

Paragon E & Q Series Instruction and Service Manual

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Introduction

You have no reason to fear your kiln. There is nothing mysterious about it. Yet there are many ways to damage a kiln. If you read and follow this manual, however, you will avoid those pitfalls and will be delighted with your kiln's ease of operation. Read this manual now to save yourself time and expense later.

This manual is written for E, Q, TnF-E and TnF-Q series Paragon kilns. The model number of your kiln is on the electrical data plate on the switch box. When you call or write about your kiln, it is important that we have the complete model number. This number will insure that you receive the correct replacement parts.

If your kiln is equipped with the Dawson Kiln Sitter®, you should find a Kiln Sitter instruction folder in your instruction packet. TnF series kilns include separate instructions for the controller in the instruction packet.

We suggest you read the manual twice. The first time read it straight through before you plug your kiln in. The second time use it as a guide as you set the kiln up and fire it.

Tremendous stresses are generated within the kiln. The insulating firebricks will actually expand and contract with each firing. This is absolutely necessary for the long life of your kiln. Hairline cracks will appear in the brick while the kiln is cold. Do not be concerned with these; they close tightly when the heated brick expands.

Manual-fire switch-operated kilns use an infinite control switch. When the switch is turned to High, the element(s) stay on continuously. At lower heat settings, the switch cycles on and off. So if you notice that your kiln is cycling on and off, do not be concerned. This is normal for your kiln.

Your Paragon dealer will be glad to help you with problems and give you suggestions for better firing. We will also be pleased to help you directly in any way we can. However, if you should have any problems with your kiln, please see or write your dealer from whom you bought your kiln. Writing the factory first will normally only delay assistance.

Thank you for purchasing a Paragon. We wish you many years of relaxation and creative enjoyment with your new kiln!

Important

Read each page of this manual in detail before you install or operate your kiln. Warranty does not cover damage caused by failure to follow instructions.

Toxic Glazes and Glass

Some glazes and glass may be unsafe and toxic when used for surfaces that will be in contact with food or drink. When you make food or drink containers, select a glaze or glass that has been formulated, tested and labeled as approved for surfaces that will be in contact with food or drink. Follow the glaze or glass manufacturer's instructions exactly, without any variations.

Important Safety Rules

An electric ceramic kiln is extremely safe to operate provided you follow these basic safety rules:

- Unplug kiln when not in use.
- Do not touch hot sides.
- Keep unsupervised children away.
- Place kiln on a non-combustible surface.
- Do not install closer than 12" from any wall or combustible surface.
- Fire only in a well ventilated, covered and protected area.
- Keep cordset away from hot sides of kiln.
- **DANGEROUS VOLTAGE:** Do not touch heating elements with anything.
- Disconnect kiln before servicing.
- Do not leave kiln unattended while firing.
- Wear safety glasses when cutting or grozing glass.
- Wear firing safety glasses when looking into the peephole of a hot kiln.
- Keep food away from your work area.
- TnF Kilns: Turn controller safety switch off when kiln fires to completion.

Setting Up the Kiln

Unpacking the Kiln

Carefully inspect your kiln as soon as it arrives. If the kiln is damaged, contact your Paragon dealer or call Paragon Industries, Inc. at 214/288-7557. (We're open Monday through Thursday, 7 a.m. to 5:30 p.m. Central time). Save all packing materials for inspection by the freight claims adjuster. Refer to your packing list for more information or see your Paragon dealer.

Where to Locate Your Kiln

1. Place your kiln in a well ventilated, covered and protected area such as the garage, basement, utility or ceramic hobby room. Do NOT store gasoline, paint or other inflammable liquids in that room.
2. Provide a minimum of 12 inches clearance between kiln and the closest wall.
3. Never allow the room temperature of your firing room to exceed 100 - 110° F. (Room temperature is measured three or more feet away from the kiln.) If necessary, use fans to lower room temperature.
4. Keep the kiln away from curtains or other combustible materials.
5. Position kiln on a level, fire-proof surface. We recommend a metal table.
6. Keep unsupervised children away from the firing area.
7. Keep the power supply cord away from the kiln case, which gets hot enough to damage the cord set.

There is little danger of serious burn from accidental contact if you exercise the same caution you would use with an electric iron.

Seating the Elements

Shipping may dislodge the elements of your kiln. Please perform the kitchen knife test to make sure the elements are seated in their grooves.

Kitchen Knife Test

CAUTION: Always unplug kiln before touching an element with anything. (Read this manual to page 9 before plugging in your kiln.)

Press the elements into their grooves by running a blunt kitchen knife or plastic comb completely around each groove. Do this before the



first firing. The element must fit all the way back into each corner and must not bulge outside the groove.

The element will not be seated in the curved portions of the groove. This is alright as long as the element is seated in the straight grooves and corners.

Before the kiln is fired there is no danger of breaking the elements. After firing, however, the elements must

be reheated if they bulge out of the groove. See "Reseating a Bulging Element," page 11.

Cleaning the Kiln

Clean your kiln before firing. Use a soft brush nozzle on a vacuum cleaner to remove brick dust from inside the kiln, especially from the grooves. A damp cloth or damp sponge may also be used to gently wipe dust from the firebricks. Clean the kiln whenever you notice dust inside.

Electric Installation

Your kiln must be plugged into a correctly wired circuit. The circuit must never be used by other appliances while the kiln is firing. Turn off the circuit breaker or unscrew the fuse for the circuit that your kiln will be plugged into. Check to see if other appliances shut off too. If that circuit powers appliances that must remain on while the kiln is firing, plug your kiln into a different circuit.

Never use an extension cord on 240 volt kilns. Avoid extension cords on 120 volt models if possible. If you must use one on a 120 volt kiln, never use one smaller than 12 gauge or longer than 20 feet. Never plug it into a ceiling outlet!

Voltage fluctuation can vary the firing time for a given pyrometric cone from as little as half to more than twice the average time. If the voltage is too low, the kiln will never reach full temperature. This can be corrected only by having the utility company adjust the voltage. (However, 208 volts cannot be adjusted to 240 volts, and vice versa.) TnF kilns will not even turn on if the voltage is too low. However, this is unusual.

The receptacle must have a separate safety grounding wire. This protects you from serious electrical shock. If you have the least doubt that your circuit is properly wired, have an electrician check it. Refer to "Locating Electrical Trouble," page 11.

Electrical Specifications

Specifications on the kiln's electrical data plate supersede specifications on this chart.

This chart is for United States and Canadian 120 and 240 volt, single phase models with a factory-installed cordset only. For foreign countries, refer to the kiln's electrical data plate. Your electrical circuit should be installed only by a licensed electrician and in accordance with local codes.

Changing the cord plug will void your warranty!

MODEL NO.	Electrical Power Rating			Circuit Size*		NEMA Config.
	Volts**	Amps	Watts	Copper Wire	Fuse Size	
E-9AX	120	10	1200	14	15	***
E-10A	120	14	1680	12	20	***
TnF-E-10	120	14	1680	12	20	***
E-13A	120	14	1680	12	20	***
TnF-E-13	120	14	1680	12	20	***
E-14A	240	13	3120	12	20	6-20R
TnF-E-14	240	13	3120	12	20	6-20R
Q-11A	120	12	1440	14	15	***
TnF-Q-11	120	12	1440	14	15	***

*These are only recommended copper wire and circuit breaker sizes. Refer to and comply with local electrical codes if they differ from our recommendations.

**Single phase only.

***Standard 120 volt outlet for amperage specified

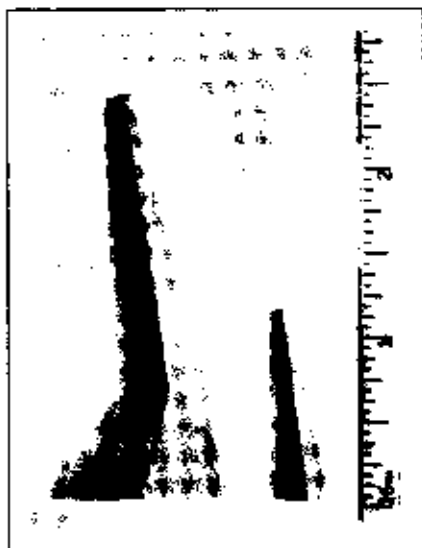
Pyrometric Cones

A pyrometer is more practical for enameling than pyrometric cones. Enameling artists using a pyrometer can skip this section.

Pyrometric cones are small pyramids of clay and mineral oxide that soften and bend when exposed to heat. They indicate when your ware has fired to maturity.

Handle cones carefully; they are fragile. Do not use if cracked. Pyrometric cones come in 1 1/8" and 2 1/2" lengths. The small cone is used in the Kiln Sitter® and the large cone is used on the kiln shelf.

Cones mounted on the shelf must be slanted 8° from vertical. They will not bend accurately if they are slanted to the wrong angle. Large cones come in either standard or self-supporting. Standard large cones must be mounted in a clay or wire plaque with 2" of the cone exposed above the cone holder. Self-supporting cones stand upright without holders. We recommend self-sup-



porting cones; they are easier to use than standard large cones.

Ceramic ware is affected by "heat work," which is the combined effect of time, temperature, and the atmosphere inside the kiln. All these factors affect the maturity of ware—not just temperature. For instance, firing to a lower temperature for a longer time will produce the same firing maturity as firing to a higher temperature for a shorter time. The "Temperature Equivalents" chart shows that a large 05 cone requires a temperature of 1915° F. to bend to 6 o'clock, yet when fired slower, will bend at only 1888° F.

Large and small pyrometric cones are stocked in numbers 022 through 01 and 1 to 10. Cone 022 matures at the lowest temperature; 10 matures at the highest. The number is stamped on the base of the cone. The cone

TEMPERATURE EQUIVALENTS ORTON PYROMETRIC CONES

Cone Number	Large Cones		Small Cones
	Heated at: 108° F. per hour*	270° F. per hour*	540° F. per hour*
022	1069	1086	1165
021	1116	1137	1189
020	1157	1175	1231
019	1234	1261	1333
018	1285	1323	1386
017	1341	1377	1443
016	1407	1458	1517
015	1454	1479	1549
014	1533	1540	1596
013	1596	1566	1615
012	1591	1623	1650
011	1627	1641	1680
010	1629	1641	1686
09	1679	1693	1751
08	1733	1751	1801
07	1783	1803	1846
06	1816	1830	1873
05	1888	1915	1944
04	1922	1940	2008
03	1987	2014	2068
02	2014	2048	2098
01	2043	2079	2152
1	2077	2109	2154
2	2088	2124	2154
3	2106	2134	2185
4	2134	2167	2208
5	2151	2185	2230
6	2194	2232	2291
7	2219	2264	2307
8	2257	2305	2372
9	2300	2336	2403
10	2345	2381	2426

*Rate of temperature increase during last several hundred degrees of firing.

Tables by courtesy of The Edward Orton, Jr. Ceramic Foundation

to use with each material is usually stated on the label by the clay or glaze manufacturer. Your supplier can also give you this information.

Check the accuracy of your Kiln Sitter or TnF controller by placing cones on the shelf. (Be sure to kiln-wash the shelves before placing cones on them.)

Mount behind the peephole the self-supporting cone rated for the firing temperature. This is the firing cone. Next to it place another one rated one cone cooler. This is the guard cone. For example, if you are firing to cone 05, place cones 05 and 06 on the shelf behind the peepholes.



Place cones 3 inches behind the peephole to protect them from exposure to cool air drafts. Place them where you have a clear path of vision to the element on the opposite side. At higher temperatures, a cone is difficult to see if a piece of ware is behind it. *Always* use firing safety glasses when looking into the peephole.

COLOR SCALE FOR TEMPERATURES

Color	Appx. Cone	Degrees F.
Lowest visible red to dark red	022 to 019	885 to 1200
Dark red to cherry red	018 to 016	1200 to 1380
Cherry red to bright cherry red	015 to 014	1380 to 1500
Bright cherry red to orange	013 to 010	1500 to 1650
Orange to yellow	09 to 03	1650 to 2000
Yellow to light yellow	02 to 10	2000 to 2400

Firing Accessories

Firing Safety Glasses

These green glasses are specially coated to filter out the infra-red and ultra-violet light inside a kiln. Also protects your eyes from heat. Reduces glare, makes the pyrometric cone easier to see, especially when firing porcelain.

All Purpose, High Fire Kiln Wash

If you fire glazed ceramics, porcelain, or any material that can stick to the kiln bottom and fuse at high temperatures, you must coat the bottom of your kiln with kiln wash.

High fire kiln wash is a powder mixture of finely ground minerals that will not melt and fuse together at porcelain temperatures. Mix it with water to the consistency of thick cream. Brush a thin, even coat on the tops

of kiln shelves and on the kiln bottom. As a powder, high fire kiln wash has an unlimited shelf life.

You should never use a regular ceramic type kiln wash, because after applying ceramic kiln wash and firing the kiln above cone 04, the kiln wash will harden and be difficult, if not impossible, to remove later when you want to fire to hotter temperatures.

While recoating with kiln wash is not necessary after each firing, scrape glaze drops from the shelves or dig them out of the bottom as soon as they appear. Then apply a new coat of kiln wash to the bare area.

Keep kiln wash away from elements. Contact will burn out elements. Kiln wash should never be applied to kiln walls or to the underside of shelves.

Kiln Coating and Repair Cement

This is a permanent, high temperature refractory cement used to repair holes or cracks in the firebrick.

Pyrometer

A pyrometer measures the temperature inside the kiln from approximately 100° F. to 2400° F. The pyrometer is especially useful for enameling on metal. It consists of a thermocouple, the indicating meter, and lead wires that connect the thermocouple to the meter.



The thermocouple (the measuring unit of a pyrometer) is inserted into the firing chamber. The E series kilns have a 1/2" hole drilled into the back of the metal case for the thermocouple. Drill a 1/8" hole at this location in the firebrick to insert a Paragon sheathed thermocouple. Some brands of thermocouples may need a 1/2" hole. Push the thermocouple into the hole until it protrudes at least 1/2" into the firing chamber.

Firing Your Kiln

Enameling on Metal

Preparation of the Copper

Enamels come in transparent or opaque. They can be purchased directly from Thompson Enamel, P.O. Box 310, Newport, Kentucky 41072. Their Lead Free Enamels come ready to use. No enamel washing is required for these enamels.

Start with one of the many pre-shaped copper forms available, or shape and trim the copper to your own design.

Firing Your Kiln

1. Heat the copper on an enameling rack to about 1400° F. to burn off oil or grease. Heat the copper to just until smoke from oil or grease stops coming off the metal and its color has changed to a purple-red-pale green iridescence that moves across the copper. This indicates that the grease has vaporized. **Do not fire the copper any longer than this point.** Otherwise excess fire scale will form, making the next cleaning step difficult.

2. After the copper cools, brush any loose scale from the copper. Use a brush or paper towel, being sure that you do not put any grease or oil onto the copper, such as fingerprints. Clean the copper with a 3M Scotch-Brite® pad. This pad does such a good job that in most cases no further cleaning will be required. Additional copper cleaning products are available in the Thompson Enamel Catalog, including Sparex No. 2.

It is best to clean the copper just before you decorate it. If you wait too long to decorate after cleaning, the copper could get dirty again.

Decorating the Copper

Counter Enameling Most enameled pieces should be counter enameled on the back side. This gives the piece a much more finished look, it eliminates a great deal of fire-scale cleaning, and it controls the chipping and cracking that can result from the different rates of expansion and contraction in copper and enamel after the enamel has been fired.

Counter or backing enamel, a mixture that gives a mottled effect, can be used for counter enameling. Or you can use regular enamel. Counter enamel is applied by the sifting method described next.

When firing counter enamel, underfire it so that the fire scale on the front of the piece isn't too difficult to remove. You can purchase a masking preparation from your supplier to help prevent fire scale. You must place the piece on a stilt when firing the other (front) side of the piece. The stilt prevents the back of the counter enameled piece from sticking to the enameling rack.

Applying Enamels Apply enamel over a clean sheet of paper so you can pour the excess back into the bottle for reuse. Transparent enamels should be applied in several thin coats. Transparent enamels can be mixed with fairly good results. If opaque enamels are mixed, however, a grainy effect results. The two basic methods of applying enamels are sifting and spatula.

Sifting or Dusting Enamel Spray or brush Thompson holding agent onto the copper. Then sift a 1/32" layer of enamel onto the copper. Use a #60 mesh sifter. If the coat is too thin, you can easily add another coat after firing. But a coat that is too thick will bubble and crack. The enamel must dry completely before firing.

Spatula or Inland Method You can use this method to decorate a small area with many different colors. Using a diluted solution of Thompson holding agent, dampen the enamels just to the saturation point, and maintain this moisture while working with the enamels. Apply the enamels onto the copper with a small spatula, and spread them out with a spreader to a coat of about 1/32" thick. Lines of contact can be formed by the spatula blade. Then spray the enamels with the holding agent to keep the grains of enamel in place. Allow the enamel to dry completely before firing.

Firing Enamel

The pyrometer is a useful accessory for manual control kilns that will allow you to maintain the temperature you want. But with a little experience, you can tell how hot the kiln is firing by the color of the interior.

Heat the kiln to 1450° F. for most enameling. If you're not using a pyrometer, you can approximate this temperature by maintaining a bright, cherry red color inside the kiln. For some techniques a hotter or cooler firing chamber is desired.

Lay the copper shape on an enameling rack. If the part that touches the rack is enameled, place a stilt under the copper. Some bowls or other shapes have enameled sides that might run during firing. These should be fired with a stilt even if the piece has a plain bottom. Use an enameling fork to place the rack into the kiln.

Firing should take about three minutes and requires undivided attention!

Look at your piece every 15 seconds through the peephole. Remove the rack when the copper piece appears a rosy red and the enamel is smooth. Place the rack on a steel pad and let it cool completely. Use a protective glove when touching the peephole cover or opening the door. These gloves are available from Paragon.

After counter enameling, you will need to clean the fire scale off the front of the piece. A 3M Scotch Brite®



Use an enameling fork and firing glove to place the enameling rack into the hot kiln.



The proper placement of an enameling rack with stilt.

pad works well for this. Then clean it with Thompson Sparex No. 2.

Wax Burnout

You can use your kiln to remove wax from jewelry molds. This is simple. Keep uppermost in mind, however, that you must prevent wax or carbon from contacting the kiln's walls or elements. When carbon collects on the sidewalls or on a heating element, the sidewalls and element must be replaced. This is because carbon is a conductor of electricity and will cause the elements to short circuit. Damage to elements from contact with foreign materials is not covered by warranty.

1. First, remember to keep the peephole cover(s) open during the entire wax elimination process. They allow fumes to escape from the kiln. Place a metal tray under your mold inside the kiln. The tray must be able to withstand 300° F. of heat, it should be about 1/2" deep, and it should be 1 1/2" smaller than the firing chamber in both width and length. The tray will catch melting wax as it drips from your mold. (You must remove the tray before the kiln gets hotter than 300° F.)

2. Heat the kiln to 300° F. and hold it at that temperature for at least one hour.

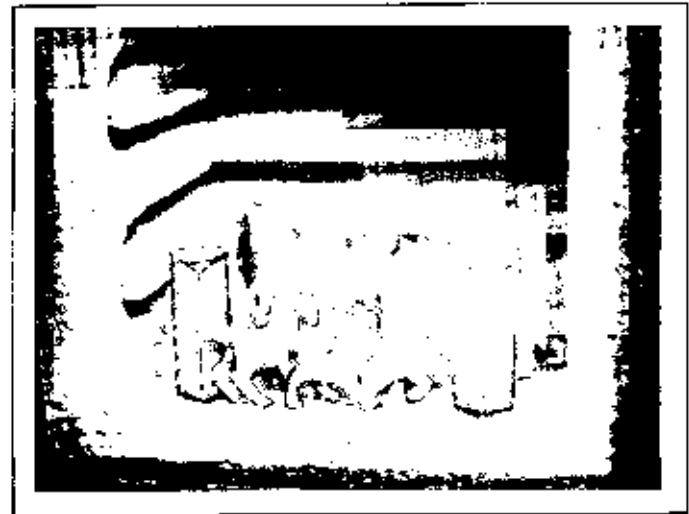
With the wax tray in the kiln, you must not fire the kiln hotter than 300° F. and you must keep it at 300° F. for at least one hour. During this hour, the wax will melt from your mold and drip into the tray. If the kiln gets hotter than 300° F., the wax will smoke and deposit carbon inside your kiln, causing expensive damage.

You will need a pyrometer or digital controller to maintain 300° F. in your kiln during the lost wax process. If you use a pyrometer, insert the thermocouple in the hole in the back of the kiln or the peephole in the door. The metal tip of the thermocouple must protrude into the firing chamber at least 1/2".

3. After the kiln has fired for one hour, open the kiln and remove the mold and metal tray. Pour the wax from the tray and leave the tray out of the kiln until your next wax elimination. (Do not leave the tray in the kiln.)

4. Heat the mold to the temperature recommended by your jeweler's supply house where you purchased the mold material. This is usually around 1350° F.

If you follow these directions, you need never worry about ruining your elements from smoking wax. If for some reason wax does smoke inside your kiln, you might be able to save the elements anyway. First, open the peephole cover(s). With the kiln empty, turn the kiln on low heat and gradually raise the temperature to 1500° F. over a period of five hours or longer. Then maintain the 1500° F. temperature for one hour.



Firing chamber partially loaded with greenware for bisque firing.



Placing pyrometric cone in position in kiln loaded for bisque firing.

Loading and Firing Low Fire Greenware

Low-fire greenware has a firing range from cone 06 to 02. The greenware must be bone dry before firing. Otherwise, it will crack or even explode during firing. Check for dryness by touching to cheek or against inside of wrist. Ware will be cold if not dry.

Low-fire greenware may be stacked so that it touches each other. It can be loaded without stilts. Load small, short pieces directly on the firebrick bottom. If you load large, flat pieces on the firebrick bottom, place short posts under them for air circulation.

Ware should be fired in the position in which it will be used when finished, except for large pieces with flat, vertical surfaces such as wall plaques and clocks. These should be fired flat to prevent warping. Pieces to be used together should be fired in place, such as a box with its lid, to ensure a good fit.

Low-fire greenware firing is simple. Just be certain the greenware is fired to the pyrometric cone recommended by the clay supplier. If the greenware is not fired hot enough, the piece will absorb moisture after it has been glaze-fired and cause the glazed surface to crack. This is called "crazing," and is most often due to underfired greenware. To help eliminate crazing, fire greenware at least one cone hotter than glaze, and even hotter if glaze can still be applied easily to the hard bisque. While glaze may be applied to greenware and fired once, separate firings produce better quality, so we do not recommend single firing of greenware and glaze.

Leave the peephole cover(s) open during the first hour of firing. For additional venting, you can leave them open during the entire firing. Allow kiln to cool to room temperature before opening door.

Loading and Firing Low Fire Glaze

The difference between loading greenware and glazed ware is that glazed pieces must not touch each other, the floor, or a shelf in your kiln during firing. If this happens they will be permanently bonded together and ruined by the melted glaze.

The natural expansion and contraction of the insulating firebrick during each firing generates tremendous stresses within the firing chamber. As a result, fine grains of firebrick may form in the firing chamber and should be removed before each firing. Wipe the firing chamber surfaces with a clean, damp cloth or vacuum with the soft brush nozzle attachment of a vacuum cleaner.

Use stilts to support low-fire glazed ware during firing. The shelf tops and kiln floor **MUST** be kiln washed with all purpose, high fire kiln wash for protection from glaze drops. Never use a ceramic kiln wash in a kiln suitable for firing porcelain.

Glazed pieces must be thoroughly dry before firing and should not be fired with greenware unless both mature at the same cone. Check to make sure that first, no two pieces of glazed ware are touching each other, the kiln walls, the floor or the shelf; and second, that the underside of the kiln shelf is clean before you place it

Firing Your Kiln

over glazed pieces. Any dust falling on your ware will cause pinholes.

You can prevent glazed pieces from sticking to the shelf or kiln bottom by "dry footing." To "dry foot" a piece, remove all glaze from the portion of the piece that will rest on the shelf. Using a wet sponge or a piece of grit cloth, clean off the glaze from the bottom of the ware and slightly above the base so that it will not run down and touch the base. Dry footing should not be used for low-fire glazed pieces that will be placed in water while used or cleaned.

Leave the peephole cover(s) open during the first hour of firing. For additional venting, you can leave them open during the entire firing. Wait until the kiln has cooled to room temperature before opening the kiln door.

Remove the stilts from the ware after firing by breaking the thin film of glaze holding them. Handle with caution; the glaze is sharp where the points touch. Remove the sharp stilt edges by rubbing with a stilt stone, electric grinder or hand grinder.



Glazed pieces stick to the kiln floor or shelf unless stilted or dry-footed.



Dry-footing glazed ware.



Removing sharp stilt points.

Loading and Firing Overglaze

Overglaze is decoration applied over fired glaze or polished porcelain bisque. Overglazes include china paints, gold, and luster, which fire from 022 to 014. You *must* coat the kiln bottom and any shelves with high fire kiln wash.

Load overglazed ware the same way you would load ceramic glaze. Use stilts and make sure ware is not touching other ware. Ware must be completely dry before firing.

China paints will crack or peel if applied heavily. Apply several light coats instead, firing between each, until you get the shade you want. Not all china paint colors reach maximum color saturation at the same temperature even when fired on the same ware. So you must know which colors you should fire first at higher temperatures to prevent burning out the original colors

in later firings. For example, reds mature at a lower temperature than other colors and are fired after the other colors have been fired. Reds and yellows should not be fired side by side. Colors also mature at a lower temperature on ceramic pieces than on porcelain or hard china. Check the overglaze manufacturer's literature for information on which cone to use with each color and type of ware.

Leave peephole cover(s) open during the entire firing. Allow kiln to cool to room temperature before opening door.

How to Cut and Fuse Glass

Basic Glass Tools

Reservoir Glass Cutter Buy a good reservoir glass cutter. A good glass cutter will last many years and is a pleasure to use. Buy your glass cutter from a stained glass supplier. The kind sold in hardware stores sometimes won't cut stained glass.

Running Pliers are used to cut thin strips of glass.

Breaking Pliers for cutting small strips.

Grozing Pliers shape the glass by chipping away the edges. The rough edges will become smooth when the glass is fired to fusing temperature.

Basic Glass Cutting

Wear safety glasses when cutting or chipping glass.

1. Lay the glass on a clean surface. Mark off the cut with a grease pencil. A small mark on each end of the glass will do. Lay a wooden straight edge over the glass and line it up with the marks you just made.

2. Hold the straight edge firmly and score the glass with the glass cutter. Press hard enough so that the scoring noise sounds steady and unbroken. But don't press harder than you need to.

3. Place the straight edge under the glass so that an edge of the wood is lined up with the score line you just made. Press down on the glass with your hands. The glass will break cleanly.

How to Cut Small Glass Squares Make all your score lines first. Then turn the glass over and tap out the squares. This is an easy, fast way to cut many small pieces.

Compatibility of Glass

Glass expands and contracts during firing and cooling. When pieces of glass are fused together, they must



expand and contract at the same rate, or the fused piece will crack. When fusing two pieces of glass, cut them from the same sheet of glass. This will guarantee compatibility. Or you can buy stained glass that has been tested and labeled as compatible.

Annealing Glass

The most common mistake in firing glass is in fast cooling rather than fast firing. The critical cooling period is called the annealing range.

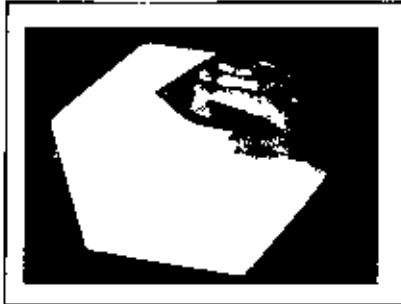
Annealing glass on cooling removes the internal stresses. Glass that is cooled too quickly contains internal stresses that can break the piece sometimes even six months after firing.

Basic Glass Fusing

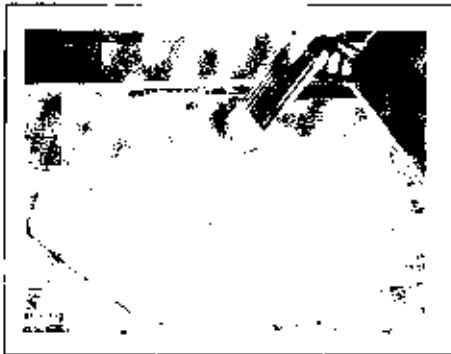
Coating the Shelf

1. Glass is fired on a kiln shelf and not directly on the bottom of the kiln. The kiln shelf must be coated with glass separator or kiln wash to keep the glass from sticking to the shelf.

Glass separator is finely ground minerals that don't melt at high temperatures. Glass separator is sold as a powder and mixed with water. Before coating the shelf, remove most of the old separator with sandpaper or grit cloth. This gives you a smooth surface. Recoat the shelf before each firing.



2. After you've mixed the separator with water, brush it onto the kiln shelf with a fine-haired paint brush or hair brush. Use two or three thin coats changing the direction of the brush stroke each time.



3. Dry the shelf overnight before firing. You can speed drying by placing the shelf in the kiln and turning the kiln on for a few minutes with the peephole(s) open. Then unplug the kiln and leave the shelf in the warm kiln.

4. The separator will never be perfectly smooth, but one way to make it smoother is to lightly rub the palm of your hand over the dried separator. The smoother you make the separator, the smoother will be the underside of your glass.

Preparing the Glass for Firing

1. After you've cut the glass pieces to the patterns, clean the glass. You can use window cleaner, rubbing alcohol, or plain water. Fingerprints will etch into the glass during firing, so handle the glass carefully after you've cleaned it.

2. Lay the glass on the shelf. Use white glue to hold the glass pieces together after you place them on the shelf.

All you need is a drop or two. Glue is especially important if you're fusing copper wire into the glass. The glue prevents the glass or wire from moving out of place before they fuse. The glue disappears during firing.

Firing Glass

1. You do not need to use cones to fire glass, though cones can be helpful. When the kiln interior becomes red, start watching the glass every few minutes by opening the door just a crack.

As the glass heats, the layers will begin to sag and fuse together. The edges will become rounded, and the surface will appear liquid. When the glass is fused the way you like it, turn off the kiln. Allow the kiln to cool slowly to room temperature before opening the kiln.



Loading and Firing Porcelain Greenware

E and TnF-E series owners, skip this section. These kilns are not designed for high temperature porcelain firing. Please do not attempt to fire your kiln above its rated temperature.

Loading porcelain greenware is similar to loading glazed ware, since both will stick to anything during firing. Greenware must be completely dry before firing, including the joints on pieces that are attached. If a piece is broken before firing, mend the break but do not attempt to fire it until the mend is also bone dry. Damp greenware or damp mended areas will form bumps on the surface of the fired ware.

Stilts **CANNOT** be used to support porcelain greenware. They would embed into the porcelain at high temperatures. To protect porcelain from sticking to the shelves or kiln floor, apply a coat of all purpose, high fire kiln wash to the shelf tops and brick bottom. Then place your ware directly on the kiln washed surfaces.

Never use ceramic kiln wash in a kiln that will ever be fired to porcelain temperatures, as the ceramic kiln wash will harden at high temperatures and be impossible to remove.

Pieces of ware that are to be used together must be fired together, such as a box and its lid. Dry all purpose, high fire kiln wash can be used to separate these pieces during firing. Wet kiln wash would be too difficult to remove.

Pieces likely to warp in firing should be supported by rolls of porcelain clay shaped to fit the objects at points of strain. Apply dry silica or high fire kiln wash to the points of contact to prevent sticking. Before firing, the support rolls must also be bone dry.

Ceramic and Glass Trouble-Shooter

Since a kiln is slightly hotter near its sidewalls, the side of the ware next to the walls will tend to shrink more than the opposite side. This can be used to your advantage with porcelain figurines that tend to warp during firing. Turn the inclined side of the figure away from the elements so the heat can help hold the piece straight.



High fire kiln wash will keep porcelain greenware that must be fired together from sticking. Kiln wash must be dry.

Make sure cones on the shelf are clearly visible. At porcelain temperatures, they are difficult to see. Leave the peephole cover in the door open during the first hour of firing. For additional venting, you can leave it open during the entire firing. Wait until kiln cools to room temperature before opening the kiln door.

Loading and Firing Porcelain Glaze

E and TnF-E series owners, skip this section. Your kiln is not designed for firing to the high temperatures of porcelain. Please do not attempt to fire your kiln higher than its rated temperature.

Porcelain pieces that have been fired together in the greenware firing *cannot* be fired together in the glaze firing. Both pieces *must* be "dry footed". Since shrinkage has already occurred in the greenware firing, the pieces will still fit even when fired separately in the porcelain glaze firing. Stilts *must not* be used to support porcelain. Porcelain softens during firing, and stilts would embed into porcelain. Make sure your shelves and kiln bottom have a good coat of kiln wash before firing porcelain.

If a piece of ware had to be supported in the porcelain bisque fire, it will stand alone in the glaze fire. The lower temperature will prevent sagging.

Close the peephole cover after the first hour of firing. You may leave the cover open during the entire firing for additional venting. Allow kiln to cool to room temperature before opening door. Cooling time is usually twice the firing time.

Loading and Firing Stoneware Greenware or Glaze

E and TnF-E series owners skip this section. These kilns are not designed for high temperature firing. Please do not attempt to fire your kiln beyond its rated temperature.

Stoneware is made from vitrifiable clays with a firing range of cone 2 to cone 10. It has a wide range of colors and textures and is popular with the potter because of its excellent throwing qualities. Usually the greenware is fired below maturity, and on the second firing, the clay and glaze mature together to form an integrated body-glaze surface.

Like porcelain greenware, stoneware is placed directly upon the kiln-washed shelves in the greenware firing.

Glazed stoneware must not touch any other ware and must be dry footed before you place it on a kiln-washed

shelf or kiln bottom. Never stilt stoneware during either firing.

Ceramic and Glass Trouble-Shooter

Ceramic Ware

Bisque

Warped ware can be caused by distorting upon removal of the piece from the mold, firing too close to the elements, or firing a piece in an unnatural position. To prevent porcelain cups or bowls from warping when firing the greenware, edge the top of a cup with pinches of dry silica or *DRY* all purpose, high fire kiln wash and place a second cup on top of the first cup, lip to lip, with handles going in opposite directions. Porcelain greenware plates may require firing in plate saggars to prevent warping during firing.

Sagging ware is usually the result of overfiring. Porcelain objects can sag if not properly supported during firing.

Glaze

Crazing is usually caused by underfired bisque. Bisque should be fired to the highest temperature at which it will still take glaze. Crazed ware may be refired to the proper cone. **CAUTION: China paints and other overglazes will burn off when fired to 06.**

Glaze too thin in spots can be caused by uneven glazing or a "hard spot" on the bisque. Ceramic glaze should be applied in flowing coats; first in one direction and the next coat in an opposite direction (horizontal, then vertical or vice-versa). Allow to dry between each coat. Some glazes may require twice the recommended coats, because of thin application. Porcelain glaze should be sprayed or a brush-on type used. "Hard spots" are sometimes the first spot where the poured slip touches the mold. Heating bisque in an oven to approximately 120° F. will help in applying glaze to hard bisque.

Crazing immediately on removing from the kiln can be caused by not firing the ware hot enough. Refire to the proper cone. Crazing in spots can be caused by not having mixed the glaze thoroughly before using.

Black specks in the ware are usually caused by organic materials not completely burned out in the bisque firing. This works its way to the surface during the glaze firing.

Pinholes and bubbles in glaze or glazed ware can be caused by too heavy a glaze application, by severe underfiring or by dust on the bisque. Damp bisque can reduce the number of air pockets and pinholes that may form when glaze dries too quickly. Clean bisque with tap water or use base coat of glaze thinned 3 parts glaze to 1 part water immediately before applying glaze in the usual manner to the bisque.

Poor color in colored glazes can be caused by too thin an application, placing ware too close to an element or to other glazed ware which may be incompatible,

insufficient venting during the early stages of firing or overfiring glazes in the red family.

Light edges on dark glass glaze pieces may be caused by the flow of the glaze away from the edges in two directions. Try an extra coat of glaze on the edges, or apply a thin coat of underglaze in the following manner: Mix 1 part water with 2 parts of suitable dark or black underglaze and brush a thin wash coat of the underglaze over the bisque ware. Then, immediately apply the first regular coat of full strength glaze. Allow to dry thoroughly between coats. Continue with number of coats recommended by the manufacturer.

Sagging glaze is usually caused by applying too much glaze on a vertical surface causing the glaze to actually sag when fired.

Crawling or bare spots on a fired piece can be caused by applying the glaze too heavily. Oil from your skin that gets on the greenware before it is fired can also cause this. Another cause may be hard spots from too much polishing of your greenware when sponging. A few drops of vinegar in your sponging water will help alleviate this problem. Crawling may be corrected by applying more glaze to these spots and refiring.

Underglaze

Streaks in underglaze are usually caused by not applying enough coats to the greenware. After a piece has been decorated with underglaze and fired, you may check it for streaks by submerging it in water and immediately removing it. The piece will appear glossy, just as if it has been glazed, and streaks and thin spots will show up. The weak spots can be touched up and refired. Be sure the underglaze has been fired before putting it under water. For interesting designs, underglaze colors may be applied over unfired matte or texture glazes that do not flow.

Overglaze

Breaking in overglaze firing can be caused by poorly fired bisque. A slow bisque fire is always better for ware that is to be china painted. The greenware should be completely dry *before* being placed in the kiln. Standing plates on edge or using a plate holder gives good heat circulation and will help in preventing plate breakage.

Purple spots in gold are usually due to a thin application of gold or too much thinner. If gold is applied accidentally to an area it will show purple after being fired unless cleaned with a good gold remover.

Broken lines in gold can be caused by overfiring or too heavy an application. However, this can be very attractive when gold is crackled over a dark color of fired glaze.

Peeling china paint can be caused by the paint being applied too heavily.

Loss of color in china painting is usually a result of overfiring or thinning your paint with too much medium when applying.

Faded colors in overglaze decals are a result of either underfiring or overfiring. If pinks and reds are drab, refire to a hotter cone. When used with a china paint background, apply and fire the decals first, then china paint and fire again. Check the recommendations of decal supplier. If decal was underfired, refire to proper firing cone. If decal was overfired, the design may be repainted in china paints and refired.

Weakening of luster colors can be caused by overfiring.

White spots in lusters or metals can be caused by moisture on the ware before it was placed in the kiln or from having been fired at the same time as other overglazes. *Apply lusters only on a dry day.*

Powdering of luster colors can be caused by too heavy an application.

Porcelain

Bumps in porcelain are usually caused by wet greenware and overfired porcelain bisque.

Lack of translucency in porcelain can be caused by the ware being poured too thick and underfired.

Cracks in porcelain bisque are often the result of a strain on the greenware while drying. *Do not force-dry greenware.* Cracks may be mended with one of the new "magic menders" available from your supplier.

Holes in lace or fabric that appear after firing can be caused by inadequate application of the slip. Wash the fabric thoroughly before dipping it into the slip. Apply enough slip to the fabric so the clay will be strong enough to hold its own weight. The fabric must burn out before the clay matures, leaving only the clay shell, which must be strong enough to support its own weight.

Glass

Cracking is usually caused by cooling the glass too fast. In the 900° F. - 500° F. range, glass goes through the "annealing" process where stresses are relieved. The glass is especially sensitive to cracking in this range. Glass can crack below 500° F. if it cools too quickly. The smaller and thinner the piece, the hotter it can be when you remove it from the kiln.

Cracking can also be caused by fusing incompatible glass. Purchase stained glass that has been tested for fusing compatibility.

Glass bubbles These are usually caused by air, grease or dirt trapped between layers of glass, or by fusing uneven layers of glass.

When you place small glass pieces on top of a larger base piece, air pockets will sometimes rise up from under the base piece. This causes a bulge in the glass. These types of bubbles appear in single layers of glass. To avoid them, redesign the piece.

When you laminate glass between two sheets of glass, trapped air may form bubbles. To avoid these bubbles, cut the top piece of glass into several butted strips. This allows the air to escape.

Frosty glass surface Dust, fingerprints, or oil on the glass surface can cause frosty, permanent images. If the glass passes through the "devitrification range" too slowly, it will tend to develop a frosty surface. To cool the glass rapidly during the devitrification range, unplug the kiln when the firing is completed. Open the door an inch or so until the temperature drops to 900° F. Then close the door again. If you are not using a pyrometer, close the door when the glass starts to lose its red appearance.

Maintenance

Locating Electrical Trouble

If your kiln stops heating while firing, check fuses or circuit breakers first. Wire heats when an electric current passes through it. If the same current passes through both a small wire and a large wire, the smaller wire will reach a higher temperature. A fuse uses this principle to protect the wiring in a building. It has a small, short wire of low melting temperature metal connected in such a manner that all current passing through the circuit must also pass through the fuse. The fuse wire size is selected so that the maximum safe current the wiring can handle will generate enough heat to melt the wire (i.e. blow the fuse). A circuit breaker uses a tiny heating element to heat a thermostat, which interrupts the current when the maximum safe amount is reached.

A blown fuse or tripped circuit breaker is not necessarily an indication of electrical trouble with your kiln or wiring. A short circuit or "short" causes a large amount of current to flow, generating so much heat that the fuse or breaker opens the circuit almost instantly. If your kiln should blow a fuse after firing for some time, there is little probability of a short. Replace the fuse or reset the breaker, and if it does not blow again as soon as the kiln is turned back on, there is no short in your kiln wiring.

A loose or poor connection at the fuse or breaker will generate heat. If the fuse or circuit breaker panel feels unusually warm, have your electrician check for loose connections, particularly at the center screw of the fuse socket, even in a new fuse box.

Electrical Troubleshooting

SLOW FIRING

Probable Cause:

- Low Voltage

Remedy: Speed up firing. If kiln still fires too slowly, have the power company check your voltage and readjust transformer if necessary.

NOT ALL ELEMENTS FIRE

Probable Cause:

- Broken Element
- Disconnected Wire Inside Switch Box

Check above parts. Always **UNPLUG** kiln before opening switch box or touching elements.

FUSE BLOWS BUT NOT IMMEDIATELY

Probable Cause:

- Overloaded Circuit

Check to see if other appliances are being used on the kiln's circuit. Have your electrician check the connections in the circuit.

NO HEAT IN KILN

Probable Cause:

- Tripped Circuit Breaker or Blown Fuse
- Cord Not Plugged In
- Kiln Sitter Plunger Not Locked Into Position (for kilns with kiln sitter)
- Limit Timer Clock Not Set (for kilns with limit timer)
- Kiln Sitter Contacts Dirty (for kilns with kiln sitter)

All Models: Check circuit breakers or fuses, make sure kiln is plugged in. Always **UNPLUG** kiln before removing switch box. **Kilns with kiln sitter:** Set timer clock *before* pushing in kiln sitter plunger. **TnF-Series:** See "TnF-Series Diagnostics" in TnF manual.

HOT PLUG OR OUTLET

Probable Cause:

- Defective Plug
- Defective Outlet

Remedy: Replace if too hot to hold. Do not fire until repaired.

Element Maintenance

How to Get the Longest Life Out of Your Elements

The elements in your Paragon kiln will last for many years of normal use. With time, however, the elements will gradually draw less and less power, finally reaching a point where they will not develop enough heat to bend the cone. Elements should be replaced when firing time becomes excessive.

High temperature elements are damaged by contact with silica or silica bearing compounds, such as glaze and kiln wash. If silica touches an element, the element will burn out during the next firing. This type of damage is not covered by warranty.

Also, reduction firing, which removes the oxygen from your kiln, will ruin your elements. The elements are protected by a coating of oxidation, which reduction firing destroys. Reduction is performed at your own risk; elements damaged by reduction are not covered by warranty.

Reseating a Bulging Element

If you seat the elements properly before firing the kiln for the first time, you will probably have no trouble in the future with an element bulging out of the groove.

However, should an element bulge out of a groove, it must be reseated immediately as follows:

1. Once an element has been fired, it becomes brittle and will break if it is bent while cold. Follow this procedure to heat element. **Always unplug kiln before touching element with anything!**

Manual Control Kilns Turn the switch to HIGH. Heat the element until it glows dull red. Turn off the switch and **UNPLUG** kiln.

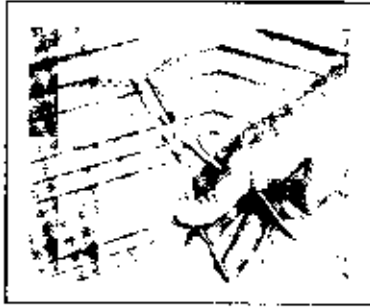
TnF-series Program the kiln to heat rapidly. When the elements glow dull red, turn off the controller and **UNPLUG** the kiln.

2. With a pair of long-nose pliers, shrink the bulging portion of the element by pressing the individual turns in the coils together slightly. Take a little from each turn so that no two turns will be pressed tightly enough to touch.

3. As the element shrinks, work it back toward the groove and into place. Work rapidly, and at the first sign of stiffness in the coils, stop bending and reheat the kiln. The elements do not have to be red to be bent safely, as the stiffening can be felt through the pliers.

4. To lengthen the element to fit into the corners, reverse the above procedure and expand the distance between coils by using snap-ring pliers. Use caution, as your warranty covers only elements that fail in service under normal use and not from being broken while cold.

5. When you have the coils positioned above the dropped recess in the grooves, reheat the kiln, turn off the switch, **UNPLUG** the kiln, and run a blunt kitchen knife around the elements to seat them into grooves and to make sure they fit all the way back into each corner.



How to Replace an Element

No mechanical skill is necessary to install Paragon replacement elements. However, your local Paragon dealer will install the element for you at a reasonable charge. If you do not have a local dealer, see your appliance shop repairman. He is more experienced in servicing heating devices than an electrician.

The replacement element for your kiln is made to fit. However, a little stretching or compressing may be necessary for a perfect fit. It is safe to bend and stretch new elements before they have been fired, but once fired and allowed to cool, elements become brittle and will break if bent.

1. **UNPLUG** the kiln and allow to cool to room temperature.
2. Remove screws on each side of switch box and let box hang by element lead wires.
3. Remove the screws in the element connectors that hold the element lead wires to the element you are replacing.
4. On the same connectors, loosen the screws that hold the element and throw old connectors away. Always use the new connectors furnished with the new element.
5. Remove and save the porcelain insulators that were under element connectors.
6. Remove the old element carefully to prevent breaking the lip of the element grooves.



If the old element burned out due to contact with foreign materials, there will probably be a melted, glazed spot in the element groove. Glazed spots left in the grooves may ruin the new element, so dig out any of these spots. The small hole left in the groove will not affect the new element. Small pieces of firebrick in the grooves should be removed with a small household paint brush or vacuum cleaner.

7. Protect the new element from accidentally coming in contact with kiln wash by placing newspaper on the kiln bottom.
8. Reach inside the kiln and push one end of the element into one of the element holes. The element end will appear at the other side of the hole outside the case. Begin threading the element into the groove.
9. The element must fit all the way into the back of each corner. Making a bend in the element at the corner will help hold the element in place during firing. Start by pushing the element into the first corner with a screwdriver. Make sure the element is pushed as far as it will go into the corner. Hold the element against the back of the corner with the screwdriver. Then gently pull the free end of the element towards you. The element will bend where the screwdriver presses against it.



Maintenance

Remember, if you do not push the element fully to the back side of each corner, the element will not stay in the grooves when fired!

If the element is slightly too long when you reach the second firebrick hole, insert element end into the firebrick hole and let the curved groove take up the extra length. You can compress the element with long-nose pliers if necessary. If the element is several inches too long, it was not pushed all the way to the back of each corner and should be rethreaded.

If the element is too short to reach the second firebrick hole, unthread some of the element. Gently stretch it in your hands. Avoid stretching only a short portion of the element. It is better to distribute the stretch over a longer section.

10. Press element down into the lower part of the groove with a plastic comb or wooden tongue depressor.

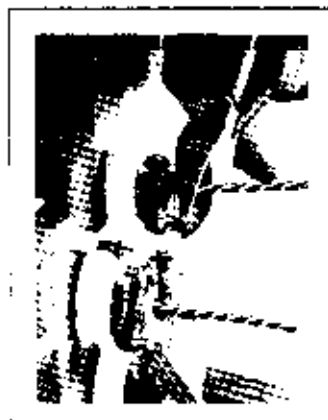
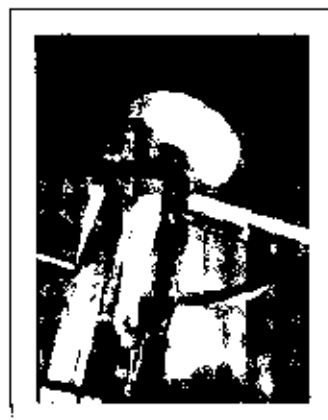
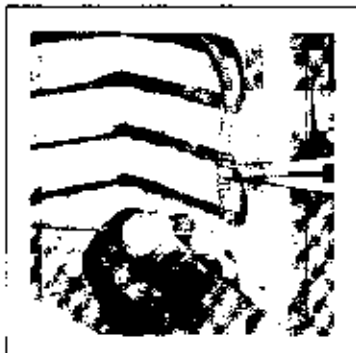
11. Reinstall the porcelain insulators. Push them flush against the heat shield. They protect element from contact with the case, so they *must not* work their way out after the element connector is tightened into place.

12. Sandpaper the eyelet of the element lead wires until bright and clean of all oxidation. (Install new lead wires if insulation on old ones is brittle.) Use the brass screw to connect lead wire eyelets to the new element connectors. Before tightening screw, adjust eyelet to where it will be tilted away from heat shield when connector is attached to element. Then hold connector with pliers and tighten brass screw securely with screwdriver.

13. Pull end of element tight and install new element connectors even against porcelain insulators to prevent insulators from slipping away from brick wall.

Use stainless screw in the element connector to hold the element. (The brass screw holds the lead wire eyelet.) Hold connector with locking pliers as you tighten the screw. Tighten the screw until it squeaks, and then tighten some more.

14. Cut off twisted end of element even with side of element connectors. Leaving the excess element sticking out past element connector could ruin your new



element! (The element could short against something in the switch box.)

15. As the switch box is moved back into place, check to see that no wire touches an element connector. Wires and wire nuts must also not touch kiln's case inside the switch box. **Wires and wire nuts will burn if they touch the case or element connectors.** Replace screws in switch box and tighten into place.

Firebrick Maintenance

Glaze Spot Repair

If glaze drips onto the kiln walls during firing, repair it at once. Otherwise the glaze will remelt each time the kiln is fired. If it spreads into an element groove, it could cause an element to burn out. Carefully dig all the glaze out of the brick with a screwdriver or knife. The small hole that remains will not harm your kiln and can be left unrepaired.

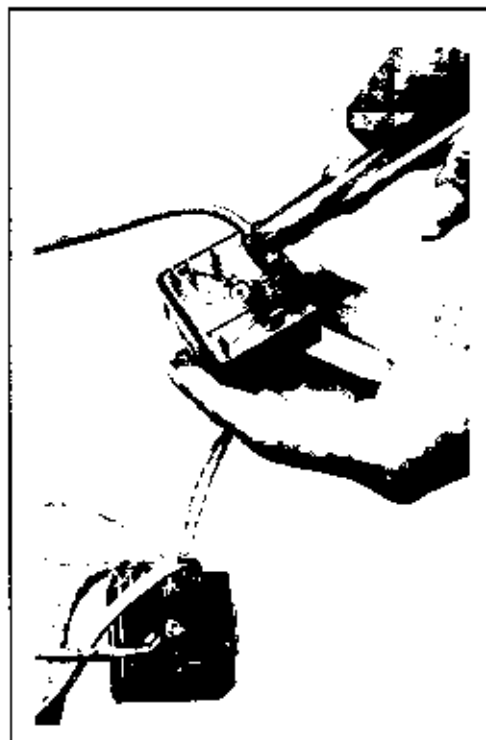
Small Piece Repair

If your kiln wall becomes chipped, leave the chipped area alone. Your kiln will continue to fire normally.

Manual Control Switch Replacement

To replace TnF electrical components, see the controller instruction booklet. If you do not have the booklet, call Paragon for another.

1. Pull off switch knob with fingertips. Some switch knobs are held in place by a set screw on the side of the knob. If knob won't come off when you pull it, check to see if a set screw is securing it to the shaft.
2. UNPLUG the kiln. Remove and save the screws at the side of the switch box that hold it to the kiln and let the switch box hang by the element lead wires.
3. Hold the new switch at the side of the switch box in the same position as the defective switch. Remove and



transfer one wire at a time from the old switch to the new one making sure each connection is tight.

4. If push-on terminals do not have a snug fit, gently squeeze the end of the terminal with pliers.



5. Remove the single nut from the front of the defective switch. Remove switch and put new one in place making sure it is right side up. Reinstall shaft nut checking to make sure it is not backwards. Tighten so switch will not turn during operation.

6. As the switch box is moved back into place, check to see that no wires are touching kiln case or the element connectors. *Wires touching case or element connectors will burn.* Tighten switch box screws. Reinstall knob.

