debris and accessible from all sides?

Are proper chains and equipment available for the removal of the form after the application?

# **CASTABLE MATERIALS**

## **RECOMMENDED EQUIPMENT**

Each piece of equipment below is described in detail in the EQUIPMENT DESCRIPTION section near the beginning of this guide. The proper equipment can be critical for a quality installation. Please contact Stellar Materials Technical Support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com) if you have any questions.

- PERSONAL PROTECTION EQUIPMENT
- PADDLE MIXER/pan mixer
- DRILL MOTOR AND BUCKET
- PLACING AND FINISHING TOOLS
- FORM VIBRATORS
- PROBE VIBRATORS
- PARTIAL UNIT EQUIPMENT (IF NECESSARY)

## **WORKING TIMES**

Thermbond® Castable Refractories must be mixed and placed quickly. Once an entire batch is added to the mixer, it takes less than thirty seconds for the material to wet completely. Based on an 80° Fahrenheit ambient temperature, most Thermbond® Castable products will set within 30 minutes after mixing. Hotter temperatures will result in shorter working times and colder temperatures will result in longer working times. In addition, larger masses will set more quickly than smaller masses. Very thin layers may require external heat sources to set, especially in cooler ambient conditions.

## **MIXING**

All mixing containers must be free of contaminants prior to using Thermbond® products.

Thermbond® Castable Refractories should be mixed in a paddle-type mixer. The paddle mixer should be clean and neutralized, and the paddle rubbers should be properly adjusted to the drum.

**IMPORTANT:** RENTAL MIXERS ARE MOST OFTEN USED FOR MIXING PORTLAND CEMENTS. EXTREME CARE MUST BE TAKEN WHEN USING A MIXER THAT WAS USED WITH PORTLAND-BASED PRODUCTS BECAUSE THERMBOND® PRODUCTS REACT ADVERSELY WITH PORTLAND-BASED PRODUCTS. THIS REACTION IS NOT A DANGEROUS REACTION, BUT WILL SERIOUSLY AFFECT THE PERFORMANCE OF THE THERMBOND®.

To clean mixer prior to use, pour two jugs of Thermbond® Formula Series or Thermbrake Series Activator into the mixer and run the mixer for five to ten minutes until foaming stops. Empty mixer completely into a container and use the liquid for cleaning any other tools that will be used to handle and place Thermbond®.

The following mixing instructions are simple, yet important. Please review them carefully noting the order of each step.

1. Turn on the mixer.
2. Pour enough pre-measured Liquid Activator into mixer or pail for the entire batch to be mixed. Adding additional amounts of liquid activator is NOT recommended. Although this action extends the set time of the material it can result severely compromised material properties and performance.
3. Add the corresponding amount of pre-blended, pre-measured dry formulation into the mixer or pail.
4. After the last portion of dry formulation is added to the mixer, mix for approximately fifteen seconds, or until Thermbond® Refractory becomes completely wetted-out, then quickly discharge the mixer.  
**Mixing too long in the mixer will cause the material to begin to set, significantly decreasing the time available to properly place the material.**
5. Discharge the contents of the mixer and place the material (see Placing and Finishing instructions herein). When mixing multiple batches of Thermbond® Castable Refractories, it is important to immediately load the mixer with the required amount of Liquid Activator for the next subsequent batch. This will prevent leftover material from the previous load from hardening in the mixer. If an application is temporarily delayed, let the mixer run with the Liquid Activator until the next load of dry mix is ready to be mixed.
6. Upon completion of the job, immediately pour a minimum of five gallons of water into the mixer to facilitate cleaning. **NEVER USE WATER IN THE MIX. WATER IN THE MIX CAN CAUSE CATASTROPHIC FAILURE, INCLUDING EXPLOSIVE SPALLING.**

DO NOT MIX LARGER BATCHES THAN CAN BE PLACED AND FINISHED WITHIN THE MATERIAL PLACEMENT TIME FOR THE THERMBOND® REFRACTORY. FAILURE TO DO THIS CAN RESULT IN VOIDS OR AIR POCKETS CAUSING EARLY FAILURE. IF MIXING BATCHES LARGER THAN EIGHT (8) REGULAR UNITS, PLEASE CONTACT STELLAR MATERIALS TECHNICAL SUPPORT FOR SPECIAL INSTRUCTIONS AT 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com).

Individual units of Castable materials may be mixed one at a time in a five gallon pail utilizing a "JIFFLER" brand or AUGER paddle mixer blade powered by a heavy duty drill motor (7 amp minimum). Mixing blades may be ordered from Stellar.

## **PLACING AND FINISHING**

When Thermbond® Castable Refractory is completely wetted-out, immediately pour the material into the area to be cast. When placing Thermbond® as a monolithic pour on the sides and bottom of a vessel (as in pouring ladles), Thermbond® must be poured from one side of the vessel and placed rapidly one pour after another until the bottom of the vessel has been completely cast in place. **POURING FROM DIFFERENT SIDES OF THE VESSEL SIMULTANEOUSLY MAY CREATE AIR POCKETS ON THE BOTTOM, WHICH COULD RESULT IN EXPLOSIVE SPALLING, AND POSSIBLE SEVERE INJURY TO OPERATING PERSONNEL.** Finishing the pour can be accomplished from all sides of the vessel. Vibration of the material is necessary to assure sound placement, free of voids and air pockets. A form vibrator is highly recommended for the best material placement and should be used whenever possible. If using a probe vibrator, a 2" diameter with a minimum of 12,000 VPM is recommended to efficiently move the material. As probe vibrators can generate substantial heat which can accelerate the hardening of Thermbond® products, extra caution should be taken to avoid leaving "rat holes" in the material. When casting Thermbond on horizontal surfaces as a repair to existing fired refractories, it is still recommended to ensure good contact between the surfaces by vibrating or tamping. Tools for mixing, placing, and finishing can be cleaned with Liquid Activator between batches.

# **RAMMABLE MATERIALS**

## **RECOMMENDED EQUIPMENT**

Each piece of equipment below is described in detail in the EQUIPMENT DESCRIPTION section near the beginning of this guide. The proper equipment can be critical for a quality installation. Please contact Stellar Materials Technical Support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com) if you have any questions.

- PERSONAL PROTECTION EQUIPMENT
- HOBART-TYPE MIXER
- PLACING AND FINISHING TOOLS
- PNEUMATIC RAMMING TOOL
- RUBBER HAMMER
- PARTIAL UNIT EQUIPMENT (IF NECESSARY)

## **WORKING TIMES**

Thermbond® Rammable Refractories must be mixed and placed quickly. Once an entire batch is added to the mixer, it should take one to four minutes for the material to wet completely. Hotter temperatures will result in shorter working times and colder temperatures will result in longer working times. In addition, larger masses will set more quickly than smaller masses.

## **MIXING**

All mixing containers must be free of contaminants prior to using Thermbond® products. Thermbond® Rammable Refractories should be mixed in a Hobart-type mixer. The mixer should be clean and neutralized.

To clean mixer prior to use, pour one jug of Thermbond® Formula Series into the mixer and run the mixer for five to ten minutes until foaming stops. Empty mixer completely into a container and use the liquid for cleaning any other tools that will be used to handle and place Thermbond®.

The following mixing instructions are simple, yet important. Please review them carefully noting the order of each step.

Once the dry and liquid components are properly proportioned, the material may be mixed as follows.

1. Pour enough pre-measured Liquid Activator into the mixing bowl for the entire batch to be mixed.
2. Pour all the dry material into the liquid in the mixer bowl.

3. Immediately turn on the mixer at low speed. Let the mixer run until the material “folds.” This should take approximately 1-4 minutes.
4. Quickly discharge the mixer. If the material is folding well prior to one minute of mixing, then the wet-to-dry ratio is too high. Lower the percentage of liquid and try again.
5. Discharge the contents of the mixer and place the material (see Placing and Finishing instructions herein). When mixing multiple batches of Thermbond® Rammable Refractories, it is important to immediately load the mixer with the required amount of Liquid Activator for the next subsequent batch. This will prevent leftover material from the previous load from hardening in the mixer. If an application is temporarily delayed, let the mixer run with the Liquid Activator until the next load of dry mix is ready to be mixed.
6. Upon completion of the job, immediately pour water into the mixer to facilitate cleaning. **NEVER USE WATER IN THE MIX. WATER IN THE MIX CAN CAUSE CATASTROPHIC FAILURE, INCLUDING EXPLOSIVE SPALLING.**

**DO NOT MIX LARGER BATCHES THAN CAN BE PLACED AND FINISHED WITHIN THE MATERIAL PLACEMENT TIME FOR THE THERMBOND® REFRACTORY. FAILURE TO DO THIS CAN RESULT IN VOIDS OR AIR POCKETS, CAUSING EARLY FAILURE.**

## **PLACING AND FINISHING**

When Thermbond® Rammable Refractory is mixed, immediately begin ramming the material into place using a pneumatic ramming tool or a rubber mallet.

Thermbond® Rammable Refractories should NEVER be vibrated into place.

# **TROWELABLE AND HAND PACKABLE MATERIALS**

## **RECOMMENDED EQUIPMENT**

Each piece of equipment below is described in detail in the EQUIPMENT DESCRIPTION section near the beginning of this guide. The proper equipment can be critical for a quality installation. Please contact Stellar Materials Technical Support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com) if you have any questions.

- PERSONAL PROTECTION EQUIPMENT
- PADDLE MIXER/PAN MIXER
- DRILL MOTOR AND BUCKET
- PLACING AND FINISHING TOOLS
- PARTIAL UNIT EQUIPMENT (IF NECESSARY)

## **WORKING TIMES**

Thermbond® Trowelable Refractories are formulated for longer working times than either the Castable or Gunnable products. Thermbond® Trowelable products are typically mixed in single unit quantities or less.

## **MIXING, PLACING AND FINISHING**

Certain Thermbond® Formula Series refractory products may be troweled into place after mixing. Please follow the directions below carefully when troweling or hand packing any of these products.

1. When mixing partial units, dry mix the bag prior to weighing out the required amount of dry material.
2. When mixing partial units, agitate the entire jug prior to weighing out the liquid. Use the wet-to-dry ratios specified on the individual product data sheets. These percentages should be calculated as a percentage of the dry material. For instance, if the wet-to-dry ratio is 19%, then for every 10 lbs of dry mix, use 1.90 lbs of Formula Series Activator.

3. Always mix the dry material into the Liquid Activator, never the reverse.
4. The material should be completely wetted-out within one minute after you begin mixing. If your mixer is not mixing the material at least this quickly, then use a Hobart-type mixer set on slow speed, or a heavy duty drill motor (at least 7 amps) with a Jiffler-type paddle blade.
5. If you need to mix the material to a wetter consistency for thinner sections, then use additional Formula Series Activator. If you need to mix the material to a dryer consistency for thicker sections, then use less Formula Series Activator. **NEVER USE WATER IN THE MIX. WATER IN THE MIX CAN CAUSE CATASTROPHIC FAILURE, INCLUDING EXPLOSIVE SPALLING.**
6. Do not mix more material at one time than can be placed within 15-20 minutes at 80°F. (If the ambient temperatures are higher, then the materials will have less working time.)
7. When troweling the materials, use a trowel with a large surface area for the best finish. When hand packing the materials, rubber gloves should be worn. To improve the appearance of the face of the material, wet the trowel or gloves slightly with the appropriate Liquid Activator when finishing the material. **NEVER USE WATER.**
8. When troweling or hand packing Thermbond on horizontal surfaces as a repair to existing fired refractories, it is recommended to ensure good contact between the surfaces by tamping.

## **GUNNABLE MATERIALS**

### **RECOMMENDED EQUIPMENT**

Each piece of equipment below is described in detail in the EQUIPMENT DESCRIPTION section near the beginning of this guide. The proper equipment can be critical for a quality installation. Please contact Stellar Materials Technical Support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com) if you have any questions.

- PERSONAL PROTECTION EQUIPMENT
  - GUNNING MACHINE
  - GUNNING NOZZLE ASSEMBLY
  - LIQUID PUMP
  - AIR COMPRESSOR
  - PADDLE MIXER
  - PLACING AND FINISHING TOOLS
  - SPARE PARTS
- Replacement parts for nozzle.

### **WORKING TIMES**

Thermbond® Gunnable Refractories are formulated to set quickly on placement. Detailed instructions for gunning Thermbond® products are detailed herein.

### **PLACING AND FINISHING**

All mixing containers must be free of contaminants prior to using Thermbond® products.

### **ON-SITE SERVICES**

Prior to beginning the job, it should be confirmed that adequate services are available at the job-site for gunning Thermbond® materials. These services include:

- Air Compressor (see Equipment Description Section )
- Adequate electrical supply
- A convenient area for equipment set-up and storage for dry material and liquid

## **COMMUNICATION**

Walkie-talkies or headset telephones can provide direct contact between the nozzle man and the crew loading the gun. This can increase efficiency and quality significantly. Care should be taken in selecting communication equipment in that structural steel can cause interference.

## **EQUIPMENT START-UP AND TESTING**

- Confirm that nozzle gate valve and air valve on the Liquid Activator pump are shut.
- Start air compressor and check air supply @ compressor is minimum 100psi.
- Place suction pipe/hose from the pump into the Thermbond® Liquid Activator drum.
- Turn on air control lever to provide pressure to the liquid pump. Check pump pressure on dial gauge is set to 85 psi. Adjust if necessary.
- Open air valve on pump to pressurize Activator feed line to nozzle.
- Open and set the additional air supply to approx. 40 psi to supply the Gunning nozzle body. This valve should be kept open throughout the gunning operation. This air provides a better dispersion of the material and prevents the liquid activator from flowing back into the dry material hose.
- When the nozzleman is in position with the nozzle assembly in his control, the Gunite machine operator should open the Main air valve on the Gunite machine to obtain the desired air exiting the nozzle tip (this will be determined by the nozzleman).
- Open the Gunning Nozzle valve to ensure Liquid Activator is being supplied to the nozzle tip.
- Check all fittings and lines for leaks. This is important since the Liquid Activator can damage some finished surfaces. **DO NOT USE WATER IN THE MIX AS THIS CAN CAUSE EXPLOSIVE SPALLING ON HEAT UP RESULTING IN CATASTROPIC FAILURE OF THE MATERIAL.**
- Close the nozzle valve once the surge is started. The pump should stop. If it continues, then the nozzle gate valve was left open or there is a leak in the Liquid Activator line.
- The pump should be running at approximately 80-100 psi.
- Make sure that all functions of the Gunning machine are operating prior to placing any material in the hopper.
- If predampening, use the appropriate Liquid Activator. Predampen in a paddle or pan type mortar mixer prior to introducing the material into the gunite machine hopper. Liquid Activator should be sprinkled over the dry mix to reduce dusting. The amount of Liquid Activator required for predampening will vary depending on the ambient temperature and humidity. Normal predampening ratios are one (1) jug of the appropriate Liquid Activator to four (4) bags of the appropriate dry material. The Thermbond Formula 8G product requires one (1) jug to every three (3) bags of dry to predampen. In higher ambient conditions, more Liquid Activator may be required for predampening to reduce dusting, but this amount should not exceed one (1) jug of the appropriate Liquid Activator to three (3) bags of the appropriate dry material. Predampened material must be able to pass through a 3/8" mesh screen before entering the gunite machine. If during predampening, excessive clumping is evident in the mix, then either too much Liquid Activator is being used and should be reduced until clumping disappears or the Liquid Activator is not being dispersed properly in the dry mix. It is recommended to order the correct number of Jugs of the appropriate Liquid Activator for predampening.
- Place dry (or predampened) material in hopper.
- Gunning may now begin.

## **GUNNING PROCEDURES**

1. The nozzle man should be in position with personal protection items (as indicated in the Recommended Equipment section) and communications gear if necessary.
2. Open the additional air supply to the nozzle and ensure pressure is set @ approx. 40 psi.
3. Open the Gunning Machine main air valve that controls the air supply to the nozzle tip.
4. Open the valve on the gunning nozzle to supply activator to the nozzle tip.
5. Turn on air to rotate the feedwheel, rotor or bowl that supplies the dry material through the hose.
6. Adjust liquid nozzle valve to obtain the proper wet-to-dry ratio. This valve is the nozzle man's adjustment. If the liquid level is too high, excessive slumping & liquid will be evident on the surface. If the liquid level is too low, excessive dust and high rebound will be evident. **DO NOT START THE INSTALLATION UNTIL PROPER CONSISTENCIES ARE ACHIEVED.**

7. Nozzle should be held approximately 3-4 feet from the substrate at all times. The position should be maintained whether gunning horizontally, vertically, or overhead. If this position is not maintained, rebound will increase, and yield will decrease.
8. The nozzle assembly should be moved in a circular motion until the desired thickness is achieved.
9. **WHEN STOPPING OR BREAKING FROM GUNNING, ALWAYS MAKE SURE THAT THE ENTIRE NOZZLE ASSEMBLY STAYS POINTED DOWNWARD FROM THE ACTIVATOR RING FORWARD TO PREVENT LIQUID ACTIVATOR FROM SEEPING BACK INTO DRY MATERIAL FEED HOSE.**
10. If gunning over existing refractories, to confirm that a proper bond has been achieved, sound out the surface of Thermbond® after gunning. Hollow sounds indicate an improper bond.

## **TROUBLESHOOTING**

### **INSUFFICIENT ACTIVATOR AT NOZZLE.**

- Air supply not connected
- Air hose is obstructed
- Pump has air lock
- Strainer not submerged in liquid
- Strainer is not clean
- Suction line has collapsed
- Liquid line is obstructed
- Liquid drum is empty
- Activator ring is not clean

**If at any time, you experience any problems gunning Thermbond® products, please contact Stellar Materials Technical Support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com)**

### **INSUFFICIENT DRY (OR PREDAMPENED) MATERIAL AT NOZZLE.**

- Air pressure is too low (material will clog in hose)
- A hose connection is split, loose, or leaking
- Air compressor output is less than 80psi, or cfm output is too low

## **SHUT DOWN PROCEDURES**

1. Turn off air to gunning machine feedwheel/bowl to stop dry material flow.
2. When dry material stops flowing, allow activator to run through the nozzle for approx 10 seconds to clean nozzle internals of any material debris then turn off nozzle valve to stop the Activator supply.
3. Crimp the hose on the special pre-dampening nozzle assembly and allow the air to build up in the line and carefully release quickly. Do this several times to purge the line of any DRY material. **EXTREME CAUTION SHOULD BE USED WHEN DOING THIS PROCEDURE TO AVOID ALLOWING THE HOSE TO KICK BACK AND INJURE THE OPERATOR.**
4. Turn off the Gunning machine Main air valve that controls the air supply to the nozzle. When laying down the nozzle assembly, **always make sure that the discharge end is pointing downward and is lower than the inlet.** The nozzle assembly should be placed in a location where it will not be damaged. It is advisable to place the nozzle into a drum of water.
5. The activator pump air valve should be turned off when shutting down. When stopping for the day, **purge out the pump and lines with water and clean nozzle assembly.** There is a Shreider type relief valve located at the base of the pump air regulator assembly. If this valve is pressed upwards it will release air pressure on the activator feedline allowing the operator to disconnect the hoses safely. **CAUTION:** In the event of the activator feedline still being pressurized we strongly recommend covering the hose connection fittings with a cloth or similar during dismantling.
6. When stopping the gunning operation for several hours, or at the end of the day, never leave dry material in the hopper. **Continue operating the machine until hopper is empty.** Leaving the hopper empty will allow the operator to visually inspect the machine for foreign objects prior to start-up. This will prevent unnecessary damage to the machine when resuming gunning operations.

## PUMPABLE MATERIALS

Certain Thermbond® materials can be pumped with conventional concrete pumping equipment. Please contact Stellar Materials Technical support @ 561.330.9300 or e mail [support@thermbond.com](mailto:support@thermbond.com) to discuss your specific application.

## THERMBOND® THERMBRAKE SERIES

Thermbrake is a castable lightweight insulating refractory. Like other Thermbond® products, Thermbrake is a two-part (dry formulation and Liquid Activator) system. When added together, Thermbrake products exhibit a fast exothermic set.

**Thermbrake Series products typically utilize a higher wet-to-dry ratio than Formula Series products, and therefore, may be packaged to require TWO JUGS OF THERMBRAKE SERIES ACTIVATOR FOR EVERY THERMBRAKE BAG. Check the wet-to-dry ratios published on the individual data sheets to confirm the proper ratio of jugs-to-bags.**

When Thermbrake products are used as a back-up insulator behind any dense refractory – Thermbond® or conventional – steaming from the backup liner after the dense lining is completely cured could be apparent for hours or days beyond the initial cure-out. Please consult a Thermbond® technical support representative for a modified schedule.

### **SPECIAL NOTES FOR THERMBRAKE 402**

Thermbrake 402 is an expanding insulating refractory. Unlike other series' of Thermbond® products, Thermbrake 402 mixes to a very thin consistency. When the liquid and dry components are combined, the expansion begins immediately. Care should be taken not to over-mix the material, as this may detrimentally affect the expansion and therefore the density. As soon as the material has been completely wetted-out, it should be placed. Thermbrake 402 should never be vibrated into place.

In order to allow for expansion on set, Thermbrake 402 should be poured to approximately 80% of the height of the form. If the material expands above the form, the excess may be cut off with a serrated edged tool.

### **SPECIAL NOTES FOR THERMBRAKE 403**

In order to achieve the published densities, Thermbrake 403 must be mixed in either a paddle-type mortar mixer or in a Hobart-type bowl mixer at low speed. Mixing at high speeds or with a drill-motor mixing blade will result in significantly higher densities, and therefore diminished coverage and insulating properties.

When Thermbond® Thermbrake 403 Refractory is completely wetted-out, it will appear dampened, but loose and granular. It will not fold or appear wet. Once wetted-out, immediately begin packing the material into place using a plastic or metal hand-tamping float by hand and not by pneumatic device.

The material should be packed just hard enough to match the "As Placed" density listed on the Technical Data Sheet. For instance, if the "As Placed" density is 85 lbs/ft<sup>3</sup>, then pack the material hard enough so that 85 lbs of mixed material fits snugly into a one cubic foot area. This should be done by each person placing the material at least at one time to get a "feel" for how hard to pack the material into place during the job. Thermbond® Thermbrake 403 should never be vibrated into place.

## FORM REMOVAL \*\*\*

Upon completion of placement, an exothermic reaction will begin and Thermbond® will rapidly develop strength. Depending upon the particular product, the ambient temperature and the casting geometry, Thermbond® will develop ample strength within approximately thirty minutes to one hour for the removal of the form.

Due to the exothermic reaction, the release agent on the form may thin and become less effective with time. Therefore, it is recommended that the forms be removed shortly after the material has developed sufficient strength. Otherwise, forms will be difficult to remove.

Typically, when the thinnest section of the application is hard enough so that it cannot be dented with trowel or similar tool, the material is hard enough to remove forms.

## CURING AND BAKE-OUT SCHEDULES FOR THERMBOND® REFRACTORIES \*\*\*

Once Thermbond® is properly placed, an exothermic reaction will begin and typically take between one (1) and four (4) hours to complete, depending upon the volume of the refractory installed. This reaction must be completed prior to the application of any external heat to the material. When Thermbond® is cool to the touch, heat may be applied to the material as described below.

In many applications, Thermbond® refractories may be installed with no bake-out schedule whatsoever, providing there is no direct flame impingement during the ramp up. Even when a bake-out schedule is required, it is typically substantially faster than conventional refractory bake-out schedules.

Some applications which require a specific bake-out schedule include (but are not limited to):

- The refractory will be in contact with molten metal (see dedicated subsection following).
- The refractory will see direct flame impingement on initial start-up.
- The refractory will be in contact with temperatures in excess of 500°F per hour on initial start-up.

Contact Thermbond® technical support at 561.330.9300, or email [support@thermbond.com](mailto:support@thermbond.com) for a clear evaluation of your application. IF NOT BAKED OUT PROPERLY, EXPLOSIVE RELEASE OF STEAM CAN OCCUR RESULTING IN INJURY TO PERSON AND/OR DAMAGE TO EQUIPMENT.

### CURING AND BAKE-OUT SCHEDULE FOR THERMBOND® IN MOLTEN METAL VESSELS

For total lining thicknesses of 18" or less, use the schedule below. For lining configurations thicker than 18", contact Thermbond® technical support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com) for a custom schedule.

1. Is there any green (unfired) refractory in the vessel other than Thermbond®? If not, skip to #3.
2. If you answered "Yes" to #1 above, this schedule does not apply. Follow the heat up schedule of the most conservative of the other refractory materials. Skip to End.
3. Is there a moisture-containing insulating back up lining in the vessel? If not, skip to #7.
4. Is the vessel a ladle? If so, skip to #7.
5. Are weep holes installed in the vessel? If so, skip to #7.
6. Install weep holes in the vessel shell to allow for the release of moisture. The weep holes should be ¼" diameter on 12" centers covering the entire area where Thermbond® insulating castable is installed.
7. After reading this section, be sure to read the following subsection "Precautions for Two-Part Insulating Systems."

8. Leave an opening in the vessel to facilitate air flow with positive pressure. For instance, in a furnace, leave the door opened approximately 12".
9. Raise temperature from ambient to 1100°F at the linear rate of not more than 200°F per hour. Never apply a direct impinging flame for any extended period of time on any one area of the liner. Always heat the refractory from one side only. **HEATING FROM BOTH SIDES OF THE REFRACTORY COULD RESTRICT THE RELEASE OF MOISTURE, CAUSING A STEAM SPALL.**
10. Hold at 1100°F for two hours per inch of maximum thickness.
11. Raise temperature at a rate of not more than 200°F per hour linear to operating temperature. NOTE: If the lining is a two-part system with a castable insulating back up, the insulation layer may steam through the weep holes for a very long time. Once the Thermbond® hot face is at operating temperature, the unit may be put on-line, regardless of whether or not the back-up layer is still steaming.
12. After following the schedule above, the Thermbond® lining is ready to accept molten metal. On the initial pour, fill the vessel approximately 1/3 full and hold for one minute. Continue filling until the vessel is approximately 2/3 full and again hold for one minute. The vessel may now be filled completely. This practice is only necessary on the initial pour for sintering purposes.
13. Subsequent pours of molten metal into a Thermbond®-lined vessel should never be made while the lining is cold. Thermbond®-lined vessels accumulate little slag, allowing little or no buffer to the extreme thermal shock of pouring molten metal on a cold liner. Prior to additional pours, Thermbond® may be preheated from a cold state with a high flame until the vessel liner reaches the approximate tap temperature of the molten metal.

If you have any questions whatsoever, please contact Thermbond® technical support at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com). IF NOT CURED PROPERLY, EXPLOSIVE RELEASE OF STEAM CAN OCCUR RESULTING IN INJURY TO PERSON AND/OR DAMAGE TO EQUIPMENT.

## **CURING AND HEAT UP PRECAUTIONS FOR TWO-PART INSULATING SYSTEMS**

- When ANY moisture-containing lightweight insulating materials are used as a back up behind Thermbond®, special precautions MUST be taken to allow for the release of steam from the lightweight materials. Please contact Stellar Materials Technical Support for further information at 561.330.9300 or email [support@thermbond.com](mailto:support@thermbond.com).
- If any other moisture-containing refractory or insulating materials are being used in the equipment, the most conservative manufacturer's curing schedule must be followed.
- If the lining is a two-part system with a castable insulating back up, the insulation layer may steam (through weep holes, for instance) for a very long time. Once the Thermbond® hot face is at operating temperature, the unit may be put on-line, regardless of whether or not the back-up layer is still steaming.
- If ceramic fiber or a similar insulating back up material is used adjacent to Thermbond®, no curing compound should be used in areas that will be in contact with Thermbond® products.

# **ADDITIONAL IMPORTANT INFORMATION\*\*\***

## **MIXING PARTIAL UNITS**

If mixing less than full units of any Thermbond® Refractory, be sure to dry-mix the dry component and agitate the liquid before mixing any material, as the contents may have settled during shipping and some segregation may have occurred. The correct way to determine the amount of the pre-mixed dry formulation to that of the Liquid Activator is:

1. Determine the weight of the pre-mixed dry formulation required.
2. Refer to the appropriate Technical Data Sheet for the correct WET TO DRY RATIO.
3. Multiply the weight of the dry formulation by the WET TO DRY RATIO.
4. This number is the amount, by weight, of Liquid Activator required.

The published wet to dry ratio range reflects possible variations of the raw materials used in our products. For mixing partial units we recommend using the median published wet to dry ratio

## **MATERIAL STORAGE PRIOR TO USE**

All Thermbond® Castable Refractories are temperature sensitive materials. Always store the pre-blended dry component and the Liquid Activator in an area where direct heat from plant equipment or direct sunlight will not cause the material to become hot. Ideally, all Thermbond® products should be stored in an area where the temperature is between 50°F and 80°F (10°C and 26.6°C).

## **MATERIAL STORAGE AND SHELF LIFE**

Dry storage of the pre-blended dry component of Thermbond® products is required. Store both the liquid and dry components in an area where the ambient temperature is between 32°F and 100°F (0°C and 37.7°C).

Stored properly, Thermbond® products have the following shelf lives:

<b>DRY MIXES</b>		<b>LIQUID ACTIVATORS</b>	
Formula Series Castable Mixes	Two Years	Formula Series	Two Years
Formula Series Gunnable Mixes	Two Years		
Formula Series Trowelable Mixes	Two Years		
Formula Series Hand Packable Mixes	Two Years		
Formula Series Rammable Mixes	One Year		
Thermbrake Series Mixes	Two Years	Thermbrake Series	Two Years

## **HEALTH AND SAFETY PRECAUTIONS**

Precautions should be taken when working with Thermbond® Dry Mixes and Liquid Activators. Review the Material Safety Data Sheets for any product being used prior to application.

# INSTRUCTIONS FOR PREPARING THERMBOND® REFRACTORIES FOR LABORATORY TESTING

## INTRODUCTION

The Thermbond binder system is very unique, and certain special procedures are necessary when mixing Thermbond refractories. Most of these procedures differ only slightly from those used when mixing traditional refractory products.

Unless otherwise indicated, ASTM procedures are to be strictly followed. Where variations from ASTM procedures are indicated, they are considered necessary and appropriate for the unique characteristics of the Thermbond binder system.

In order to fully understand these mixing and placing instructions, the Installation Guide should be read in its entirety. Some of the terminology herein is written with the assumption that the reader has done so. Be sure to read this entire procedure before beginning.

Thermbond's® technical support staff is available to provide assistance for laboratory testing at 561.330.9300 weekdays from 9am to 5pm Eastern Standard Time, or at [support@thermbond.com](mailto:support@thermbond.com).

## MIXING PROPORTIONS

Thermbond products are packaged to be mixed in full "unit" quantities. In other words, depending on the particular family of products, one or two complete bags is packaged to be mixed with one or two complete jugs. See the products associated Technical Data Sheet for details.

Since most laboratory testing will require less than full unit quantities, it will likely be necessary to weigh out the appropriate amount of dry material and the corresponding amount of Liquid Activator.

The amount of dry material to be used should be enough to fill approximately 40% of the mixing bowl.

Before weighing out a portion of the dry material, it is necessary to dry mix the entire bag as packaged to compensate for any intra-bag settling or segregation which may have occurred in shipping.

**In order to determine the necessary amount of liquid required for the dry material to be mixed, call Stellar Materials Incorporated at 561.330.9300 with the lot number stamped on the bottom of the bag and request the "wet-to-dry ratio" for that particular lot.**

These percentages should be calculated as a percentage of the dry material. For instance, if the wet-to-dry ratio is 12%, then for every 10 lbs of dry mix, use 1.20 lbs of Liquid Activator.

**NOTE:** Thermbond Liquid Activators are HEAVIER THAN WATER and must be measured by weight and NOT BY VOLUME.

Before weighing out a portion of the liquid material, it is necessary to agitate the entire jug thoroughly to compensate for any intra-jug settling.

## FORMS AND MOLDS

Thermbond materials bond tenaciously to most inorganic substrates. Molds must be **PLASTIC** and completely clean and smooth to achieve proper results. **NO FORM RELEASE SHOULD BE USED.** If you have problems releasing the materials from the molds, the plastic molds should be replaced with new molds. If you need new molds, call Stellar at 561.330.9300.

## **MATERIAL MIXING**

Once the dry and liquid components are properly proportioned, and the molds are properly prepared, the material may be mixed.

For all Thermbond materials, a Hobart-type lab mixer should be used on low speed, and the materials should be mixed at ambient conditions of 70-80 degrees Fahrenheit and 40-60% relative humidity.

The following steps should be followed exactly in the order indicated. Read the entire procedure before beginning.

1. Pour all the liquid to be mixed into the mixer bowl.
2. Pour all the dry material into the liquid in the mixer bowl.
3. Immediately mount the mixer bowl onto the mixer.
4. Immediately connect a **stainless steel** mixing blade to the mixer.
5. Immediately turn on the mixer at low speed. Let the mixer run until the material "folds."

When mixing Formula Series or Tabular Series castable products, this folding should occur within sixty seconds.

When mixing Formula Series Rammable products, this folding should occur within 1-4 minutes.

When mixing Thermbreak 402, no folding will occur. Mix the material until it is completely wetted-out and the consistency of pancake batter. This should take no more than twenty seconds.

When mixing Thermbreak Series hand castable products, no folding will occur. The material should be mixed until the blades are leaving the sides of the mixing bowl almost entirely clean of material with each pass. This should occur within sixty seconds.

## **MATERIAL PLACEMENT**

Once the material is mixed properly, it should be immediately placed into the molds or forms per ASTM procedures. Do not cover the samples. Once completely placed in the molds, do not move the samples until they are ready to be removed.

## **REMOVAL FROM MOLDS**

Thermbond® materials should be allowed to set for a minimum of 24 hours prior to removal from molds.

## **SAMPLE PREPARATION**

Test samples must **never** be wet-cut green. When obtaining test samples from large panels, the following procedures apply:

Materials with densities less than 110 lbs/ft<sup>3</sup> - dry cut from green material before firing.

Materials with densities greater than 110 lbs/ft<sup>3</sup> **must be fired** prior to wet cutting.

Samples should then be dried to 230 F for five hours before testing.

## **FIRING THE MATERIAL**

Follow ASTM firing procedures.

# LIMITED WARRANTY

**Stellar Materials Incorporated (“Stellar”) extends the following limited warranty for Thermbond® Refractories only to its distributors, industrial commercial customers, and commercial customers who have had Stellar products installed by Stellar or installation agents approved by Stellar (each, a “User”).**

## **1. LIMITED WARRANTY**

**Limited Warranty Period.** All Thermbond® Refractories (“products”) are manufactured to meet published physical properties within tolerances established by Stellar when the material is stored, mixed, placed, and cured according to Thermbond® standards, and Stellar warrants all Thermbond® Refractories to be free from defects for a period consistent with the shelf life of the material as described from time to time in this Installation Guide or until it is installed, whichever period shall expire first.

**Limited Warranty Remedies.** If, prior to expiration of the foregoing applicable limited warranty period, any of such products shall be proved to Stellar’s satisfaction to be defective or nonconforming, Stellar will repair or replace such defective product, F.O.B. Stellar’s plant or other destination designated by Stellar, or will refund or provide User with a credit in the amount of the purchase price paid therefor by User, at Stellar’s sole option. User’s exclusive remedy and Stellar’s sole obligation under this warranty shall be limited to such repair or replacement, F.O.B. Stellar’s plant or other destination designated by Stellar, or refund or credit by Stellar, and shall be conditioned upon Stellar’s receiving written notice of any defect within a reasonable period of time (but in no event more than sixty (60) days) after it was discovered or by reasonable care should have been discovered. **In no event shall Stellar’s liability for such defective or nonconforming products exceed the purchase price paid by User therefor.**

**Exclusions.** This warranty (i) does not cover shipping expenses to and from Stellar’s factory or other destination designated by Stellar for replacement of defective product or any tax, duty, custom, inspection or testing fee, or any other charge of any nature related thereto, nor does it cover the costs of removing defective product or reinstalling, or testing repaired or replaced product or finishing the reinstallation thereof; (ii) does not apply to, and shall be void with respect to, product not installed in accordance with installation instructions or requirements; product altered by a party other than Stellar or Stellar’s authorized service agents; product which has been rendered defective or nonconforming as a result of mixture with any defective or nonconforming materials of any party other than Stellar; product that was subjected to abuse, negligence, misuse, misapplication, accident, damages by circumstances beyond Stellar’s control, improper installation (if by others than Stellar), operation, maintenance or storage, or any use or service other than normal use or service; and (iii) does not apply to product not manufactured by or for Stellar. With respect to product not manufactured by Stellar, Stellar’s warranty obligations shall in all respects conform and be limited to the warranty actually extended to Stellar by its suppliers, but in no event shall Stellar’s obligations be greater than those provided under Stellar’s limited warranty set forth herein.

**THE FOREGOING LIMITED WARRANTIES ARE IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NO EMPLOYEE, REPRESENTATIVE**

**OR AGENT OF STELLAR (OTHER THAN AN OFFICER OF STELLAR) IS AUTHORIZED TO ALTER OR MODIFY ANY PROVISION OF THIS LIMITED WARRANTY OR TO MAKE ANY GUARANTEE, WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ORALLY OR IN WRITING, WHICH IS CONTRARY TO THE FOREGOING.** Any description of the product, whether in writing or made orally by Stellar or Stellar’s agents, or specifications, samples, models, bulletins, drawings, diagrams, engineering sheets or similar materials which may have been used in connection with any promotional materials or

otherwise used in selling products to, or creating purchase orders for, User or for any agent acting on behalf of User (other than Stellar) are for the sole purpose of identifying the product and shall not be construed as an express warranty or to modify this limited warranty in any manner whatsoever. Any suggestions by Stellar or Stellar’s agents regarding use, application or suitability of the product shall not be construed as an express warranty or to modify this limited warranty in any manner unless confirmed in writing by an authorized officer of Stellar.

## **2. LIMITATIONS OF LIABILITY; CONSEQUENTIAL DAMAGES**

**Improper Use Disclaimer.** Product sold by Stellar is not intended for use (i) in connection with any nuclear facility or activity, (ii) in connection with any material not specifically approved in the Installation Guide, or (iii) in any manner or use otherwise contrary to the Installation Guide. If so used, Stellar disclaims all liability for any nuclear damage, other damage, injury or contamination, and User shall indemnify and hold Stellar, and its officers, agents, employees, successors, assigns and customers, harmless from and against any and all damages, liability, claims, losses or expenses of whatever form or nature (including attorneys’ fees, court costs, out-of-pocket expenses and other costs of defending any action) that they or any of them may sustain or incur, whether as a result of breach of contract, warranty, tort (including negligence) or otherwise, by reason of such use.

**Consequential Damage Disclaimer.** **Stellar’s liability with respect to product proved to its satisfaction to be defective or nonconforming within the limited warranty period, and for which no other exclusions or limitations set forth in this limited warranty are applicable, shall be limited to replacement or refund as provided in this limited warranty, and in no event shall Stellar’s liability exceed the purchase price of the product involved.** Stellar shall not be subject to any other obligations or liabilities, whether arising out of breach of contract, warranty, tort (including negligence) or other theories of law, with respect to product sold or services rendered by Stellar, or any undertakings, acts or omissions relating thereto. Without limiting the generality of the foregoing, Stellar specifically disclaims any liability for property or personal injury damages, penalties, special or punitive damages, damages for lost profits or revenues, loss of use of product, cost of capital, cost of substitute products, facilities or services, construction or other delays, downtime, shutdown, or slowdown costs, or for any other types of economic loss, and for claims of User’s customers, agents, principals, partners, or other affiliated parties or affected third parties (all of the foregoing, “Affected Parties”) for any such damages.

**EVEN IF THE REPLACEMENT REMEDY SHALL BE DEEMED TO HAVE FAILED OF ITS ESSENTIAL PURPOSE UNDER SECTION 2-719 OF THE UNIFORM COMMERCIAL CODE, STELLAR SHALL HAVE NO LIABILITY TO USER FOR CONSEQUENTIAL DAMAGES, SUCH AS LOST PROFITS, LOST REVENUE, DAMAGE TO OTHER PRODUCT, OR LIABILITY OR INJURY TO USER, ANY AFFECTED PARTY, OR ANY OTHER THIRD PARTY. STELLAR SHALL NOT BE LIABLE FOR AND DISCLAIMS ALL CONSEQUENTIAL, INCIDENTAL AND CONTINGENT DAMAGES WHATSOEVER.**

### **3. INDEMNIFICATION BY USER**

By use of products manufactured by or for Stellar, User agrees to indemnify, hold harmless, and defend Stellar, and Stellar's officers, agents, employees, successors, assigns and customers, from and against any and all damages, liability, claims, losses and expenses of whatever form or nature (including attorneys' fees, court costs, out-of-pocket expenses and other costs of defending any action) arising out of or resulting in any way from claims by User, any Affected Party, or any other third parties against Stellar alleging a breach of contract or warranty by Stellar, to the extent that such damages, liability, claims, losses and expenses may be payable by Stellar to User pursuant to and as limited by Stellar's limited warranty obligations as contained in this limited warranty, so as to effectively limit Stellar's obligations to Affected Parties or other third parties to those set forth in this limited warranty.

### **4. PATENT INDEMNIFICATION**

Stellar will, at its own expense, defend or settle any suits that may be instituted against User for alleged infringement by the product of any United States patent, provided that (a) such alleged infringements consist of the use of the product for any of the purposes for which such product was sold, (b) User shall have made all payments for such product then due hereunder, (c) User shall give Stellar immediate notice in writing of any such suit and

transmit to Stellar immediately upon receipt all processes and papers served upon User, and (d) User shall permit Stellar through its counsel, either in the name of User or in the name of Stellar, to defend such suit(s) and give all needed information, assistance and authority to enable Stellar to do so.

In case of a final award of damages in any such suit, Stellar will pay such award but will not be responsible for any compromise or settlement made without its written consent. In case the product itself is in such suit held to infringe any valid patent issued in the United States and its use enjoined, or in the event of a settlement or compromise approved by Stellar that shall preclude future use of the product sold to User by Stellar, Stellar shall, at its own expense and at its sole option, either (a) procure rights to continue using such product, (b) modify the product to render it non-infringing, (c) replace the product with non-infringing product, or (d) refund the purchase price paid by User for the product after return of the product to Stellar. Notwithstanding the foregoing, Stellar shall not be held responsible for infringements of combination or process patents covering the use of product in combination with other goods or materials not furnished by Stellar.

The foregoing states the entire liability of Stellar for patent infringement, and **in no event shall Stellar be liable for consequential or incidental damages attributable to an infringement**, nor shall Stellar be liable for infringement based on the use of the product for a purpose other than that for which sold by Stellar. As to any product furnished by Stellar to User manufactured in accordance with designs proposed or furnished by User or any claim of contributory infringement resulting from the use or resale by User of product sold hereunder, User shall indemnify Stellar for any award made against Stellar or settlement by Stellar for any patent, trademark or copyright infringements, including attorneys' fees, court costs, out-of-pocket expenses and other costs of defending any action.

## **TECHNICAL SUPPORT**

Thermbond's® technical support staff is available to provide technical assistance for pre-job planning at 561.330.9300 weekdays from 9am to 5pm Eastern Standard Time, or at [support@thermbond.com](mailto:support@thermbond.com). Updated technical data and contact information is also available on the Internet at [www.thermbond.com](http://www.thermbond.com).

