THERMBOND
REFRACTORY SOLUTIONS

INSTALLATION GUIDE

MIXING AND USING INSTRUCTIONS

STELLAR

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,
check the table of contents on the next page for the appropriate section containing preparation, mixing, placing and finishing instructions.

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:

Company Headquarters	**European Headquarters**
Stellar Materials LLC North and South America, Asia, Australia, and India	**Stellar Materials International** Europe and Middle East
Telephone: (561) 330-9300 **Fax:** (561) 330-9355	**Telephone:** +31 (10) 2460264 **Fax:** +31 847598123

Email: support@thermbond.com

Website: www.thermbond.com

Experience the Difference.

TABLE OF CONTENTS

PRODUCT INFORMATION

PRODUCT DESCRIPTION

Thermbond® Refractories and Thermbond Concretes are available in many different formulations and may be applied using many techniques.

THERMBOND® FORMULA SERIES

Thermbond's® Formula Series refractory products consist of two parts, a dry formulation and a liquid activator. When mixed together these products exhibit a fast exothermic set and can be he heated at a much faster rate than conventional refractory products. Formula series dry formulations are mixed only with Formula Series Liquid Activator and are packaged in bags and jugs with red Thermbond® labels.

THERMBOND® THERMBRAKE SERIES

Thermbond's® Thermbrake series insulating refractory products consist of two parts, a dry formulation and a liquid activator. When mixed together these products exhibit a fast exothermic set and can be he heated at a much faster rate than conventional refractory products. Thermbrake series dry formulations are mixed only with Thermbrake Series Liquid Activator and are packaged in bags and jugs with blue Thermbond® labels.

THERMBOND® HEATBRAKE SERIES

Thermbond's® Heatbrake series insulating refractory products consist of two parts, a dry formulation and a liquid activator. When mixed together these products exhibit a fast exothermic set and can be he heated at a much faster rate than conventional refractory products. Heatbrake series dry formulations are mixed only with Heatbrake Series Liquid Activator and are packaged in bags and jugs with yellow Thermbond® labels

THERMBOND® 7000 SERIES

Thermbond's® 7000 Series refractory products consist of a dry material that is mixed with **water**. This material will require a longer set time and different heat up characteristics than Formula, Thermbrake and Heatbrake series products. Thermbond® 7000 series products are packaged in bags with green Thermbond® labels.

THERMBOND CONCRETE SERIES

Thermbond's® Concrete series products consist of two parts, a dry formulation and a liquid activator. When mixed together these products exhibit a fast exothermic set and will set at a faster rate than conventional concrete products. Concrete series dry formulations are mixed with Concrete Series Liquid Activator and are packaged in bags and jugs with purple Thermbond® labels.

PACKAGING AND LABELING

Thermbond® Formula, Thermbrake, Heatbrake and Concrete products are most commonly supplied in pre-measured quantities called “Units,” with each “Unit” consisting of a pre-measured amount of dry formulation and a pre-measured amount of Liquid Activator. The dry component is supplied in bags and the liquid component is supplied in jugs. Bulk packaging for the dry and liquid component is also available.

Thermbond® 7000 Series products are typically supplied in 55 pound bags. They are also available in bulk packaging.

Thermbond® products are labeled with the product name and a serial number which can be found on one end of the bag.

SEE THE INDIVIDUAL TECHNICAL DATA SHEET TO DETERMINE ITS PROPER WET-TO-DRY RATIO AND THE UNIT EQUIVALENT (NUMBER OF BAGS TO JUGS).

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 or contact a Thermbond representative for a brief product description of each formulation.

Thermbond® product suffixes, when used, are consistent throughout the product line, and are designed to convey certain characteristics of the products. Suffixes can be combined to convey multiple characteristics. 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
"C"	Custom binder system
"E"	Extended working and setting times (even longer than "L" mixes)
"F"	Finer grain sizing
"G"	May be applied by gunning
"J"	More flowable consistency (higher activator content)
"K"	More flowable consistency (same activator content)
"L"	Longer working and setting times
"P"	Patch and repair mix may be applied by troweling, hand packing, or casting
"Q"	Super Quick Setting
"R"	Ramming Grade
"S"	Slurry grade
"W"	Designed to be applied in thin sections as a washcoat

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:

DRY MIXES		LIQUID ACTIVATORS	
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	Two Years		
Thermbrake Series Mixes	Two Years	Thermbrake Series	Two Years
Heatbrake Series Mixes	Two Years	Heatbrake Series	Two Years
7000 Series	One Year	N/A	
Concrete Series	One Year	Concrete Series	One Year

THERMBOND PRE-JOB CHECKLIST

The sections following this one cover details for installing different grades of Thermbond materials. However, we recommend reviewing the checklist below. If there are any aspects of working with Thermbond that you may not be completely familiar with for your application please contact technical support at #561.330.9300 weekdays from 9am to 5pm Eastern Standard Time, or at support@thermbond.com. Updated technical data and contact information is also available on the Internet at www.thermbond.com.

- ☐ Do installers have experience with a project like this?
- ☐ Do installers have experience using Thermbond on a similar project?
- ☐ Will this project require API 936 or other specified testing or pre-qualification?
  - o Identify requirements on order.
- ☐ Will Stellar Installation Support be required?
  - o Complete Installation Support Request
- ☐ Will a Dry-Out schedule be required?
  - o Complete Dry-Out Request Form

Material Handling & Mixing

- ☐ Where will material be stored?
  - o Risk of moisture contamination?
  - o Temperature of material above 80°F or below 50°F? Affect placement?
- ☐ What mixing equipment is being used?
  - o Is equipment suitable for type of mix? Clean & good condition?
  - o Will batch size be able to be placed within 15 minutes?
  - o Location of mixing equipment relative to where it is being applied?
  - o What are expected ambient conditions – temperature & humidity?

Application Method

- ☐ Gunniting?
  - o Do installers have experience gunniting Thermbond?
  - o Pre-dampening? How? What type of mixer?
  - o Type and quality of gunnite machine?
    - ▪ Bowl or barrel size, air pressures, material flow rates?
    - ▪ Good quality seals and pads? Spares?
  - o What size compressor will be available?
  - o Distance material will travel from gun to nozzle?
    - ▪ How high is the placement relative to the gun machine? Booster?
  - o Will a Thermbond Pump & Nozzle Assembly be rented and used?
- ☐ Ramming?
  - o Do installers have experience ramming Thermbond?
  - o What type of mixer will be used? Hobart? Other?
  - o How close is mixer to placement area?
- ☐ Casting or Hand-Packing?
  - o Do installers have experience with Thermbond?
  - o Type and quality of mixing equipment?
  - o Vibration?
- ☐ Pumping or Shotcreteing?
  - o Please involve technical support right away.

INSTALLATION OF FORMULA CASTABLE MATERIALS

Proper preparation of crews, equipment, forms, and vessels is key to successful Thermbond® installations. Due to the relatively short working times of Thermbond products it is highly recommended that a complete review of the job set-up and procedure is done before mixing and placing Thermbond.

PREPARATION

Thermbond® materials will bond to most non-plastic forming materials so it is necessary to thinly coat all forms with a release agent (e.g. a vegetable oil or non-sulfur grease). Steel forms must be coated with a primer prior to applying a release agent. Note: Be sure **not** to coat areas on forms that will be in contact with joint sections where refractory will be bonding to refractory. Form release in these areas will not allow a proper bondingsurface.

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

- Existing surface being bonded to (if not Thermbond®) must be tested for reactivity prior to veneering it with Thermbond®. Brush a small amount of Activator onto the surface. If a visible reaction occurs, brush the whole surface with a thin layer of Activator and repeat this until no visible reaction occurs anymore. The surface being bonded to must not be wet so make sure that any remaining Activator on the surface has been removed prior to veneering.
- 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 come apart from within, taking the Thermbond® veneer with it. If the refractory is not clean and solid, the veneer may delaminate.
- The surface being bonded to must be rough. 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.

HEALTH AND SAFETY

Care 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.

MIXING

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.

To clean a mixer prior to use, pour two jugs of Thermbond® Formula Series Activator into the mixer and run the mixer for five to ten minutes until foaming stops. Empty the 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 important. Please review them carefully noting the order of each step.

1. Only mix as much material as can be placed immediately upon completion of mixing.
2. Pour enough pre-measured Liquid Activator into mixer or pail for the entire batch to be mixed. Adding additional liquid activator is **not** recommended as it can compromise 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 forty-five seconds, or until Thermbond® Refractory becomes completely wetted-out and folds upon itself. 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 thematerial.**

5. 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.
6. Upon completion of the job, immediately pour water into the mixer to facilitate cleaning.

NEVER USE WATER WITH THERMBOND FORMULA SERIES PRODUCTS. WATER IN THE MIX CAN CAUSE CATASTROPHIC FAILURE, INCLUDING EXPLOSIVE SPALLING.

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 (10 amp minimum).

MIXING PARTIAL UNITS

If mixing less than full units of any Thermbond® Refractory, be sure to dry-mix the dry component 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 DRYRATIO.
3. Multiply the weight of the dry formulation by the WET TO DRYRATIO.
4. This number is the amount, **by weight**, of Liquid Activatorrequired.

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.

PLACING AND FINISHING

When Thermbond® Castable Refractory is removed from the mixer, 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. 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. Extra caution should be taken to avoid leaving "rat holes" in the material. Pneumatic vibrating equipment is preferred as electric vibrators can generate substantial heat which can accelerate the hardening of Thermbond® products. When casting Thermbond on horizontal surfaces as a repair to existing fired refractories, vibration or tamping is still recommended to ensure good contact between the surfaces. Between batches, tools for mixing, placing, and finishing can be cleaned with Liquid Activator.

CURING

The curing is finished once the exothermic reaction is complete and material cools to ambient temperature. The time the material takes to cure will depend upon the particular product, the ambient temperature, temperature of materials in direct contact and the casting geometry. Note that thermally conductive materials in direct contact with Thermbond® can greatly influence setting time. Typically, when the thinnest section of the application is hard enough so that it cannot be dented with a trowel or similar tool, the material is hard enough to remove forms.

Due to the exothermic reaction, any release agent on the forms 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 more difficult to remove.

INSTALLATION OF FORMULA RAMMABLE MATERIALS

Proper preparation of crews, equipment, forms, and vessels is key to successful Thermbond® installations. Due to the relatively short working times of Thermbond products it is highly recommended that a complete review of the job set-up and procedure is done before mixing and placing Thermbond.

PREPARATION

Thermbond® materials will bond to most non-plastic forming materials so it is necessary to thinly coat all forms with a release agent (e.g. a vegetable oil or non-sulfur grease). Steel forms must be coated with a primer prior to applying a release agent. Note: Be sure **not** to coat areas on forms that will be in contact with joint sections where refractory will be bonding to refractory. Form release in these areas will not allow a proper bonding surface.

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

- Existing surface being bonded to (if not Thermbond®) must be tested for reactivity prior to veneering it with Thermbond®. Brush a small amount of Activator onto the surface. If a visible reaction occurs, brush the whole surface with a thin layer of Activator and repeat this until no visible reaction occurs anymore. The surface being bonded to must not be wet so make sure that any remaining Activator on the surface has been removed prior to veneering.
- 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 come apart from within, taking the Thermbond® veneer with it. If the refractory is not clean and solid, the veneer may delaminate.
- The surface being bonded to must be rough. 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.

HEALTH AND SAFETY

Care 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.

MIXING

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

To clean mixer prior to use, pour the appropriate amount of Thermbond® Formula Series Activator into the mixer and run the mixer for five to ten minutes until foaming stops. Empty the 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 important. Please review them carefully noting the order of each step.

1. Only mix as much material as can be placed immediately upon completion of mixing.
2. Pour enough pre-measured Liquid Activator into the mixing bowl for the entire batch to bemixed.
3. Pour all the dry material into the liquid in the mixerbowl.
4. Immediately start mixing at low speed. Let the mixer run until the material "folds" upon itself and looks homogenious. This should take approximately 2-4 minutes.
   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. 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 tryagain.
6. 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.
7. Upon completion of the job, immediately pour water into the mixer to facilitate cleaning. **NEVER USE WATER WITH THERMBOND FORMULA SERIES PRODUCTS. WATER IN THE MIX CAN CAUSE CATASTROPHIC FAILURE, INCLUDING EXPLOSIVESPALLING.**

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.

MIXING PARTIAL UNITS

If mixing less than full units of any Thermbond® Refractory, be sure to dry-mix the dry component 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 DRYRATIO.
3. Multiply the weight of the dry formulation by the WET TO DRYRATIO.
4. This number is the amount, **by weight**, of Liquid Activatorrequired.

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.

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.
To increase working time, spread material out on a mortor board while it is waiting to be placed.
Thermbond® Rammable Refractories should NEVER be vibrated into place.

CURING

The curing is finished once the exothermic reaction is complete and material cools to ambient temperature. The time the material takes to cure will depend upon the particular product, the ambient temperature, temperature of materials in direct contact and the casting geometry. Note that thermally conductive materials in direct contact with Thermbond can greatly influence setting time. 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.

Due to the exothermic reaction, any release agent on the forms 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 more difficult to remove.

INSTALLATION OF FORMULA TROWELABLE AND HAND PACKABLE MATERIALS

Proper preparation of crews, equipment, forms, and vessels is key to successful Thermbond® installations. Due to the relatively short working times of Thermbond products it is highly recommended that a complete review of the job set-up and procedure is done before mixing and placing Thermbond.

PREPARATION

Thermbond® materials will bond to most non-plastic forming materials so it is necessary to thinly coat all forms with a release agent (e.g. a vegetable oil or non-sulfur grease). Steel forms must be coated with a primer prior to applying a release agent. Note: Be sure **not** to coat areas on forms that will be in contact with joint sections where refractory will be bonding to refractory. Form release in these areas will not allow a proper bondingsurface.

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

- Existing surface being bonded to (if not Thermbond®) must be tested for reactivity prior to veneering it with Thermbond®. Brush a small amount of Activator onto the surface. If a visible reaction occurs, brush the whole surface with a thin layer of Activator and repeat this until no visible reaction occurs anymore. The surface being bonded to must not be wet so make sure that any remaining Activator on the surface has been removed prior to veneering.
- 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 come apart from within, taking the Thermbond® veneer with it. If the refractory is not clean and solid, the veneer may delaminate.
- The surface being bonded to must be rough. 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.

HEALTH AND SAFETY

Care 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.

MIXING

All mixing containers must be free of contaminants prior to using Thermbond® products. Thermbond® Trowelable and Hand Packed Refractories should be mixed using a Hobart-type mixer or may be mixed in a pail utilizing a "JIFFLER" brand or AUGER paddle mixer blade powered by a heavy duty drill (10 amp minimum).
The mixer should be clean and neutralized.

To clean mixer prior to use, pour the appropriate amount of Thermbond® Formula Series Activator into the mixer and run the mixer for five to ten minutes until foaming stops. Empty the 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 important. Please review them carefully noting the order of each step.

1. Only mix as much material as can be placed immediately upon completion of mixing.
2. When mixing partial units:
    a. Dry mix the bag prior to weighing out the required amount of dry material.
    b. Refer to the appropriate Technical Data Sheet for the correct WET TO DRYRATIO.
    c. Multiply the weight of the dry formulation by the WET TO DRYRATIO.
    d. This number is the amount, by weight, of Liquid Activatorrequired.

    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.
3. After the last portion of dry formulation is added to the mixer, mix for approximately forty five seconds, or until Thermbond® Refractory becomes completely wetted-out and folds upon itself. 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 thematerial.**
4. Mix the material to the desired consistency, for thinner application use additional Formula Series Activator, for thicker application use less Formula SeriesActivator.
5. When mixing multiple batches of Thermbond® Castable Refractories, it is important to immediately loadthe 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.
6. Upon completion of the job, immediately pour water into the mixer to facilitate cleaning.
   NEVER USE WATER WITH THERMBOND FORMULA SERIES PRODUCTS. WATER IN THE MIX CAN CAUSE CATASTROPHIC FAILURE, INCLUDING EXPLOSIVE SPALLING

PLACING AND FINISHING

When troweling the material use a trowel with a large surface area for the best finish, work a thin first layer into the existing refractory, once the thin layer has been applied additional layers of material can be added.
When hand packing the materials, rubber gloves should be worn.
Wet the trowel or gloves slightly with the appropriate Liquid Activator to improve the finished appearance of the face of the material.. **NEVER USE WATER**.

CURING

The curing is finished once the exothermic reaction is complete and material cools to ambient temperature. The time the material takes to cure will depend upon the particular product, the ambient temperature, temperature of materials in direct contact and the casting geometry. Note that thermally conductive materials in direct contact with Thermbond can greatly influence setting time. 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.

Due to the exothermic reaction, any release agent on the forms 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 more difficult to remove.

INSTALLATION OF FORMULA GUNNABLE MATERIALS

Proper preparation of crews, equipment, forms, and vessels is key to successful Thermbond® installations. Due to the relatively short working times of Thermbond products it is highly recommended that a complete review of the job set-up and procedure is done before mixing and placing Thermbond.

PREPARATION

Thermbond® materials will bond to most non-plastic forming materials so it is necessary to thinly coat all forms with a release agent (e.g. a vegetable oil or non-sulfur grease). Steel forms must be coated with a primer prior to applying a release agent. Note: Be sure **not** to coat areas on forms that will be in contact with joint sections where refractory will be bonding to refractory. Form release in these areas will not allow a proper bondingsurface.

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

- Existing surface being bonded to (if not Thermbond®) must be tested for reactivity prior to veneering it with Thermbond®. Brush a small amount of Activator onto the surface. If a visible reaction occurs, brush the whole surface with a thin layer of Activator and repeat this until no visible reaction occurs anymore. The surface being bonded to must not be wet so make sure that any remaining Activator on the surface has been removed prior to veneering.
- 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 come apart from within, taking the Thermbond® veneer with it. If the refractory is not clean and solid, the veneer may delaminate.
- The surface being bonded to must be rough. 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.

EQUIPMENT

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

GUNNING MACHINE

Thermbond® Gunning Refractories should be installed using a gunite machine with a shallow bowl. For best results we recommend the maximum output of the gunning machine be less than 2.7 cubic yards/hour (2 cubic meters/hour).

GUNNING NOZZLE ASSEMBLY

We strongly recommend using a gunning nozzle and pump set from Stellar Materials. Our pre-mix nozzle assembly is specially designed for the application of Thermbond materials (nozzle connection diagram is included with the assembly).

AIR COMPRESSER

We recommend using a compressor unit rated at 750 CFM @ 100 PSI, the unit should have dedicate air to the gunning machine plus additional air ports for running the activator pump and auxiliary air to the nozzle.

PREDAMPENING MIXER

Use a paddle or pan type mixer will be require for pre-dampening the gunning material prior to gunning.

For assistance in determining if you have the proper equipment please contact Stellar Materials technical support.

HEALTH AND SAFETY

Care 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.

PLACING AND FINISHING

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

COMMUNICATION

Communication between the nozzle man and the crew loading and operating the gunning machine is very important. Proper communication will increase efficiency and quality significantly.

EQUIPMENT START-UP AND TESTING

- Confirm that nozzle gate valve and air valve on the Liquid Activator pump areshut.
- Start air compressor and check if the air supply is a minimum100psi.
- 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 and set to 85 psi. Adjust if necessary.
- Open air valve on pump to pressurize Activator feed line tonozzle.
- 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 WITH THERMBOND FORMULA SERIES PRODUCTS 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 Activatorline.
- The pump should be running at approximately 80-100psi.
- Make sure that all functions of the gunning machine are operating prior to placing any material in the hopper.
- When pre-dampening, use the appropriate Liquid Activator and pre-dampening ratio listed on the technical data sheet. Liquid Activator should be sprinkled over the dry mix to reduce dusting, a plastic pail with 1/8" holes drilled in the bottom can be used to disperse the Liquid Activator over the dry material in the mixer.
- Pre-dampened material must be able to pass through a 3/8" mesh screen before entering the gunite machine. If during pre-dampening, 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 pre-dampening.
- Place pre-dampened material inhopper.
- Gunning may nowbegin.

GUNNING PROCEDURES

1. Open the additional air supply to the nozzle and ensure pressure is set at approximately 40 psi.
2. Open the gunning machine main air valve that controls the air supply to the nozzle tip.
3. Open the valve on the gunning nozzle to supply activator to the nozzletip.
4. Turn on air to rotate the feed wheel, rotor or bowl that supplies the dry material through thehose.
5. 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.**
6. 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.
7. The nozzle assembly should be moved in a circular motion until the desired thickness is achieved.
8. **WHEN STOPPING, ALWAYS MAKE SURE THAT THE ENTIRE NOZZLE ASSEMBLY STAYS POINTED DOWNWARD TO PREVENT LIQUID ACTIVATOR FROM SEEPING BACK INTO DRY MATERIAL FEED HOSE.**
9. 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 improperbond.

TROUBLESHOOTING

INSUFFICIENT ACTIVATOR AT NOZZLE	INSUFFICIENT DRY MATERIAL AT NOZZLE
No air supply or air hose is obstructed	Air pressure is too low
Pump has air lock and is not priming	Material clogging hose
Strainer not clean or not submerged in liquid	Hose connection is split, loose or leaking
Liquid drum is empty or riser tube is plugged/broken	Compressure CFM is too low
Activator ring in nozzle assembly is not clean	Gunning machine pockets plugging or material bridging

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

SHUT DOWN PROCEDURES

1. Turn off air to gunning machine feed wheel/bowl to stop dry material flow.
2. When dry material stops flowing, allow activator to run through the nozzle for approximately 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. **Use extreme caution 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 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 the next start-up. This will prevent unnecessary damage to the machine when resuming gunning operations.

CURING

The curing is finished once the exothermic reaction is complete and material cools to ambient temperature. The time the material takes to cure will depend upon the particular product, the ambient temperature, temperature of materials in direct contact and the casting geometry. Note that thermally conductive materials in direct contact with Thermbond can greatly influence setting time. 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 fully cured.

INSTALLATION OF THERMBRAKE SERIES MATERIALS

Proper preparation of crews, equipment, forms, and vessels is key to successful Thermbond® installations. Due to the relatively short working times of Thermbond products it is highly recommended that a complete review of the job set-up and procedure is done before mixing and placing Thermbond.

PREPARATION

Thermbond® Thermbrake materials will bond to most non-plastic forming materials so it is necessary to thinly coat all forms with a release agent (e.g. a vegetable oil or non-sulfur grease). Steel forms must be coated with a primer prior to applying a release agent. Note: Be sure **not** to coat areas on forms that will be in contact with joint sections where refractory will be bonding to refractory. Form release in these areas will not allow a proper bonding surface.

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

- Existing surface being bonded to (if not Thermbond®) must be tested for reactivity prior to veneering it with Thermbond®. Brush a small amount of Activator onto the surface. If a visible reaction occurs, brush the whole surface with a thin layer of Activator and repeat this until no visible reaction occurs anymore. The surface being bonded to must not be wet so make sure that any remaining Activator on the surface has been removed prior to veneering.
- 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 come apart from within, taking the Thermbond® veneer with it. If the refractory is not clean and solid, the veneer may delaminate.
- The surface being bonded to must be rough. 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.

HEALTH AND SAFETY

Care 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.

MIXING

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

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

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 published individual data sheets to confirm the proper ratio of jugs-to-bags.

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

1. Only mix as much material as can be placed immediately upon completion of mixing.
2. Pour enough pre-measured Liquid Activator into mixer or pail for the entire batch to be mixed. Adding additional liquid activator is NOT recommended as it can compromise material properties and performance.
3. Add the corresponding amount of pre-blended, pre-measured dry formulation into the mixer or pail.

4. **Thermbrake 402** is an expanding insulating refractory and 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 403 Refractory when completely wetted-out, will appear dampened, but loose and granular. It will not fold or appear wet. Once wetted-out, immediately begin packing the material into place.
5. 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.
6. Upon completion of the job, immediately pour water into the mixer to facilitate cleaning.

NEVER USE WATER WITH THERMBRAKE SERIES PRODUCTS. WATER IN THE MIX CAN CAUSE CATASTROPHIC FAILURE, INCLUDING EXPLOSIVE SPALLING.

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 (10 amp minimum).

MIXING PARTIAL UNITS

If mixing less than full units of any Thermbond® Refractory, be sure to dry-mix the dry component 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 DRYRATIO.
3. Multiply the weight of the dry formulation by the WET TO DRYRATIO.
4. This number is the amount, by weight, of Liquid Activatorrequired.

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.

PLACING AND FINISHING

When Thermbond® Castable Refractory is removed from the mixer, immediately pour the material into the area to be cast. Tools for mixing, placing, and finishing can be cleaned with Liquid Activator between batches.

THERMBRAKE 402

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. Thermbrake 402 should never be vibrated into place.

THERMBRAKE 403

In order to achieve the published densities, 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/ft3, then pack the material hard enough so that 85 lbs of mixed material fits snugly into a one cubic foot area Thermbond® Thermbrake 403 should never be vibrated into place.

CURING

The curing is finished once the exothermic reaction is complete and material cools to ambient temperature. The time the material takes to cure will depend upon the particular product, the ambient temperature, temperature of materials in direct contact and the casting geometry. Note that thermally conductive materials in direct contact with Thermbond® can greatly influence setting time. 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 removeforms.

Due to the exothermic reaction, any release agent on the forms 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 more difficult to remove.

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.

INSTALLATION OF HEATBRAKE SERIES MATERIALS

Proper preparation of crews, equipment, forms, and vessels is key to successful Thermbond® installations. Due to the relatively short working times of Thermbond products it is highly recommended that a complete review of the job set-up and procedure is done before mixing and placing Thermbond.

PREPARATION

Thermbond® Heatbrake materials will bond to most non-plastic forming materials so it is necessary to thinly coat all forms with a release agent (e.g. a vegetable oil or non-sulfur grease). Steel forms must be coated with a primer prior to applying a release agent. Note: Be sure **not** to coat areas on forms that will be in contact with joint sections where refractory will be bonding to refractory. Form release in these areas will not allow a proper bonding surface.

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

- Existing surface being bonded to (if not Thermbond®) must be tested for reactivity prior to veneering it with Thermbond®. Brush a small amount of Activator onto the surface. If a visible reaction occurs, brush the whole surface with a thin layer of Activator and repeat this until no visible reaction occurs anymore. The surface being bonded to must not be wet so make sure that any remaining Activator on the surface has been removed prior to veneering.
- 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 come apart from within, taking the Thermbond® veneer with it. If the refractory is not clean and solid, the veneer may delaminate.
- The surface being bonded to must be rough. 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.

HEALTH AND SAFETY

Care 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.

MIXING

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

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

Heatbrake Series products typically utilize a higher wet-to-dry ratio than Formula Series products, and therefore, may be packaged to require two jugs of Heatbrake series activator for every Heatbrake bag. Check published individual data sheets to confirm the proper ratio of jugs-to-bags.

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

1. Only mix as much material as can be placed immediately upon completion of mixing.
2. Pour enough pre-measured Liquid Activator into mixer or pail for the entire batch to be mixed. Adding additional liquid activator is NOT recommended as it can compromise material properties and performance.
3. Add the corresponding amount of pre-blended, pre-measured dry formulation into the mixer or pail.

4. **Heatbrake 508-B** Refractory when completely wetted-out, will appear dampened, but loose and granular. It will not fold or appear wet. Once wetted-out, immediately begin packing the material into place.
5. 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.
6. Upon completion of the job, immediately pour water into the mixer to facilitate cleaning.

NEVER USE WATER WITH HEATBRAKE SERIES PRODUCTS. WATER IN THE MIX CAN CAUSE CATASTROPHIC FAILURE, INCLUDING EXPLOSIVE SPALLING.

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 (10 amp minimum).

MIXING PARTIAL UNITS

If mixing less than full units of any Thermbond® Refractory, be sure to dry-mix the dry component 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 DRYRATIO.
3. Multiply the weight of the dry formulation by the WET TO DRYRATIO.
4. This number is the amount, by weight, of Liquid Activatorrequired.

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.

PLACING AND FINISHING

When Thermbond® Castable Refractory is removed from the mixer, immediately pour the material into the area to be cast. Tools for mixing, placing, and finishing can be cleaned with Liquid Activator between batches.

HEATBRAKE 508-B

In order to achieve the published densities, 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/ft3, then pack the material hard enough so that 85 lbs of mixed material fits snugly into a one cubic foot area Thermbond® Heatbrake 508-B should never be vibrated into place.

CURING

The curing is finished once the exothermic reaction is complete and material cools to ambient temperature. The time the material takes to cure will depend upon the particular product, the ambient temperature, temperature of materials in direct contact and the casting geometry. Note that thermally conductive materials in direct contact with Thermbond® can greatly influence setting time. 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 removeforms.

Due to the exothermic reaction, any release agent on the forms 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 more difficult to remove.

When Heatbrake 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.

INSTALLATION OF 7000 SERIES MATERIALS

Proper preparation of crews, equipment, forms, and vessels is key to successful Thermbond® installations. Due to the relatively short working times of Thermbond products it is highly recommended that a complete review of the job set-up and procedure is done before mixing and placing Thermbond.

PREPARATION

Thermbond® materials will bond to most non-plastic forming materials so it is necessary to thinly coat all forms with a release agent (e.g. a vegetable oil or non-sulfur grease). Steel forms must be coated with a primer prior to applying a release agent. Note: Be sure **not** to coat areas on forms that will be in contact with joint sections where refractory will be bonding to refractory. Form release in these areas will not allow a proper bondingsurface.

The seams in the form work need to be tightly sealed to prevent the Thermbond® 7000 Series material from seaping out through cracks in the form work during casting.

HEALTH AND SAFETY

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

MIXING

Thermbond® 7000 series castable products are formulated for full thickness applications.
Unlike other Thermbond product these products are mixed with **water** and have longer working and setting time.

These products are prepared using a paddle, pan or Hobart type mixer. Only potable water should be used for mixing.

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

1. Only mix as much material as can be placed immediately upon completion of mixing.
2. The water addition range is critical and normally specified on the material technical data sheet, over liquefying can significantly influence material properties. Water additions can change depending on required flow-ability or the addition of stainless steel needles or poly-fibers. In these cases contact Stellar Materials for assistance.
3. Dry mix the material for 30 seconds before adding the pre-measuredwater.
4. Add the water quickly and watch for the material to start folding upon itself (it can take between 1 and 3 minutes before you see this transition), then continue mixing for an additional 2minutes.
5. The mixing time can vary depending on the type, size, and speed of the mixer. Normal mixing time is between 3 and 5 minutes.
6. Upon completion of the job, immediately pour water into the mixer to facilitate cleaning.

PLACING AND FINISHING

When Thermbond® Castable Refractory is removed from the mixer, immediately pour the material into the area to be cast. Vibration of the material is necessary to assure sound placement that is free of voids and air pockets. This material allows extended placement time which will vary depending on ambient conditions. Vibration is required to properly place, knit, and level this material. If using a probe vibrator, a 2" diameter with a minimum of 12,000 VPM is recommended to efficiently move the material. Extra caution should be taken to avoid leaving "rat holes" in the material. Pneumatic vibrating equipment is preferred as electric vibrators can generate substantial heat which can accelerate the hardening of Thermbond® products.

CURING

Total setting time for this material will vary depending on ambient conditions. The material should be left undisturbed for 10 to 12 hours to allow the material to set before removing the forms. No additional setting time is required after form removal.

INSTALLATION OF CONCRETE SERIES MATERIALS

Proper preparation of crews, equipment, forms and vessels is a key to successful Thermbond® Concrete installations. Due to the relatively short working times, it is highly recommended that preparation procedures be followed explicitly. Thermbond® Concretes bond to themselves when proper procedures are followed, so cold bonding or lamination is of little concern even if Thermbond® Concrete has started to set.

All required equipment and materials should be staged as close to the casting site as possible before beginning the application.

PREPARATION

It is necessary that any forming work or form preparation be performed prior to mixing Thermbond® Concrete products. Thermbond® Concrete materials will bond to most non-plastic forming materials so it is necessary to thinly coat all forms with a release agent (e.g. a vegetable oil or non-sulfur grease). Steel forms must be coated with a primer prior to applying a release agent. Note: Be sure **not** to coat areas on forms that will be in contact with joint sections where concrete will be bonding to concrete. Form release in these areas will not allow a proper bonding surface.

In order to assure a proper bond to an existing concrete surface, the following care should be taken:

- The surface being bonded to must be structurally sound and clean. When repairing existing concrete, make sure that the concrete is chipped back to solid, clean material. Remove all deteriorated concrete and dust including any concrete penetrated by foreignmatter.
- On concrete repair to vertical or overhead surfaces please contact Stellar Materials for additional instructions.
- Brush a small amount of Activator onto the surface. If a visible reaction occurs brush a thin layer of Concrete Activator over the entire surface being repaired. Allow the material time to react and completely dry before casting the Thermbond Concrete.
- The surface being bonded to must be dry. Due to the exothermic reaction of Thermbond® Concrete 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. If it has, scarify it with a pneumatic or electric wire wheel brush prior to attempting to bond to it. If the surface is wet or oily, the joint will delaminate.
- 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 it with a pneumatic or electric wire wheel brush 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.

HEALTH AND SAFETY

Care 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.

MIXING

All mixing containers must be free of contaminants prior to using Thermbond® Concrete products.
Thermbond® Castable Concretes 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 and need to be properly cleaned and neutralized before mixing Thermbond® Concrete materials.

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

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

1. Only mix as much material as can be placed immediately upon completion of mixing.
2. Pour enough pre-measured Concrete Activator into mixer or pail for the entire batch to be mixed. Adding additional liquid activator is **not** recommended as it can compromise material properties and performance.
3. Add the corresponding amount of pre-blended, pre-measured dry formulation into the mixer or pail. After the last portion of dry formulation is added to the mixer, mix for approximately fifteen seconds, or until the Thermbond® Concrete 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.
4. When mixing multiple batches of Castable Concretes, it is important to immediately load the mixer with the required amount of Concrete 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 Concrete Liquid Activator until the next load of dry mix is ready to be mixed.
5. Upon completion of the job, immediately pour a minimum of five gallons of water into the mixer to facilitate cleaning. **NEVER USE WATER WITH THERMBOND CONCRETE SERIES PRODUCTS. WATER IN THE MIX CAN CAUSE CATASTROPHIC FAILURE, INCLUDING EXPLOSIVE SPALLING.**

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 (10 amp minimum).

MIXING PARTIAL UNITS

If mixing less than full units of Thermbond® Concrete, be sure to dry-mix the dry component 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 DRYRATIO.
3. Multiply the weight of the dry formulation by the WET TO DRYRATIO.
4. This number is the amount, by weight, of Liquid Activatorrequired.

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.

PLACING AND FINISHING

When Thermbond® Concrete is completed mixing, immediately pour the material into the area to be cast. Vibration of the material is necessary to assure sound placement that is 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. Extra caution should be taken to avoid leaving “rat holes” in the material. Pneumatic vibrating equipment is preferred as electric vibrators can generate substantial heat which can accelerate the hardening of Thermbond® products.
When casting Thermbond® Concrete on Concrete surfaces as a repair , it is still recommended to ensure good contact between the surfaces by vibrating or tamping. Between batches, tools for mixing, placing, and finishing can be cleaned with Liquid Activator.

CURING

The curing is finished once the exothermic reaction is complete and material cools to ambient temperature. The time the material takes to cure will depend upon the particular product, the ambient temperature, temperature of materials in direct contact and the casting geometry. Note that thermally conductive materials in direct contact with Thermbond® can greatly influence setting time. 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 removeforms.

Due to the exothermic reaction, any release agent on the forms 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 more difficult to remove.

BAKE-OUT SCHEDULES FOR FORMULA SERIES 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.

In many applications, Thermbond® refractories may be installed and fired in rapidly providing there is no direct flame impingement and there is adequate air flow during the firing in process. When a bake-out schedule is required, it can be substantially faster than conventional refractory bake-out schedules provided there is proper air flow, air exchange, and uniform heat distribution.

Contact Thermbond® technical support at 561.330.9300, or email **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.**

HEAT UP Schedule for Multiple Component Linings

- When ANY moisture-containing materials are used as a back up behind Thermbond®, special care MUST be taken to allow for the release of steam from those materials.
- Please contact Stellar Materials Technical Support for further information at 561.330.9300 or email support@thermbond.com.
- If any other refractory or insulating materials are being used in the equipment, the most conservative 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.
- 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.

BAKE-OUT SCHEDULES FOR 7000 SERIES REFRACTORIES

Once Thermbond® 7000 material is properly placed it typically takes between 10 and 12 hours to completely set, depending upon the volume of the refractory installed. This material must be left undisturbed; movement and vibration can delay setting time.

All Thermbond® 7000 series refractories will require a bake-out schedule. It is critical to properly remove the steam (water) and this requires proper air flow, air exchange, and uniform heat distribution.

Contact Thermbond® technical support at 561.330.9300, or email **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.**

HEAT UP Schedule for Multiple Component Linings

- When ANY moisture-containing materials are used as a back up behind Thermbond®, special care MUSTbe 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.
- If any other moisture-containing refractory or insulating materials are being used in the equipment, the most conservative manufacturer's curing schedule must befollowed.
- 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.

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.

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. FORM RELEASE SHOULD NOT BE USED. If you have problems releasing the materials from the molds, the plastic molds should be replaced with new molds. If you do not have plastic molds or have any other issues using plastic molds please contact Stellar technical support at 561.330.9300 to discuss options.

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

When mixing Formula 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 Thermbrake 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 Thermbrake or Heatbrake 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/ft3 - dry cut from green material before firing. If dry cutting is not desired then fire the panels prior to wet cutting. If the panel size is too large for the firing oven it is possible to cut the panel to a manageable size by wet cutting the green sample. The smaller sample panel then must be fired before wet cutting test samples. Avoid using the edge of the smaller panel that was wet cut green as part of the test samples.

Materials with densities greater than 110 lbs/ft3 must be fired prior to wet cutting. Again if the panel size is too large for the firing oven it is possible to cut the panel to a manageable size by wet cutting the green sample.
The smaller sample panel then must be fired before wet cutting test samples. Avoid using the edge of the smaller panel that was wet cut green as part of the test samples.
Wet cut test samples should then be dried to 230 F for five hours before testing.

FIRING THE MATERIAL

Follow ASTM firing procedures.

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. Updated technical data and contact information is also available on the Internet at www.thermbond.com.

Technical Advisors are available for on site support to provide suggestions and recommendations to contractors and end users regarding Stellar Materials LLC products, please contact your local Thermbond representative for more details.