Firebrick Maintenance

Kilns are very hard working tools. After the first few firings, the steel case of a new kiln discolors and hairline cracks appear in the firebricks. This is normal.

Though the insulating firebrick is fragile enough to carve with a fingernail, it is a miracle of physics. It can routinely withstand temperatures over 2000°F, which is hot enough to melt copper, bronze, brass, and aluminum. Nevertheless when properly maintained, firebricks can survive many hundreds of firings.

The high temperatures inside a kiln cause tremendous stresses. Since the insulating firebricks expand and contract with each firing, cracks appear in the bricks while the kiln is cold. Do not be concerned with these. The cracks close tightly when the heated bricks expand and function as expansion joints.

Cracks in the firebrick bottom usually should not be repaired. As long as you are supporting the kiln with the correct stand and the kiln case is tight, the cracks in the bottom are nothing to worry about.

If you use silica sand on the kiln shelves, be careful not to allow the sand to seep onto the firebrick bottom. The sand will get into the cracks and widen them.

Do not be concerned with the line of light that appears around the edge of the door or lid at high temperatures. This is due to the natural expansion of the firebricks and does not affect the firing.

It is okay to open the kiln lid or top a half inch or so for a few seconds to check on the hot glass inside. This has little effect on the life of the firebricks.

Preventive Maintenance

Caution: Do not breathe the dust that forms when you vacuum the kiln or mix kiln wash. Wear a mask.

Vacuum the Kiln

One of the easiest kiln maintenance tasks you can perform is regular vacuuming. This is especially important if you fire glazes. Vacuum the kiln before every glaze firing.

Use the soft brush nozzle on a vacuum cleaner. Be sure to vacuum the element grooves, the inner surface of the kiln lid or roof, and the underside of kiln shelves.

Vacuuming the grooves is essential if clay has exploded inside the kiln. Pieces of greenware that lodge inside the grooves can cause element failure.

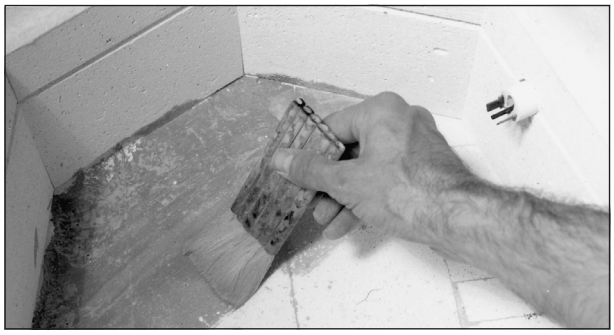
Vacuum the kiln often if you use silica sand on the shelves to support ware. Sand can ruin the elements if it filters down into an element groove.

As you vacuum the kiln, examine the walls for glass or glaze particles that have embedded into the firebricks. Dig these out carefully with a screwdriver.

Coat the Brick floor

Coat the firebrick floor of your kiln with kiln wash or glass separator. Do this even if you are firing only glass and feel that you will never overfire your kiln. (The kiln wash or glass separator must be rated to 2400°F.)

1. Pour water into a disposable container and add powdered kiln wash until it has the consistency of coffee cream. Stir until lumps dissolve.
2. Apply three thin layers of kiln wash rather than one thick layer. You can use a small paintbrush or a Chinese haik brush. Allow the kiln to dry before firing.



Coat the firebrick floor with kiln wash or glass separator. If your kiln has sidewall elements, hold a piece of cardboard in front of the elements to protect them from contact with kiln wash.

If the kiln wash cracks or flakes off, reapply it only to the bare spots. Do not remove the kiln wash from the firebrick floor and apply a fresh coat. This is unnecessary and messy.

Avoid splashing kiln wash onto the firebrick walls, especially if you have sidewall elements. Contact with kiln wash and glass separator destroys elements, often during the next firing.

Do not apply kiln wash to ceramic fiber firing chambers. Kiln wash is meant for firebricks and ceramic shelves.

Note: Leave the floor uncoated if your kiln has an element in the floor.

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Fire Dry Ware and Shelves

Greenware and shelves should be bone-dry and warm to the touch. If you must fire moist ware, wait until all signs of vapor have disappeared before heating past 200° F. At higher temperatures the moisture turns to steam, which is not good for the firebricks and can cause the ware to explode.

Top-Loading Kilns: Extending Life of Top Wall Bricks

The wall area of a top-loading kiln that is most prone to brick damage is the top rim of sidewall firebricks. This is because people lean against the edge of the kiln to load and unload. Place as little weight as possible on the kiln.

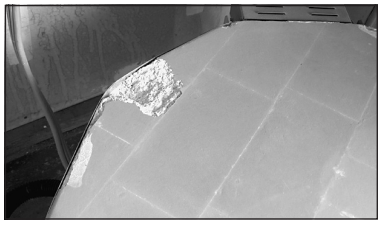
Reduce brick damage by cutting a piece of plywood about 3" - 4" wide shaped to fit over the edge of the kiln when the lid is open. Lean against the plywood instead of directly against the brick rim. The plywood should be curved to the shape of the kiln. The plywood will help distribute weight evenly against several bricks instead of only one.

Be Gentle with the Kiln

During loading and unloading, do not touch the sidewalls of the kiln with anything. Do not allow a shelf to bump into the firebricks. The extra time and care you spend loading and unloading may add years of life to your kiln.

Allow only trusted people to load and unload your kiln. They must be gentle, or your kiln will quickly show wear. Do not let your students touch your school kiln until you have given them a lesson in care of the kiln.

Lower the kiln lid (or close the kiln door) gently. Slamming the lid can crack the bricks the first time it happens.



Be gentle. Slamming the lid can break the firebricks.

Lids with a locking support arm: Fully disengage the arm before lowering the lid. Otherwise you can break the lid near the hinge. Lids with a spring counterbalance: Hold the lid handle and guide the lid until it is fully opened. If you let go of the handle too soon, the lid will slam back, damaging the bricks.

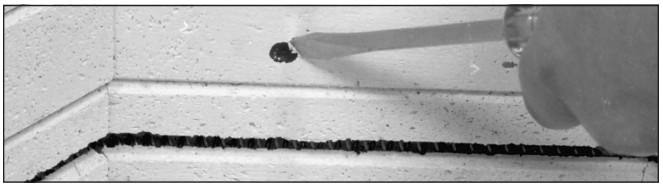
From time to time, check the condition of the lid support or spring system and the lid handle.

Keep the lid closed when you are not using the kiln. This keeps dust out and prevents the lid from dropping while you are away. Do not store anything inside the kiln or on top.

When firing heavy loads in the kiln, place a spare shelf directly onto the kiln floor. The shelf spreads the weight of the load over the entire floor.

Most large kilns are designed to be fired on a kiln stand. It raises the kiln off the floor and helps to dissipate heat under the kiln. The top of the stand should be directly under the kiln walls. A stand that is too small for the kiln will strain the brick bottom.

The kiln stand should be level and rock-steady. An unlevel stand can stress the firebricks. A stand that rocks can cause the kiln to move when jarred, knocking over ware against the sidewalls inside the kiln.



Remove Melted Glaze and Glass from the Bricks

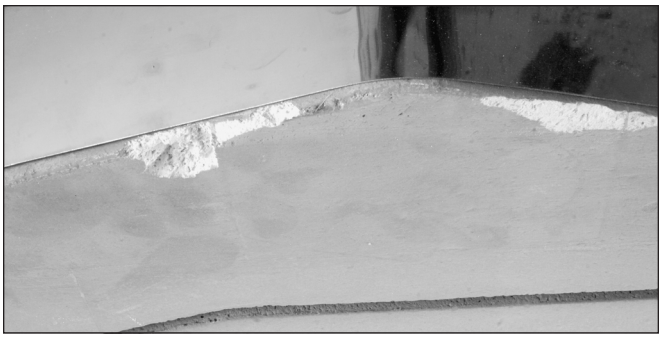
If glaze, glass, or other materials drip onto a kiln wall or the kiln floor, repair before the next firing. Otherwise these materials will remelt and embed deeper into the firebricks. Remove the contaminant by scraping gently with a putty knife. If you remove kiln wash from the kiln floor, apply a fresh coat to the bare spot.

Repair Cement Techniques

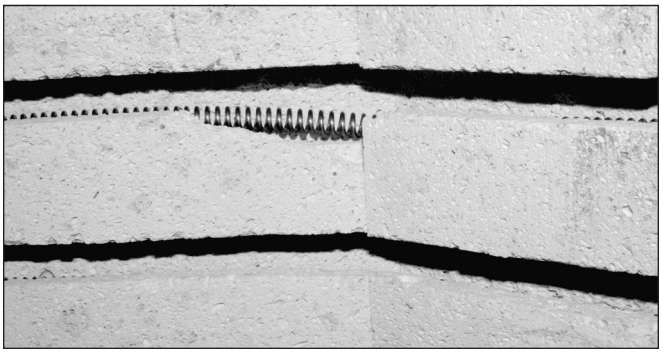
The purpose of the firebricks:

1) Insulate the firing chamber
2) Support the heating elements

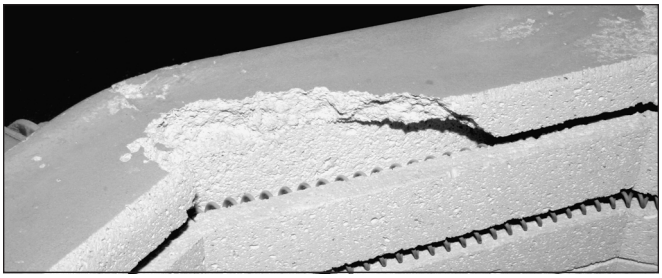
Do not repair damaged bricks as long as they continue to insulate the kiln and to support elements. (An exception: Dust is falling from the brick roof.) Most firebrick damage is cosmetic and does not affect the firing results. Examples of cosmetic damage:



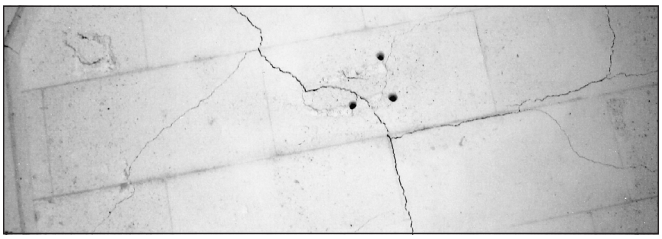
Minor lid damage. Since it is on the edge, dust will not fall into the firing chamber. To repair, sand lightly and coat (see next page). But do not fill.



This is minor damage. It should not be repaired because the element does not bulge outside the groove; the brick still supports the element. Also, the groove does not insulate the kiln. The part of the firebrick that insulates is between the kiln's outer steel case and the elements.



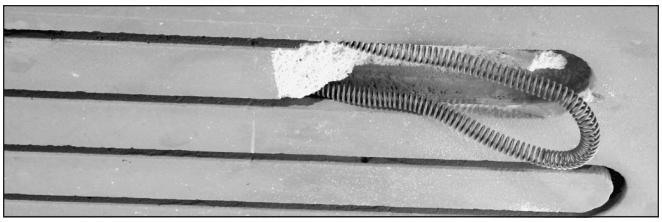
A damaged top brick in a top-loading kiln does not need to be repaired so long as 1 ½" of brick surface remains to form a seal against the lid. The brick still supports the element.



These cracks in the brick floor close tightly during firing.

Some of the reasons to repair firebricks:

- The lid coating is flaking onto the ware.
- Dust is falling onto the ware from lid cracks.
- An element pin in the lid is falling out.
- Glaze or glass has embedded into a wall or floor.



- An element is sagging because of a damaged brick groove.
- You need to plug a vent hole.

Coating the Kiln Lid

On top-loading firebrick kilns, the inside of the lid and top rim of wall bricks can be coated for longer wear. Liquid Kiln Coating is a refractory cement that we have formulated for coating firebrick lids here at the factory. (The door or lid of ceramic fiber kilns and front-loading firebrick kilns do not need the coating.)

The coating hardens and protects the firebrick surfaces. One application lasts through many firings even though the coating will seem to disappear after the first firing.

If you splash the coating onto an element, remove as much of the cement as possible from the element. Do not fire the kiln until the coating is completely dry.

Coating that is applied too thick will flake off the lid after you fire the kiln. If the roof or inner surface of the lid peels, sand the peeled area of the lid and apply kiln coating to the bare spots.

Sand the peeled areas of the lid and reapply the coating.

If you are coating over a freshly patched firebrick surface, allow the cemented patch to dry first.

Liquid Kiln Coating Instructions

1. Shake the container until the liquid coating is thoroughly mixed. Pour some of the coating into a bowl. Stir the coating just before you apply it to the firebricks.

2. Apply the coating with a large, soft sponge such as the type used for wallpaper. Moisten the sponge with water squeezing out the excess.
3. Dip the moistened sponge into the bowl of kiln coating. Wipe the coating over the lid surface. Work quickly, and wipe off the excess. The coating should be thin enough so that you can still see the grains of the bricks underneath.
4. Allow the coating to dry completely before firing the kiln.

Repair Cement Basics

We use Paragon's Liquid Kiln Coating & Repair Cement at the factory to make lids and bottoms. It comes in pint bottles.

1. The thinner the cement seam, the better. Try to make the two firebrick surfaces match as closely as possible for a thin seam.
2. Vacuum all firebrick surfaces that are to be cemented. Remove all traces of dust. (If you do not have a vacuum, you can remove dust with a dry paintbrush or with canned air. Do not breathe the brick dust.)

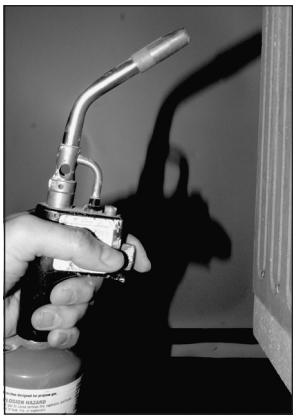
3 Spray a fine mist of water onto both firebrick surfaces before cementing. Mix 1 drop of liquid dishwashing soap to 1 cup of water. The soap reduces surface tension of the water to help it absorb into the bricks. Use a small spray bottle.

Note: Water is unnecessary if you work rapidly. The water on the bricks merely allows you more time to work with the cement.

4 After you have cemented the firebrick pieces and pressed them tightly into position, do not reposition the pieces. Otherwise the bond may not hold. If you move the pieces after the cement has set, you will see hairline cracks in the cement. In this case, remove the repair piece and cement and start over from the beginning.

5 Gently wipe off excess cement from the brick surface. However, do not sand smooth until the cement dries overnight.

Speed-Drying the Cement



Sometimes it is necessary to dry the cement quickly so the patched firebrick piece doesn't fall out of place. This technique allows you to patch difficult areas such as a lid or roof. Speed-drying the cement eliminates the need to hold a prop against the repaired lid while the piece dries.

After you have cemented the brick patch, heat the cement seam with a propane torch. Hold the torch 5 - 6 inches away from the firebrick surface for about 10 seconds. **Move the torch back and forth so the firebrick does not get too hot in one place.** (Otherwise you may heat-shock the wet cement.) Let the patch dry overnight before firing the kiln.

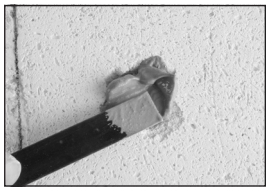
You can purchase a propane torch from a home improvement center. Buy the type that has a push-button igniter. When you press the button, a blue flame appears. When you release the button, the flame goes out.

For kiln maintenance, do not use the older manual propane torches. Turning them on and off is awkward. You first turn a knob to start the flow of propane and then hold a match under the nozzle. The push-button type is much safer and worth the extra expense.

Powdered Firebrick Filler

Do not fill in firebrick gouges or low spots with solid repair cement. When applied as a filler, the cement will break out later from the firebrick due to a difference in thermal expansion between the cement and the brick.

Fill brick gouges with Kaolin Grog mixed with repair cement. (Kaolin Grog, available in 5 lb. bags, is powdered firebrick.) Kaolin Grog filler more closely matches the coefficient of expansion of the firebrick and stays in place. Add just enough cement to hold the Kaolin Grog together.



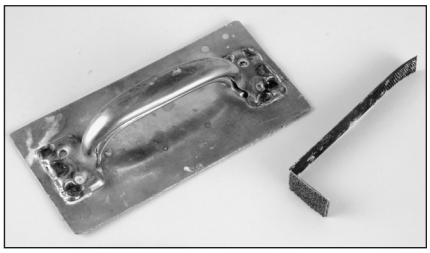
Note: The gouged firebrick floor shown in the photos at right does not need to be repaired. We simply used this as an example. Small gouges in the brick floor do not affect firing results.

Making Firebrick Patches

Patching a broken firebrick is not difficult. It just requires patience and a little practice. Make firebrick patches to repair the lid, walls, and floor of a kiln.

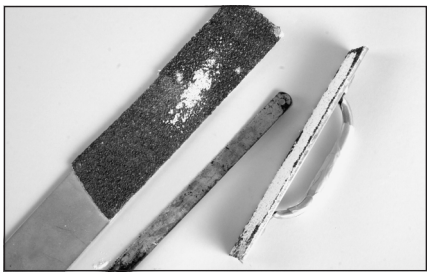
Firebrick Sanding Blocks

Use coarse sandpaper such as 285 grit to make a sanding block. Remove the peel-away backing from self-adhesive sandpaper and stick the sandpaper to the sanding block.



Sanding blocks made with 285 grit self-adhesive sandpaper. The block on the right is made from banding steel.

For sanding small firebrick sections, you may need a sanding block as small as ½" x 1". Banding steel, which is used to reinforce shipping crates, makes a good miniature sanding block. Bend a 6" piece of banding steel 90 degrees at one end. The length of the bend should be whatever size block you need, such as 1". Then cut the sandpaper to the correct size, peel off the sandpaper backing, and press the sandpaper onto the outer bent end of the banding steel.



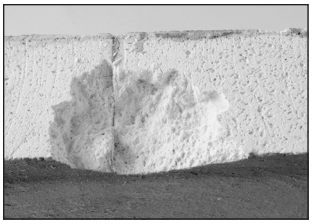
The left sanding block is 1 ¼" wide; the right sanding block is 1" wide. In the center is a hacksaw blade used to cut firebricks.

You can also make sanding blocks from strips of sheet metal, wood, etc.

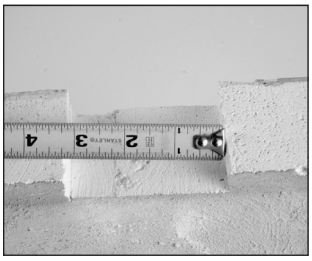
Repairing The Damaged Brick

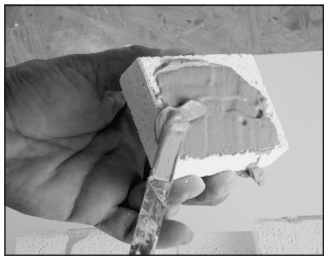
Practice patching firebrick scraps before working on your kiln.

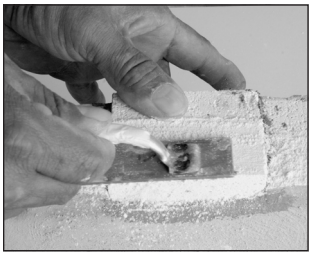
1 With a hacksaw blade, cut an outline around the broken brick section. Cut a small rectangle or square.

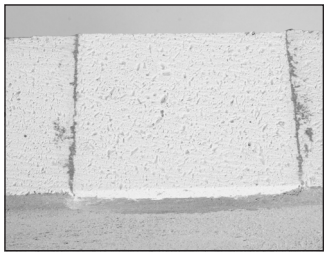


Use this technique to repair wall damage where the lid touches the kiln wall.









2 Use the hacksaw or small sanding block to remove most of the brick within that outline. Then sand the brick to smoothen the bottom of the recess. If the repair section is small, you will need a miniature sanding block.

3 After the recess is smooth, make a firebrick piece to fit into the recess. The piece should be a little smaller in width and depth so that the brick seam is 1/16” or less on all sides. Spend time to make the plug fit precisely. The seam should be only 1/16”. A thicker seam may break later due to the difference in expansion between the firebrick and cement.

4 Use a brush, vacuum cleaner, or canned air to remove the dust. (Wear safety glasses when using canned air.)

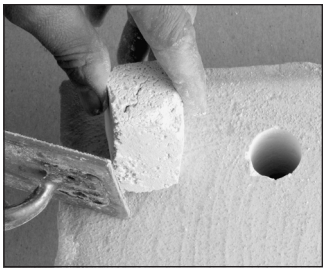
5 Spray a fine mist of water onto all mating brick surfaces.

6 Working rapidly before the water dries out, wipe firebrick repair cement onto mating surfaces.

7 Press the plug tightly into place. Do not move it once the mating surfaces make contact. Hold the brick piece for one minute.

8 Remove excess cement while it is still wet. Allow to dry for 24 hours. Then sand the surface smooth if necessary.

Plugging a Firebrick Hole



You can make a firebrick insert to fill a drilled firebrick hole:

1 Cut a firebrick that is the same length as the width of the kiln wall and slightly larger than the hole you are filling.

2 With a sanding block, round the firebrick piece. It should be 1/16” smaller in diameter than the hole.

3 Coat the plug with repair cement and insert into the hole until the plug is flush. Wipe off excess cement. If necessary, sand after the cement has dried.

Cementing Broken Pieces

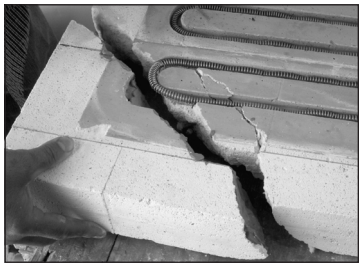
Broken firebrick pieces can be cemented together provided there is enough surface area for the bond.

1 Use a brush, vacuum cleaner, or canned air to remove the dust. (Wear safety glasses when using canned air.)

2 Spray a fine mist of water onto all mating brick surfaces. Mix 1 drop of liquid dishwashing soap to 1 cup of water. The soap reduces surface tension of the water to help it absorb into the bricks.

3 Working rapidly before the water dries out, wipe firebrick repair cement onto mating surfaces.

4 Press the piece tightly into place. Do not move it once the mating surfaces make tight contact. Hold the brick piece for 1 minute.



5 Allow to dry for 24 hours. Then sand smooth if necessary.

Cementing Flat Sections

When cementing firebricks together, make the cement seam as thin as possible—1/32" - 1/16". If the seam is too thick, it will break due to the difference in expansion between the bricks and the cement.

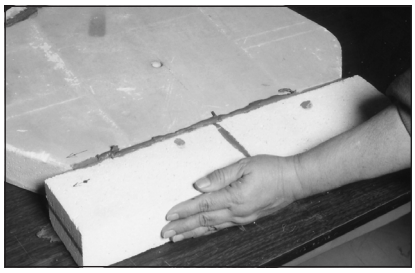
The ideal way to cement bricks together is along flat surfaces, because sliding the surfaces together after applying the cement makes a thin seam.

1 First, the bricks you are cementing should fit as precisely as possible. Rub the surfaces with a sanding block, and then rub them against each other until they slide smoothly. Vacuum all surfaces.

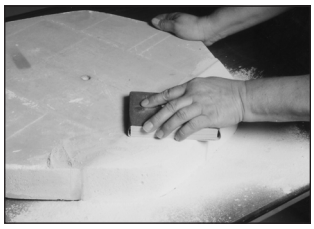
2 Pour the cement into a 12" x 36" galvanized steel or plastic tray.

3 Do not spray or soak the mating brick surfaces in water. That is unnecessary, because by dipping into a tray, you can coat the entire brick surface with cement in several seconds leaving plenty of time to work with the cement. Of the two surfaces you are cementing, dip only one surface into the cement tray. Leave the mating surface dry of cement.

4 After dipping the bricks into the tray, do not wipe off excess cement. Also, do not be concerned with trying to cover the entire brick surface with cement. The cement may cling to the outer edges and not to the inner section of the surface that you have dipped. That's okay.



5 Slide the mating surfaces together. If the cement is mixed with the proper proportion of water, the brick surfaces will slide together smoothly. To achieve a 1/16" - 3/32" seam, slide the surfaces back and forth about 5 times, sliding about 3" before changing the direction. Each time you change directions, the seam will become thinner. In a few seconds, it will be difficult to slide smoothly. The cement has set. Stop moving the pieces.

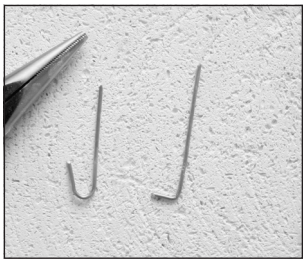


6 Allow the cement to dry. After 24 hours you can lift the brick sections without breakage.

Wall Repairs

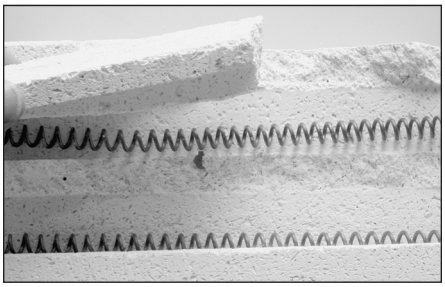
Repairing Firebricks with Element Staples

In some cases, element staples (also called pins) can hold small broken brick sections together:

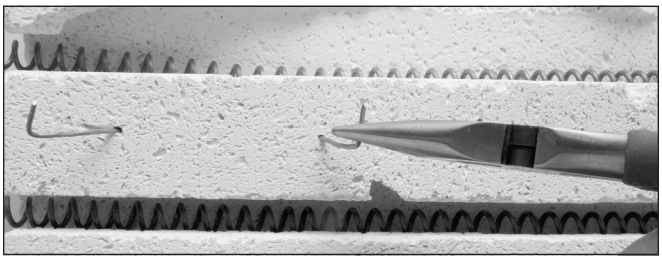


1 Bend a "U" shaped element staple with pliers to form an "L" shape.

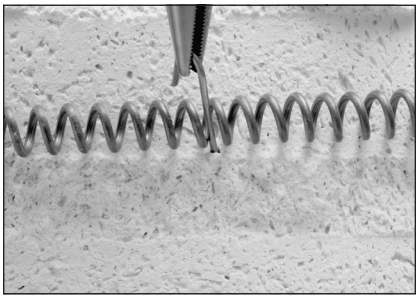
2 Fit the broken brick piece back into the wall where it fell out.



3 Grasp an element staple with pliers, and press the staple at an angle into the broken brick piece. Use two staples tilted away from each other. (Pressing the staples in at an angle holds the broken brick better than pressing the staples straight in.) Press the staples until flush with the surface of the firebrick. Be careful to avoid pressing a staple into an element. The staple should also be short enough so that it does not touch the kiln case on the other side of the brick wall.



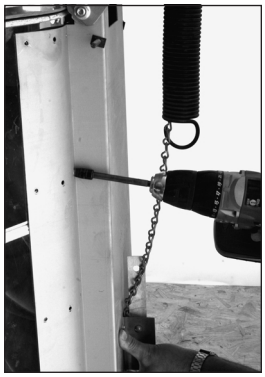
Alternately, you can pin elements in place where a brick groove has broken off. This will prevent elements from touching. Press the element pin over only one element coil.



Replacing Top Firebricks On a Top-Loading Kiln

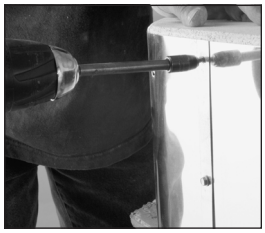
Switch-Operated Models and Non-Sectional Digital Models:

1 Raise the lid. Unhook the bottom of the LiteLid spring. Gently lower the lid.



2 Remove the screws on the LiteLid hinge section that is attached to the back of the kiln. Models without lid spring: Remove the lower hinge from the back of the kiln.

3 Gently lift the lid and LiteLid assembly from the kiln.



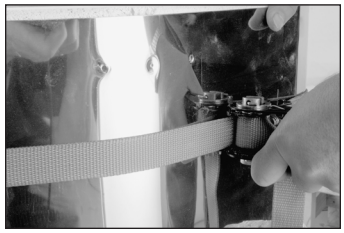
4 Remove the top screws that fasten the stainless steel case together in the back of the kiln. Loosen the bottom screw, but do not remove it.

5 Blank 2" high bricks: Lift out the damaged bricks. Grooved bricks: Heat the element in the damaged bricks with a propane torch until the element is red. Use needle-nose pliers to pull the red-hot element out of the way. Lift out the bricks.

6 Insert replacement bricks. It may be necessary to sand the ends for a good fit. Grooved bricks: Heat the element that is to go into the new bricks with a propane torch until the element is red. Use needle-nose pliers to push the red-hot element into the brick grooves.

7 Line up the screw holes of the case with a kiln case tightener (available from Paragon). Reinstall the screws that you removed in step 4.

Note: Do not over-tighten screws especially if you use a power drill. Set the power drill on slow speed.



8 Reinstall the LiteLid assembly onto the back of the kiln. Attach the bottom of the spring to the LiteLid. Models without lid spring: Reinstall the screws in the lower hinge.

Sectional Digital Models:

Note: See photos, previous section, and "Separating the Sectional Paragon Kiln," publication IM-209.

1 Raise the lid. Unhook the bottom of the LiteLid spring. Gently lower the lid.

2 Lift the lid from the kiln. Loosen the screws in the clamps that hold the top section of stainless steel case together. They are on the side of the kiln.

3 Blank 2" high bricks: Lift out the damaged bricks. Grooved bricks: Heat the element in the damaged bricks with a propane torch until the element is red. Use needle-nose pliers to pull the red-hot element out of the way. Lift out the bricks.

4 Insert replacement bricks. It may be necessary to sand the ends for a good fit. Grooved bricks: Heat the element that is to go into the new bricks with a propane torch until the element is red. Use needle-nose pliers to push the red-hot element into the brick grooves.

5 Insert replacement bricks. It may be necessary to sand the ends for a good fit.

Note: Do not over-tighten screws especially if you use a power drill. Set the power drill on slow speed.

6 Tighten the screws of the case clamps that you loosened in step 2.

Lid Repairs

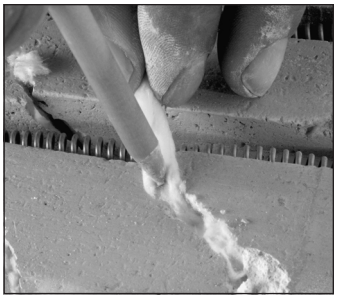
Repairing Lid Cracks

Dust may fall from cracks in the lid. This does not affect ceramic greenware, but dust can ruin glazed ware and glass. Before a glaze or glass firing, vacuum the lid cracks. If dust continues to fall even after vacuuming, load the kiln so that ware on the top shelf is away from the lid cracks.

You can also stuff the cracks with ceramic fiber. The cracks must be at least 1/16" wide. Hairline cracks are too small to accept the ceramic fiber.

1 Roll the ceramic fiber in the hands to form a pencil-like strand.

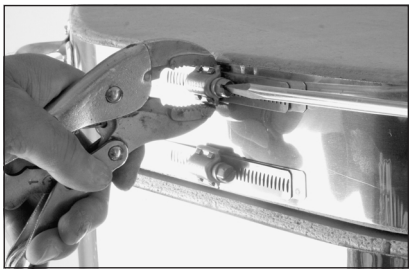
2 Press it into the cracks with a small stick or putty knife being careful not to damage the firebricks further.



Sometimes tightening a loose lid band helps to keep cracks from opening wider:

1 Grasp the clamp with pliers to prevent it from twisting.

2 Tighten the screw to take up the slack in the lid band. Tighten until the screw feels snug. Try not to over tighten.



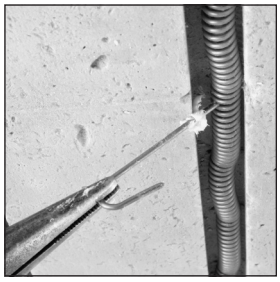
Replacing the Lid/Roof Element Pins of a Glass Kiln

The elements in the lid or roof of most Paragon glass kilns do not need pins. The element coils are wider than the groove opening, so the elements stay in place without pins.

The earlier lid/roof elements were held in place with pins. You can use either kiln repair cement or Pyrolite to secure a pin that becomes loose or falls out. (Pyrolite is a refractory joint adhesive. It comes in a 10.3-ounce plastic tube that fits into a caulking gun applicator.)

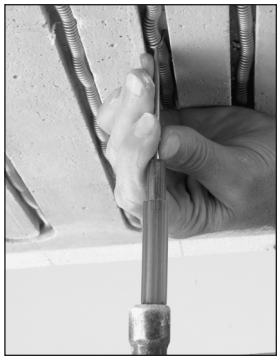
1 Unplug the kiln.

2 Dip the element pin into kiln repair cement or Pyrolite. You will need only a small amount on the prongs of the pin.



3 Insert the pin into the firebrick lid or roof at a sharp angle. (If you insert the pin so that it is vertical when the lid is closed, the pin may eventually work its way out of the groove again.) Cover only one element coil with the pin.

Caution: Make sure the tip of a pin does not touch another pin inside the firebrick lid or roof.



4 Optional: Use a screwdriver to gently tap the pin further into the lid.

5 Important: Let the cement or Pyrolite dry completely before firing the kiln.

Securing a Lid/Roof Element with Pyrolite

Pyrolite is a refractory joint and patch compound. It comes in a 10.3-ounce plastic tube that fits into a caulking gun applicator.

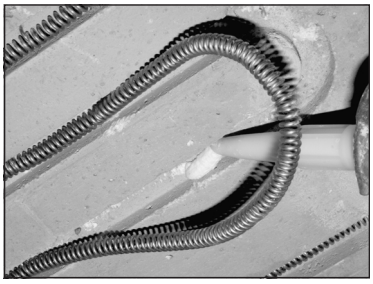
Note: You can gently move a cold nickel-chrome element, which is the type that Paragon uses in lid/roof glass kiln grooves. But you should not move a cold iron-chrome-aluminum element, which becomes brittle after it has been fired. To find out which type of element you have, touch the element with a magnet. The iron-chrome-aluminum element attracts the magnet; the nickel-chrome element does not.)

1 Unplug the kiln.

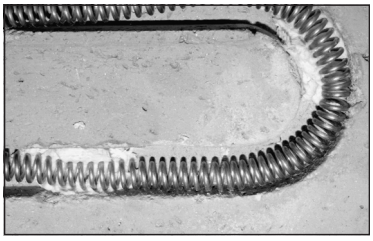
2 While the element is cold, gently pull the sagging element section from the groove so that the element is positioned just out of the groove.

3 Vacuum the groove. Remove loose debris so that the Pyrolite can stick to the firebrick.

4 Squeeze a bead of Pyrolite into the groove.



5 Press the element into the groove. It is okay for the element to partially embed into the Pyrolite. But the side of the element that is toward the firing chamber should not be covered with Pyrolite. Completely embedding the element in Pyrolite could cause the element overheat.



6 Allow the Pyrolite to dry completely before firing the kiln.

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