

## **CONGRATULATIONS!**

Congratulations on being the owner of a CRESS FIREMATE<sup>R</sup> ceramic kiln! This kiln is a safe, reliable, and very popular automatic kiln, which gives you a fast energy efficient firing. Because it gradually increases power throughout the firing process, and senses and adjusts for room temperature and small voltages changes incoming to your home, the Firemate subjects your ware to the least possible thermal shock and gives you highly repeatable and consistent firing results. Unlike most other kilns, the elements from top to bottom are each adjusted electrically to give the most uniform firing possible. The FIREMATE<sup>R</sup> has been patented in 16 countries for its excellent and unique control system.

The use of firebrick will give you the slowness in cooling that museum quality art requires while the FIREMATE<sup>R</sup> has the unique ability to add more speed to the age-old process without hurting the quality of the ware.

We sincerely wish you many years of creative and rewarding use of your CRESS FIREMATE<sup>R</sup> kiln.

CRESS MANUFACTURING COMPANY, INC.  
4736 Convair Dr., Carson City NV 89706

### **UNPACK SHIPMENT IMMEDIATELY**

When this shipment was given to the carrier, neither the carton nor contents were damaged. In case of damage or loss (either obvious or concealed) save all packing material. Concealed damage or loss discovered by the consignee (that was not noted at time of delivery) must be reported to the delivering carrier immediately upon discovery. At that time, an inspection of the merchandise by the carrier's representative should be requested. Failure to report such a damage or loss within 15 days places the burden of proof upon the claimant to show this damage or loss was caused while in the carrier's possession.

Our limited warranty covers manufacturing defects only. Call us if a freight problem occurs so we may help. Phone (775) 884-2777 or (800) 423-4584.

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### **IMPORTANT SAFEGUARDS!**

Please read and observe the following safety warnings before operating your kiln:

1. Install kiln 18" or more from any wall or combustibles.
2. Fire only on stand or legs furnished.
3. Never fire hotter than cone 10 or 2350 °F.
4. Do not fire hotter than the manufacturer's recommendation for your clay, glazes, or decals, or permanent damage may result to your kiln or ware.
5. Do not open lid until kiln has cooled.
6. Before opening lid, turn off all switches, then carefully open lid and test that lid brace is securely engaged before allowing lid to stand freely.
7. Do not leave kiln unattended while firing.
8. Never use an extension cord.
9. Operate kiln only in a well-ventilated room.
10. Unplug kiln before servicing or cleaning.
11. Dangerous Voltage - Do not touch heating elements with anything.
12. Do not touch hot sides of kiln or hot lid. Burns may result.
14. Never store anything under kiln; never lean objects against kiln.
15. Do not store or use flammable liquids or sprays in the same room with your kiln.
16. Do not store or use your kiln outside; keep rain and moisture away from kiln.
- 17 Do not use kiln if cord is damaged.
18. Wall receptacle must not be corroded.
19. Use kiln only with adequate electrical supply and with the correct voltage, amperage and correct fuse size (not too large or small). Be sure the wire size is large enough (avoid aluminum wiring). Do not use a 208 VAC kiln on 220 VAC.
20. Kiln must be grounded properly.
21. Wear goggles when looking thorough peephole.
22. Wear protective gloves when handling hot peephole plugs.
23. When firing objects to be used with food and drink, use only supplies tested and labeled "safe" for such purposes.
24. Avoid breathing fumes from materials being fired.

It is imperative that you read all instructions before operating the kiln.

## **KILN PLACEMENT AND INSTALLATION**

All kilns should be located in an area free from flammable materials such as drapes, boxes, paper, spray cans, paint, gasoline, etc. All kilns must be located a minimum of 18 inches from every vertical surface. Do not place any kiln under any overhead obstruction such as cabinets, shelf, drapes, hanging plastic, etc., and never lean anything against your kiln. Do not store anything between the kiln and a wall or under your kiln; keep these areas clear at all times. Keep material off the top of your kiln; do not use the lid as a shelf.

Recommended floor surfaces include cement, ceramic tile with cement grout, brick, or stone. If it is necessary to put your kiln on a synthetic or wooden floor, use a sheet of fireproof material underneath your kiln and extending 24" beyond the kiln in all directions. A layer of hard firebrick is also acceptable for this purpose. Floor coloration may be sensitive to heat.

Good housekeeping must be maintained at all times in the kiln area for safety.

Your kiln must be fired on the metal stand provided; it has been designed specifically for the height and weight of your kiln. Do not use any other stand. Be sure to center the kiln on the stand so that it is stable, and position it so that the cord does not touch the sides of the kiln, which will be hot during firing. It is also important that the stand and kiln be level (use a bubble level for this purpose), otherwise there is a possibility of pieces of ware falling during firing. Screw the stand to the kiln with the screws provided.

Use your kiln only in a well-ventilated room. Vapors containing poisonous gases are possible when firing certain materials. Do not breath fumes from kiln when firing.

## **ELECTRICAL SPECIFICATIONS**

Proper electrical wiring is necessary to safely and efficiently operate a kiln. Even though the voltage is a full 120 volts or 234 volts at the meter, the voltage on which the kiln operates will be somewhat lower at the kiln location. Make sure your electrical outlet has the correct electrical capacity and voltage to handle your kiln. It is necessary to measure the voltage at the location of the kiln with the kiln turned on. Voltage drops occur on all wiring. Proper electrical wiring will provide an adequate operation voltage and current at the kiln without significant voltage drop. (Voltage may be temporarily low during brownouts especially on a hot day in the summer when all your neighbors have their air conditioning turned on and during peak electrical usage periods in your area). If the wire coming from your power source to the kiln is too small or too long the kiln will not operate properly, even if the wire meets national electrical safety codes. If the voltage is low, the kiln may not reach the maximum desired temperature or will fire too slowly. This may reduce element life. 230 volt and 240 volt kilns may be used with 220 volt to 245-volt power.

Do not attempt to change the receptacle on an existing line without using the services of a licensed electrician. The electrician will know whether the wire size is correct. It is advisable to use a larger wire size than absolutely necessary to prevent voltage drop, especially if the run to the meter is long. The increase in cost is usually very small compared to the long-term savings in firing times and line loss (voltage loss). Never cut the plug off and replace it. If the plug becomes damaged, change the entire cord with a CRESS factory supplied cord that will meet temperature (105 C) as well as electrical requirements. The outlet must be in good condition or heating of the cord and plug cap will occur. Do not use an extension cord at any time.

Temperature rating specifications as well as the electrical rating requirements for your kiln are listed on a decal on the kiln. Your electrician must make sure all local codes are met with your house wiring. Your licensed electrician is responsible for meeting the requirements for the local and national codes.

## KILN ACCESSORIES

There are several items which are either necessary or are commonly used in conjunction with your kiln. The most important are shown below:

### Kiln Wash

Kiln wash is a refractory material that is used as a coating on parts of the kiln and kiln shelves to prevent ware or glazes from adhering to them. It is usually purchased as a dry powder, and then is mixed with water to the consistency of heavy cream and applied with a paintbrush.

### Kiln Furniture

Kiln furniture consists of shelves and posts (available in a variety of shapes and heights). They are used so that ware may be fired in several layers to take full advantage of the space in the firing chamber of the kiln. Kits containing the most commonly needed assortment of furniture for each kiln model are available.

### Stilts

Stilts are small (high temperature) metal or ceramic prong supports used to raise glazed or overglazed ware off the kiln shelf to avoid sticking problems. They are available in a wide variety of shapes and sizes.

### Pyrometric Cones and Cone Holders

Pyrometric cones are the most widely used method of indicating temperature in the kiln. They are small elongated-pyramid shaped indicators made of ceramic material especially formulated to melt at various specific heats (see methods of temperature indication for a more detailed discussion of cones). They are available in two sizes (large for any location in the kiln and small for use with kiln sitters) and in a wide range of temperatures.

Various types of holders for the large cones are available to insure that they are held uniformly at the correct angle. Also available in some cone numbers are self-supporting large cones with wide bases, which do not require cone holders. Cones are the most accurate measurement method available for firing ceramics.

### Pyrometers

A pyrometer consists of a temperature-sensing device (thermocouple) in the kiln connected to a meter on which the temperature in the kiln is displayed. It is useful in showing how rapidly the kiln is heating and in warning when the desired temperature is neared. It is especially valuable when firing glass, which is sensitive to differences in temperature of only a few degrees. Do not use a pyrometer as a substitute for cones. A pyrometer measures only air temperature - and not the time/temperature relationship essential for firing ceramics.

## KILN OPERATION

The kiln is used to apply a certain amount of heat over a period of time to a ceramic piece to produce a chemical change, resulting in a finished piece. Firing too fast causes stress to occur that can physically break the piece or stress the ceramic piece so that it breaks on its own sometime after the firing. The patented FIREMATE control system applies the heat smoothly, (not in stepped increases) permitting faster firing without damaging the ceramic ware. The firebrick retains just enough heat so that when the cooling process starts, the bubbles from chemical gases from the vitrification process can escape the glazed surface. Rapid cooling fiber kilns can produce imperfections from trapped air in the glaze. Your ceramic pieces will achieve their best possible finish because you have the best firing equipment available. The maximum degree of heat and the length of time necessary vary widely according to many factors, such as the type of ware (porcelain, earthenware, stoneware, etc.) or glaze, paint or decal, the thickness of the piece, the size of the load being fired, and the voltage available.

### Shut-off Devices

#### Kiln Sitter<sup>®</sup>

**CAUTION:** The kiln Sitter<sup>®</sup> control is a valuable aid when firing your kiln and is engineered to give you years of trouble-free operation when it is properly adjusted and maintained as outlined in the kiln Sitter<sup>®</sup> operating manual. It is, however, recommended that the kiln Sitter<sup>®</sup> not be left unattended beyond the estimated firing time. An uncontrollable accident, such as greenware falling against the end of the kiln-Sitter<sup>®</sup> tube, may cause an overfiring which could damage your kiln. Should this occur, the operator should be in attendance to shut off the kiln manually, using the witness cones behind the peepholes as a guide. The Kiln Sitter<sup>®</sup> should be used mainly to achieve consistent firing from one firing to the next and not as a failsafe shut off device. Note: because the small cone is placed on its side in the Kiln Sitter<sup>®</sup> with the weight of the rod pressing down on it, the small cone may bend one to two cone numbers before the witness cone. With experience, you may use one or two cone numbers higher in the Kiln Sitter<sup>®</sup> than the actual cone you wish to achieve.

Never use lubricant of any kind on the Kiln Sitter<sup>®</sup>!

The Kiln Sitter<sup>®</sup> does not take the place of watching the large cones through peepholes, but can help achieve repeatable and uniform firings. It must be kept in good working order and adjustments checked before each firing.

Before leaving the factory, every Kiln Sitter<sup>®</sup> is adjusted and its operation carefully checked. However, it is possible that the adjustments have changed in shipment or uncrating. Therefore, the following adjustments must be checked and readjusted if necessary before each firing.

**WARNING:** You are responsible for the adjustment and maintenance of the Kiln Sitter<sup>®</sup>. The warranty does not cover overfiring regardless of cause. The kiln will not overfire if witness cones are watched and the kiln shut off manually. Because the Firemate kiln is very repeatable as compared to a manually operated kiln or most other automatic kilns, the timer should be used. The Firemate kiln helps compensate for voltage fluctuations and room temperature changes, but cannot correct for load variations. Heavy loads will take longer than light loads.

### Adjustments

The firing gauge is used for adjustment only, and must never be left in place on the refractory tube during firing. Remove the rubber band to release the firing gauge. Store the firing gauge for future use after you complete the kiln sitter adjustments.

Check the centering of the actuating rod with the firing gauge in place.

The actuating rod must travel freely in the center of the oblong slot without touching the sides at any point, or the rod will stick and the Kiln Sitter<sup>®</sup> will fail to operate. If additional adjustment is needed, loosen two screws that hold the guide plate and move the plate to the right or left as required. Re-tighten screws and recheck its position until the actuating rod is centered. Press down on the release claw and check full travel of the actuating rod. See that it does not touch the sides of the refractory tube.

Lift the Kiln-Sitter weight to its vertical position. The release claw should just barely clear the trigger. If not, loosen the set screw in the center of the weight and slide the trigger up or down and retighten set screw securely so that it does.

Make sure all switches are off., including the timer, Kiln Sitter<sup>®</sup>, and Thumbwheel switch. Remove the firing gauge and store in a safe place for future adjustment checks. Raise the weight to its vertical position with one hand, with your other hand raise the actuating rod on the inside of the kiln until the claw engages the trigger. Let go of the weight and push the plunger all the way in until it locks. (limit timers must be set above the off position for this test) Slowly let the actuating rod down until the weight is released. The weight should not stick in the vertical position. It should fall freely and cause the plunger (button) to pop out into its original "off" position. Repeat several times to make sure all moving parts are free and functioning properly.

Now raise the weight only 1/2 of the way up. Push in plunger and allow weight to drop. Plunger should pop out to its original position. This checks that the weight's pivot is not too tight.

#### Kiln Sitter Operation

1. Check Kiln Sitter<sup>®</sup> adjustments.
2. Turn all switches to "off" position.
3. Remove the firing gauge and store. Serious damage to the kiln and the Kiln Sitter<sup>®</sup> will result if the kiln is fired with its gauge in place on the refractory tube.
4. Apply a thin coat of high fire kiln wash to the top edges of the metal cone supports and the lower side of the actuating rod being careful not to apply any in the slot of the refractory tube. Warning: Remove kiln wash from the actuating rod and cone supports and recoat with high fire kiln wash before each firing. Failure to do this will cause the cone to stick to the metal parts (when the cone softens at high heat) and will cause overfiring.
5. Lift the weight up and press down on the release claw to hold it up in position.
6. While holding the release claw down with one hand, place a small cone (1 1/8" long) under the actuating rod using your other hand. Be careful not to knock any kiln wash off the metal parts while inserting the cone. The cone should be resting with a flat side down on the cone supports.  
WARNING = Keep the cone away from the refractory tube. If the cone touches the tube during firing, it will stick to it and cause overfiring.
7. When loading, keep shelves and objects at least 1/2" from the tube, cone supports, cone and actuating rod (interior of kiln), also keep the area around the kiln and Kiln Sitter<sup>®</sup> (exterior) clear of all objects. Nothing must interfere with the weight when it falls or the kiln will overfire.
8. Push plunger in so that it remains locked in. The indicator pointer on the limit timer must be above the "off" position to allow the button lock to engage.
9. FIRE WARE CHECKING LARGE PYROMETRIC CONES BEHIND PEEPHOLES. (SEE METHODS OF TEMPERATURE INDICATION) DO NOT USE KILN SITTERR AS AN AUTOMATIC SHUT OFF BUT ONLY AS AN AID TO REPEATABLE FIRING.
10. TURN TIMER "OFF" MAKING SURE THE PILOT LIGHT GOES OUT. MAKE SURE THE KILN SITTER<sup>®</sup> BUTTON POPS OUT AND TURN THE THUMBWHEEL TO "0" AND THE SPEED CONTROL TO "MANUAL". UNPLUG THE KILN IF THE KILN WILL NOT BE USED FOR LONG PERIODS OF TIME.

#### Limit Timer

The limit timer is a clock motor driven device that causes the Kiln Sitter<sup>®</sup> to shut power off to the kiln after a preset number of hours. It is not a substitute for firing with cones, but a backup to the Kiln Sitter to help prevent severe damage to the kiln caused by Kiln Sitter<sup>®</sup> failure. The timer may be set for any period up to 20 hours and may be readjusted during firing. Of course, to be of use as a backup device, the unit must be set properly for a time great enough to fire your ware, but for a time less than required to overfire. It should be set 30 minutes longer than the estimated firing schedule. The Firemate is so repeatable that the timer will have significant value as a backup device.

Warning: We cannot extend our warranty to cover damage caused by overfiring for any reason, since we have no control on proper use of the limit timer. Do not leave any kiln unattended while firing. Watch pyrometric cones placed behind peepholes, to prevent overfiring.

#### Limit Timer Operation

1. Use the Kiln Sitter<sup>®</sup> instructions and the following steps.
2. Set the indicator knob for the estimated time of firing plus 30 minutes. This is required before the plunger will stay locked-in.
3. The time does not start until the plunger is pushed in. It runs even when the kiln switches are turned off, if the plunger is pushed in.
4. If the timer shuts the Kiln Sitter off before your ware is fired, the firing may be completed by lifting up the Kiln Sitter<sup>®</sup> weight, pushing in the plunger, and letting the weight down gently, You then fire manually turning all switches off when the witness cone (behind the peephole) bends.
5. Turn the timer switch to "off", and the Thumbwheel switch to "off" after every firing even if the Kiln Sitter<sup>®</sup> appears to have operated properly.

#### LOADING

CAUTION; Make sure timer is set to "off", thumbwheel is set to "0" and both pilot lights are off to prevent any possibility of electrical shock and burns from the heating elements.

The insulating firebrick used in ceramic kilns is soft and fragile. Care should be taken to avoid damaging the liner when loading (or unloading) the kiln.

Make sure that any ware you put into your kiln is bone dry (not cold to the touch). If pieces are hand molded make sure that no air pockets remain in the clay. This causes small "explosions" when fired, since the air expands and the moisture turns to steam. Hollow out the solid pieces whenever possible. Thick solid pieces can be fired safely only at very slow heating and cooling rates. Solid pieces tend to crack and break more easily during firing than hollowed pieces.

Your kiln is designed to provide as uniform a heat as possible throughout the firing chamber. The kiln should be loaded in a balanced manner; mix heavy pieces and light pieces. When firing in the same load, light and heavy ware should be alternated on the same shelf and distributed throughout the kiln to help the kiln heat evenly. This will assure that all pieces receive the same heat treatment.

Your ware will fire more evenly if you allow for sufficient air circulation around pieces. If it is necessary to place pieces on the floor of the kiln, it is recommended that you stilt them to allow for air circulation underneath. It is best to fire with a shelf at least 1/2" off the floor of the kiln.

Never place ware closer than 1/2" from the elements in the kiln. One inch is preferable. Place large, flat pieces that take up the full width of the kiln so that their edges are between element grooves. This will prevent the edges from heating up before the center of the piece, causing possible damage by cracking from uneven expansion. To prevent unstable objects from falling during firing use stilts to make sure they do not wobble. Take care that stilts will not strain rims and other delicate areas.

It is important to always place shelves so that there is at least one element groove between shelves or between a shelf and the lid. This will allow each compartment to heat evenly up to the proper temperature.

**KEEP SHELVES AND WARE AT LEAST 1/2" AWAY FROM ANY PART OF THE KILN SITTER. WHEN PLACING POSTS, LINE THEM UP SO THAT EACH POST IS DIRECTLY ABOVE THE POST BELOW (SEE ILLUSTRATION) TO PREVENT STRESSING AND POSSIBLE WARPING OF SHELVES. POSTS MUST RUN IN COLUMNS THROUGHOUT THE KILN.**

Remember when loading to place a large (witness) cone behind each of the peepholes for each firing so that you can monitor the progress of that firing. For an accurate reading, cones should be placed 2" to 3" behind peepholes to avoid a cooling draft. Also check the operation of the Kiln sitter and remember to put a small cone in the Kiln sitter (see Kiln sitter operation). For more information on cones and their use, see the section on temperature indication.

There are variations in loading techniques depending upon the type of ware being fired. The following are recommendations for loading different kinds of ware.

Loading Bisque



Low fire ceramic greenware pieces will not adhere to each other when fired; therefore they may touch one another. They may be stacked and set directly on shelves without sticking. In some cases they may be nested or placed on top of one another, if the weight is evenly distributed on the piece below. Do not, however, place a heavy piece upon a small piece or the weight may cause the lower piece to warp or crack. Tile and large flat pieces should be fired flat on a shelf so they do not warp. Slow firing is required in such cases because the shelf mass effects the temperature uniformity across the flat piece. Strain on any delicate portion of a piece could result in distortion. Fire bisque items with their lids in place to assure a good fit. Remember that although low fire greenware pieces may be touching there must still be enough room for sufficient air circulation around pieces for even firing results.

#### Loading for glaze firing

Glaze is finely ground glass suspended in a liquid. Two glazed pieces, if allowed to touch each other will adhere to one another when the glazes melt and re-solidify. Glaze will also adhere to the kiln or kiln shelf. Therefore stilts are used when firing most glazed pieces. Stilts are small ceramic or pointed metal supports; a wide variety is available (see the kiln accessories section). In some cases a piece may be dry footed (the base left unglazed). Be sure that the glaze is not applied too heavily, or it may "run" and stick to the shelf or the bottom of the kiln.

Remember to prepare the kiln with kiln wash, as described earlier, especially when firing a glaze to prevent any glaze from permanently adhering to the kiln bottom or shelves.

Glazed pieces should not be placed closer than 1/2" to one another since glaze bubbles before it smooths to its final surface. Bubbles and fumes from this process will contaminate adjacent pieces if spacing is not at least 1/2". We do not recommend that glazed pieces and bisque be fired in the same load, since they are normally fired at different temperatures and since this could cause discoloration. Bisque is normally fired one cone hotter than the same piece when glazed fired.

Do not stack or nest glazed pieces. Do not fire glazed pieces requiring lids with the lids in place, as they will stick together permanently.

#### Loading Overglaze, China Paint, Lusters, and Gold

Loading for overglaze pieces is the same as for your glazed ware, except that lusters should be spaced at least 1" apart to avoid cross contamination.

#### Loading stoneware and porcelain

It is necessary to fire stoneware and porcelain at a much higher temperature than that used for low fire ware or glaze. At this heat the ware becomes much softer than ceramic bisque. For this reason it may stick to other pieces and so should not be stacked or nested. It will also tend to distort in shape unless the maximum temperature is accurately controlled and the piece is properly supported. Hollow greenware pillars made of the same material as the ware are often used for support so that the expansion and shrinkage of the support is the same as that of the ware. Do not support high-fire ware on ordinary stilts. Often simpler shapes are supported by a reusable "setter" shaped holder for a particular piece. Do not place ware closer than 3/4" from the elements to avoid uneven heating and distortion of the piece.

Use high fire kiln wash. Some prefer to load stoneware onto surfaces sprinkled with silicaflour, sometimes called "flint". Keep "flint" away from the elements.

#### Loading glass

Do not fire small thin pieces of glass and large thick pieces in the same load. Glass sagging is very sensitive to variation in temperature. Load only one or two shelves; keep the bottom shelf 3" or more off the kiln floor and keep glass pieces at least 3" or more from the kiln top. Do not crowd pieces at any time. Terra cotta molds, dusted with whiting (calcium carbonate) to prevent the glass from adhering to the mold, are used in sagging sheet glass to shape. Do not use ceramic bisque molds for sagging glass.

## FIRING

### Methods of Temperature Indication

#### Pyrometric cones

There are two basic devices for monitoring the temperature inside the kiln. The first, most essential and most widely used method is the pyrometric cone. A cone is a small elongated pyramid shaped indicator made of ceramic material which is formulated to melt when subjected to a sufficient amount of heat. It does not indicate temperature per se but the effects of temperature over a period of time. Cones react very similarly to the ceramic ware, since they are similar in composition. They deform as a result of the influence of heat, time, and kiln atmosphere, revealing what is happening in the kiln and when the proper firing temperature has been reached. There is a whole series of cones available (see cone number -

temperatures chart), made to melt at different temperatures. Cones are available in two sizes (see illustration). The large (senior or witness) cones may be used at any location in the kiln to check temperature uniformity and firing progress, and the small (junior) cones are designed for use in the Kiln Sitter<sup>R</sup> (shutoff).

Always use a large cone of the number corresponding to the maximum desired temperature behind each peephole during every firing in order to monitor firing progress and check the operation of the Kiln Sitter<sup>R</sup>. Place the cone 2" to 3" behind the peephole to avoid cooling drafts and obtain an accurate indication. Do not place it too close to the elements. Be sure to position it so that you will be able to see the tip when it bends. It is important always to stand Pyrometric cones at the pre-cut angle provided by the base of each cone; this should be approximately 8 degrees away from vertical in the direction the cone is expected to bend. Setting the cones consistently at this angle assures that each cone (of the same number) will bend at uniformly the same temperature. Cone plaques or wire cone holders are commercially available. Holders may also be made from brick or clay. Holders made from fire brick are generally reusable and trouble free. An excellent way to check the temperature on any shelf in any location in the kiln is to use a cone plaque containing three large cones. One is for the desired maximum firing temperature. The other two should be numbered above and below the firing cone. For example, if firing to cone 06, use a cone 05, 06, and 07 (use a small cone 06, 05 or 04 in the Kiln Sitter<sup>R</sup>. (The weight of the rod and adjustment of the Kiln Sitter<sup>R</sup> may require the hotter small cone in the sitter to achieve the desired firing temperature.) These are often referred to as the guide cone, firing cone, and guard cone. The lower temperature (guide) cone bends as a warning that the desired temperature will soon be reached, the firing cone should bend until the tip is level with the base of the cone, and the guard cone, if bent too far, signals overfiring. See illustration for the proper degree of deformation.

**Junior size cones are intended specifically for use with the Kiln Sitter<sup>R</sup> (automatic shutoff) mechanism (see section on Kiln Sitter<sup>R</sup> operation). There will be a difference in the reaction of the cone in the sitter<sup>R</sup> relative to the large cone of the same number in a holder. The fact that the large cone is heavier, more upright, and bends under its own weight, while the small cone in the sitter is encouraged to bend slightly sooner by gravity and the weight of the Kiln Sitter<sup>R</sup> rod on top of it. It may be necessary to use a small cone one (or two) number(s) hotter in the Sitter<sup>R</sup> than the correct large cone number to achieve the desired results. Normally if firing to cone 04 or colder you will need one or two cone numbers hotter in the Kiln Sitter<sup>R</sup>. If firing to cone 5 or hotter you will normally use a junior cone that is one cone number hotter in the kiln Sitter<sup>R</sup>. When you get to know your kiln and the typical cone reactions you will be able to achieve consistent firing results.**

Be sure to keep the pyrometric cones bone dry so that they will not crack in the kiln. Once dropped, roughly handled or exposed to moisture, cones develop small cracks that tend to make them bend prematurely and give an inaccurate temperature indication.

The cones generally used in firing clays and glazes in pottery work are numbered ranging from 07 to 04. A very common one that works satisfactorily in most cases is 06. Cones used to fire china paint, gold, and decals range from 015 to 019. Cone 4 to cone 6 is used for porcelain. Stoneware may be fired to cone 8 or cone 10. All clay and glaze manufacturer's recommend the correct heat treatment for their products. Clays and glazes do vary, so check labels or ask your local ceramic supply dealer for advice on the proper cones to use, since he knows the characteristics of the clays and glazes he handles.

### **Pyrometer (optional)**

The second commonly used device for reading the temperature in the kiln is the pyrometer. This consists of a temperature sensing device (thermocouple) connected to a meter which indicates the temperature inside the kiln. Its principle value to the hobbyist is as a monitoring device which gives warning when the maximum firing temperature is neared. It is also very valuable in working with glass, which is extremely sensitive to differences in heat of only a few degrees. In firing ceramic materials, the ideal situation is to fire with both Pyrometric cones and a pyrometer, since cones reveal what is happening to the ceramic in the kiln only at the final firing stage and the pyrometer shows the actual air temperature continuously through the firing. The pyrometer does not take into account the effects of time on the firing process as does the cone.

When using a pyrometer, be sure that the meter is hung on a wall or shelf near the kiln (not on the kiln itself) away from the radiated heat of the kiln and away from drafts to obtain a more accurate reading. Another way of gauging the approximate temperature is by the color produced by different heats. A kiln can be fired visually with sufficient experience and a knowledge of the corresponding colors and temperatures. For example, the temperature of the lowest visible red heat (observing the entire kiln atmosphere not just the elements) is 1060°F. See the temperature-color chart for the temperatures corresponding to other colors.

### **Kiln Break in:**

The purpose of the first (break in) firing is to get rid of any moisture in the kiln, to burn off the oil coating on the elements, and to test the operation of the Kiln Sitter<sup>R</sup>. Read all safe guards (page 1-0) and study

directions on firing before breaking in your kiln. Fire the kiln empty to cone 020 or 019 (using the cones supplied). This should take approximately 4 hours. Set your limit timer for 4 hours.

On the second firing, we recommend that you fire up to cone 05 to get a good oxide coating on the elements which will help protect them. This firing should take about 5 hours; Set the timer for 5 1/2 hours. We do not recommend firing glaze in the second kiln firing. (the fumes could be hard on the unprotected elements). We also recommend that you fire with the kiln furniture in place. This will test the shelves, a very small percentage of which may crack on the first firing. (Test firing shelves is a wise precaution for any new shelves.)

### **Firing:**

A kiln is designed to produce the extremely high temperatures necessary to chemically alter ceramic materials. It is therefore imperative that you observe all safety precautions.

#### **Safety cautions:**

Do not leave the kiln unattended, such as firing over night. Even though your kiln has a Kiln Sitter<sup>R</sup>, and limit timer, it is required to use a large cone visible through the peephole to check firing progress. Check witness cones at (1) hour intervals throughout firing, at the expected shutoff time and every half hour thereafter until the cone is properly bent or the Kiln Sitter<sup>R</sup> has turned off. Always check to see that the shutoff devices have operated correctly and manually turn the timer to "off" and the Thumbwheel to "^" and check that both pilot lights are out. Always monitor the progress of each firing. Never open the lid while the kiln is firing. This could cause serious burns as well as damage to the ware. After firing always allow the kiln to cool with the lid closed until it is cool enough for you to unload it with your bare hands.

#### **Firing Speed:**

The main consideration for firing speed is that you should not fire faster than the ware will absorb heat, and you should not cool faster than the ware will release heat. Firing and cooling rapidly will result in stressing and even cracking the ware due to uneven expansion. Very thick pieces, such as hand molded sculptures, require very slow heating and cooling. Set the speed control on "normal" or "A" for pieces made in molds, while a setting of "E" can be used for most handmade pieces. For very thick handmade pieces or for low temperature soaking of these pieces or porcelain, use the manual setting for soaking, then turn the speed control to "E" or slow speed when you want to proceed.

Remember that during firing you will not endanger your ware by turning the kiln off before maturity. If you ever hear pieces cracking or falling, or if your kiln has been jarred, turn the kiln off. Wait until it is cool, then open and check for problems that may have developed. Replace all cones with new ones before firing again.

#### **BEFORE FIRING:**

- A. Turn Thumbwheel to "^" position so upper pilot light is off.
- B. Turn timer to "off" position.
- C. Raise lid and lock in place. Gently test that lid is locked in open position.
- D. When necessary, kiln wash cone supports and allow to dry.
- E. Place desired junior cone in Kiln Sitter<sup>R</sup>.
- F. Load kiln Placing senior cone behind peepholes. Lower lid to closed position.
- G. Insert all peepholes except the top one.

#### **FIRING:**

**STEP 1** Set timer on Kiln Sitter<sup>R</sup>.

**STEP 2** Push in plunger on Kiln Sitter<sup>R</sup>.

**STEP 3** Rotate Thumbwheel to "1"

**STEP 4** Set FIREMATE<sup>R</sup> speed control as desired (usually "A" for items made in a mold or for china paint using the fastest speed. Use "E" for handmade pieces which corresponds to the slowest speed other than "manual" ).

**STEP 5** Periodically check senior cone: when senior cone bends or Kiln Sitter<sup>R</sup> turns off, manually turn Thumbwheel to "^" position and timer on Kiln Sitter<sup>R</sup> to "off". Turn speed control to "stop". Allow to cool before opening.

**NOTE:** Firemate<sup>R</sup> will click on and off during its operation. This audible noise is caused by a relay lowering average power as required by the programmer. The blue-white flash, which can be seen in the panel vents, is caused by the relay contacts interrupting power as necessary for its proper operation. This energy efficient power reducing system has been tested at Cress for over 25 years and has proven to be extremely reliable.

#### **MANUAL FX OPERATION**

1. Set speed control to "stop" or "manual."
2. Rotate Thumbwheel to desired position.  
"1" is low

"4" is medium  
"7" to "10" is high

#### **BENEFITS OF THE FIREMATE<sup>R</sup> KILN INCLUDE:**

FX elements are all tuned for excellent temperature uniformity (probably the best uniformity in a hobby ceramic kiln anywhere in the world) when used in connection with the FIREMATE control.

FX kilns are all designed for cone 10 operations.

FX kilns have built-in preprogrammed soaking: Thumbwheel slows down automatically as temperature increases employing a patented feedback technique.

FX kilns all have an automatic voltage compensation circuit to help even out results when your house voltage varies during operation.

FX kilns all have a room temperature compensation circuit. For instance, cold room temperatures cause the Thumbwheel to turn up slightly faster to cause the kiln heating to be constant from firing to firing.

FX kilns slow down as ceramic loads increase - a desirable feature to allow for more soaking and more even distribution of the temperature with heavier loads at a single setting.

#### **Firing Glass**

Glass is very sensitive to variations in temperature of only a few degrees. We strongly recommend that you use a pyrometer to measure temperature when working with glass. Glass must be allowed to pass through the lower temperatures slowly to prevent shattering, then it may be fired rapidly up to temperature (firing rapidly at this point helps preserve colors). Glass softens quickly once the critical temperature is reached and sagging begins (usually approximately 1500 °F for glass slumping); it is wise to check it often at this point (at 10 minute intervals) and when it has slumped properly, turn off all switches, crack the lid at the lower lid prop position for up to ten minutes to prevent over softening of the glass, then close the lid and allow to cool completely.

Glass is slumped onto terra cotta molds dusted with whiting (calcium carbonate) to prevent sticking. Be sure to read the glass loading section.

#### **For firing glass (slumping or stretching):**

**STEP 1** Set lid at lower lid prop position.

**STEP 2** Set Thumbwheel to "1" and speed control to manual. Fire to 700 °F (approximately one hour.)

**STEP 3** close lid. Turn Thumbwheel to 9.

**STEP 4** Fire to approximately 1500 °F, checking at intervals for proper slumping.

**STEP 5** When proper slumping is reached, turn Thumbwheel switch to "" and timer to "off", crack lid at the lowest lid prop position for up to ten minutes.

**STEP 6** Close lid. Allow cooling completely.

The standard firing schedules given above may be varied when necessary depending upon individual circumstances. If your voltage is high and your kiln is firing too rapidly, or if you are firing an extremely thick, heavy piece and you wish to fire very slowly, you may use slower firing in step 3 above by leaving Thumbwheel on "1" and just turning the speed control to "normal". This will allow the power to gradually increase to higher settings for a slower less heat shocking firing schedule.

#### **FIRING CHARTS:**

It is a valuable practice to keep a written record of each firing, noting the settings (even the degree of deformation of witness cones and their locations.) This firing chart allows you to repeat good results and successful firings and avoid repeating less than satisfactory firing results.

#### **AFTER FIRING:**

After every firing, check the limit timer, there should be approximately 10 to 15 minutes left at time of Kiln Sitter<sup>R</sup> shut off. You should correct the timer on the next firing if there is more than 30 minutes left on the timer so that the timer works as an effective backup on the firing. Should the Kiln Sitter<sup>R</sup> fail and you forget, this could be a very important safety factor in saving the kiln and your work from destruction.

Also check the Kiln Sitter<sup>R</sup>. Observe the pilot lights (they should be off) and the position of the Kiln Sitter<sup>R</sup> weight: make sure it has fallen and has actually turned the kiln off. Correct any miss adjustment problems early before damage is done to the kiln and ware. Always turn the Thumbwheel to "" and the limit timer to "off" after each firing even if the Kiln Sitter appears to have functioned correctly. The Kiln Sitter is used for added safety and for controlled firing; it is not fail proof and can not be guaranteed to turn off every time.

Always allow plenty of time for the kiln to cool (at least twice as long as it took to fire) before opening the lid. Do not unload it until you can do so with bare hands.

#### **FIRING FOR BEST RESULTS**

The following suggestions are general good practices to be observed for the most satisfactory results. Don't try to hurry the firing or cooling of your ware. It can absorb and release heat only so fast without damage to the ware. Slow heating and cooling rates add quality and minimize crazing, cracking and breakage problems. Let the kiln cool at least over night. then crack the lid and let pieces cool until they may be handled with bare hands. If this suggestion is not observed you will put permanent stress in your pieces making them weaker and more subject to breaking and crazing.

Watch firings closely to protect from overfiring. Firing too hot will damage fine detail and fade colors. Keep the inside of your kiln free from dust and chips, which cause imperfections in pieces. A vacuum cleaner is useful in this regard.

Always fire only bone dry ware.

A cone plaque containing three cones (guide cone, firing cone, and guard cone- see temperature indication) is often useful as a monitoring and warning device. Always place witness cones uniformly at an 8 degree angle from vertical.

## RECOGNIZING FIRING FAULTS

**BLOTCHY BISQUE** is likely to be caused by stacking too compactly, not allowing for sufficient air circulation during firing which results in uneven firing. Try loading more loosely and refiring.

**WARPED BISQUE** may be due to one the following causes:

Overfiring.

Placing ware too close to the elements.

Stressing delicate area by improper support.

Removing ware incorrectly from the mold.

**FAILURE OF GLAZE OR UNDERGLAZE TO ADHERE TO THE WARE** (crawling glaze) can be attributed to one of the following causes;

Dirty bisque surface. Dust and skin oil are the most common offenders. Try to clean, recover and refire the ware.

Damp bisque. Allow to dry completely, then reapply and refire.

Underfired or overfired bisque. If Underfired, refire to proper cone, then reapply glaze and refire.

Overfired bisque becomes too hard to absorb the glaze media.

Too thick a coating of underglaze.

Incompatibility of glaze and/or underglaze and ware. Your ceramic supply dealer can best advise you on clays and glazes that are compatible (expand and shrink at the same rate and do not chemically ruin each other.)

**PUDDLING AND RIPPLING** of glazes is caused by applying an excessively thick coating of glaze. If this effect is not desired, merely coat pieces more lightly on future ware.

**DROPPING GLAZES** on vertical surfaces is caused by overfiring glaze and by excessive glaze thickness.

**SHINY SURFACE ON A MAT OR TEXTURED GLAZE** can be attributed to overfiring. Also textured glazes are often applied too thinly. If this is the case, reapply and refire to the proper cone.

**CLOUDY APPEARANCE OF A TRANSPARENT GLAZE** can be attributed to overfiring. Also textured glazes are often applied too thinly. If this is the case, reapply and refire to the proper cone.

**CLOUDY APPEARANCE** can be caused by dirty brushes, by placing the piece too close to the elements, by too heavy an application of glaze, or by placing pieces too close to one another in the kiln, resulting in cross contamination.

**DISCOLORED GLAZES** are often caused by one of the following reasons;

Contamination of glaze by chemicals in the ware, especially if one fired.

Dirty brushes.

Loading pieces too closely, causing cross contamination of glazes by fumes or bubbles.

Placing pieces very close to the kiln elements, creating hot bands across the piece due to direct radiation from the elements. This can leave a band of slightly faded glaze across the piece.

Overfiring. Too high a heat will frequently cause colors to fade.

**PINHOLE, BUBBLED GLAZE AND CRATERS** may be attributed to one of several causes;

Immature bisque. If your bisque is not fired hot enough to complete the vitrification and remove all vapors from chemical reactions that come from the ware, they may erupt into the glaze.

Dust on the ware or in the kiln.

Firing too rapidly.

Cooling too rapidly. Craters are sometimes formed by cooling the ware too rapidly, which freezes the crater formed when the glaze bubbles. You can try merely refiring to minimize the effect of these defects, or you may apply a thin coat of glaze and refire to the proper cone which may correct the problem.

**FADED DECALS** are usually due to under or over firing. Check the manufacturers' recommendations and refire Underfired ware to the proper cone.

**TROUBLE WITH REDS** is common; they are quite sensitive and often they appear faded or contain washed out areas or dark spots. Probable causes and corrective measures (where possible) are listed below.

Too thin a coating of the red glaze. Try reapplying a thicker coat and refiring.

Overfiring. Reds are generally fired to a temperature ranging from cone 07 to cone 06. They do not do well at greater heats.

Incompatibility with other colors: Some colors (such as green and yellow) due to chemical composition tend to make achievement of bright reds difficult. If you suspect this problem, ask your ceramic supply dealer which glazes may be used with his reds.

Insufficient air circulation during firing: This usually results in black spots. Reds need sufficient oxygen to mature. Try leaving peephole plugs out until true red (no pun intended) heat has been reached.

Soaking too long at maximum temperature.

**CRACKING AND CRAZING** (crazing is characterized by many very fine cracks running throughout the glaze surface) may be caused by one or more of the following reasons;

Entrapped moisture. Make sure greenware or bisque is bone dry before firing.

Internal stress due to rough handling:

Too rapid or uneven heating or cooling (especially in heavy, thick pieces.) If this occurs, then all of the piece does not expand or contract at the same rate, resulting in stress which is released by crazing or cracking. You can usually tell if a glaze cracked during heating or during cooling by carefully examining the crack. Smooth rounded, and/or sealed cracks indicate crazing during the heating phase & sharp angular edged or separated cracks indicate too rapid cooling (possibly a draft from opening the lid or peephole too fast). If you suspect you are firing at too fast a rate for your ware to properly absorb the heat, the following is a useful check. Place a cone on a shelf in the middle of the load. Put a bisque bowl over it, and fire as usual. Afterward compare this cone with the witness cone you used for the firing. If it is not deformed to the same degree, you are firing too rapidly for the weight of the load.

Incompatible clays and glazes: Check with your dealer for compatible materials. Crazing may often be minimized by refiring slowly to a slightly higher temperature than that to which the ware was previously fired.

**DELAYED CRAZING** (crazing which does not develop immediately but may appear months after firing) is the result of internal stress, usually caused by too rapid cooling (which may seem very slow to the hobbyist). Permanent internal stress combined with a small jolt, or vibration, can crack the piece months after firing. If delayed crazing is a problem, try refiring to the proper temperature and cooling very slowly. Do not open the lid or peepholes during the cooling period.

#### **KILN MAINTENANCE**

You can protect your kiln and add many extra years to its life by using this maintenance guide.

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Before each loading:

Before each loading:

Visually check kiln and its furniture.

Remove glaze spots on shelves, posts, kiln bottom or kiln sidewalls.

Clean kiln by removing chips and dust. A vacuum cleaner works well for this purpose.

Check kiln shelves for cracks. Sand any rough spots on shelves and recoat with kiln wash. Also recoat areas where the kiln wash has worn off. Avoid thick kiln wash layers. There is no need to kiln wash shelves every time you fire.

Kiln wash floor where it has worn thin. This may not be required every firing. Sand rough spots and recoat. Keep a smooth layer not over 1/16" thick. Kiln wash built up to a thick layer may damage kiln floor by pitting due to differential thermal expansion.

Whenever possible, use a clean kiln-washed shelf on the kiln floor to protect it.

Check Kiln sitter:

Test condition of the sensing rod. It must be centered in the porcelain tube and move freely in order to operate properly. During firing the pivot point may become corroded or residue from firing you ware may build up which can cause overfiring. Replace rod or remove and clean rod when necessary. Replace the rod if it becomes warped or bent even slightly.

check cone supports and tube assembly. A thin layer of kiln wash must be maintained. Remove any accumulation of foreign material and recoat with kiln wash. If the cone supports are damaged either by bending or contamination by a non-removable material, replace them. Keep kiln wash off the tube assembly. If the end of the tube assembly breaks at the point which holds the cone supports, the tube assembly must be replaced to avoid erratic over and underfiring.

Check Kiln sitter adjustments whenever your firing was peculiar or every 10 firings as shown in the kiln sitter instruction manual. Heat, corrosion and mechanical wear cause changes in the adjustment over a period of time. Be careful!

Keep the outside of the kiln clean. It is easier to clean before burning contaminants onto the stainless jacket. Use glass cleaner when kiln is cool.

RARELY NEEDED MAINTENANCE

Lid Brace: Be aware of lid brace operation every time the kiln is fired. Replace lid brace if it becomes bent, or does not function perfectly. **WARNING** - Do not use kiln if lid brace is not in perfect operating condition.

Lid Band: Tighten lid band when necessary. The normal differential expansion and contraction of the brick and lid band cause a gradual loosening of the lid band.

Stainless Steel Case: Normally the case never needs tightening from normal use, but tighten if needed.

Pilot Lights: Replace pilot lights if the lens becomes damaged or they fail to operate.

Cord: Check the cord every three months for heating. If cord becomes hot during firing, replace cord and wall receptacle. Check cord for heat near wall plug after the kiln has been firing for over three hours. Have a licensed electrician replace the cord with a CRESS cord and receptacle to make sure the heat specification as well as the amperage and voltage specifications are met.

## TROUBLE SHOOTING

PROBLEM	PROBLEM CAUSE	SOLUTION
Thumbwheel does not turn	Speed control switch has dirty contacts.  Speed control is defective.  Panel wiring is hitting against PRD11AGO relay causing relay to be stuck closed.	Flip (turn) speed control switch from fast to slow setting counterclockwise and then back to the fast setting – repeat 3 times to loosen dirt.  Replace speed control switch (INF 240D953B)  Push wiring away from relay
Thumbwheel stops at 3 or 4	Thumbwheel power switch INF2031B is out of calibration.	Replace power switch INF24031B under the thumbwheel if you cannot hear the switch cycling. Check through screen and plastic window



		in motor to see if motor is turning, if it turns but thumbwheel is not turning up – replace the motor.
Thumbwheel goes to 10 in one hour and does not stop.	Wire or element is interfering with the PRD11AGO relay operation.  Defective PRD11AGO relay.	Check for wire or element interfering with PRD11AGO relay. Move wires so there is no interference. Replace PRD11AGO relay.
Pilot lights do not light and kiln does not heat.	No power to kiln. Defective pilot light. Defective switch under thumbwheel. Loose connection.	Plug kiln in. Push plunger of kiln sitter in. Reset circuit breaker or replace fuse. Check kiln wiring. Disconnect all other appliances, light, etc. on the same circuit to isolate problem. Check wall receptacle.
Circuit breaker or fuse blows instantly after kiln is turned on.	Short circuit.	Check with volt-ohm meter to see that you have at least 5 ohms between all prongs on kiln plug with thumbwheel set to 9. If reading is less than 5 ohms check kiln wiring for short.
Circuit breaker or fuse blows after a while.	Defective house circuit breaker.	Check electrical specifications to see if your fuse or breaker is large enough. If not call a qualified electrician. Do not merely install a larger fuse or breaker. Replace circuit breaker or fuse. Clean wire and tighten connections to circuit breaker or fuse. Do not use aluminum wiring. Use only copper wiring. Ventilate kiln room to prevent excessive heat in area where fuse box is. Remove other appliances, lights, etc. from kiln circuit. Have electrician check wall receptacle.
Kiln warms up but does not reach red heat.	Incorrectly wired wall receptacle.	Green wire in kiln cord is connected to case ground. Black and white wires in kiln cord are “hot” and connected to controls. White in house wiring is the neutral and is eventually grounded in main house electrical panel. A qualified electrician is required for this work. Do not attempt this work yourself.
<b>PROBLEM</b>	<b>PROBLEM CAUSE</b>	<b>SOLUTION</b>
One pilot light does not light.	Loose connection.	Replace pilot light and retighten connection.
Plug cap gets hot.	Corroded or worn out receptacle. Corroded cord prong. Loose or corroded cord cap connections.	Replace wall receptacle as well as the cord.
Intermittent overfiring and underfiring.	Kiln sitter tube assembly is defective. Cone supports are bent or dirty. End of tube assembly is broken. Tube assembly pivot points may be dirty.	Replace kiln sitter cone supports or the entire tube assembly if damaged.
Kiln sitter plunger will not remain in.	Timer is set to “0”. Strain on kiln sitter faceplate. Kiln not adjusted properly, wrong cone used in kiln sitter.	Set timer above “0”. Adjust kiln sitter. Turn timer all the way to 20 hours, then back. Set timer correctly for firing.

Kiln shuts off too soon.	Circuit breaker blows. Safety timer may have been set incorrectly. Rarely, relay vibration may cause the plunger button to pop out prematurely.	Replace circuit breaker if needed, check wall receptacle for voltage. Put shock mounts on relay studs if necessary. Call 1800-423-4584 for help.
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## FIRING CHARTS

It is a valuable practice to keep a written record of each firing, noting the settings, (even the degree of deformation of witness cones and their locations). This firing chart allows you to repeat good results and successful firings and avoid repeating less than satisfactory firing with undesirable results.

## GLOSSARY

**BISQUE** - Any fired undecorated clay object.

**CERAMICS** - a general term applying to any fired piece of clay material.

**HINA** - A translucent high fire ceramic body.

**CLAY** - Earth that is relatively pure silica and alumina; usually a blend of different clays and minerals, combined to achieve various effects and different properties.

**CONE** - see pyrometric cone.

**CRATERING** - Imperfections in glaze caused by rapid cooling, which "freezes" bubbled glazes before they can smooth out, leaving pits.

**CRAZING** - A network of hairline cracks in a glazed surface that appears after firing.

**DECAL, CERAMIC** - A design or picture, usually overglaze, which is applied to and fired onto the ware.

**DRY-FOOTING** - Wiping glaze off of the base of objects before firing. This is an alternative to stiling glazed ware to keep the piece from sticking to the shelf when firing.

**EARTHENWARE** - Porous ware made of low fire clays.

**ELEMENTS** - Coils of wire having high electrical resistance and resistance to high temperatures which serve to convert electrical energy to heat in the kiln.

**ENAMELING** - Application of finely ground colored glass to metals (usually copper or silver) resulting in a glaze-like finish after firing.

**FIREBRICK** - refractory blocks used in making the insulating firing chamber of the kiln.

**FIRING** - Applying heat to ceramic materials to cause a change in their chemical composition (see maturity).

**FIRING CHAMBER** - The space in the interior of the kiln where the ware is heated.

**FURNITURE, KILN** - Any of a wide assortment of shelves and posts used in loading a kiln. They are used in supporting ware to take full advantage of the firing space.

**GLAZE** - Finely ground glass, suspended in liquid, applied to ceramic ware to give it a glossy (usually) glass-like surface when melted by firing.

**GREENWARE** is any unfired clay object.

**HIGH FIRE** - Firing to very high temperatures; anything over cone 4. Commonly (cone 6) used with porcelain and stoneware.

**KILN SITTER<sup>R</sup>** - A mechanical device for shutting off the kiln at the desired temperature using pyrometric cones. It is intended for consistent controlled firing. This device does not always shut off due to operator induced mechanical variables and must be checked manually.

**KILN WASH**, - A refractory material used as a coating to prevent sticking of ware and glazes to parts of the kiln and shelves. It is a powder that is mixed with water and applied with a brush.

**LIMIT TIMER** - Primarily a safety shutoff device (backup) which turns off the kiln should the kiln sitter fail. It operates strictly by time, rather than temperature and does not exclude the requirement to attend the kiln when firing. This safety device works best with the Firemate kiln because the firings are so repeatable that the set time can be set close to the expected firing time.

**LOW FIRE** - Ware fired only to medium temperature as for earthenware, pottery, or terra cotta.

**LUSTER** - An overglaze giving an iridescent finish.

**MATURITY** - The point at which bisque is completely fired and glazes reach the intended smooth, glassy state.

**NESTING** - Stacking one piece of greenware inside another, a technique used in loading for bisque firing.

**OHMMETER**- An electrical measuring device for measuring electrical resistance. This is used to check elements for aging or an open circuit.

**OVERGLAZE** - Decorative material applied on top of a glazed surface. Examples are decals, gold and other metallics, lusters, and china paints. They are always low-fired (cone 018 to cone 014)

**PEEPHOLE PLUG** - A piece of refractory material used to close the peephole.

**PINHOLES** - Imperfections in a glazed surface characterized by tiny holes.

**PINS** - Short pieces of high temperature wire used to anchor elements in place.

**PORCELAIN** - A type of clay body which becomes vitreous and translucent when high fired.

**POST** - Columns of refractory material used to support shelves in the kiln. They are available with square, triangular or circular cross sections and in many different heights.

**PYROMETER**- A high temperature thermometer consisting of a heat sensing device (thermocouple) connected to a meter readout. This is especially important in working with glass. This is an excellent device to measure the progress of a firing and temperature profile of a kiln.

**PYROMETRIC CONE** - A small elongated pyramid of ceramic material that is formulated to soften and deform at a specific temperature plus time condition, indicating that the ware is mature and the firing complete.

**SHELVES** -Slab of refractory material used in the kiln to support ware being fired (see furniture).

**SILICA** - (SILICAFLOUR, FLINT) A mineral powder used to prevent sticking of porcelain and other high fire clays during firing.

**SLIP** - Liquid clay used in casting shapes with molds.

**SOAKING** - Heat treating objects in a kiln by keeping them at a particular temperature for a period of time.

**STILTS** - Small ceramic or high temperature metal prongs used to raise a piece off the kiln shelf. Used chiefly in glaze firings to prevent sticking to the kiln or shelf. Many styles are available.

**STONEWARE**. - A ceramic body that is vitreous but not translucent when high fired. It usually contains a high percentage of grog (fired clay particles) and is usually made of native clays.

**TERRA COTTA** - A natural, low fire red clay.

**THERMAL SHOCK** - the result of putting ware through sudden changes in temperature.

**THERMOCOUPLE** - Two wires of different metals that are inserted into the kiln and comprise the temperature sensing part of the pyrometer. It produces a very small voltage in proportion to the difference in temperature between the tip (hot junction) of the thermocouple inside the hot kiln and the cold junction on the outside of the kiln.

**UNDERGLAZE** - Decorative material applied to greenware or bisque.

**VENTING** - Allowing air into the kiln and vapors to escape by propping the lid slightly open and sometimes opening the peepholes. Usually done only in the early stages of firing.

**VITRIFY** - To fully fuse ceramic material to a glass-like state so that it is nonporous and watertight without glazing.

**WARE** - General term for any shaped ceramic object whether or not it is in a finished state.

**WARPAGE** - Deformation of ware during firing, is usually due to overfiring or improper placement in the kiln.

**KILN SITTER** - A mechanical device for shutting off the kiln at the desired temperature using pyrometric cones. It is intended for consistent controlled firing. This device does not always shut off due to operator induced mechanical variables and must be checked manually.

**KILN WASH** - A refractory material used as a coating to prevent sticking of ware and glazes to parts of the kiln and shelves. It is a powder that is mixed with water and applied with a brush.

**LIMIT TIMER** - Primarily a safety shutoff device (backup) which turns off the kiln should the kiln sitter fail. It operates strictly by time, rather than temperature and does not exclude the requirement to attend the kiln when firing. This safety device works best with the Firemate kiln because the firings are so repeatable that the set time can be set close to the expected firing time.

**LOW FIRE** - Ware fired only to medium temperature as for earthenware, pottery, or terra cotta.

**LUSTER** - An overglaze giving an iridescent finish.

**MATURITY** - The point at which bisque is completely fired and glazes reach the intended smooth, glassy state.

**NESTING** - Stacking one piece of greenware inside another, a technique used in loading for bisque firing.

**OHMMETER** – Is an electrical measuring device for measuring electrical resistance. This is used to check elements for aging or an open circuit.

**OVERGLAZE** - Decorative material applied on top of a glazed surface. Examples are decals, gold and other metallics, lusters, and china paints. They are always low-fired (cone 018 to cone 014)

**PEEPHOLE PLUG** - A piece of refractory material used to close the peephole.

**PINHOLES** - Imperfections in a glazed surface characterized by tiny holes.

**PINS** - Short pieces of high temperature wire used to anchor elements in place.

**PPORCELAIN** - A type of clay body which becomes vitreous and translucent when high fired.

**POST** - Columns of refractory material used to support shelves in the kiln. They are available with square, triangular or circular cross sections and in many different heights.

**PYROMETER**- A high temperature thermometer consisting of a heat sensing device (thermocouple) connected to a meter readout. This is especially important in working with glass. This is an excellent device to measure the progress of a firing and temperature profile of a kiln.