The Kiln:

Care and Use Instructions

The Clay Warehouse

Contents

Table of Figures

List of Tables

1.0 Introduction

Welcome to the “The Kiln: Care and Use Instructions” manual for The Clay Warehouse. This manual outlines The Clay Warehouse’s firing processes, kiln tools, and best practices for loading and unloading the kiln. It also provides instruction on how to respond to safety incidents. Your understanding of the procedures in this manual supports a safe and efficient environment for kiln operations.

2.0 Kilns

The Clay Warehouse runs two kilns. Both kilns can be used for any type of firing. The kilns can run at the same time.

The two kilns operated at The Clay Warehouse are:

- Shrek (KM122PK)
- Fiona (KM1027)

3.0 Types of Firings

There are two daily firings—bisque, and glaze. The Clay Warehouse supports two additional firings, lustre and special. These firings happen on an as-needed basis.

3.1 Bisque

Bisque firing is typically the first of two firings. Bisque firing removes the molecular water particles and transforms the raw clay into ceramic. Bisque firing is necessary before applying glazes in our kilns. If pieces are wet, bisque firings require a preheat.

3.2 Glaze

Glaze is what gives pottery its glossy, waterproof quality. A glaze firing comes after the bisque firing. Glaze firing does not require a preheat because pieces are not wet enough to cause an explosion.

3.3 Lustre

Lustre firing is a low-fire firing. Its purpose is to burn off suspending agents that hold the metals in an overglaze. When the firing is done, the pieces have fired on metal adornments.

3.4 Special

Special firings are done at the request of customers. For example, a low-fire glaze firing. Special firings must be booked ahead of time and must be approved by either Scott or Courtney.

4.0 Greenware and Glazeware

On the firing shelves, you'll find pieces at two different stages of the firing process: greenware and glazeware. The shelves are labelled "To Be Bisque Fired" (for greenware) and "To Be Glaze Fired" (for glazeware).

While the shelves are mostly well organized, you may find a piece on the wrong shelf, so it's important to be able to tell the difference between greenware and glazeware. "Table 1" outlines differences between greenware and glazeware.

Table 1: Differences between greenware and glazeware.

Considerations	Greenware	Glazeware
Form	• Raw clay form	• Gone through a chemical change to become ceramic • Can no longer be returned to raw clay form
Firing Stage	• Has not gone through bisque firing	• Has gone through bisque firing • Waiting for glaze firing
Condition	• May be wet • Delicate • Usually muted in colour • No powdery texture • When you flick it, it sounds hollow	• Dry • More durable • Powdery texture • When you flick it, it gives off a high-pitched sound
Loading	• Pieces can touch other pieces • Pieces do not stick together	• Pieces must not touch • Pieces do stick together

5.0 Kiln Parts and Tools

To plan a load, come familiar with the kiln parts and the supporting tools. Understanding both will ensure successful firings.

5.1 Important Kiln Parts

There are four kiln parts you need to be aware of for each load:

- Heating elements
- Thermocoupler
- Controller Touch Pad
- Fire Brick

5.1.1 Heating Elements

Heating elements are electrical coils that circle the inside of the kiln. Heating elements generate heat inside the kiln. During firings, shelves and pieces should not touch the heating elements.

5.1.2 Thermocoupler

The thermocoupler protrudes into the kiln approximately 1 inch and reads the heat in the kiln. To ensure exact reading during firings, shelves and pieces should not touch the thermocoupler. When loading and unloading the kiln, be mindful not to hit the thermocoupler.

5.1.3 Controller Touch Pad

The controller touch pad is used to program the kiln for firings. The controller touch pad allows you to set precise temperature control during firings.

5.1.4 Fire Brick

Fire brick lines the kiln inside and is specially designed to withstand high temperatures. Fire brick can be damaged due to its soft nature, so be careful when loading pieces and shelves into the kiln.

5.2 Supporting Kiln Tools

Supporting tools will help with safety and organization when loading the kiln. With practice you'll learn when to use which tool. Most tools are found on the shelves behind the kilns.

5.2.1 Kiln Shelves

Kiln shelves are used to layer the pieces in the kiln. The shelves are supported by four kiln posts (discussed in the **Other Tools** section) organized between the pieces.

There are two types of shelves, Advancer shelves and Cordierite shelves. They come in half kiln and full kiln sizes. "Table 2" shows the differences between the two types of shelves and what to consider for each when loading and storing them.

Table 2: Differences between Advancer and Cordierite shelves.

Considerations	Advancer	Cordierite
Qualities	• Are thin and light weight • Can conduct electricity	• Are thick and heavy • Cannot conduct electricity • Requires kiln wash, so glaze does not stick
Loading	• Make sure shelves do not touch elements • Make sure elements are not sagging • Ensure loads are well-supported by posts	• Won't conduct electricity • Make sure shelves do not touch elements • Make sure elements are not sagging • Ensure loads are well supported by posts
Storage	• Store in dry space (absorbed moisture may result in steam explosion inside the kiln) • Store upright on edges	• Store in dry space • Store upright on edges • Kiln washed shelves should be touching to avoid chipping

5.2.2 Old Cordierite Shelves

The Clay Warehouse has several *old* Cordierite shelves. They are stored with the Advancer shelves and the new Cordierite shelves. Because the old Cordierite shelves should be used with caution, it's important to be able to identify them.

NOTE

Use the old Cordierite shelves only when you have no other choice.

To differentiate the old Cordierite shelves from the new Cordierite shelves:

- Observe the kiln wash—if it's flaking off, it's an old shelf
- Observe the shape by holding the edge of the shelf to eye level—if you see the centre dipping, it's an old shelf

Because there's a lack of kiln wash on the old Cordierite shelves, pieces can stick to the glaze drips which can break the piece or pluck a portion off the kiln shelf. The dip in the centre puts the shelf at a higher risk of breaking in the kiln.

5.2.3 Other Tools

Supporting kiln tools (shown in "Table 3") help with safety and planning loads.

Table 3: Tools used with the kiln.

Tool	Description	Use
Posts	• Are rectangular posts that vary in height	• To support kiln shelves • Stack 1 or ½ inch spacers on the posts for height increases
Cookies	• Are coaster-shaped stones	• To prevent a glazed piece from melting onto the kiln shelf
Stilts	• Are small platforms with wires sticking upwards	• To place small, glazed pieces onto wires, so the pieces don't stick to the kiln shelf
Plate Crank	• Are portable shelves for stacking plates	• To optimize height space when plates are being fired • Do stack plates in bisque firings • Do not stack plates in glaze firings
Bead Bar	• Are metal bars	• To hang small, glazed pieces, so pieces don't stick to shelf
Safety Gloves	• Are standard safety gloves to protect your hands from heat and sharp objects	• To wear when handling anything hot • To wear when cleaning glaze drips
Witness Cones	• Are small cones with a number associated with the temperature to be fired at	• To measures heat in special firings
Peepholes	• Are small ceramic hands and ceramic spheres with holes	• To allow control over oxygen flow in the kiln • Remove or insert, depending on oxygen flow needed for firing
Glaze Eraser	• Is a hollow stone rectangle	• To scrape glaze drips off advancer shelves
Brick Grinder	• Is a small brick with a handle	• To clean glaze drips off cordierite shelves
Brick	• Are stone brick	• To prop open the kiln for faster cooling

6.0 Loading the Kiln

Loading a kiln must be done carefully and requires planning before you begin. In this section, you'll learn how to plan your kiln load.

NOTE

In case of injuries, a first aid kit is stored at the front desk.

Contact Scott or Courtney to report injuries.

6.1 Planning

Planning a load requires understanding of air flow and where the hottest and coolest areas are inside the kiln. You also need to plan for piece sizes and the type of firing you're loading for.

All kiln firings require consideration of:

- Firing speed and heating rates
- Cone type
- Placements:
    - Pieces
    - Posts
    - Shelves

6.2 Understanding Heat and Air Flow

When loading a kiln, you need to arrange the pieces to be fired for the best flow of heat and air, according to the piece sizes in the load. When viewing the kiln from the top, the hottest area is the outer edges near the elements and the coolest area is the middle. When viewing the kiln from the side, the hottest area is the middle, and the coolest areas are the top and the bottom layers. See "Figure 1" and "Figure 2" for visuals of the hottest and coolest areas in the kiln.

Allow air to flow through the pieces and between the shelves. Ensure enough coils are exposed to the top and bottom layers (because they are the coolest areas).

Find more on loading pieces in section "7.0 Loading a Bisque Firing" on page 9 and section "9.0 Loading a Glaze Firing" on page 12.

Figure 1: View of the kiln from the top showing hottest and coolest areas.

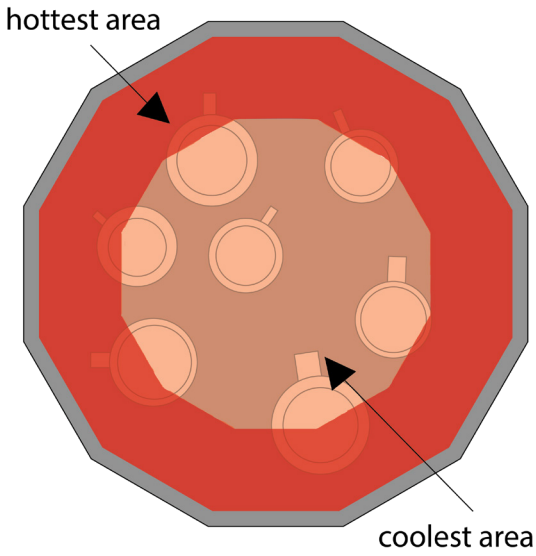
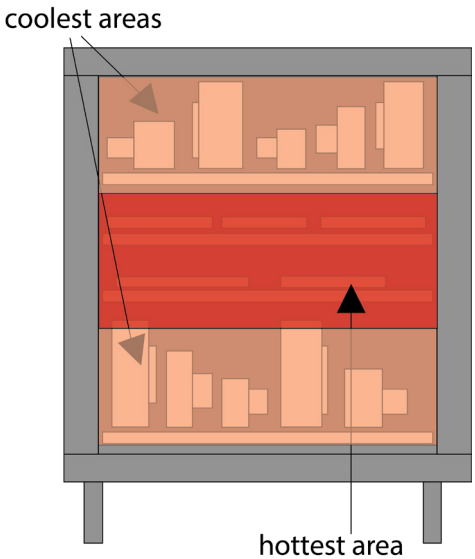


Figure 2: View of the kiln from the side showing hottest and coolest areas.



6.3 Using Cones

Cone: refers to a specific temperature in the kiln.

Example: cone 6 = 2232°F

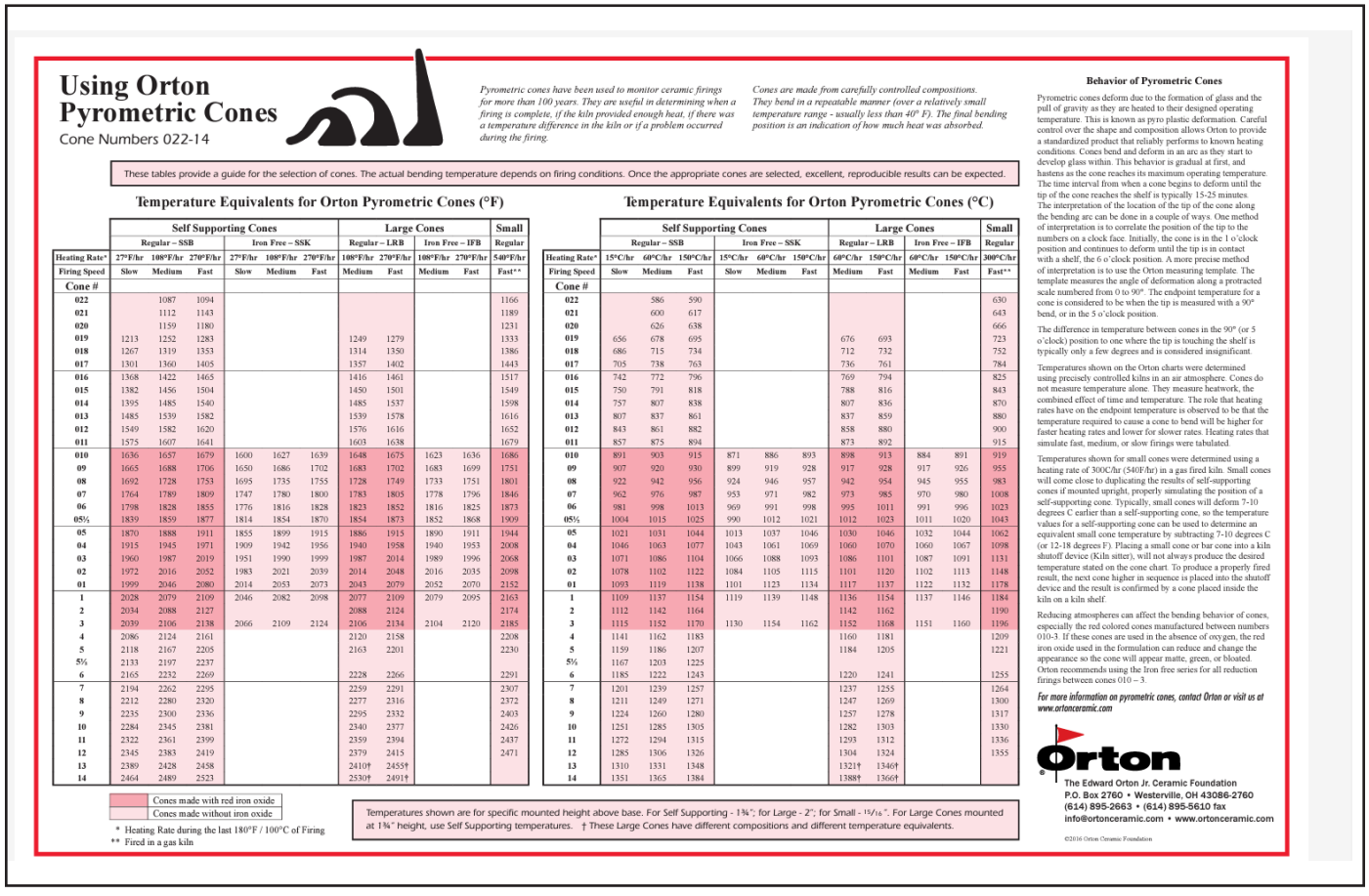
Witness cone: small cone that's placed in the kiln to test the temperature.

Cones measure the heat in the kiln, like the thermal coupler. There are different cones for different temperatures. "Figure 3" shows which temperature each cone references. The chart shows the melting effect on witness cones during firing. You can see the chart on the wall behind the kilns.

A very melted witness cone means the kiln reached the cone before the desired temperature. A moderately melted witness cone means the kiln reached the desired temperature. An un-melted witness cone means the kiln did not reach or exceed the desired temperature.

Witness cones are used to test the kiln if a firing does not go as expected. Regular firings typically do not require witness cones.

Figure 3: Using Pyrometric Cones chart.



Using Orton Pyrometric Cones

Cone Numbers 022-14

Pyrometric cones have been used to monitor ceramic firings for more than 100 years. They are useful in determining when a firing is complete, if the kiln provided enough heat, if there was a temperature difference in the kiln or if a problem occurred during the firing.

Cones are made from carefully controlled compositions. They bend in a repeatable manner (over a relatively small temperature range - usually less than 40° F). The final bending position is an indication of how much heat was absorbed.

These tables provide a guide for the selection of cones. The actual bending temperature depends on firing conditions. Once the appropriate cones are selected, excellent, reproducible results can be expected.

Temperature Equivalents for Orton Pyrometric Cones (°F)

	Self Supporting Cones						Large Cones				Small
	Regular – SSB			Iron Free – SSK			Regular – LRB		Iron Free – IFB		Regular
Heating Rate*	27°F/hr	108°F/hr	270°F/hr	27°F/hr	108°F/hr	270°F/hr	108°F/hr	270°F/hr	108°F/hr	270°F/hr	540°F/hr
Firing Speed	Slow	Medium	Fast	Slow	Medium	Fast	Medium	Fast	Medium	Fast	Fast**
Cone #											
022		1087	1094								1166
021		1112	1143								1189
020		1159	1180								1231
019	1213	1252	1283				1249	1279			1333
018	1267	1319	1353				1314	1350			1386
017	1301	1360	1405				1357	1402			1443
016	1368	1422	1465				1416	1461			1517
015	1382	1456	1504				1450	1501			1549
014	1395	1485	1540				1485	1537			1598
013	1485	1539	1582				1539	1578			1616
012	1549	1582	1620				1576	1616			1652
011	1575	1607	1641				1603	1638			1679
010	1636	1657	1679	1600	1627	1639	1648	1675	1623	1636	1686
09	1665	1688	1706	1650	1686	1702	1683	1702	1683	1699	1751
08	1692	1728	1753	1695	1735	1755	1728	1749	1733	1751	1801
07	1764	1789	1809	1747	1780	1800	1783	1805	1778	1796	1846
06	1798	1828	1855	1776	1816	1828	1823	1852	1816	1825	1873
05½	1839	1859	1877	1814	1854	1870	1854	1873	1852	1868	1909
05	1870	1888	1911	1855	1899	1915	1886	1915	1890	1911	1944
04	1915	1945	1971	1909	1942	1956	1940	1958	1940	1953	2008
03	1960	1987	2019	1951	1990	1999	1987	2014	1989	1996	2068
02	1972	2016	2052	1983	2021	2039	2014	2048	2016	2035	2098
01	1999	2046	2080	2014	2053	2073	2043	2079	2052	2070	2152
1	2028	2079	2109	2046	2082	2098	2077	2109	2079	2095	2163
2	2034	2088	2127				2088	2124			2174
3	2039	2106	2138	2066	2109	2124	2106	2134	2104	2120	2185
4	2086	2124	2161				2120	2158			2208
5	2118	2167	2205				2163	2201			2230
5½	2133	2197	2237								
6	2165	2232	2269				2228	2266			2291
7	2194	2262	2295				2259	2291			2307
8	2212	2280	2320				2277	2316			2372
9	2235	2300	2336				2295	2332			2403
10	2284	2345	2381				2340	2377			2426
11	2322	2361	2399				2359	2394			2437
12	2345	2383	2419				2379	2415			2471
13	2389	2428	2458				2410†	2455†			
14	2464	2489	2523				2530†	2491†			

Temperature Equivalents for Orton Pyrometric Cones (°C)

	Self Supporting Cones						Large Cones				Small
	Regular – SSB			Iron Free – SSK			Regular – LRB		Iron Free – IFB		Regular
Heating Rate*	15°C/hr	60°C/hr	150°C/hr	15°C/hr	60°C/hr	150°C/hr	60°C/hr	150°C/hr	60°C/hr	150°C/hr	300°C/hr
Firing Speed	Slow	Medium	Fast	Slow	Medium	Fast	Medium	Fast	Medium	Fast	Fast**
Cone #											
022		586	590								630
021		600	617								643
020		626	638								666
019	656	678	695				676	693			723
018	686	715	734				712	732			752
017	705	738	763				736	761			784
016	742	772	796				769	794			825
015	750	791	818				788	816			843
014	757	807	838				807	836			870
013	807	837	861				837	859			880
012	843	861	882				858	880			900
011	857	875	894				873	892			915
010	891	903	915	871	886	893	898	913	884	891	919
09	907	920	930	899	919	928	917	928	917	926	955
08	922	942	956	924	946	957	942	954	945	955	983
07	962	976	987	953	971	982	973	985	970	980	1008
06	981	998	1013	969	991	998	995	1011	991	996	1023
05½	1004	1015	1025	990	1012	1021	1012	1023	1011	1020	1043
05	1021	1031	1044	1013	1037	1046	1030	1046	1032	1044	1062
04	1046	1063	1077	1043	1061	1069	1060	1070	1060	1067	1098
03	1071	1086	1104	1066	1088	1093	1086	1101	1087	1091	1131
02	1078	1102	1122	1084	1105	1115	1101	1120	1102	1113	1148
01	1093	1119	1138	1101	1123	1134	1117	1137	1122	1132	1178
1	1109	1137	1154	1119	1139	1148	1136	1154	1137	1146	1184
2	1112	1142	1164				1142	1162			1190
3	1115	1152	1170	1130	1154	1162	1152	1168	1151	1160	1196
4	1141	1162	1183				1160	1181			1209
5	1159	1186	1207				1184	1205			1221
5½	1167	1203	1225								
6	1185	1222	1243				1220	1241			1255
7	1201	1239	1257				1237	1255			1264
8	1211	1249	1271				1247	1269			1300
9	1224	1260	1280				1257	1278			1317
10	1251	1285	1305				1282	1303			1330
11	1272	1294	1315				1293	1312			1336
12	1285	1306	1326				1304	1324			1355
13	1310	1331	1348				1321†	1346†			
14	1351	1365	1384				1388†	1366†			

Cones made with red iron oxide

Cones made without iron oxide

* Heating Rate during the last 180°F / 100°C of Firing

** Fired in a gas kiln

Temperatures shown are for specific mounted height above base. For Self Supporting - 1¾"; for Large - 2"; for Small - 15/16". For Large Cones mounted at 1¾" height, use Self Supporting temperatures. † These Large Cones have different compositions and different temperature equivalents.

Behavior of Pyrometric Cones

Pyrometric cones deform due to the formation of glass and the pull of gravity as they are heated to their designed operating temperature. This is known as pyro plastic deformation. Careful control over the shape and composition allows Orton to provide a standardized product that reliably performs to known heating conditions. Cones bend and deform in an arc as they start to develop glass within. This behavior is gradual at first, and hastens as the cone reaches its maximum operating temperature. The time interval from when a cone begins to deform until the tip of the cone reaches the shelf is typically 15-25 minutes. The interpretation of the location of the tip of the cone along the bending arc can be done in a couple of ways. One method of interpretation is to correlate the position of the tip to the numbers on a clock face. Initially, the cone is in the 1 o'clock position and continues to deform until the tip is in contact with a shelf, the 6 o'clock position. A more precise method of interpretation is to use the Orton measuring template. The template measures the angle of deformation along a protracted scale numbered from 0 to 90°. The endpoint temperature for a cone is considered to be when the tip is measured with a 90° bend, or in the 5 o'clock position.

The difference in temperature between cones in the 90° (or 5 o'clock) position to one where the tip is touching the shelf is typically only a few degrees and is considered insignificant.

Temperatures shown on the Orton charts were determined using precisely controlled kilns in an air atmosphere. Cones do not measure temperature alone. They measure heatwork, the combined effect of time and temperature. The role that heating rates have on the endpoint temperature is observed to be that the temperature required to cause a cone to bend will be higher for faster heating rates and lower for slower rates. Heating rates that simulate fast, medium, or slow firings were tabulated.

Temperatures shown for small cones were determined using a heating rate of 300C/hr (540F/hr) in a gas fired kiln. Small cones will come close to duplicating the results of self-supporting cones if mounted upright, properly simulating the position of a self-supporting cone. Typically, small cones will deform 7-10 degrees C earlier than a self-supporting cone, so the temperature values for a self-supporting cone can be used to determine an equivalent small cone temperature by subtracting 7-10 degrees C (or 12-18 degrees F). Placing a small cone or bar cone into a kiln shutoff device (Kiln sitter), will not always produce the desired temperature stated on the cone chart. To produce a properly fired result, the next cone higher in sequence is placed into the shutoff device and the result is confirmed by a cone placed inside the kiln on a kiln shelf.

Reducing atmospheres can affect the bending behavior of cones, especially the red colored cones manufactured between cones 010-3. If these cones are used in the absence of oxygen, the red iron oxide used in the formulation can reduce and change the appearance so the cone will appear matte, green, or bloated. Orton recommends using the Iron free series for all reduction firings between cones 010 – 3.

For more information on pyrometric cones, contact Orton or visit us at www.ortonceramic.com

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Source: © 2016 Orton Ceramic Foundation, http://www.ortonceramic.com/pyrometric-cones.

6.4 Organizing Pieces

To plan your load, understand the pieces that need to be fired. Before you begin your load, follow these steps:

1. Look at the firing shelf to gain a sense of what's there.
2. Refer to the shelf labels to confirm whether the pieces are for a bisque firing or glaze firing
3. Consider:
    - Which type of firing are you loading?
    - Which pieces are the biggest in width and height? Plan for similar heights on the same kiln shelf.
    - How can you ensure all pieces get enough heat? Plan for the highest pieces at the bottom and at the top.
    - Are there plates? Plan for flatter pieces to go in the middle.

Remember, when considering the vertical layers of kiln shelves, the centre of the kiln is the hottest. Plan for flatter pieces in the middle because fewer elements are needed to heat them. Plan for taller pieces at the bottom and top, so you can expose more elements and increase oxygen flow.

NOTE

Sometimes customers put items on the wrong shelf, so it's up to you to identify that. When in doubt, ask a colleague.

6.5 Using Posts

Posts are placed on top of the shelves between pieces to hold the shelf above. This creates layers of pieces.

To plan for kiln posts:

1. Find four posts that are higher than the tallest piece on the shelf
2. Leave room between the pieces to be fired for four posts to be placed on each shelf (except for the top shelf)

"Figure 4" shows four kiln posts arranged between pieces on a shelf. Notice the posts are not touching the edges of the kiln or the pieces.

NOTE

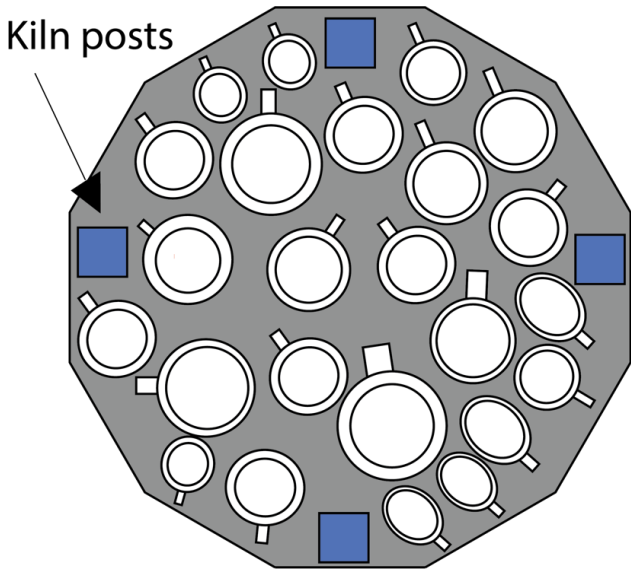
Use a ruler to ensure posts are higher than the pieces on the shelf. Place the ruler horizontally on top of the post. Keeping the ruler flush on the post, slide it left and right to see if it hits anything.

To place kiln posts:

1. Ensure posts are in the same place on each shelf layer for stability.
2. Make sure enough elements are exposed in each layer–more elements should be exposed in the top and bottom layers to ensure pieces are exposed to enough heat.
3. If you need more height, use spacers (1 and ½ inch options are on the shelf).

If the spacer is not high enough, you'll need to go up another post size.

Figure 4: Kiln posts between pieces



6.6 Using Shelves

Shelves are placed on top of posts to create layers of pieces for firing.

To plan for kiln shelves:

- Leave enough space for the thermal coupler.
- Ensure shelves are stable.
- Ensure shelves do not touch heating elements.
- When firing plates, ensure shelves are flat. There should be no 'step' where shelves meet in the middle. The 'step' risks breaking plates.

7.0 Loading a Bisque Firing

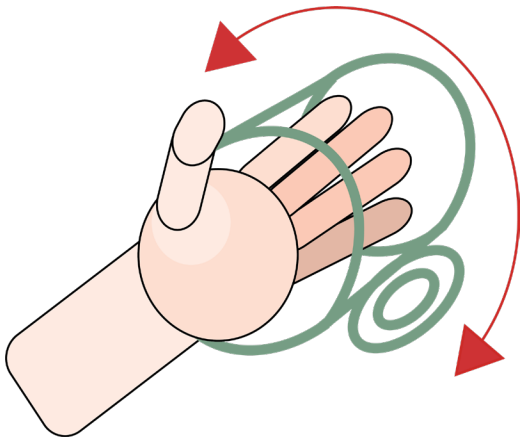
Look at the greenware on the "To Be Bisque Fired" shelves. Gain a sense of the sizes of pieces. Refer to the steps in section, "6.0 Loading the Kiln" on page 6, for best practices.

7.1 Handling Greenware

CAUTION

You will break greenware if you pick it up by the handle!

Figure 5: Four fingers used to distribute weight when handling greenware.



Greenware can break easily and must be handled with care. Pick up one piece at a time and be mindful of how you're holding it. Pick pieces up so the weight is distributed evenly across your fingers or hand.

To distribute weight when handling mugs, insert four fingers across a large surface area, as shown in "Figure 5".

Even when you are being as careful as possible, accidents can happen. If a piece of greenware breaks:

- Do not load into the kiln.
- Leave the broken piece on the shelf, so the customer can see it.

Broken greenware will be recycled.

7.2 Assessing Wetness and Thickness

CAUTION

A piece that is too wet can explode in the kiln.

During the planning phase for a bisque firing, consider the wetness and thickness of the pieces to be fired. Load pieces with similar wetness into one kiln, because the preheat time depends on the wetness level.

To figure out the wetness level of greenware, touch the piece to a sensitive spot on your body, such as your forearm. If the piece adjusts to the temperature of your body, it's dry. If the piece stays cold, it's wet.

Consider the thickness of greenware. A thicker piece stays wet longer. The top of a piece may be thinner than the bottom, creating some wet and some dry areas. If the piece allows, flip it over, so the wet bottom gets more air flow and dries more quickly.

When in doubt about wetness level, put on a preheat. A preheat is safe to do whether the pieces are wet or dry. Use the guide in "Table 4" to set the preheat time.

Table 4: Guide for preheat time by wetness level.

Wetness Level	Preheat Time (hours)
Slightly wet	2
Medium wet	6-8
Very wet	10-12

Deciding wetness levels by touch comes with practice. Don't be afraid to leave a piece for the next load**.** You have up to a week to make sure everything fits.

7.3 Placing Pieces

When placing pieces for a bisque firing:

- Group pieces of similar heights
- Focus on maximizing the load
- Allow pieces to touch each other, allowing for stacking or leaning
- Ensure nothing will fall over
- Keep pieces away from the elements

When getting close to top of kiln, use a ruler to measure how much space you have between top shelf and top of kiln. This saves you carrying fragile greenware over to the kiln to test the height.

When you're finished loading the pieces, take a final look at the "To Be Bisque Fired" shelf. Is there anything else of the same wetness level that can be loaded into the kiln?

7.4 Optimizing Space in a Bisque Firing

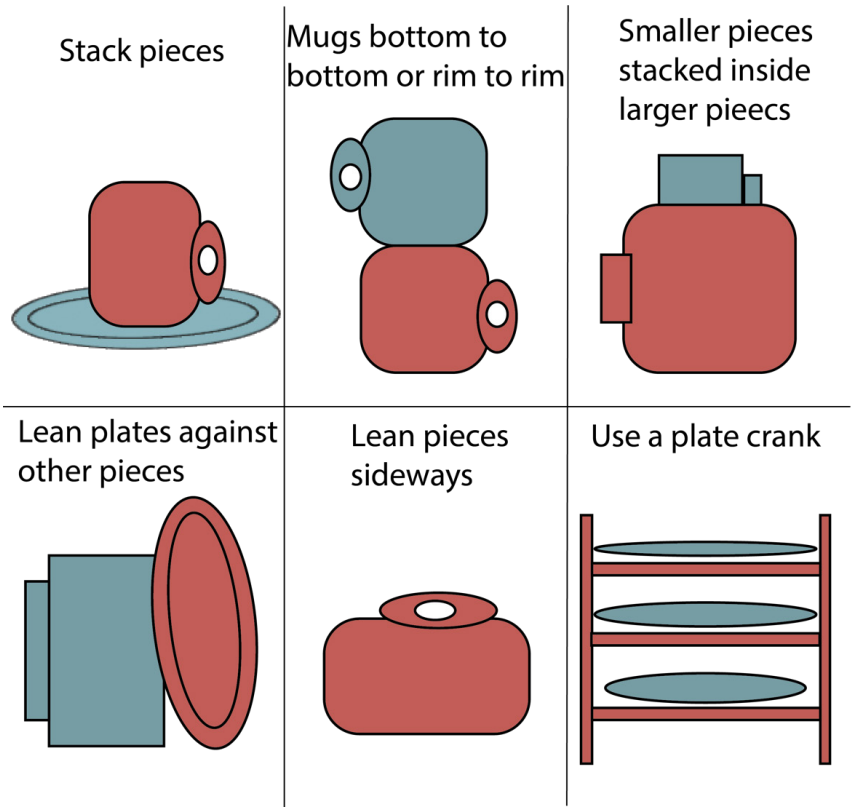
Loading any kiln must be done carefully. Because items can touch in a bisque firing, you can get creative with how you use the space.

You can:

- Stack items
- Experiment with mugs bottom to bottom and rim to rim
- Put small pieces inside bigger pieces
- Lean a plate against other pieces, so it's vertical
- Rest a piece sideways to save height space
- Consider using a plate crank

See "Figure 6" for stacking examples. Be careful and make sure stacks are sturdy.

Figure 6: Tips for stacking pieces in a bisque firing.



8.0 Setting a Bisque Firing

NOTE

If there's an open space, don't be afraid to rework what's already there to use the space better.

When the kiln is loaded, you can prepare to set the kiln for firing:

1. Close the lid
2. Clip the lid closed
3. Ensure all peepholes are inserted

Use the controller touch pad to set the kiln. The screen will display a number for how long it fired on the most recent firing and "CPLT" (complete).

To set the kiln for a bisque firing:

1. Press **Stop**
2. Select Cone Fire
3. If necessary, set preheat (refer to "Table 4" for a guide on preheat time by wetness level)
4. Screen will display cone level
    a. Select **Cone 06**
    b. Select **Enter**
5. For "Speed", select slow or medium
6. Press **Enter**
7. Select **Enter** to bypass "Hold"
8. Press **Start**

Slow speed: good for bisque firing

Medium speed: good for firings with a long preheat

A bisque firing does not need to sit at a peak temperature. It can reach peak and then turn off, so no "Hold" is needed. How to set a "Hold" will be covered in the Setting a Glaze Firing on page 18.

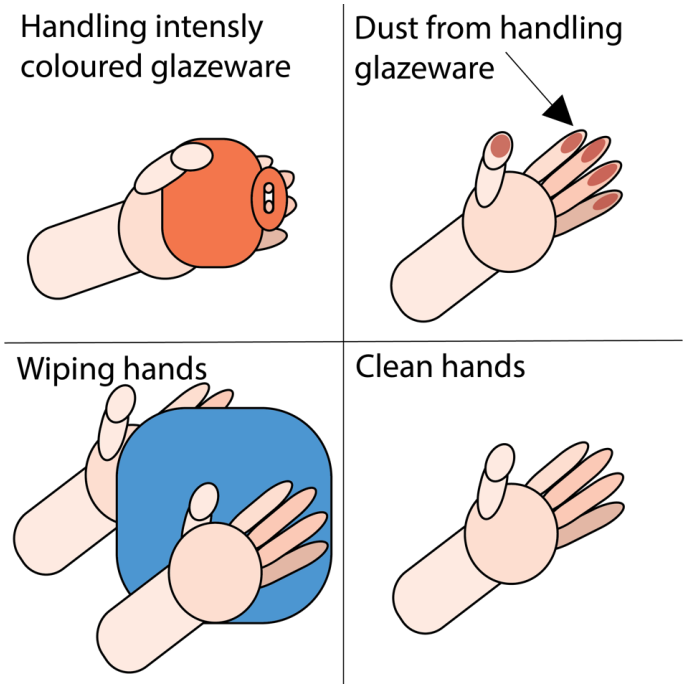
Pre-heat can happen during the day because there are no fumes, so you can start the kiln right away.

9.0 Loading a Glaze Firing

Look at the glazeware on the "To Be Glaze Fired" shelves. Gain a sense of the sizes of pieces to load. Consider which pieces are the highest and widest.

Refer to "6.0 Loading the Kiln" on page 6 for more strategies for spacing pieces for the best flow of air and heat.

Figure 7: Wiping dust off hands between glazeware handlings.



9.1 Handling Glazeware

Before glazeware is fired, the glaze creates a dusty coating. This coating can transfer to your fingers and from there, onto other pieces. Be aware of dust transfer when handling glazeware. Use caution, especially when you have handled a piece that is an intense colour followed by a piece that is a light colour.

Wipe your hands between handlings to avoid dust transfer, as shown in "Figure 7".

9.2 Assessing Glaze

Be aware of where the glazed areas of the pieces are and ensure those areas do not touch anything. When the kiln is fired, glazed pieces permanently stick to each other if touching. They will also stick to the kiln shelf or the sides of the kiln.

When arranging items, you may be tempted to flip a mug upside down to use space better. Be mindful that if there is glaze on the mug rim, it will fuse to the bottom of the kiln.

If you notice dust transfer on any of the items, use your hand to brush it off. While a bit of dust transfer likely won't be permanent after a firing, keep in mind that customers invest a lot of time in their work. We want to ensure the best experience possible!

NOTE

To test whether there is glaze on a piece, gently scratch a hidden area. If dust comes off, the piece is glazed.

NOTE

Flip the bottom of each item over to make sure it's clean. If it's not clean, the piece is at risk of sticking to the shelf.

9.3 Placing Pieces

When placing pieces in the kiln, remember to leave space for the four kiln posts.

When planning piece placement for a glaze firing:

- Group pieces with similar heights.
- Arrange items as close as possible without touching.
- Point handles to the outside to maximize space.
- Be mindful of dust on hands.
- Use test pieces to fill small sections of space.

Test pieces: small pieces of glazeware used to test glazing techniques.

9.3.1 Small Piece Placement

When loading small pieces, such as buttons and ornaments, assess whether they can be hung. If they can be hung, use a bead bar.

To use a bead bar:

1. String items onto bead bar.
2. Rest the bar with dangling pieces on posts that are higher than the pieces.

If pieces cannot be hung and are covered in glaze, use stilts. The stilts will prevent the glaze from sticking to anything.

To use kiln stilts:

1. Rest the piece(s) on top of the wires.
2. Place the stilt on the kiln shelf close to, but not touching other pieces.

Pieces should be resting on the stilt wires and nothing else. Pieces will stick if you:

- touch the pieces to the bottom of the stilt
- touch pieces to glaze drips already on the stilt

9.4 Placing Shelves

Placing shelves for a glaze firing requires extra care because pieces must not touch each other.

When placing shelves:

- Double check that none of the items are touching.
- Ensure you don't move the posts.
- Ensure you don't shift any of the pieces with the shelves or your fingers, which puts pieces at risk of touching and fusing together.
- Ensure the shelves are perfectly aligned.

9.5 Optimizing Heat in a Glaze Firing

Keep in mind, the coolest areas in the kiln are the:

- Top layer
- Bottom layer
- Centre of the shelf

Expose as many elements as possible to the bottom and top layers. If too few elements are exposed, the pieces won't be as brilliant or as food safe as they could be.

When getting close to top of kiln, take stock of how many heating elements you have left. Plan the kiln load so:

- At least three elements are exposed to the top layer and bottom layer
- Pieces are not higher than the top brick

If you load pieces higher than the top brick, you're risking pieces not getting as hot as they could be.

NOTE

If there's an odd section of space or heat is not optimized, don't be afraid to rework what's already there to use the space better.

10.0 Setting a Glaze Firing

When you're ready to set the kiln:

1. Close the lid
2. Clip the lid closed
3. Ensure all peepholes are inserted

Use the controller touch pad to set the kiln. The screen will display a number for how long it fired on the most recent firing and "CPLT" (complete). To set the kiln for a glaze firing:

1. Select **Stop** to set the kiln to "Idle"
2. To set the kiln to fire, select **Cone Fire**
3. To set no preheat, select **Enter**
4. To set temperature, select **5**
5. Select **Enter**
6. To set speed, select **Fast**
7. Select **Enter**
8. To set "Hold" temperature, select **30**
9. To delay start:
    c. Select **Delay**
    d. Enter a time on the keypad
    e. Select **Start**

"Hold": the kiln will reach peak temperature and hold that temperature for a set time.

The kiln will start the countdown before it starts to turn on. A glaze firing needs cone 6, but because the kilns run hot, set it at cone 5.

11.0 Unique pieces and special requests

Keep an eye out for unique pieces and pieces with notes on them. Customers may have special instructions for firing.

For example, a customer may want their dish with a lid to be fired with the lid on. **Use your own discretion with special instructions.** Because the lid will be touching the dish, make sure there is no glaze on the top of the plate or the rim of the lid. If there was glaze on the top of the dish, regardless of customer instructions, fire the lid and the dish separately. This avoids the items sticking.

Sometimes you'll find greenware on the glaze shelf—either by accident or on purpose. Customers may not want to put glaze on their piece, so they choose to fire their piece only once for a raw finish.

Typically, this happens with non-functional items. If there's a functional piece, like a mug on a glaze shelf, it's unlikely the customer wants to fire without glaze.

12.0 After Loading Bisque and Glaze Firings

After setting the kiln, reorganize the firing shelves, so pieces that are left over are at the front of the shelf. Pieces get fired on a first-come-first-serve basis.

Some situations call for exceptions:

- When class pieces are prioritized
- If someone rents a full or a half kiln

13.0 Other Firings

In addition to the daily firings, The Clay Warehouse supports two more types of firings:

- Lustre
- Special

13.1 Lustre

A lustre firing is typically done at cone 018 but can be different temperatures depending on the overglaze that is used. The usual firing time is around 3 hours in length and cool down can take around 12 hours.

Lustre firings need an oxygen rich environment to create brilliant colours. To ensure oxygen levels are rich, leave out at least one peephole from the top.

When you're ready to set the kiln:

1. Close the lid
2. Clip the lid closed
3. Remove one peephole from the top

Use the controller touch pad to set the kiln. The screen will display a number for how long it fired on the earlier firing and "CPLT" (complete). To set the kiln for a lustre firing:

1. Select **Stop** to set the kiln to "Idle"
2. To set the kiln to fire, select **Cone Fire**
3. To set no preheat, select **Enter**
4. To set temperature, select **018**
5. Select **Enter**
6. To set speed, select **Fast**
7. Select **Enter**
8. Select **Enter** to bypass "Hold"
9. To delay start:
    f. Select **Delay**
    g. Enter a time on the keypad
    h. Select **Start**

13.2 Special Firings

Special firings are firings that are done at the request of the customer. For example, a low-fire glaze firing at cone 06.

Special firing pieces must not have glaze on the bottom. If pieces do have glaze on them then they must be stilted.

Special firings need:

- The customer to label everything that needs a stilt, so there are minimal mistakes
- No higher than cone 7 and no lower than cone 016
- Bookings ahead of time that are approved by Scott or Courtney

14.0 Unloading Kilns

CAUTION!

Kilns are very hot when unloading! Wear safety gloves.

While bisque-fired pieces are less fragile than glaze-fired pieces, when unloading a kiln, be careful with all the pieces you handle.

Typically, unloads happen around 300 degrees F (refer to the controller display screen to confirm the temperature).

To unload a kiln:

1. Use safety gloves to protect your hands from the heat
2. Load pieces onto a trolley
3. For bisque firings, stamp a date onto the bottom of each piece with the date stamp (glaze firings do not need a stamp)
4. Put away posts and shelves

Match posts by height to keep pieces organized.

NOTE

Use a brick or post to prop open the kiln to allow it to cool.

14.1 Putting Pieces onto Shelf

The type of firing you're unloading will determine which shelf you unload onto. Refer to labels on shelves to confirm where to unload.

Both bisque and glaze shelves are arranged so older pieces are on the highest shelves. When unloading:

1. Move pieces higher on the shelf
2. Stamp the recently unloaded pieces (for bisque firings)
3. Place pieces on the shelves

15.0 Explosions

Explosions may occur inside the kiln during firings. When this happens, chunks may break off the pieces. These chunks may break other pieces around the piece that exploded.

When you find an explosion:

1. Remove all pieces, posts, and shelves from the kiln
2. Remove larger debris
3. Sweep as much as possible
4. Vacuum the entire kiln and around every heating element

When the kiln is firing, air can move debris from earlier explosions. You want to prevent debris from landing on another piece and ruining it.

16.0 Cleaning Glaze Drips

CAUTION!

Glaze drips can be sharp!

Glaze drips happen when glaze melts off a piece during a firing. Glaze drips should be cleaned as soon as possible. Cleaning glaze drips on Advancer shelves and Cordierite shelves have their own procedures and safety precautions explained in this section.

Glaze drips happen when:

- Someone uses too much glaze
- It's a very drippy glaze
- The temperature in the firing was too hot

16.1 Cleaning Glaze Drips off Advancer Shelves

To clean glaze drips off Advancer shelves:

1. Gather the following materials:
    - Glaze eraser
    - Safety glasses
    - Shelf to be cleaned
2. Bring materials to the garbage can
3. Use the glaze eraser to gently scrape the drip until its gone
4. Make sure the dust falls into the garbage can
5. Wipe dust with a safety glove or broom

16.2 Cleaning Glaze Drips off Cordierite Shelves

To clean glaze drips off Cordierite shelves:

1. Gather the following materials:
    - Brick grinder
    - Safety glasses
    - Safety mask
    - Shelf to be cleaned
2. Bring the materials outside
3. Grind the surface to break off wash and glaze
4. Grind until you expose the raw shelf

If you cannot deal with a glaze drip right away, set the shelf away from other shelves, so no one touches it. Notify Courtney or Scott for cleaning.

References

Figure 2. Using Orton Pyrometric Cones by Orton Ceramic Foundation, © 2016. Source: https//www.ortonceramic.com/pyrometric-cones.