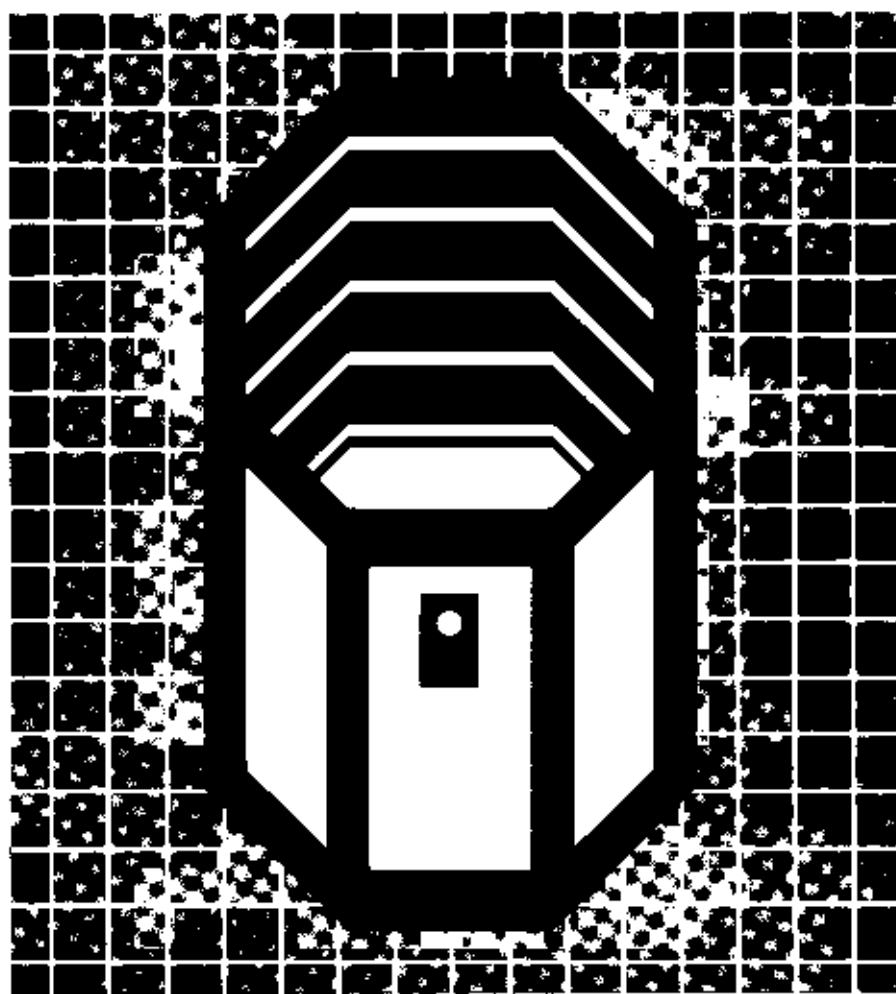




Energy-Saver Kiln Owner's Manual



For Manual and Automatic* Kilns

*U.S. Patent No. 4,705,930



LETTER FROM THE PRESIDENT

Thank you for selecting a Duncan Energy-Saver Kiln for your ceramics needs.

At Duncan, a great deal of pride and a total commitment to producing only the very best go into every item we make.

Every effort has been taken to ensure that you will have years of trouble-free enjoyment from what I honestly believe is the finest kiln available.

To ensure your fullest enjoyment of your Energy-Saver Kiln, please take a few minutes to read this short manual. It tells you all you need to know about the proper operation of your kiln.

Whether you're using your kiln for personal use or firing the creative work of others, knowing the proper way to use your kiln will give your ceramic pieces the look of quality.

*Have fun, enjoy your kiln,
and welcome to the Duncan Family!*

Larry R. Duncan
President



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Directions for Unpacking

- Open packing.
- Check kiln for damage.

In case of damage, save all packing material and report the damage to the carrier within seven (7) days.

Shipping damage is not covered by manufacturer's guarantee.



Electrical Needs

Your kiln will operate properly only if it is plugged into an outlet that has the correct electrical capacity and voltage to handle it. Because an incorrect connection can be hazardous, a qualified electrician should always be consulted to determine whether the kiln can be wired into the existing electrical supply.

Check your kiln's rating plate to be certain its voltage requirement is the same as your electrical supply and do not have the kiln installed unless the proper voltage is available. If you have any doubts as to the service in your home or studio, ask your local electric company to have someone check the circuit for you.

Whether you use an existing circuit or have a new one installed, you should have a qualified electrician's help.

If provided, the plug and cord attached to the kiln must not be changed or altered in any way; such a move will void the warranty, as will improper electrical installation.



Setting Up Your Kiln for Safe Operation

1. Position the kiln close to, but slightly to the left of the appropriate electrical source. The kiln should be in a covered, well-ventilated area with adequate lighting. (Kilns should be fitted with an overhead canopy-type exhaust hood, or be kept near a window with an exhaust fan, because of the gases which can be released as a by-product of the firing process.) The floor beneath the kiln should be concrete; any other surface will need protective, heat-resistant covering.

2. The kiln should be level; otherwise glazed pieces could topple from their stilts and there is a good chance the kiln-sitter will malfunction. In leveling a stand, place a shim under the appropriate leg or legs.

3. Center the kiln on the stand provided, allowing at least 10 inches of space between the kiln and adjacent walls or objects. Keep kiln away from all flammable materials such as curtains, shelves and paper.

4. Route the electrical cord so that it will not touch the kiln case.

5. Remove the hearth plate, then vacuum the inside of the kiln, being sure to remove any brick dust in the element grooves.

6. Remove kiln-sitter firing gauge.

7. While the hearth plate is still removed, apply a coat of kiln wash to the top of the hearth plate and the tops of the other kiln shelves. (Never apply kiln wash to the kiln walls, sides or undersides of shelves, or underside of lid, and be careful not to splash kiln wash on the elements.)

Also apply a thin coat of kiln wash to the top of the kiln-sitter's cone supports and the bottom of the sensing rod. (Do not apply kiln wash to the bar or cone, or to the end of the porcelain tube of the kiln-sitter. Beware of a thick wash application on the kiln-sitter parts, for this could cause the kiln-sitter to overfire.) Let kiln wash dry thoroughly before loading the kiln.

8. Set all switches to **OFF** and connect to power source.



Cautions

Your kiln was designed with safety in mind. However, good common sense is required in the operation of a kiln. Please observe these cautions; they are for your protection.

- Kiln surface may be hot. Do not touch. Do not place anything on top of the lid. Keep children away unless supervised.
- Disconnect electrical supply before attempting any servicing.
- Operate kiln only on stand provided.
- Do not fire hotter than the cone or temperature listed on the rating plate.
- Do not open lid until kiln has cooled.
- Operate kiln in a well-ventilated, covered area.
- Never plug a kiln into an outlet unless you are certain it has the correct electrical service to handle the kiln.
- Always place hearth plate directly on the floor of the kiln. Never use kiln posts under this plate.
- Never attach an extension cord to your kiln.

Cautions, continued

- When operating kiln, do not allow the cord to touch the kiln case.
- Never allow shredded paper or other flammable materials to accumulate in the same room with your kiln.
- Remove firing gauge and adjust kiln-sitter prior to your first firing.
- Extremely hot gases are vented through the lid vent hole. Do not place flammable materials above kiln. If a lid vent plug is used, use caution and protective gloves when inserting plug.
- When kiln is not in operation, keep switches in OFF position.



Kiln-sitter

The kiln-sitter is a mechanical control which is turned on by hand and turned off by the action of the bar or small cone bending under the kiln-sitter rod. When the kiln-sitter turns off, the kiln will no longer heat.

WARNING: There is no warranty, express or implied, that covers damage due to overfiring. A properly set and maintained kiln-sitter will certainly make the chance of an overfiring remote, nevertheless, the owner is wholly responsible for the proper adjustment and operation.

Kiln-sitter Adjustment

When shipped from the factory your kiln-sitter (see Fig. 1) was in adjustment but there is a possibility that it might have been jarred during shipment or delivery. Therefore, the following steps must be taken and all necessary adjustments made before the first firing.

1. Turn off all switches.
2. Install firing gauge.

The firing gauge (see Fig. 2) was held in place by a rubber band when your kiln left our factory. If the gauge has been removed, it should be positioned over the sensing rod and cone supports. (The word **TOP** should be up.)

FIG. 1

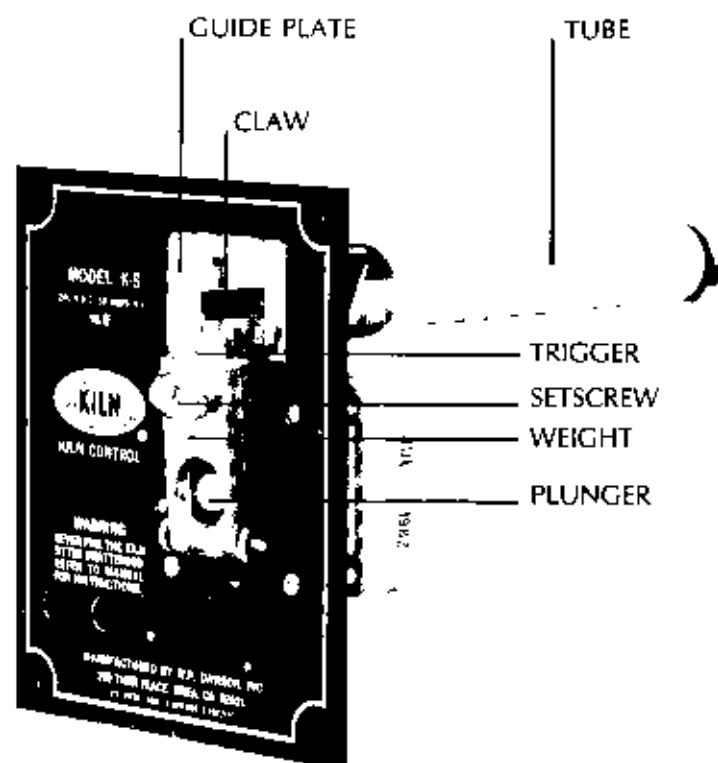
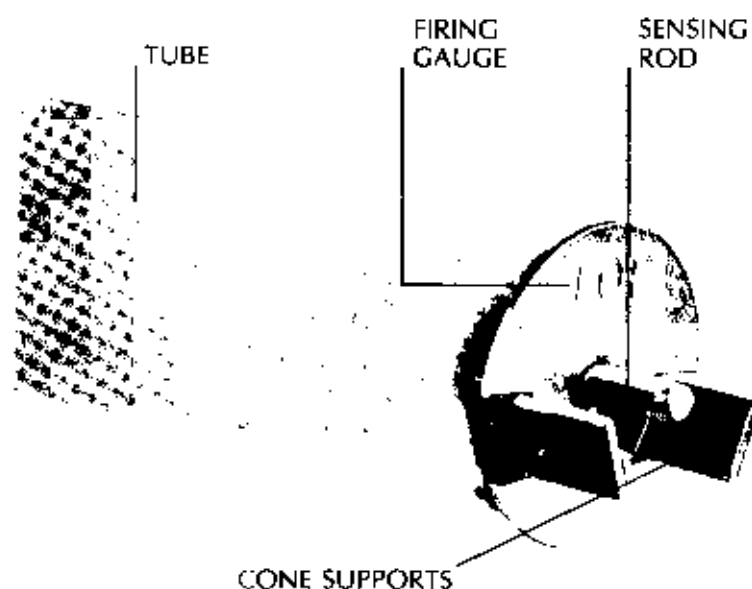


FIG. 2



Kiln-sitter, continued

3. Check position of claw.

With the firing gauge in position, raise the weight up against the guide plate. Pull the swivel assembly and check for a 1/16 inch clearance between the inside of the claw and the trigger, as shown in Figure 3. The setscrew on top of the claw may be loosened if adjustment of claw position is necessary. Retighten setscrew firmly.

Set claw 1/16 inch from trigger, as shown.

Set trigger to just clear claw, as shown.

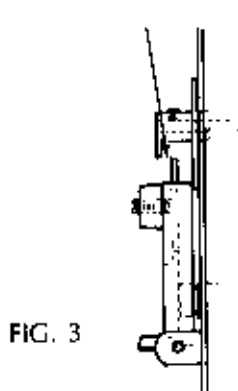


FIG. 3

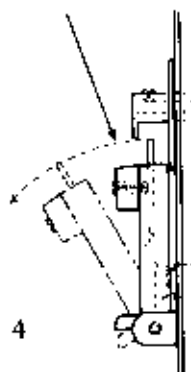


FIG. 4

4. Check position of trigger.

With the firing gauge in position, raise the weight up against the guide plate, then slowly swing it forward. The trigger should just clear the tip of the claw, as shown in Figure 4.

The setscrew in front of the weight may be loosened to raise or lower the trigger, but it must be firmly retightened or the force of repeated falling of the weight may cause the trigger to creep out of adjustment (see Fig. 5).

Check travel of sensing rod.

Remove the firing gauge and keep it for future periodic adjustments. The sensing rod is now free to travel vertically within the center of the tube cavity (see Fig. 6).

By holding a small mirror inside the kiln so you can see the path of the sensing rod and by pressing down on the claws, you can easily check the movement of the rod within the tube cavity. It should not touch the sides at any point.



FIG. 5

FIG. 6



FIG. 7



If necessary, the sensing rod can be centered by loosening the two guide plate screws or the front of the kiln-sitter and moving the guide plate to the right or left, as required. Be sure guide plate screws are firmly retightened (see Fig. 7).

NOTE: This kiln-sitter adjustment should be repeated once every 20 firings or once every month.



Test Firing

Before you load a new kiln with ware, it is important to run two preliminary firings. One is to ensure that your kiln-sitter is operating properly, and the other is to build up a good oxide coating on the elements.

Kiln-sitter Test

The kiln-sitter mechanically shuts off your kiln when the pyrometric bar or small cone in the mechanism bends. Because this is such an important device, it is necessary to ensure that it is operating properly before doing any firing. Use the following kiln-sitter instructions and the 019 bar and cone provided with your kiln to perform this test.

1. Remove firing gauge (see Fig. 8).

FIG. 8



2. Turn off all kiln switches. The life of the kiln-sitter will be increased if kiln switches are off before engaging kiln-sitter.
3. Kiln wash should be applied to top of cone supports and bottom of the sensing rod. (See **Setting Up Your Kiln for Safe Operation** on page 4.)
4. Raise weight up against guide plate.
5. Press claw down lightly until it engages trigger.

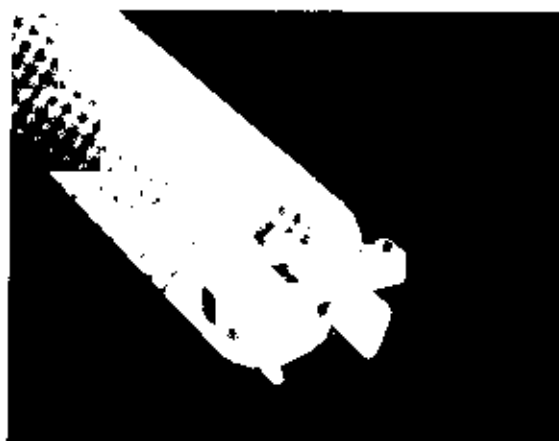


FIG. 9

6. Insert pyrometric bar or small cone in the kiln-sitter and place witness cones on the shelves, as described on page 10.

While holding claw down, center pyrometric bar on the cone supports. (See Fig. 9.) If a small cone is used, carefully place cone under the sensing rod with a flat side on the cone supports. Cone should be against the metal step of the cone supports, with the center of the cone parallel with the end of the tube.

Generally, you will find that a small cone in the kiln-sitter needs to be one cone hotter than the firing (witness) cone on the shelf to obtain correct results. While this is true in most cases, particularly for cones 06, 05 and 04, test your particular kiln; it may act differently, depending on the kiln-sitter adjustment and the desired firing (witness) cone.

For the cone 019 test firing, the 019 kiln-sitter bar will usually result in a fully matured 019 firing (witness) cone.

If a pyrometric cone is used, you can vary the shut-off temperature slightly by the way the cone is positioned in the kiln-sitter. If the cone is moved so that the thinner section of the cone is under the sensing rod, shut-off will occur sooner than when a thicker section of the cone is under the rod. However, make certain that you have at least 1/16 inch of the cone overhanging the cone support on each side or an early shut-off can be expected.

7. Close lid.

Test Firing, continued

8. Turn safety timer knob clockwise to appropriate time (for cone 019 test firing, set at 5 on scale).

9. Push firmly on the plunger until it locks.

10. Fire the kiln according to the instructions on pages 13 and 14. During the cone 019 test firing, the kiln-sitter weight will drop in approximately 3 hours, shutting off the kiln.

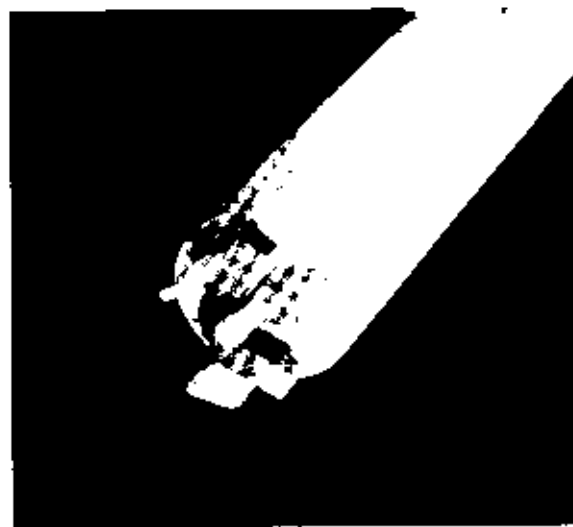
When the kiln is cool to the touch, you can open it and inspect the cones. If all adjustments have been made correctly, the kiln-sitter bar or cone will be bent to an approximate 90-degree angle (see Fig. 10), a shape similar to the illustration and your firing (witness) cone will be bent within the range shown on page 10.

Preliminary Cone 06 Firing

This firing is necessary to allow a coating of oxide to form on the elements before ware is fired.

Place a witness cone on the hearth plate.

FIG. 10



During this firing, do not fire any ware, because a pure atmosphere in the firing chamber is necessary to allow a good oxide coating to form on the elements. This is important, as a good coating increases the life of the elements.

CAUTION: Since the kiln-sitter bar or cone is the triggering element that normally shuts off the kiln, its correct positioning is important for proper firing. IF BAR OR CONE IS DISLODGED BY ACCIDENT OR ALLOWED TO COME IN CONTACT WITH THE PORCELAIN TUBE, AN OVERFIRING MAY RESULT WHICH COULD CAUSE SERIOUS DAMAGE TO YOUR KILN.

Set safety timer for 6 hours for this firing. Now follow the instructions on the kiln which are also described on pages 13 and 14. Under ideal conditions, this firing will take 4-6 hours; however, **abnormally low voltage can lengthen the firing time.**

When the kiln shuts off, record the length of time it took the kiln to fire on your firing record. This information will be helpful to you in estimating firing times in the future, although a loaded kiln will take longer to fire than an empty one.

Do not be concerned about odors during this firing or the next few firings; they come from the elements and moisture in the brick or the ware.



Description of Kiln Parts



Kiln Fiber

Ceramic fiber similar to the fiber used by NASA for heat insulation and protection in outer space. Durable and lightweight. Energy-efficiency is better than brick. *Ceramic fiber is NOT asbestos.*

Treat fiber lids gently. Like all efficient insulating materials, ceramic fiber contains trapped air spaces beneath its hard outer surface, making it somewhat resilient. Do not poke the surface, lean on it or set objects on the lid.

Caution: In case of skin irritation, do not rub or scratch inflamed area. Wash with mild soap and water. Use a skin cream or lotion if needed. Use gloves when replacing lids or bottoms, and place parts in plastic trash bags for disposal.

A Note About Fiber . . .

After several firings, you may notice some changes in the fiber portions of your kiln. *Although the performance of the kiln is not affected, we'd like to bring them to your attention.*

All materials expand and contract when they are heated and then cooled. During the firing process, the fiber will expand and contract, too. When your kiln is cool, you may observe the following changes:

Changes	What Should You Do?
* Small cracks may appear in the fiber lid or bottom of the kiln.	* Nothing! This is normal and is not reason for concern. It is strictly cosmetic.
* The lid may shrink and the lid band may become loose.	* This is normal and is not reason for concern. Simply tighten the lid band clamps with a screwdriver when the kiln is cool.

Description of Kiln Parts, continued

Kiln Brick

The walls of the kiln are made of insulating brick which helps keep the heat produced by the elements inside the kiln and allows heat to build up to the required temperatures.

Most wall bricks are grooved to hold and support the elements. The wall bricks are not cemented together but are held in place by the pressure of the kiln case. With use, fine cracks may form in the brickwork. These cracks close up during firing and open up as the kiln cools, serving as expansion joints. Kiln brick is extremely fragile and will chip or crack easily. *Never lean on the brick surface when loading the kiln for firing.*

Elements

The kiln's heat is produced by electric elements (coiled wires) set in grooved wall brick. During firing these elements are very soft; however, when they cool they become extremely brittle and should be handled carefully. When you turn your kiln on, the elements normally will hum for a short time.

Take care to prevent foreign materials, especially glaze and kiln wash, from coming into contact with the elements and ruining them. Keep the kiln clean by regular vacuuming, as excessive brick dust in the element grooves will shorten the elements' life span.

Peepholes

Peepholes allow you to look into the kiln firing chamber and determine the progress of your firing by checking the witness cones and the kiln's interior.

Care should be taken when looking into the peepholes so that the heat radiated from the firing chamber does not injure your eyes, face, glasses or contact lenses. Dark glasses are a good protective device and also will make the witness cones easier to see.

Lid Vent Hole

Permits the continuous escape of moisture and gases from the kiln chamber during the firing cycle.

Plugs

Peephole plugs are used primarily to stop drafts from entering the firing chamber. However, the plugs need not fit tightly.

During firing, never unplug a peephole for more than a few seconds. This can cause a draft in the firing chamber which could chill the witness cones, causing them to bend incorrectly or could fracture the ware near the peepholes.

Safety Timer

This is a back-up shut-off device designed to turn the kiln off if the kiln-sitter fails to do so, thereby protecting your kiln from severe damage by overfiring.

The numbers around the safety timer knob indicate hours of firing time. Since the safety timer will override the kiln-sitter, your timer should always be set for **one half hour** longer than the estimated firing time. When that period of time has elapsed, the safety timer should turn off the kiln if the kiln-sitter has failed to do so, whether the ware is mature or not.

Switches

Note: The EA 716 Automatic does not have these switches.

Each switch controls a group of elements. On models with more than one switch, the top switch controls the top set of elements and the bottom switch, the bottom elements.

On ES models, the small light next to each switch indicates when the switch is out of the **OFF** position.

On EA models, the small light next to each switch is on continuously when the plunger is in, indicating that there is power in the kiln.

These switches are infinite, which means that, as you turn a switch counterclockwise, the amount of heat the elements will produce increases by degrees. The switches cycle on and off, causing a slight intermittent popping noise. The amount of "on" time increases as the switch setting increases until, at the HI-FIRE setting, the switch is on continuously.

The switch settings have been developed to compensate for the natural rise of heat to the top of the kiln. Therefore, on kilns with more than one switch, the top switch marking positions are different from the bottom ones. If your kiln should develop a tendency for the top to be hotter or cooler than the bottom, adjust the switch settings to correct the problem.

Hearth Plate

The hearth plate provides protection for the kiln floor and a base for kiln firing. **Place the hearth plate directly on the floor of the kiln. Never use kiln posts under this plate.**

(See Diagram of Kiln Parts on page 24.)



Kiln Accessories

Pyrometric Cones

When firing ceramic ware, a ceramist does not speak in terms of temperature but refers to a specific cone number. Since different clays and glazes require different firing conditions to mature properly, cones are available in a series of numbers to allow for these differences.

There are two types of cones needed for your kiln:

1. Kiln-Sitter Cones: One is placed in the kiln-sitter for each firing. It is a small cone or bar designed for this purpose. Duncan recommends the **Orton Pyrometric Bar** for your kiln-sitter (Fig. 11).

FIG. 11



For the proper bar or cone to use, refer to the chart **Choosing Your Cone** on page 23 to select the proper cone.

2. Witness Cones: Witness cones should be placed behind each peephole and/or on each shelf. Duncan recommends the **Orton Self-Supporting Large Cones** for your kiln. They should be placed at least 2 or 3 inches from the peephole to protect them from cool drafts and usually in a series which includes: a **guide** cone, a **firing** cone and a **guard** cone. The **guide** cone is one cone cooler than your desired **firing** cone and is placed at one end. It will signal the **approach** of maturity. The **firing** cone is the cone to which you wish to fire and is placed in the middle. At the other end is the **guard** cone, which is one cone hotter than the **firing** cone and which, if bent, means the kiln and ware have exceeded the maturing point recommended. The cones must be positioned so the bending of one does not interfere with the bending of the others. One good way is to place them side by side in a line so they will all bend in the same direction.

While using three witness cones is best, be sure to use at least one witness cone on each shelf. Use the cone equal to your desired firing.

The most common causes of problems with a ceramic piece is the result of either underfiring (kiln shut off before reaching the desired cone) or overfiring (kiln shut off after exceeding desired cone).

A kiln-sitter bar or cone by itself will not guarantee that your firing achieves the desired cone. This is especially true when the kiln-sitter is out of adjustment. Placing a witness cone on the shelf with the pieces indicates the actual cone achieved during the firing. In most cases, if the poor result was caused by underfiring, it can be corrected by adjusting your kiln-sitter and firing the piece over again, using new cones.

Pieces that were exposed to an overfire cannot be corrected by refiring, but the next load can be correctly fired by adjusting your kiln-sitter.

FIG. 12



A witness cone is sometimes known as a **Large Self-Supporting Cone** (Fig. 12).

Select the cone that corresponds to the desired firing cone and place it as close to the middle of the shelf as possible.

As the cone matures, it will bend toward the direction it points, so be sure to leave enough space for it to fall without touching a piece.

The products used by most ceramists have a firing range, rather than an exact maturing point. So, if the appearance of your glaze or ware is satisfactory and your firing cone is bent within the range shown (see Fig. 13), your piece is properly matured.

Witness Cone Interpretation

Did your firing reach the desired cone?
Use this guide as a reference.

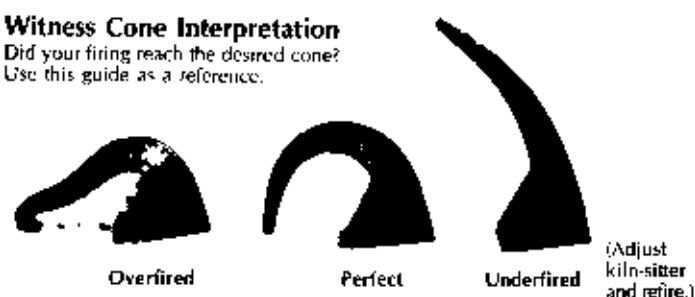


FIG. 13

Kiln Accessories, continued

Commonly Used Firing Cones

Type of Firing Large Witness Cone

BISQUE

For stains, acrylics	04
For Crackletone Glazes	06
For stains that have glazed areas	04
For general-purpose ware	04
For Duncan Red-Strokes	03
For porcelain	6
For stoneware	6-10

GLAZE

Luster (Mother-of-Pearl)	020
Metallic overglazes (Bright Gold, White Gold)	019
China paints*	019
Decals*	018
Hobby ceramics glazes**	06
Porcelain or stoneware glazes	6

*Check manufacturer's label for recommended witness cone.

**When properly fired to cone 06, Duncan glazes labeled as safe for food containers comply with the Food and Drug Administration's safety requirements concerning lead and cadmium release.

Kiln Wash

A protective coating that is applied to the top of the hearth plate and the tops of the kiln shelves to prevent any glaze drips from adhering permanently to these surfaces. *Never apply kiln wash to fiber surfaces.*

Kiln wash is usually purchased in a powdered form. Mix it with water to the consistency of skim milk. Using a standard paint brush (2" to 4"), apply a coat of the kiln wash mixture to the top side of all shelves (including the hearth plate).

Kiln Furniture

A general term for the shelves and posts used to divide the kiln's interior for efficient use of its space. Stilts are used on all shelves to support glazed ware. A good variety of shelves, posts and stilts is available from your ceramics supplier.

Pyrometer

A pyrometer consists of a meter with a temperature scale and a thermocouple which is inserted into the kiln to measure temperature. It can be used as a guide for advancing switches or for gauging the cooling of the kiln, of which

the cone tells nothing. It is **not**, however, an accurate way to determine the maturity of the ware and should never be used in place of witness cones because it measures only temperature. **Time, as well as temperature, is critical to properly mature ceramic ware;** therefore, only the witness cones on the shelf can record maturity correctly. If a firing is controlled solely by means of a pyrometer, the ware could easily be underfired. (Your kiln case already has a hole for the thermocouple, so simply drill the hole through the brick and insert the thermocouple several inches into the chamber. Complete installation instructions are included with the pyrometer.)



Loading the Kiln

General Guidelines

■ Before loading, make certain that all the kiln switches are off, the inside of the kiln is free of dust (vacuuming also removes black metallic dust from kiln-sitter deterioration) and that the tops of all shelves (including the hearth plate) are coated with kiln wash.

■ Make certain that you have properly placed a bar or small cone in the kiln-sitter before loading the kiln.

■ Only bone-dry ware should be loaded in your kiln. Damp ware may crack during firing and sometimes even explode, which could damage other ware and the elements. Greenware should be air-dried for approximately 2 days after casting, depending on the size of the piece, and glazed ware should dry 4 to 6 hours before firing. Drying should not be hastened by placing the pieces on the top of the kiln as this may tend to crack or warp them.

■ Three posts are used to support each shelf. Before positioning a shelf on the posts, make sure that the shelf clears the ware by at least 1 inch. Place posts of the proper size and length on the shelf prior to placing ware (see Fig. 14).

FIG. 14



Loading the Kiln, continued

■ Lower shelves into kiln carefully so as not to damage the kiln walls or the kiln-sitter tube. Place shelves so that you have at least one element between shelves and one element between the top shelf and the top of the kiln.

■ Keep shelves and ware at least 1 inch from the kiln-sitter sensing rod and 1/2 inch from the wall of the kiln. Plan your load and shelf arrangement before actually loading. Since dropped ware or shelves can damage the inside of your kiln, always load carefully.

■ Try to keep ware of the same relative height on one shelf to fully utilize the space. Mix light and heavy pieces on the same shelf; this will help the kiln heat evenly (see Fig. 15).

FIG. 15



■ Be careful not to jar kiln after loading, as your ware could be broken or your kiln-sitter bar or cone could be dislodged.

■ Place witness cones on each shelf (including the hearth plate), preferably behind each peephole.

■ Large flat pieces should be placed so that their edges are between elements. This will prevent the edges from heating before the centers and may eliminate possible cracking.

Loading Greenware for Bisque Firing

Greenware pieces can touch each other, be nested or even stacked, as they will not adhere to each other when fired. However, if you stack, be sure not to strain the rim of any piece, place heavy pieces on fragile ones, or stack them so compactly that heat cannot penetrate to the center of all the ware. Greenware can be placed directly on shelves; stiling is not required.

Generally, ware should be fired in its natural

position except for pieces with flat vertical surfaces, such as wall plaques and clocks. These should be fired flat to prevent warping. Thin cups can be fired upside down or a pair can be stacked lip to lip to prevent deformation. Pieces with lids should be fired with the lids in place to ensure a good fit.

Loading for Glaze Firing

Glazed pieces may not touch or they will bond together permanently. Allow at least 1/2 inch between pieces so they will not contaminate each other during firing (when bubbles form and gases are released).

The tops of shelves (including the hearth plate) should always be covered with kiln wash and the undersides of the shelves should be clean, as dust or particles falling on the ware may cause imperfections in the glaze finish.

Glazed ware must be stilted or dryfooted to keep it from sticking to the shelves. Stiling is the preferred method for low-fire (cone 04, 05 or 06) glazes.

Do not place greenware and glazed ware in the same load, as they mature at different cones and the gases in the clay body of the greenware can cause glaze discoloration.

Loading for Overglaze Firing

The same rules apply for loading an overglaze firing as for loading a low-fire glaze firing.

Special care should be taken to allow at least 1 inch between pieces decorated with lusters so they will not contaminate each other during firing.

Loading Porcelain for Bisque Firing

Porcelain is a high-fire clay body which vitrifies (becomes nonporous) when fired. In its natural state, porcelain varies from white to light grey; however, a wide variety of colored porcelain bodies are available.

The tops of all shelves (including the hearth plate) must be coated with Duncan Kiln Wash which has been formulated for high-fire usage.

Some pieces (for instance, a teapot with a spout and handle) are likely to sag in a porcelain firing. Hand-formed rolls of the same clay body can be used to support the parts that may sag. To prevent them from fusing together during firing, apply alumina hydrate to the rolls where there is contact with your ware. To remove the kiln wash, wash piece after firing and use an abrasive scrubber.

Simple shapes, such as plates, can be supported by commercially made setters designed for that particular article. Again, kiln wash must be applied.

Loading the Kiln, continued

When firing greenware pieces with lids, apply alumina hydrate to the pieces at any point where contact is made.

Load the greenware carefully as it will stick together and has a tendency to distort in shape.

Never place a piece closer than 3/4 of an inch from the sidewalls, as unequal heat tends to increase the possibility of distorting the shape.

Stilts should not be used to support porcelain clay bodies because these bodies become very, very soft in the process of maturing and will adhere to the stilts.

Loading Porcelain for Glaze Firing

Any glazed ware should be dryfooted. Pieces that require support during the bisque firing will not require support during the glaze firing, because the lower temperature requirement will not produce sagging.

Loading Stoneware for Bisque or Glaze Firing

Stoneware is a high-fire clay body which normally vitrifies (becomes nonporous) when fired, and has a range of textures and natural colors.

Greenware items can be stacked on top of each other as they will not adhere to one another when fired, but be careful not to strain the rim of any piece. Greenware can be placed directly on shelves; stiling is not required. Be sure that your greenware items are bone-dry. Dampness in the ware can cause your pieces to crack and perhaps explode.

For a glaze firing, the tops of the shelves must be coated with Duncan Kiln Wash and the ware is usually dryfooted rather than placed on stilts.



Firing the Kiln

CAUTION

1. Kiln surface may be hot. Do not touch. Do not place anything on top of the lid. Keep children away unless supervised.
2. Unplug kiln before attempting any servicing.
3. Do not operate kiln closer than 10 inches from any wall or combustible material.

4. Operate kiln only on stand provided.
5. Do not use extension cords with kilns.
6. Do not fire hotter than the cone or temperature listed on rating plate.
7. Do not open lid until kiln has cooled.
8. Operate kiln in well-ventilated, covered area.

OPERATING INSTRUCTIONS BEFORE FIRING STEPS — ALL MODELS

- A. Turn all switches to the **OFF** position.
- B. Place desired bar or cone in kiln-sitter.
- C. Load kiln, placing desired witness cone on each shelf.
- D. Close lid; do not prop.
- E. Insert all peephole plugs.
- F. Set safety timer.
- G. Push in plunger of kiln-sitter. (Note: for EA 716 model, this turns kiln ON.)

FIRING STEPS — MANUAL MODELS

Step 1. Turn all switches to **LOW** or 1. Fire for 2 hours.

Step 2. For firing ceramic ware (bisque or glazes), turn all switches to **HIGH** or 3.

Step 2. For firing overglazes (metallics, decals, lusters), turn all switches to **MEDIUM** or 2.

Step 2. For firing porcelain and stoneware, turn all switches to **HI-FIRE** or 4.

After kiln has turned off, allow to cool before opening.

FIRING STEPS — AUTOMATIC MODELS

Turn switches (if your kiln has them) to desired firing — **OVERGLAZE**, **CERAMIC**, or **HI-FIRE** (porcelain and stoneware).

Firing stages will automatically advance unless power is interrupted. After kiln has turned off, allow to cool before opening.

The Boss (EA 1229-2) has an override switch, allowing you to either fire the kiln automatically, as designed, or manually.

NOTES

Lid Vent Hole

It is recommended that the lid vent hole be left open during the entire firing cycle on bisque, glaze and overglaze firings (below cone 04), to permit the escape of moisture and gases.

Firing the Kiln, continued

If desired, the lid vent plug can be inserted into the lid vent hole after two hours on the HI-FIRE setting for porcelain and stoneware firings. Use caution when inserting the lid vent plug as extremely hot air is rising through the hole. A heat-resistant glove is recommended.

Lid Safety Switch (export models only)

If, by mistake, the lid is raised during kiln operation, the lid safety switch will interrupt power to the kiln. On some models, it releases the kiln-sitter plunger. If this is the case, to continue the firing cycle, turn all infinite switches off, make sure lid is closed, check time remaining on the safety timer, push in plunger, and return infinite switch(es) to the position they were in when the lid was raised.

It is recommended that you record each of your firings. This practice will enable you to duplicate your successful firings, avoid unsuccessful ones, and record the results of any modifications you incorporate into your procedures.

NOTE: The factory markings for the switches were developed after many test firings under varying conditions to produce an even-firing kiln. However, your witness cones may indicate that your kiln has a tendency for the top to be hotter or cooler than the bottom, depending on the type of load. If this is so, you may want to adjust the switch settings to compensate for any variations. Make a mark with a pencil on the control panel for your new settings so you can correct or repeat these adjustments.

It will not hurt your ware to stop the firing prior to maturity. If the kiln is jarred or if you think a piece of ware has fallen over, never chance ruining the entire load. Turn the safety timer off to stop firing the kiln.

If your kiln shuts off before the ware is mature, the safest thing to do is to cool your kiln, set fresh cones, and refire as usual.



Cooling & Unloading the Kiln

The cooling period is very important. If the lid is opened prematurely before the kiln is sufficiently cool, there is a good chance you will damage both the ware and the kiln. Allow it to cool at least twice as long (or longer) than it took to fire before opening.

Unload the kiln only if the pieces are cool enough to handle with your bare hands. As you unload, check the firing cone on each shelf to determine if the ware or glaze has been properly matured — as it is always advisable to refire underfired ware.

When unloading a glaze firing, remove the stilts from the ware. Handle the ware carefully and check for stilt marks which should be ground off with an abrasive stone as they are sharp.



Firing Faults

Imperfect ceramic articles are usually the result of incorrect color application, improper firing or lack of information. The following chart lists some of the common faults that can result from improper firing. There are other problems that can occur which may or may not be related to your kiln. For information on these, check your color manufacturer's or supplier's literature.



Firing Hints

The length of time your firings will take depends upon the thickness of the ware, the size of the kiln, the amount of ware in the firing chamber and voltage variations. Your kiln's firing time will also increase as the elements age. Do not rush a firing; this could create unnecessary problems (see **Recognizing Firing Faults** on page 15).

Recognizing Firing Faults

PROBLEM	POSSIBLE CAUSES	POSSIBLE REMEDIES
Cratered or Bubbled Glaze	<ol style="list-style-type: none"> 1. Underfiring. 2. Glaze applications too thick. 3. Immature bisque. 	<ol style="list-style-type: none"> 1. Grind down the bubbles, add a thin coat of glaze and refire to proper firing cone.
Crazing	<ol style="list-style-type: none"> 1. Underfired or immature bisque. 2. Kiln cooled too rapidly. 3. Thermal shock (removing piece from kiln too soon or subjecting it to extreme temperature changes). 4. Improperly formulated body. 	<ol style="list-style-type: none"> 1. Sometimes can be corrected by refiring the piece one cone hotter than the original glaze firing.
Cloudy Transparent Glazes	<ol style="list-style-type: none"> 1. Glaze applied too heavily. 2. Not fired hot enough. 	<ol style="list-style-type: none"> 1. Refire to proper firing cone.
Greyed or Discolored Glazes	<ol style="list-style-type: none"> 1. Ware placed too close to element. 2. Overfiring. 3. Insufficient application of glaze. 4. Fired with incompatible colors or greenware. 5. Applied to greenware. 6. Insufficient ventilation during firing. 	<ol style="list-style-type: none"> 1. Although difficult to correct, sometimes refiring to the proper firing cone will work. 2. Try applying a heavy coat of glaze and refiring if Remedy #1 doesn't work. 3. Glazes that have greyed usually cannot be salvaged.
Shiny Matte Glazes	<ol style="list-style-type: none"> 1. Misfiring, either overfiring or underfiring, depending upon glaze composition. 	<ol style="list-style-type: none"> 1. If underfired, refire to proper firing cone. 2. If overfired, this is difficult to correct. Sometimes applying another coat of glaze and refiring will help.
Pinholes	<ol style="list-style-type: none"> 1. Underfired bisque. 2. Dust left on ware or in the kiln. 3. Glaze was applied to greenware. 4. Firing too rapidly. 5. Improperly adjusted slip. 	<ol style="list-style-type: none"> 1. Refire to proper firing cone. 2. Apply a thin coat of glaze before refiring. 3. Problem best remedied before glazing. Properly adjust slip with silicate of soda, properly fire and clean bisque.
Smooth Texture Glazes	<ol style="list-style-type: none"> 1. Insufficient application. 2. Misfiring. 	<ol style="list-style-type: none"> 1. Reapplying glaze and refiring to proper cone will usually correct the problem.
Distorted Bisque	<ol style="list-style-type: none"> 1. Overfiring. 2. Ware incorrectly removed from the mold. 	<ol style="list-style-type: none"> 1. It is not usually possible to save these pieces.
Cracked Metallic Overglazes	<ol style="list-style-type: none"> 1. Overfiring. 2. Too heavy an application. 	<ol style="list-style-type: none"> 1. Refire the object to cone 06 to burn off the overglaze, then apply another coat and refire to the firing cone recommended by the overglaze manufacturer.
Faded Decals	<ol style="list-style-type: none"> 1. Overfiring. 2. Underfiring. 	<ol style="list-style-type: none"> 1. If decal was overfired, the problem cannot be corrected. 2. If decal was underfired, refire to the proper firing cone. Note: In both cases, check the manufacturer's firing recommendation to determine if it was over- or underfired.
Blistering During Decal Firing	<ol style="list-style-type: none"> 1. The decal firing was too hot, causing the glaze to start to react. 	<ol style="list-style-type: none"> 1. It is not usually possible to save these pieces.



Kiln Maintenance

Although the kiln is one of the most vital and expensive pieces of equipment a ceramist can own, it is often abused, misused, and neglected. Many extra years of firing service can be had if the kiln is understood and treated with respect.

Careful attention to the following preventative maintenance instructions will greatly increase your kiln's life span.

EVERY LOADING

1. Check the kiln-sitter's sensing rod and cone supports

Check sensing rod for free and centered travel. This can be done as you place the bar or cone in the kiln-sitter. If sluggish movement is noticed, follow Tube Assembly Examination Procedures on page 20.

Continued operation at high-fire temperatures will eventually cause the cone supports and end of the sensing rod to deteriorate or bend. This will, in turn, affect the adjustment between the trigger and claw. If this occurs, both the rod and cone supports must be replaced.

Excess kiln wash must not be allowed to accumulate on cone supports. Keep the protective layer very thin; excess wash can be easily removed by hand. If any nonremovable materials accumulate, cone supports must be replaced.

2. Check the kiln interior

Examine the inside of the kiln to be sure it is free of dust. It is best to vacuum your kiln interior before every firing or at least before each glaze firing, as floating dust will adhere to maturing glaze.

3. Check the kiln shelves

The shelves and hearth plate do not have to be recoated with kiln wash for every firing but an adequate coating should be maintained. Brush any loose particles of kiln wash from the shelves and check every shelf for cracks before placing it in the kiln.

EVERY 20 FIRINGS OR EVERY MONTH

1. Check kiln-sitter adjustment

Due to heat, corrosion and mechanical wear, the kiln-sitter may slip out of adjustment over a period of normal use or the repeated fall of the weight could force the trigger to creep. To ensure consistent firing, it is recommended that the steps outlined on page 6 be carefully repeated.

2. Tighten the kiln case and lid band

Due to the expansion and contraction of your kiln during firing, the clamps on the case will need to be tightened occasionally. Tighten clamps with a screwdriver when the kiln is cool.

WHENEVER NECESSARY

1. Remove glaze spots from shelves or kiln brick

Whenever spots of glaze appear on either shelves or brick, they should be removed prior to the next firing. If this is not done, the glaze will remelt and spread with every firing.

On side brick, if the glaze spot spreads to an element, the element will burn out. Dig the spot out of the side brick with a screwdriver or knife. Chip the glaze off the shelves (safety glasses should be worn) and touch them up with kiln wash.

After removing glaze, be sure to vacuum the firing chamber before firing.

2. Repair any badly damaged brick

Small chips, dents and gouges in brick need not be repaired as they do not affect the kiln's firing ability. However, any sizable damaged spot needs to be repaired (see page 19 for instructions).



(Please note information on ceramic fiber on page 8. If fiber areas need repair, consult your Duncan Distributor.)

3. Clean the outside

A clean exterior will not improve your kiln's firing ability, but it might increase its resale value and general appearance. Use a stainless steel cleaner to remove the stains around the peepholes caused by the gases being released, and glass cleaner to keep the stainless steel looking like new.



Troubleshooting

Caution: It should be remembered that your kiln, like a range or dryer, is an electrical appliance. It has been built for many years of reliable operation; however, if you do have trouble, consult this chart for possible causes before you call a serviceperson.

These solutions are not the total answer but may save you unnecessary costs. Have all electrical wiring done by an authorized serviceperson.

TROUBLE	POSSIBLE CAUSES	REMEDIES
Kiln will not heat and pilot light(s) not on.	<ol style="list-style-type: none"> 1. Kiln-sitter plunger not pushed in. 2. Blown fuse or tripped circuit breaker. 3. If just repaired, kiln may be wired wrong. 	<ol style="list-style-type: none"> 1. Push in plunger. 2. Replace fuse or reset circuit breaker. 3. Have wiring checked.
Fuse or circuit breaker trips immediately after turning on kiln.	<ol style="list-style-type: none"> 1. Short circuit in kiln. 2. Electrical service wired wrong. 3. Overloaded circuit. 4. If just repaired, kiln may be wired wrong. 5. Circuit breaker or fuse may be too small. 	<ol style="list-style-type: none"> 1. Have wiring checked. 2. Have electrician check wall receptacle. 3. Disconnect any other appliances from the circuit. 4. Have wiring checked. 5. Consult an electrician.
Fuse or circuit breaker trips after being on for some time.	<ol style="list-style-type: none"> 1. Short circuit in kiln. 2. Defective circuit breaker or fuse(s). 3. Circuit breaker or fuse size may be too small. 	<ol style="list-style-type: none"> 1. Have wiring checked. 2. Replace circuit breaker or fuse(s). 3. Consult an electrician.
Cracks in kiln bottom. Small cracks are normal, see page 9.	<ol style="list-style-type: none"> 1. Case loose. 	<ol style="list-style-type: none"> 1. Place kiln on floor; loosen, then tighten 2 bottom case clamps. Retighten periodically. Reposition kiln on stand.
Excessive time to complete firing, maximum temperature not attained.	<ol style="list-style-type: none"> 1. Inadequate wiring to kiln. 2. Insufficient voltage to kiln. 3. Loose connection in kiln wiring, wall receptacle or service wiring. 4. Elements are wearing out. 5. Part of kiln is not heating. 	<ol style="list-style-type: none"> 1. Consult an electrician. 2. Consult your electric company. 3. Have all connections checked and tightened. 4. Replace elements. 5. See next item.
A section of the kiln does not heat up.	<ol style="list-style-type: none"> 1. Defective or broken element.* 2. Defective switch. 3. Loose connection. 	<ol style="list-style-type: none"> 1. Replace element. 2. Replace switch. 3. Check and tighten.
Kiln shut off before firing cone is matured.	<ol style="list-style-type: none"> 1. Safety timer might have shut kiln off early. 2. Wrong cone in kiln-sitter. 3. Kiln-sitter out of adjustment. 4. Power failure caused automatic kiln to recycle to start. 	<ol style="list-style-type: none"> 1. If kiln just turned off, reset timer and push plunger; otherwise, cool kiln and refire with new cones. 2. When kiln has cooled, check and correct. 3. Make adjustment. 4. Reset timer and refire.
Lid handle slides up on lid.	<ol style="list-style-type: none"> 1. Lid strap loose. 	<ol style="list-style-type: none"> 1. Loosen lid band, reposition band and handle, tighten lid band.
Top or bottom of kiln overfires consistently.	<ol style="list-style-type: none"> 1. Some elements older than others. 	<ol style="list-style-type: none"> 1. Change switch setting to compensate for the unevenness or replace the old elements.
One pilot light not working (on kiln with more than one).	<ol style="list-style-type: none"> 1. Defective pilot light. 2. Defective switch. 3. Loose or defective wiring to switch. 	<ol style="list-style-type: none"> 1. Replace pilot light. 2. Replace switch. 3. Tighten or replace.
Hot plug/wall receptacle.	<ol style="list-style-type: none"> 1. Loose connection in receptacle or worn-out receptacle. 	<ol style="list-style-type: none"> 1. Have electrician check receptacle.
Kiln-sitter plunger will not stay in.	<ol style="list-style-type: none"> 1. Safety timer not set. 2. Problem in kiln-sitter mechanism. 	<ol style="list-style-type: none"> 1. Set safety timer, then push in plunger. 2. Have authorized Duncan kiln repair outlet check kiln-sitter.
Power failure ES models		If power is off more than 15 minutes, cool kiln, replace cones and restart. OTHERWISE: If in LOW position, allow kiln to continue to fire. If in HIGH position, cool kiln, replace cones and refire.
Power failure EA models		Reset timer and allow kiln to continue to fire until cone or timer shuts kiln off. Allow to cool and check cones for maturity. Refire if necessary.

*If one element is broken or burned out, a whole section or bank of elements will not work. Unless you have an ohmmeter or a continuity checker, the only way to determine which element in the section is damaged is by visual inspection.



Kiln Repair

If you decide to do the job yourself, most repairs can be accomplished with a screwdriver, a pair of pliers (preferably needle-nose) and a nut driver. Otherwise, have an authorized Duncan kiln repair outlet do it. Standard replacement parts will come with installation instructions; use only Duncan parts in your kiln.

The most important thing about repairing a kiln is to be certain you know what the problem is — otherwise you may spend time and money to replace the wrong part.

Control Panel Removal and Replacement

CAUTION: When repairing any part of the kiln, make sure to remove the electrical plug from the wall socket or be absolutely certain the electrical supply has been disconnected.

1. After disconnecting electrical supply, remove the screws holding the control panel onto the kiln; then carefully pull the unit out, keeping it level so the kiln-sitter tube will not gouge the brick.

Before disconnecting any wires, observe where and how they are attached. You may even want to sketch their location for reference when reconnecting them.

2. When the kiln-sitter tube is free of the kiln, disconnect the wires which connect each infinite switch to the kiln by pulling off the two slip-on terminals attached to the lower part of each switch. (Some models have only one switch (see Fig. 16).) Your control panel will not be free of the kiln.

Whenever you take off the control panel, it is advisable to check the wiring for discoloration, worn spots, or loose connections.

3. To replace the control panel, attach the wires to each switch. In attaching the wires, it is critical that the two top wires go to the top switch and the two bottom wires go to the bottom switch. It also is important that the wire attached to the bottom U-terminal connector is routed to the right of the kiln-sitter tube, as shown (see Fig. 17).

4. Carefully reposition control panel onto kiln, pressing all wires to the front of panel so they will not come in contact with the heat shield or kiln-sitter tube. Replace screws. Test for short circuits and check the kiln-sitter adjustment before firing kiln.

Test For Short Circuits

With kiln unplugged, activate kiln-sitter, then turn on both switches. Check element tester's batteries. Place test probes on plug's round ground blade (see Fig. 17A) and on one of plug's hot blades, then on other hot blade. If the

FIG. 16



FIG. 17



FIG. 17A



element tester lights, a short circuit exists and must be corrected before the kiln's plug is inserted into the electrical outlet.

Switch Replacement for ES Models

1. Unplug kiln. Pull knob off switch. If necessary, pry off with screwdriver. Remove control panel. Disconnect all wires connected to switch being replaced. Free switch from control panel by removing pal nut with crescent wrench.

2. Position new switch in control panel right side up and so its nubs fit into locator holes. Screw pal nut onto switch shaft and tighten firmly.

Kiln Repair, continued

3. Reconnect wires to switch as follows:
 - a. To tab P attach single wire from pilot light. (On some EA models, the pilot light is not connected to the switch.)
 - b. To tab L¹ attach wire from left kiln-sitter contact as you face inside of control panel. When working on collar, this is the wire connected to left terminal screw of interconnect plug.
 - c. To tab L² attach wire from right kiln-sitter contact; this wire has the other pilot light wire attached. When working on collar, this is the wire connected to right terminal screw of interconnect plug.
4. Connect wires from elements to switches and reposition control panel on kiln. Replace switch knob. If knob fits loosely, use screwdriver to slightly spread slot in switch shaft.
5. Test for short circuits with element tester and check kiln-sitter adjustment before test-firing kiln

Brick Repair

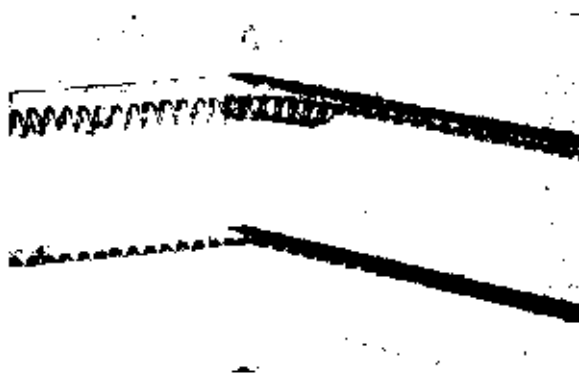
Generally, it is not advisable to try to repair wall brick as this usually causes more damage than it corrects. However, whenever glaze is on the brick it should be dug out with a screwdriver or knife prior to the next firing.

CAUTION: When repairing any part of the kiln, make sure to remove the electrical plug from the wall socket or be absolutely certain the electrical supply has been disconnected.

Brick Replacement

Brick should only be replaced when it is too chipped to provide insulation or when it can no longer hold elements in the grooves. Sometimes pinning your elements into the groove with element staples will enable you to postpone this job until the elements need to be replaced (see Fig. 18).

FIG. 18



1. Be sure you have proper replacement bricks. Remove the lid, unscrewing that part of the hinge attached to the kiln case.

2. If any of the bricks you need to remove have good elements, use the following procedures to save them. Heat the kiln at HI-FIRE until the elements glow a dull red, then turn the kiln off and unplug it or disconnect electrical supply. Very gently lift the softened element out of the groove with needle-nose pliers, just enough to allow the removal of the damaged brick and any other bricks that will have to be removed (see Fig. 19).

FIG. 19



3. Loosen case clamps and remove as many screws from the kiln case as necessary to free the bricks to be removed. Depending upon where the brick needing replacement is located, it may be necessary to remove the whole case. Minimize your work by removing only as many parts as necessary to loosen the case enough to remove the brick.

4. Carefully remove all necessary bricks. Insert the replacement brick, plus any other bricks that have been removed, being sure the recessed groove is down (see Fig. 20).

FIG. 20



5. Tighten the case clamps, aligning the peepholes, kiln-sitter tube hole, and the holes in the base plate with the case. Then replace all screws and parts that were removed, including the lid.

6. Plug in kiln or reconnect power, heat the elements to soften them, being sure that the loose elements are not touching each other, then unplug the kiln. Use closed needle-nose pliers or a table knife to carefully push the element in the slot and down into the groove.

7. If the surface of the brick that touches the kiln lid is uneven, use a sanding block to sand the surface until it is even with the adjoining brick (see Fig. 21 on next page).

Kiln Repair, continued

FIG. 21



8. Vacuum the kiln and check the kiln-sitter adjustment and lid safety switch adjustment before firing.

Sensing Rod Replacement

1. Follow steps to remove tube assembly. Remember to unplug kiln or disconnect electrical supply.
2. Once the tube assembly is free, loosen the setscrew in the swivel and remove the sensing rod.
3. Insert new sensing rod and line it up with the ends on the cone supports. Tighten setscrew.
4. Follow tube assembly replacement steps.
5. Adjust kiln-sitter.

CAUTION: When repairing any part of the kiln, make sure to remove the electrical plug from the wall socket or be absolutely certain that the electrical supply has been disconnected.

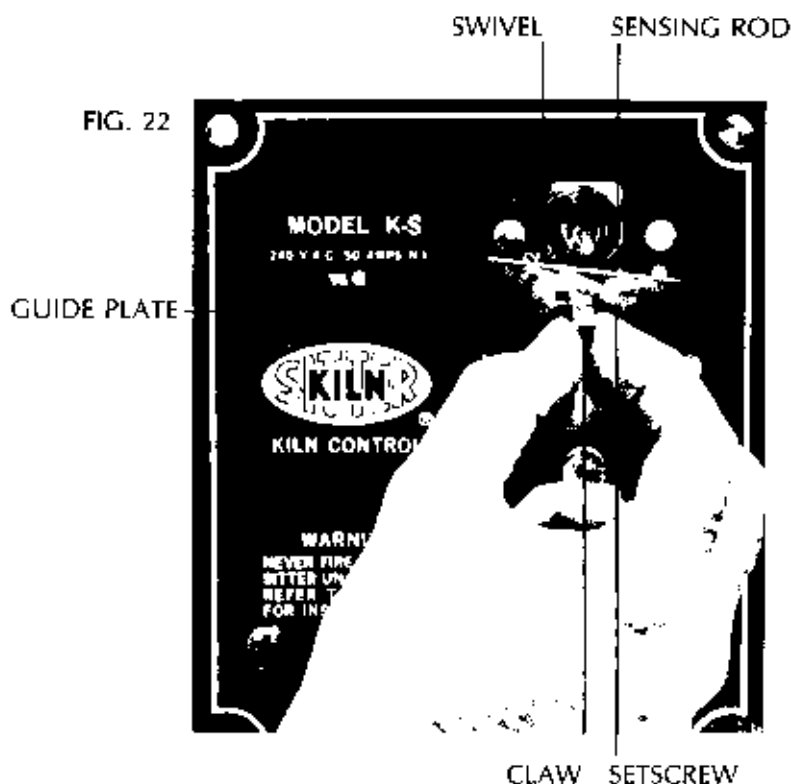
Kiln-sitter Tube Examination & Replacement

To check the tube assembly and swivel for corrosion, move the sensing rod up, down and around to make sure that it is free. Sluggish movement can be caused by an accumulation of residue or by corrosion around the small nipple swivel which the sensing rod passes through. To make sure, the tube assembly should be removed for a closer look at the swivel.

Tube Assembly Removal

1. Unplug the kiln or disconnect electrical supply and remove control panel.
2. Remove the two screws holding the guide plate. Unscrew the claw setscrew and remove the claw and guide plate from the sensing rod (see Fig. 22). Remove claw after tube is free.
3. Free the tube from the front plate by removing the two flat-headed screws which were hidden behind the guide plate.

FIG. 22



Tube Assembly Replacement

1. Attach the tube assembly, being sure it is positioned so the cone support slots point down.
2. Replace the guide plate and fit claw onto the end of the sensing rod.
3. Tighten the claw setscrew.
4. Replace the control panel, pressing all wires to the front of the panel so they will not come into contact with the heat shield or the kiln-sitter tube.
5. Adjust the kiln-sitter according to the instructions on pages 5 and 6 and test-fire as described on pages 7 and 8.



Choosing Your Cone

Choosing the right cone is very important. Use the following chart as a general guide in selecting the right cone. Always check label on jar. There are exceptions.

Type of Firing	Shelf Cone Desired	Orton Pyro- Bar Type Cone for Kiln-sitter	Orton Pyramid Type Cone for Kiln-sitter	Large Witness Cones
Bisque				
For stains, acrylics	06-04	06-04	05-1/2-03	06-04
For Crackleton Glazes	06	06	05-1/2	06
For stains that have glazed areas	04	04	03	04
For general-purpose ware	04	04	03	04
For Duncan Red-Strokes	03	03	02	03
For porcelain	6	7	7	6
For stoneware	6-8	7-9	7-9	6-8
Glaze				
Luster (Mother-of-Pearl)	020	020	020	020
Metallic overglazes	019	019	019	019
China paints*	019	019	019	019
Decals*	018	018	018	018
Hobby ceramics glazes**	06	06	05-1/2	06
Porcelain or stoneware glazes	6	7	7	6

*Check manufacturer's label for recommended witness cone.

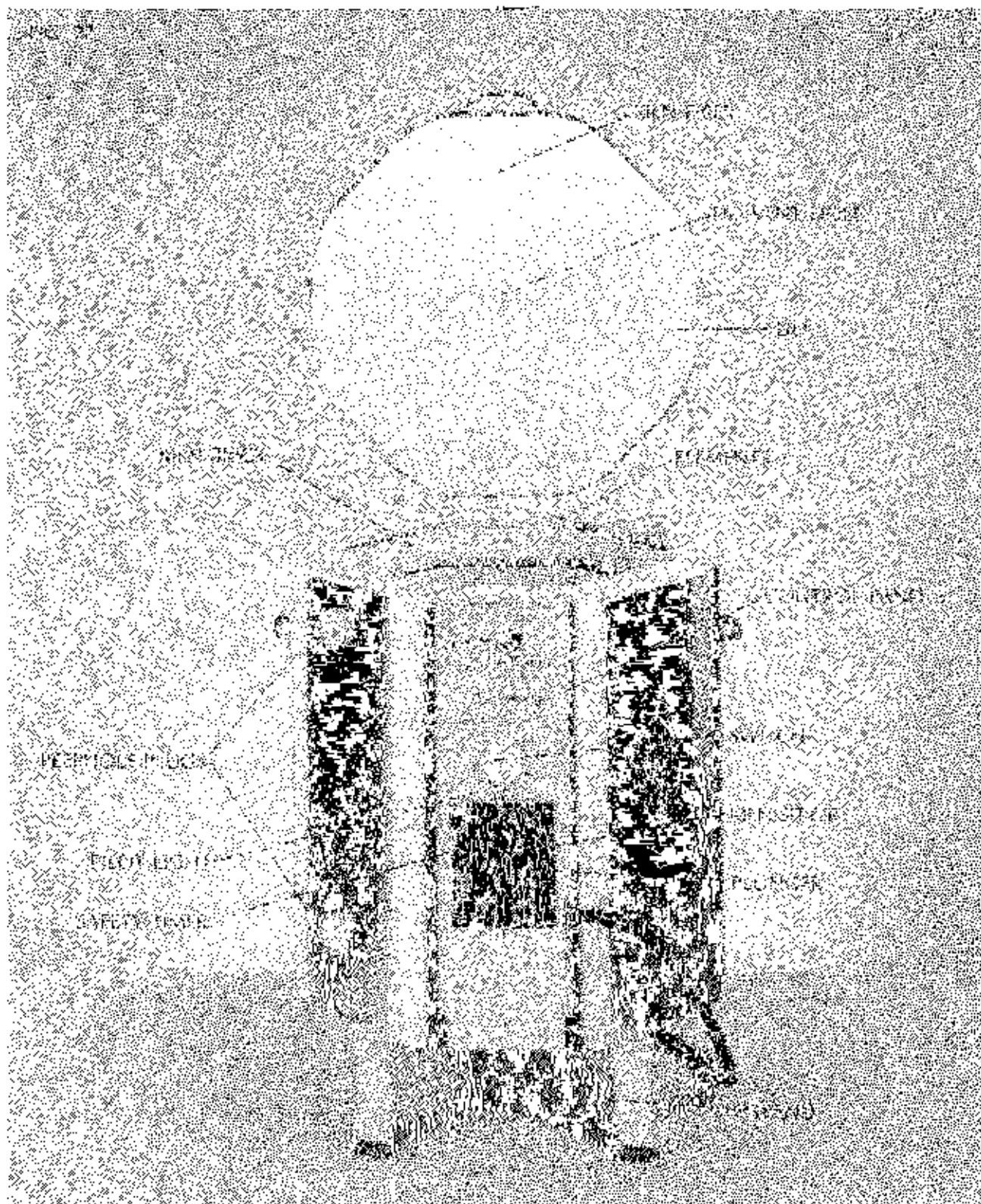
**When properly fired to witness cone 06, Duncan glazes labeled as dinnerware safe comply with the Food and Drug Administration's safety requirements concerning lead and cadmium release.

Be aware that the lower the cone number, the cooler the firing, and vice versa. Thus, numbers prefaced by zero (cone 05, for example) are cooler than numbers which stand alone (such as cone 5). Heat increases as the cone numbers increase — cone 06 is cooler than cone 05, and cone 6 is hotter than cone 5. (See **Conversion Table for Pyrometric Cones** on page 25.)

Note: These are general guidelines. Always check the specific product label for recommended witness cone.



Diagram of Kiln Parts



Conversion Table for Pyrometric Cones

°C	°F	Orton Cones	British Cones	Seeger Cones
600	1112	—	022	022
605	1121	022	—	—
615	1139	021	—	—
650	1202	020	021	021
660	1220	019	—	—
670	1238	—	020	020
690	1274	—	019	019
710	1310	—	018	018
720	1328	018	—	—
730	1346	—	017	017
750	1382	—	016	016
770	1418	017	—	—
790	1454	—	015	015a
795	1463	016	—	—
805	1481	015	—	—
815	1499	—	014	014a
830	1526	014	—	—
835	1535	—	013	013a
855	1571	—	012	012a
860	1580	013	—	—
875	1607	012	—	—
880	1616	—	011	011a
895	1643	—	—	—
900	1652	011	010	010a
905	1661	010	—	—
920	1688	—	09	09a
930	1706	09	—	—
940	1724	—	08	08a
950	1742	08	—	—
960	1760	—	07	07a
980	1796	—	06	06a
985	1805	07	—	—
1000	1832	06	05	05a
1020	1868	05½	04	04a
1040	1904	05	03	03a
1060	1940	04	02	02a
1080	1976	—	01	01a
1100	2012	—	1	1a
1115	2039	03	—	—
1120	2048	—	2	2a
1125	2057	02	—	—
1140	2084	—	3	3a
1145	2093	01	—	—
1160	2120	1	4	4a
1165	2129	2	—	—
1170	2138	3	—	—
1180	2156	—	5	5a
1190	2174	4	—	—
1200	2192	—	6	6a
1205	2201	5	—	—
1230	2246	6	7	7
1250	2282	7	8	8
1260	2300	8	—	—

In Duncan publications, the US cone is shown in boldface type, and the British-German equivalent cone is shown in lighter type.