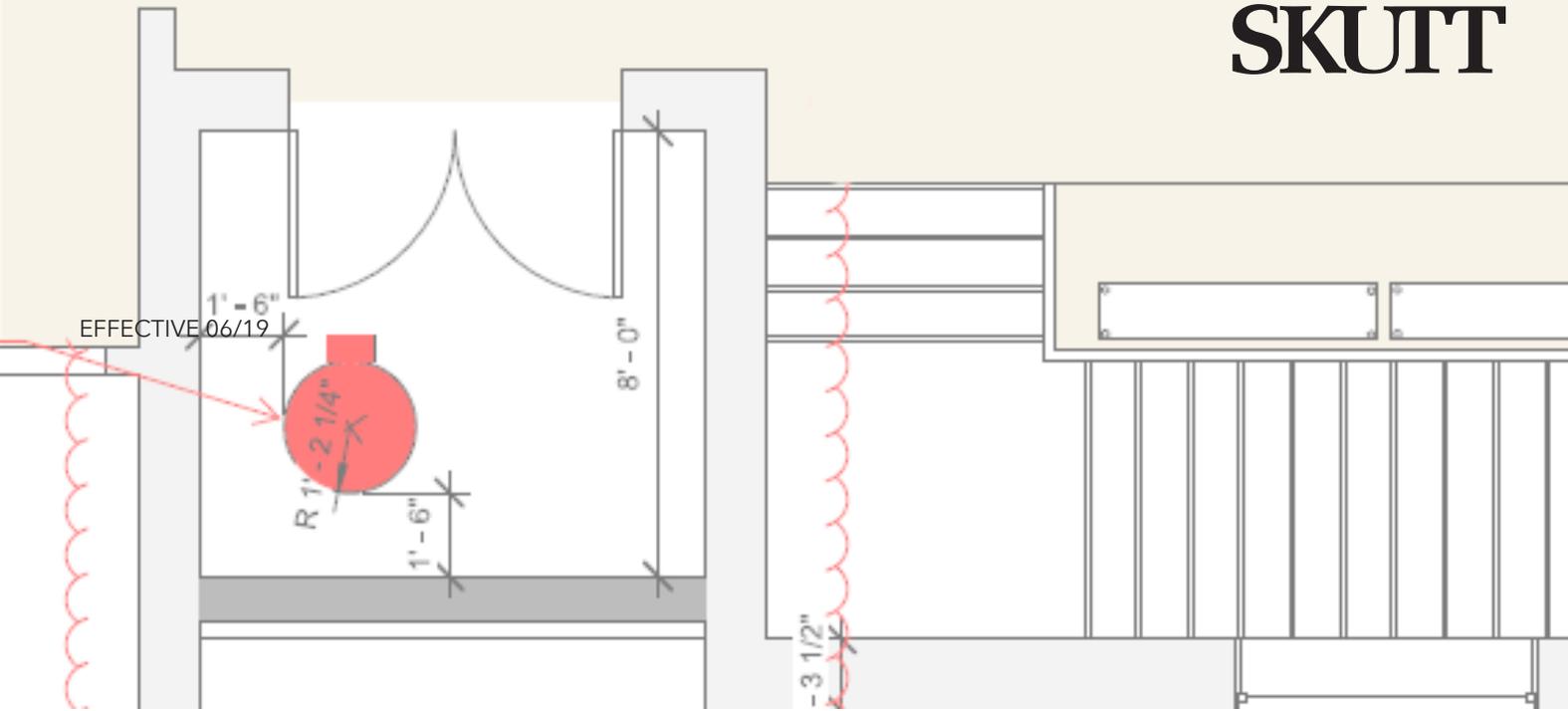


Kiln Management

A Complete Guide for Art Coordinators
Managing Kilns in Schools



SKUTT



INTRODUCTION

Having an organized approach to Kiln Management can save School Districts thousands of dollars, improve safety, and provide Art Coordinators with the tools necessary to run an efficient and effective Ceramics Program.

In this report we will look at the entire process, from kiln room design to the retirement of the kiln at the end of its useful life. Every school is a little different and you will need to make adjustments to these guidelines to fit your particular program. Below are the main topics of discussion.:

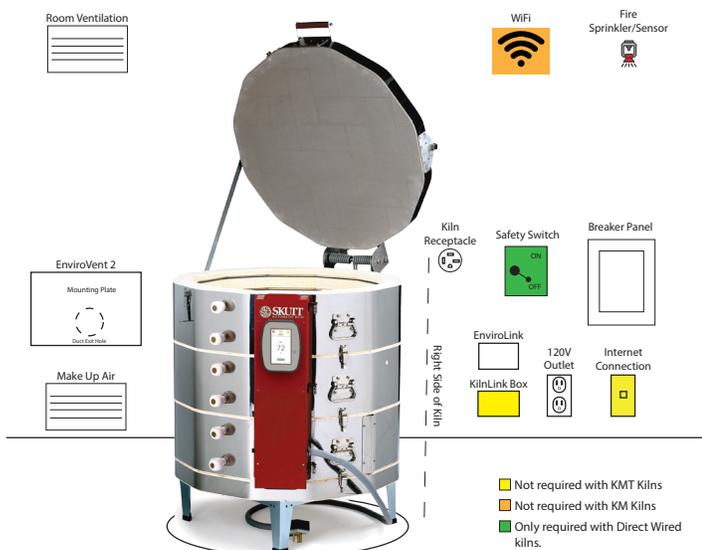
- Designing the Kiln Room
- Bids - Contractors and Suppliers
- Kiln Maintenance and Repair
- Safety Guidelines
- Room Temperature and Smoke
- Firing Policy
- Management Tools



Designing The Kiln Room

When you are fortunate enough to start with the blank canvas of a new school we suggest you take full advantage of it by making your voice heard to the architects and contractors. Often times they will cookie cut designs they have done in the past leaving you without the resources you need to run the program as you want.

With existing schools adding new ceramics programs you will often have to make some concessions but hopefully with the aid of this document you can steer the project in the right direction. Either way, it more difficult and expensive to change or add things later.



Below are some of the most important elements you want to consider when designing the Kiln Room:

- Kiln Room Location
- HVAC
- Fire Suppression
- Kiln Ventilation
- Building Codes
- Electrical
- Internet Connection

KILN ROOM LOCATION

Finding a location for kilns in existing schools is often challenging but not insurmountable. New schools can be much easier if you work closely with the Architects and Contractors in the design process. Below is a list of considerations for locating and designing the kiln room. A sample layout can be found in Addendum 1.

Locate the Kiln Room Close to the Art Room

This sounds obvious but often times teachers are forced to pack up delicate projects and transfer them across campus. Ideally the kiln room should be located adjoining the classroom. At the very least it should be located on the same floor so the teacher can use a cart to transfer the student's projects using a ware cart. Having the kiln room close also makes it easier for the teacher to monitor the firing process.

Locate the Kiln Room in an Area That Can Be Secured

Kilns get hot. That is what they are designed to do. They need to be secured from students and other faculty that may not be aware of the safety concerns.

The temperature of the metal bands surrounding the kiln can reach temperatures up to 460 °F. Placing the kilns in areas where others are required to access supplies can expose them to the potential of being burned. Also, those not familiar to kilns may inadvertently place items on or near the kiln that can cause a fire.

If the room is not equipped with a lock, appropriate warning signs should be placed on the door and a protective barrier such as a Kiln Safety Screen should be placed around the kiln.

Outbuildings

The same rules apply to kilns placed in outbuildings as do with kilns located in the main building. Here are some common things to avoid when placing kilns in out buildings:

- **Exposure** - Do not place kilns in areas that can expose the kiln to rain. Even though the kiln is covered by a roof, often times an open wall can expose the kiln to rain which is blown in from the side. Another concern is debris blowing in and igniting against the kiln.
- **Humidity** - Exposure to high levels of humidity can significantly reduce the functional life of a kiln. This is especially true in coastal areas where the moist air contains salt.
- **Excessive Temperatures** - If the kiln is exposed to temperatures in excess of 100 °F the kiln will shut down to protect the electronics in the controller.
- **Access** - Kilns get hot enough to burn a person's skin. Make sure any out building is secure against unauthorized access.
- **Uneven Floors** - A kiln needs to sit on a level floor. It also important to be able to roll a ware cart around the kiln for loading. The Uniform Mechanical Code requires the kiln to be placed on 2" of solid masonry. Floors of gravel or dirt are problematic and not up to code.



HVAC

If the kiln room is not adequately designed and firing procedures are not followed, there is a possibility that the fire suppression system could be activated. It is important to work closely with the HVAC contractors to make sure they understand the effect kilns can have on the temperature of the room.

Calculating the Amount of Ventilation Needed

They will need to know the BTU output of the kiln in order to calculate what is required for the system to keep the room cool enough to prevent the fire suppression system from being activated. This value can be found by pulling up the Specification Sheet for the proposed model. Just go to "Build A Spec" on the Skutt Website under the "Shop" heading and enter the model voltage and phase of the kiln. It will then create a Specification PDF that you can send to the Architect or HVAC contractor. They will then use this BTU value, along with the dimensions of the room and the insulation in the walls and ceiling, to calculate the airflow and/or AC needed to keep the room under 100 F while the kiln is firing.



Automatic Kilns are designed to shutoff when the controller is exposed to a factory set temperature. This feature is designed to protect the circuitry in the kiln from being permanently damaged. If the room is allowed to reach a temperature of 100 °F or above, the controller will shut off the kiln. This temperature is registered inside the control box. Temperatures above the kiln may be significantly higher and therefore all ventilation and fire suppression systems should be designed accordingly.

Often times the school's ventilation system is designed to shut down during certain hours to save energy. The HVAC system for the kiln room should be independent of this system or strict firing procedures must be followed with regards to the hours the kilns may be fired.

Make-Up Air

Any time you take air out of a room, you need to have a path for air to come into the room to replace it. This is often accomplished through the use of a ventilation grate in the door or to the outside. Make sure that the air you are bringing into the room is not hotter than the air you are trying to cool. Some times contractors will try to bring make up air into the room from crawl spaces in the ceiling that are not temperature controlled and the air can be quite hot.

FIRE SUPPRESSION

Heat Sensors and Sprinkler Heads

The heat sensor for the kiln room may be adjusted for the unique environment of the kiln room. Likewise, Fire Sprinklers may be equipped with higher temperature fuses. These fuses are color coded to represent the temperature at which they will melt and activate the sprinkler system. Never locate the kiln directly under a Fire Sprinkler or Heat Sensor unless adjustments have been made to raise their activation temperature.

Consult with your facilities manager to see what the maximum allowable sprinkler solder link or glass bulb is allowable. Fire codes differ by area.

Maximum Ceiling Temp		Head Rating		Classification	Solder Link Color	Glass Bulb Color
F	C	F	C			
100	38	135-170	57-77	Ordinary	Uncolored or Black	Orange or Red
150	66	175-225	70-107	Intermediate	White	Yellow or Green
225	107	250-300	121-149	High	Blue	Blue
300	149	325-375	163-191	Extra High	Red	Purple
375	191	400-475	204-246	Very Extra High	Green	Black
475	246	500-575	260-302	Ultra High	Orange	Black
625	329	650	343	Ultra High	Orange	Black



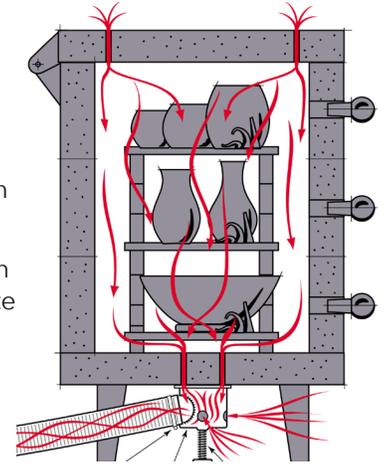
KILN VENTILATION

Kiln Ventilation is different than room ventilation. Nearly every electric kiln company has a version of a "Downdraft Vent". These vents are recommended to actively remove fumes from the kiln chamber and vent them outside much like a dryer.

The purpose of these vents is to remove the fumes before they can linger in the kiln and damage the elements. They are also recommended by The Orton Foundation (a not-for-profit Ceramic Industry foundation) to improve the quality of the atmosphere in the kiln in order to minimize defects.

Since the fumes are vented to the outside, it is recommended to locate the kiln near an outside wall. They may also be vented through the roof. The vent will require a separate 120V receptacle.

The EnviroLink is an accessory device that can automatically start the downdraft vent when the kiln is started and automatically turn it off when the kiln has cooled.



BUILDING CODES AND SAFETY LISTINGS

According to the Uniform Mechanical Code all kilns must be placed on a minimum of 2 inches of solid masonry which extends at least 12" beyond the outside perimeter of the kiln. They must have clearances from any combustible material in accordance to those recommended in the installation manual. For almost all kilns this clearance is 18" around the complete perimeter of the kiln.

It is a requirement of many school districts to install only electrical equipment that has been listed by a Nationally Recognized Testing Laboratory (NRTL) like Underwriters Laboratories (UL). These companies test products to certain electrical safety standards. Products with these listings will have the listing mark on their serial plate.

POWER REQUIREMENTS

It is extremely important to order your equipment to match your available power supply. You will need to know the voltage and phase which is, or will be, available at the location where the kiln is installed.

Make sure whoever provides you with this information knows that kilns are designed specifically to run on 208V or 240V. If they give you an answer of 220V they either do not know the voltage or are assuming that it will run on either. It helps to get a signature to ensure due diligence. (See Appendix 3).

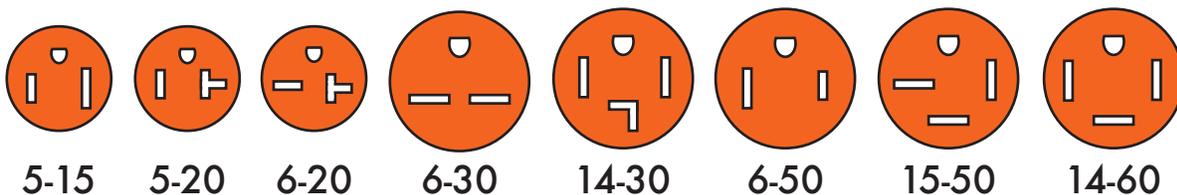
Sometimes both 1PH or 3PH supplies are available at the school but only one is available in the room that the kiln will be installed. Again, a signature can help ensure the correct information.

Receptacles

Of course, it is imperative to match the plug on the kiln. See Appendix 4 for identifying the correct receptacle for your kiln model. Model names with PK at the end indicate that it is a Production Kiln. Due to their high amperage, they do not come with a plug and must be hard wired to a junction box.

The power cord on a kiln is only 6.5 ft. long so locating the receptacle in the correct spot is important. The power cord always exits out of the right side of the kiln's control box so the receptacle should be located on the wall behind the kiln on the right-hand side. The receptacle should be mounted 12" to 18" from the floor to ensure the plug will reach, and the floor will not cause the cord to put upward pressure on the plug.

Be sure the receptacle is placed in the right orientation. Unlike 120V receptacles, the ground should be on top.



Circuit Breakers and Wire Gauge

Circuit Breakers are designed to shut power off to the kiln if there is an electrical short. In order to meet electrical code requirements, the breaker size must not exceed the electrical rating of any component in the kiln that will be exposed to the full electrical load which is measured in Amps.

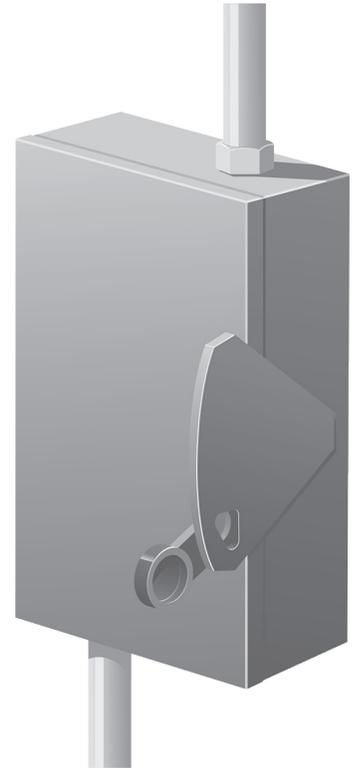
Many of our kilns draw 48 Amps and are equipped with a 50 Amp plug. In order to be up to code, these kilns need to be connected to a 50 Amp breaker. Circuit breakers trip based on exposure to heat. If there is a direct short, the breaker heats immediately and trips. As the breaker ages, it is more likely to trip at lower temperatures, causing "nuisance trips". Elevated temperatures in the room can also contribute to nuisance trips.

For this reason, you may choose to remove the 50 Amp plug that comes with many popular 1 PH kilns found in schools, and direct wire it to a junction box. This will allow you to use a 60 Amp breaker while still adhering to the National Electrical Code.

Any kiln that is direct wired must have a way of cutting the power to the kiln that is visible from the kiln. This can be accomplished by direct wiring the kiln to a junction box with a safety switch or by locating the kiln in an area that has line of site to the breaker box.

If you still would like to have a plug and power the kiln through a 60 Amp breaker, you can remove the NEMA 6-50 plug and install a NEMA 14-60 plug and corresponding receptacle. This plug will require a Neutral wire to be run to the outlet. It will not be used by the kiln but is required because, if the equipment is ever replaced, another installer may assume the Neutral is connected.

The wire gauge used from the breaker box to the outlet must be of sufficient size to handle the amperage of the kiln for a given distance. We recommend a wire gauge to be used that is good for up to 50 ft. As electricity flows over distances it can lose voltage in the form of heat. If the gauge of the wire is increased the amount of loss decreases. This is why we recommend increasing the recommended wire gauge for every 50 ft. of run.



INTERNET CONNECTION

If you want to take advantage of the technology available in Kiln Monitoring, you will want to make sure you have internet available in your kiln room. The new touchscreen controllers require a Wifi signal and the standard Touch pad controllers will need a physical connection through a network cable.



In either situation, it may be necessary to involve your IT department to recognize the equipment and allow it to transfer information through your school's fire wall system. For more information on working with your IT Department see [Addendum for more details](#).

Some Kiln Rooms are surrounded by cement walls which make it difficult for Wifi signals to pass through. In some situations it may be necessary to add a Wifi Access Point in the Kiln Room to get a strong enough signal.



Bids

Often times in new construction design of the room and equipment purchasing decision have already been made by the Architect or Contractor. Some are very competent and others know very little about the wants and needs of Ceramic Programs. When possible, we suggest you become proactive in the process. This will not only help ensure you get the equipment you need; it will also help avoid mistakes that can delay the project or cost the district extra money.

Architects often specify the same type of kiln over and over, not taking advantage of recent changes in technology. One of the reasons we still sell KilnSitter kilns is because Architects don't always keep up on new technology and use the same specification they used in the last school they designed. This is really doing a disservice to the school and the Art Teacher.

Skutt is more than happy to meet with Architects you frequently work with to make sure they understand the unique needs of a kiln room and are up on the latest technology. Often times it is difficult to get appointments with them because they think we are trying to sell them when in reality we are just trying to help them avoid making mistakes. It is therefore best if an administrator with the school can request the meeting.



HELPFUL TIPS

Most manufacturers in the ceramic industry do not sell direct to Contractors (some do). They usually need to buy from an Authorized Distributor. Many of these Distributors can perform the same services with a better understanding of the products they are installing. If you are going to purchase the equipment from the contractor, or any middleman, make sure they are well trained on kilns.

Make sure whoever wins the bid orders the correct voltage and phase kiln model. We run into this all of the time and it is time consuming and expensive to fix. If it is a replacement kiln, there is no guarantee that the old kiln was ordered correctly so don't just order the exact same model. In fact, that may be why the kiln is being replaced prematurely.

To complicate things further, often times people you think should know, like facilities managers and electricians, will give you the wrong information because they are used to working with equipment that can run on a wide range of voltages. The safest bet is to actually have someone test the outlet with a meter and inspect the wire gauge and breaker to make sure it is suitable for the new kiln.

Try and have the kiln delivered at the very end of the project. When it sits around the job site waiting to be installed it often gets damaged and key components get misplaced and sometimes even thrown out. We have heard stories of workers who will stack things on it, spill things on it, hit it with a forklift and even stand on it when a ladder is not handy.

Here are a few services you will want to consider including in the bid:

- **Freight Damage Inspection**
- **Inside Delivery**
- **Set-up and Testing**
- **Training**

Often times the lowest bidder is not able to perform these services. If they agree to perform these services, make sure they have access to trained kiln professionals. If you are making your decision based on a discount off of the Manufacturer's suggested retail price, be sure to check that the price they are discounting from is based on the published price of the Manufacturer.

Finally, make sure all the items that are required to fire the kiln are included in the bid. We have had many a teacher come into his or her new classroom ready to teach only to find they do not have a furniture kit or no one installed an outlet for their EnviroVent2. Here is a list of equipment that is generally considered to be the bare minimum required by most school districts.

- **The Kiln** - Includes the stand and the peep plugs. If they have a KilnSitter Kiln they will need pyrometric cones designed to fit in the tube assembly as well.
- **The EnviroVent 2** - Includes everything necessary to install unless additional ducting is needed. Be sure to note on the order that the kiln should be drilled in the factory to accommodate the EnviroVent 2.
- **The Furniture Kit** - Includes shelves, kiln wash and an assortment of posts.

DELIVERY AND INSTALLATION

Having someone who knows kilns receive them from the shipper can be invaluable. Trying to collect on a freight claim once it has been signed for can be a frustrating to say the least. Often times our distributors will make the driver wait for them to open the box and inspect the kiln if they see something that worries them.

Kilns are heavy, which is why our kilns are designed to be easily taken apart to move through doorways or down staircases in smaller sections. Knowing how to take them apart and reassemble them is critical to the performance and safety of the kiln.

If the kiln is drop shipped to the school's location, it is important to have a trained kiln professional scheduled to bring the kiln into the classroom and set it up. Again, it is better to have the kiln ordered, received, delivered, and set up by a trained kiln professional so one person or organization is accountable for any issues.

FINAL INSPECTION

Contractors are not always the best qualified persons to inspect ceramic equipment and ensure it is installed correctly and functioning as designed. We recommend that someone who is specifically trained in kilns inspect the installation and perform a diagnostic check on the kiln before the job is signed off. An inspection should include the following:

- **Voltage Check** - Does the voltage match the designated rating on the kiln's serial plate.
- **Voltage Under Load** - Does the voltage drop significantly when the power is turned on. This situation will not only affect the performance of the kiln but can indicate a potential fire hazard.
- **Amperage** - This test can indicate if something became loose or was damaged during shipping or installation. Do all of the readings match the manufacturers specifications?
- **Thermocouple** - Does the display indicate that the kiln is rising in temperature.
- **EnviroVent Function Test**
 - Does it pull a flame into the kiln?
 - Is it installed in a way that ensures a negative pressure system?
 - Are the switches accessible to the teacher?
 - Is the collection cup positioned correctly?
- Is there any damage to the kiln that the contractor would be responsible for?
- If equipped with the capability, is the kiln able to connect to the internet?

TRAINING

Training is a critical component of every Ceramics Program. Lack of knowledge concerning the kiln can result in the following concerns:

- **Safety for the teacher and the students.**
- **Damage to the kiln and/or the work inside the kiln.**
- **Teachers who avoid using the kiln out of fear of making mistakes.**
- **Activation of the fire suppression system.**

Local Distributor Provided Training

Many Authorized Distributors offer teacher training on request, or as part of the delivery service. It is not a requirement of their distributorship so there may be a fee involved. Not all distributors are capable of providing training so be sure to ask if that service is available.

Manufacturer Provided Training

On occasion, Skutt provides teacher training at a Distributors location or as a class at State Art Education Shows. Skutt will also put together on site training if a minimum number of teachers are guaranteed and their schedule allows it. This is usually coordinated through the local Skutt Distributor. This training is not always available and should not be assumed as a service that will be provided as part of a bid.

Online Training and Phone Support

The Skutt Website contains many videos and printed documents that can assist teachers in learning how to operate and maintain their kilns. We recommend these resources be used as a supplement to personal training. They can be found at <https://skutt.com/skutt-resources/operation/>.

Teachers should have access to the manual for the kiln and be encouraged to read it before contacting the factory or the Distributor with questions. If they have additional questions, they can contact the factory or the Distributor who provided the kiln.

Kiln Maintenance Program

A Kiln Maintenance Program that includes periodic inspections, an organized system for scheduling repairs and routine maintenance can limit downtime, improve safety, maximize performance, and extend the useful life of the kilns.

INSPECTIONS

It pays to be proactive in the maintenance and care of your kilns. Often times future repairs can be anticipated and planned for to minimize downtime during critical periods of the school year. Inspections can be performed by factory trained kiln technicians. They can be independent contractors or employees of a Skutt Authorized Distributor.

We recommend these inspections be done yearly and include the inspection items listed in this document: <https://skutt.com/skutt-resources/repairs/kiln-maintenance/> . Basic maintenance and minor repairs can be performed at the time of the inspection. After an inspection is performed, the technician should log their notes (in KilnLink if available) and submit all recommendations for repairs to the Art Coordinator so the repairs can be scheduled.

REPAIRS

All kilns will eventually need repairs. There are certain components that have a useful life and there are other parts of the kiln that can be damaged in normal use. Partnering with a qualified repair person is critical to keeping a kiln running efficiently and safely.

Eventually a kiln will reach a point where it does not make economic sense to spend more resources to keep it operating. Having a set of criteria to retire kilns will save the district money in the long term

Repair Budget

Below is a list of common repairs that you should expect throughout the life of the kiln. We are giving you some estimated costs for replacement along with the estimated life of the part. These estimates will vary on a number of factors so your actual results may vary. Labor estimates are based on average hourly rates and travel time. Local rates will vary.

Thermocouples

Thermocouples are the temperature measuring sensors that protrude into the kiln. The controller uses this signal to determine when the kiln elements should cycle on and off. If the teacher is using only low-fire clay and glazes (Cone 04 to 06 range) they generally last about 100 to 150 firings. If the teacher is using mid-range or high-fire clay and glazes they could need replacing 40 to 60 firings. They are currently less than \$20 in parts to replace.

Your in house maintenance personnel should be able to change these in 5 minutes. This will save the time of scheduling a technician coming out and avoid service call fees. There is a video with step by step instructions on the website.

Elements

Elements are the metal coils that heat up the kiln chamber. If the teacher is using only low-fire clay and glazes (Cone 04 to 06 range) they generally last about 800 to 1200 firings. If the teacher is using mid-range or high-fire clay and glazes they could need replacing every 40 to 60 firings. A full set of elements for a standard sized kiln in a school is currently around \$350. Labor on average will be \$400

Relays

Relays are the components that receive the signal from the controller and turn power on or off to the individual kiln sections. Their expected life is estimated by the number of times they cycle. The average relay will fail after 300,000 cycles and the average number of cycles per firing is 3,000. This means you should plan on changing your relays every 100 firings. The average school kiln has 3 relays and it is recommended they all be replaced at the same time. A set of relays costs around \$90. Labor on average will be \$200.

Other

There are other components that may need to be replaced in the kiln throughout it's life. The most common is brick. It is recommended to schedule brick replacement when elements are being replaced.

The chart below is a very loose estimate of the cost of kiln maintenance over a 10 year period assuming the following criteria:

Average of 50 firings per year. The number of firings will vary drastically between schools.

Average of \$50/hr. labor rate plus \$100 service call. Thermocouple estimate does not include any labor because it is assuming the repair will be made by school staff. Labor rates and service call charges will vary.

Model/Firing Type	Thermocouple	Relay	Elements	10 YR. Total	Avg/Year
Low Fire KM1227	\$80	\$1200	\$300	\$1580	\$158
High Fire KM1227	\$200	\$1200	\$6000	\$7400	\$740

Finding a Qualified Kiln Repair Person

Skutt does not certify technicians however we will recommend technicians that we have worked with in the past or who have gone through training in our plant. Most local Skutt Distributors have a list of factory trained personnel.

Please contact Skutt before working with a kiln repair contractor. We will let you know our experience working with them. Whoever you work with, make sure that they use genuine Skutt parts. Substitutes can lead to poor performance, void the UL listing and, most importantly, create an unsafe kiln.

Warranty Repairs

All warranty repairs need to be pre-approved by Skutt. If you purchased the kiln from a local Skutt Distributor contact them first. If you are not sure where the kiln was purchased, contact Skutt and be ready to provide them with the information on the Serial Plate which is located on the side of the kiln. They will need the serial number, model name, voltage and phase of the kiln to determine when it was manufactured and if it is still under warranty.

Skutt warranties it's kilns for 2 years. Unlike many companies, this includes the cost of the parts AND the labor to replace them. We even pay for up to an hour of travel time for the repair person. Also, we never prorate any part of the warranty. In other words, the warranty covers 100% of the repair for the full two years.

Teacher Provided Maintenance

Most schools do not want teachers working on kilns for obvious liability issues. There are however a few things they can do that will help prolong the life of the kiln. The most important, is to vacuum it out every few months. This, along with keeping the lid closed, prevents dust and debris from building up on the elements which will significantly shorten their useful life.

Facilities Personnel Maintenance

Thermocouple replacement is the most common repair needed on kilns and, on Skutt Kilns, one of the easiest to perform. Training you maintenance staff to replace elements can save the school district lots of money and limit the down time for the teacher. All of the work is done with the kiln unplugged and the whole repair takes less than 5 minutes. Maintenance personnel can watch a short 5 minute video and feel confident making the repair. <https://skutt.com/skutt-resources/repairs/thermocouples/>

Retiring a Kiln

We estimate a kiln will last 10 to 15 years in a school environment before it no longer makes sense to invest in repairs. This is usually when a high percentage of the brick has deteriorated badly and the kiln is in need of another major investment like new elements or a new controller.

Safety Guidelines

AVOIDING BURNS

Our number one concern is of course the safety of the students and faculty. Kilns get hot, so the first thing we think of when we think of safety is not getting burned. At peak temperature, the outside of the kiln can get up to 460 °F. This is of course hot enough to burn someone who comes in contact with the kiln. Fortunately, most people can sense that the kiln is hot way before they get close enough to touch it.

Our primary tool in preventing burns is to limit access to the kiln room while the kiln is firing. This is especially important where there are young kids or kids with special needs present. We can do this in several ways.

Physical Barriers and Signage

In a perfect world all kilns would be secured behind a locked door in a dedicated kiln room. Unfortunately, this is not always the case. Often times the kiln room is in a supply room where others need access. If the door can be shut and locked, check with the facilities person to ensure there is an alternative means of providing make-up air for the HVAC system in the room.

If the door cannot be locked, there should be signage on the door that indicates there is a hot kiln located in the room. Ideally this signage would have a universal symbol that indicates a heat warning for those who cannot read or speak another language.

If there is no door to close, for example if the kiln is located in the classroom, a kiln screen should be set up around the kiln to prevent access while the kiln is firing. Your local Ceramic Supplier should have a source for these screens.

Locate Items That Need to be Accessed While the Kiln is Firing Away from the Kiln

Never store products that need to be accessed while the kiln may be firing near the kiln. You don't want to put someone in the situation where they may be tempted to squeeze by, reach around or reach over the kiln to get something.

Eliminate Trip Hazards

A cluttered kiln room is an unsafe kiln room. Eliminate or move anything on the floor that someone could potentially trip over and fall onto the hot kiln.

LOADING HAZARDS

Before a teacher begins loading the kiln, they should check that all of the hardware supporting the lid to make sure it is tight and not corroded. If a piece of hardware that supports the lid breaks loose while the teacher is loading the kiln it could come down on their head. This should also be a key part of the yearly inspection.

Install Lid Lifters on Every Kiln

Kiln lids are heavy. If there is not a spring-loaded Lid Lifter installed on the kiln, one should be added. This will limit the risk of muscle strain while opening the lid. Often times teachers are not tall enough to open the lid using the handle and are forced to grab the lid in the middle to lift it high enough for the lid brace to latch. A Lid Lifter makes this possible, however a better solution if possible, would be to provide the teacher with a shorter kiln that allows them to open the lid using the handle. If this is not possible provide them with a stable step stool to open the lid.

Provide Shorter Teachers, Shorter Kilns

We already mentioned that opening the lid can be challenging for shorter teachers. Loading the kiln can also be challenging. Our most popular kilns purchased by schools are 27" deep. This can be loaded safely by persons 5' 6" tall or taller. We recommend our 22" deep kilns for teachers who are shorter than this.

FUMES

Many glazes used to contain lead and other heavy metals that produced fumes when fired that were unhealthy to breath. These have been removed from commercial glazes for some time now. There is however organic material that burns out of the clay and glazes that can be unpleasant to breath and should be vented out of the kiln room.

All Kilns Should Be Fitted with a Downdraft Vent such as the EnviroVent 2

Room Temperature and Smoke

There are two reasons why we want to avoid overheating the room; the first is to prevent the kilns software from shutting off the kiln and the second is to avoid unnecessarily activating the schools Fire Suppression System.

The software in the kiln's controller is designed to shutoff the kiln if the temperature of the controller reaches a point that could risk damaging the electronics. If the temperature inside the control box reaches 160 °F the kiln will stop firing. The temperature in the room and the temperature of the kiln both play a part in this.

We have calculated that if the temperature in the kiln room rises above 100 °F the kiln is likely to shutdown the firing. If this happens the teacher will see error code "E-bd" displayed on the controller along with an alarm sounding.

Fire Suppression Systems can be activated by heat or smoke. Kilns are designed to contain heat and will never heat a room to the level that would risk fire when properly installed, operated and maintained. On rare occasion they can unnecessarily activate a Fire Suppression System if the room is not designed to take into account the presence of a kiln or if the kiln is not operated as intended.

Below are some of the things that can contribute to the Fire Suppression System being unnecessarily activated or the kiln overheating.

- ***Kiln is fired when the schools HVAC system is shut off.***
- ***Some schools automatically shut down, all, or portions of the HVAC system when the school is mostly empty to save money. In smaller rooms with no other source of cooling this could potentially allow the ceiling temperature to reach 136 °F which would activate the lowest rated temperature setting.***
- ***HVAC system is not designed to handle the BTU output of the kiln.***
- ***This should be verified at the time of installation.***
- ***Door/Window which is suppose to be left open to supply return air for the HVAC, is closed.***
- ***All HVAC systems require a source to replenish the air they vent out of the building. If this source is blocked, the system will not work as designed. Check with the facilities manager to see if the teachers are required to leave a door or window opened during the firing. In an ideal world the system would be designed so this is not the responsibility of the teacher.***
- ***Fire Sprinkler is located directly above the Kiln.***
- ***Sometimes Architects will place a Sprinkler head right above the kiln. As mentioned earlier, the lowest setting for these to be activated is 136 °F. Under the right conditions it is possible to hit this temperature. Most likely the room would have inadequate ventilation or ventilation that was not on for this to happen. The sprinkler system should be fitted in these situations with a higher temperature fuse. Even if the sprinkler is not directly over the kiln there could be issues in small rooms with low ceilings and poor ventilation. (See Addendum 2)***
- ***The Kiln Lid is left propped open while the kiln is firing.***
- ***Any kiln that is equipped with an EnviroVent 2 should only be fired with the lid shut and all the peep plugs in place. If the kiln is not Equipped with a downdraft vent then one should be installed.***
- ***Something combustible was placed in the kiln that created smoke.***
- ***Anything that will combust when the kiln is fired needs to be removed before it is loaded in the kiln. It is not only bad for your kiln; it can also set off smoke detectors. Below are some techniques and materials that are common that may cause issues:***
 - Paper Clay - Clay mixed with paper pulp to create a lighter weight sculpture. This is usually not a problem if the room and kiln are well vented and you are using a commercially prepared clay.
 - Items Dipped in Slip - Items (i.e. lace, leaves, branches...) are dipped in clay slip and when the slip burns out the clay retains the shape.
 - Balloons or Paper Used to Shape Around - Balloons are inflated to form clay around. These should be popped and removed before firing.
 - Pasta to Make Impressions - Different shapes of pasta are used to create shapes in the clay.
 - Combustibles Placed In the Kiln to Create A Reduction Atmosphere - Certain glazes will take on new looks when fired in a reduction atmosphere.

Procedures and Guidelines

We will break this section up into 5 categories

- *Permissions*
- *Firing*
- *Training*

PERMISSIONS

Clearly defined guidelines regarding what people are and are not allowed to do will help Art Coordinators ensure safety guidelines are followed, budgets stay on track and the ceramic program runs efficiently.

Who is allowed in the kiln room?

Whenever possible, access to the kiln room should be limited to the Art Teacher and their supervisors. People not trained on the guidelines associated with the kiln room may create issues that we are trying to avoid. Here are some of the main problems we have seen with unlimited access in the past.

- *New items brought into the kiln room to store and placed on, or too close to, the kiln and risking a fire or tripping hazard.*
- *New items brought into the room that will need to be accessed by people who have not been trained in terms of safety around a kiln.*
- *Students playing with the programs or damaging the kiln.*
- *Unauthorized use of the kiln by untrained people.*
- *Venting is turned off during a firing causing the room to over heat.*

The door should remain locked when authorized personnel are not present. If this is not possible, signs should be posted and kiln screens should be placed around the kiln.

Who is allowed to operate the kiln?

Only properly trained and authorized personnel should be allowed to load, program, and fire the kiln. Untrained personnel can cause the following problems:

- *Damage bricks when loading shelves and ware.*
- *Program the kiln in such a way that damages the kiln and/or the ware inside of the kiln.*
- *Overheats the room by not turning on the ventilation system.*
- *Activates the Fire Suppression System by not checking for combustibles around the kiln or by placing combustible material in the kiln.*
- *Injures themselves due to improper kiln safety training.*

All personnel should be authorized to fire the kiln by the Art Coordinator only after they have attended an approved training session. At that point they the Art Coordinator would do the following:

- *Provide the teacher with a key to the kiln room.*
- *Provide the teacher with a pass code to the kiln (KMT Kilns only).*
- *Add teacher as a user to KilnLink so they can monitor their firings and receive text alerts (KilnLink enabled kilns only).*

Who is allowed to perform/order Maintenance and Repairs on the kiln?

Kilns require regular maintenance and, at times, repairs. Establishing who is to do the work and who is allowed to order work to be done is critical to avoiding confusion and ensuring safety. When the kiln generates an Error Code indicating a problem with the kiln the teacher needs to know who to contact to get the work scheduled. It is common to have them contact their supervisor (Art Coordinator, Principle...) or the maintenance department to order the work to be done. They can also contact their local supplier or Skutt's technical support Department to make sure the Error was caused by an actual problem or through an error in programming.

FIRING

Programming Modes

The standard controllers have 2 modes of firing. One mode, ConeFire Mode, uses preset programs designed by engineers to create the proper heatwork. The programs automatically adjust the final temperature to correct for how the kiln is performing. This is the programming mode we recommend all teachers use for standard ceramic projects.

Ramp/Hold Mode is used only when the project (i.e. Fused Glass, Crystal Glazes) cannot be fired using ConeFire Mode. We consider this an advanced firing mode that requires additional training. The new KMT controller has both ConeFire Mode and GlassFire Mode built into the programming. We recommend schools who want to fire both Ceramics and Glass purchase kilns with these controllers or upgrade their older controllers using the KMT Upgrade Kit.

Low Fire, Mid-Range and High Fire Clay and Glazes

Clay and glazes are generally categorized as Low, Mid-Range or High Fire. This refers to the temperature range to which they can be fired. It is important to keep them labeled and separated because they can not be used together. A low fire clay fired to a High Fire temperature will actually melt in the kiln and can often ruin it as a result.

Most newer automatic kilns can be configured to prevent teachers from over firing the kiln based on the materials they are using. If the school only uses Low Fire Ceramic products it is a good idea to set the controller with a "MAX" temperature. If the teacher tries to program a high temperature with the MAX temperature feature set, it will not let them.

Another key consideration when determining if teachers are allowed to use Mid-Range and High Fire materials is cost. As we read earlier the maintenance costs for Low Fire ceramics is much less than Mid-Range and High Fire. There are however valid artistic and functional reasons for allowing teachers to use the higher temperature products.

Loading

The following rules should be applied when loading a kiln:

- Make sure there are no bare spots on your kiln washed shelves. Patch any areas that are bare.
- Make sure the lid brace is securely in place before loading.
- Never put flammable material in the kiln (i.e. paper, plastic, rubber, wood, pasta...). When ignited it could create smoke which can activate the fire suppression system.
- Always post the first shelf at least 1" off the floor of the kiln.
- Load the kiln with the mass distributed evenly from top to bottom.
- On a glaze firing make sure there is no glaze that is touching the shelf or applied in a way that would cause it to drip onto the shelf.
- Leave 2 inches of space around the thermocouple.
- Do not place items closer than 1 " from the elements.
- Leave 2" of space between items on the top shelf and the lid.

Preheat

The Preheat feature is used to allow moisture left in the greenware (unfired clay) to slowly evaporate before the kiln reaches a temperature that would turn it to steam. Firing pieces with residual moisture in them without preheating can result in cracking and can even cause pieces to explode in the kiln.

All greenware should be bone dry before placing it in the kiln. Do not use the Preheat feature to speed up the drying time as excessive moisture will damage the kiln. Moisture levels can easily be tested by holding each piece up to your cheek. If the clay still feels cool, it still has moisture in it and should be allowed more time to air dry.

It can be harder to judge if all the moisture is gone on thicker items. All larger/thicker pieces should be preheated for at least 1 Hour. This will add 3 hours to the overall Bisque firing program so if you are required to stay with the kiln throughout the firing you may want to use the Preheat Only feature on the New KMT Controller to run the Preheat on a separate day. If you have a standard KM Kiln, you will need to program a 1 segment program using the Ramp/Hold programming feature with the Rate of 60/hr to 180°F with a 1 Hour hold. Instructions for using this feature can be found here: <https://skutt.com/skutt-resources/operation/kilnmaster-controller-red-control-box/>.

Bisque Fire

The purpose of the Bisque firing is to burn out all of the organics and residual moisture in the clay so it can be glazed. A Slow firing is recommended to ensure all of the carbon is burned out of the clay and does not gas out during the glaze firing and create pinholes. Pinholes are little holes in the glaze that are created at the peak of the firing when the glaze is fluid and carbon left in the clay combusts and breaks through the surface of the glaze.

A Slow Firing will take approximately 12 hours from the time the teacher presses Start to the time the kiln reaches peak temperature and shuts off. Cooling time will vary based on the size of the kiln but should take approximately 12 hours before the kiln can be unloaded.

Whether you are firing High Fire clay or Low Fire Clay it should always be Bisque fired to cone 04 or 05. This keeps the bisque porous enough to accept glaze while still burning out the carbon.

It is not realistic to ask teachers to stick around for 12 hours to ensure the kiln shuts off and has begun the cooling cycle. For this reason schools have developed the following options for teachers depending on their resources and policies:

Use Delay Start

Delay Start is a feature that allows the User to enter a delay time that delays the start of the kiln. This allows the kiln to begin heating early in the morning before the teacher comes in so it can shutoff at a time when it is reasonable for the teacher to be there. After 4 hours of firing the outside temperatures of the kiln remain under 200°F. For example, lets say the teacher loads the kiln at 4:00 PM. If the teacher entered a 12 Hour Delay and pressed Start, the kiln would begin firing at 4:00 AM and shutoff at 4:00 PM when they are ready to go home.

Use KilnLink to Monitor the Kiln With Smartphone or Remote Computer

New technology allows us to connect kilns to the cloud for remote monitoring. If the classroom is equipped with a KMT Controller the teacher can monitor the kiln via a free App. KilnMaster Controllers with KilnLink installed can be monitored through accessing the website MySkutt.com and logging into their account.

Fire Bisque Using Medium Speed

While not ideal, bone dry pieces that are not excessively thick (over 1/2") or large (12" tall/wide) should be fine if fired using the Medium Speed. If cracking or pinholing is experience they will want to switch to one of the 2 other solutions listed above.

Glaze Firing

The Glaze Firing takes about 7.5 hours when firing Low Fire glazes and up to 9 hours when firing High Fire Glazes. Low fire Glazes should be fired to the Cone rating listed on the packaging. Ideally you will fire 2 cones hotter than your Bisque firing. (Bisque at 04 and Glaze at 06). Again, make sure pieces are adequately cleaned so no glaze will touch or run off onto the shelf. A good rule of thumb is no glaze within 3/16" from the bottom of the piece. Also, be careful that no glazed pieces are touching when you load the kiln.

Before Starting the Kiln

- Make sure all of the Peep Plugs are in place and the lid is closed before pressing start if you have a DownDraft vent. If you do not have a DownDraft Vent, leave the top Peep Plug out for the entire firing.
- Inspect around the kiln to make sure there are no flammable materials.
- Make sure the power cord is not touching the kiln.
- Make sure the rooms ventilation system is on and will remain on for the entire kiln firing.
- Calculate what time the kiln firing is scheduled to end so you can be there to check it (or remember to check it with KilnLink). Bisque firings are approximately 12 hours and Glaze firings are around 7.5 hours.
- Make sure signs warning the kiln is firing are displayed prominently before leaving the kiln room.
- Leave the door open if this is required for adequate make up air for your ventilation system other wise make sure it is shut. Consult your facilities manager if you are not sure.

After the Firing

Wait until the kiln has cooled to 125 F before opening the lid. Take notes in your Kiln Log of the results. You can download a Kiln Log here: <https://skutt.com/skutt-resources/resources-just-for-you/manufacture/resources/>

TRAINING

Training is a critical component to a successful clay program. All teachers should be trained before being allowed to fire the kiln. Adequate training is necessary to ensure safety, protect property and ensure quality results. This training can be provided in a number of ways. Whatever means you choose to provide the training, a proper program should contain the following components:

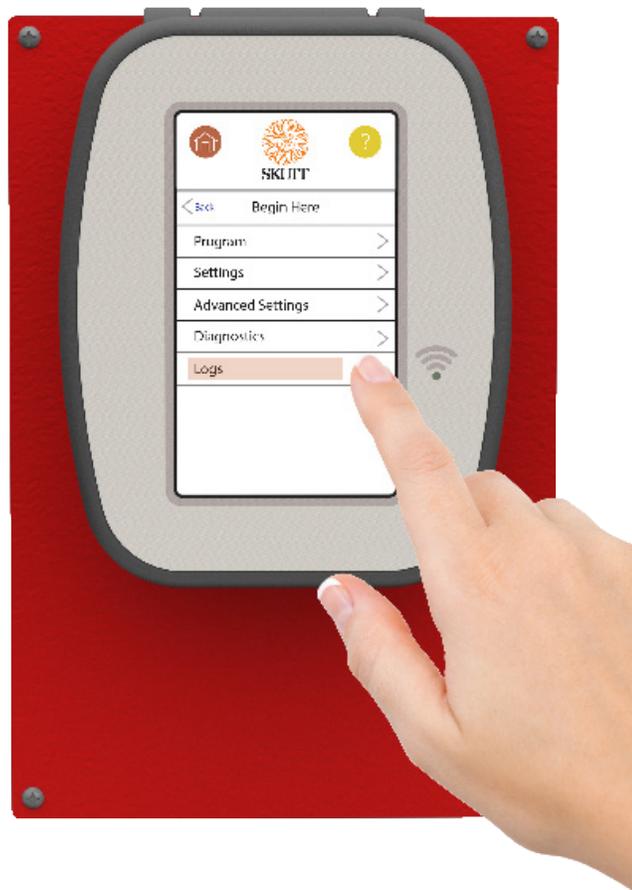
- General Ceramic Program Safety
- Guidelines and Procedures for Firing
- General Ceramics Education
- Kiln Operation and Safety
- Periodic Training Updates
- Signed Verification that Training Was Provided

Resources for Training

Each School or District may vary on their preferred guidelines and equipment they use. Many Schools will develop their own training Handbook with the help of vendors and other ceramic professionals. These may include documents such as these as well as videos on how to fire kilns.

Skutt provides a training video and manual with every kiln which can be used as integral parts of your training program. Some Ceramic Suppliers also provide training upon request. Additional training can often be found in the classes provided at State or National Art Education Shows.

It is hard from an economical stand point to justify flying Skutt representatives around the country to provide training. However, if we are in your area and you can gather together a significant number of Art Teachers, we can occasionally provide training at your location.



Examples of Use

Monitoring

Example 1

Teacher receives a text message that the Kiln generated an error code and has stopped firing. She opens her App and sees that the error code indicates the control board sensed the controller was getting too hot and stopped the firing. She returns to the kiln room and notices that she forgot to turn on the room vent. She turns on the vent and presses start to continue the program.

Example 2

The teacher has a meeting across town with his supervisor which happens to be near to where he lives. Normally he would have to return to the classroom to make sure the kiln had successfully completed the firing and shut off. Instead, after the meeting he opens his Kiln App and is able to verify that, yes indeed, the kiln has completed the firing and is now cooling. He now can get home in time to pick up his daughter from band practice.

Example 3

The Art Coordinator has established a policy that all the Elementary Schools in her district can only use low fire clay. She then set up a text alert to notify her if any of the kilns ever exceeded 2000 °F. At 3:30 PM she receives a text alert from KilnLink notifying her that Kiln 1 at Skutt Elementary has reached 2000 °F. She then opens up her App and sees that the teacher has accidentally input Cone6 instead of Cone 06. She instantly calls the teacher and has her stop the firing and saves the kiln from being ruined by melted clay. She also makes a note to have her kiln technician set a MAX temperature limit on that kiln.

Managing Teachers

Example 1

It is time for teacher reviews. One of the goals the Art Coordinator had set for each teacher was to fire at least 6 clay projects in the Fall Semester. During the review the Art Coordinator is able to pull up the Teachers firing History and see that they did indeed complete 6 firings during that timeframe. She also had a discussion with him about firing over night which is against school policy.

Managing Kilns

Example 1

The school district has been going through some budget cuts and the principle has asked the Art Coordinator to find ways of trimming the budget without sacrificing the quality of education. The Art Coordinator has to order a kiln for a new school being built in her district and is looking to see how she can do this without going over her budget. She opens up her KilnLink to see if there are any kilns not being used. She finds a Kiln at a school where there is a new Art Teacher that focuses his classes on 2D projects. She can see that the kiln has not been fired in 2 years, is only 3 years old and is the correct voltage and phase. She then has the kiln moved to be installed in the new school saving the district thousands of dollars.

Managing Maintenance and Repairs

Example 1

The Teacher at Skutt High School is panicking because their kiln generated an Error Code and he only has a few days to get everything fired before Christmas Break. The Art Coordinator tries calling their normal Kiln Repair Technician but they are on vacation in Miami for the Holidays. Not sure what to do he calls Skutt and talks to Perry in technical support. Perry listens to the Art Coordinators story and says "Hold on a second. Let me check the diagnostics on the kiln and see what is going on." With the Coordinators permission, Perry logs into Skutts Administrator version of KilnLink, finds the school, and can see that AMP 3 is reading 0 indicating there is a relay out.

Luck has it that the local Skutt Distributor has the part in stock (they almost always do) and they know of another Kiln Repair person that can come out the next day to install the relay.

Skutt Kiln Order Request

DATE : _____

Please fill out this form and provide it to the authorized Skutt distributor listed in the bottom right hand corner of the form. If no distributor information is provided, please contact Skutt Kilns directly for a recommended distributor in your area.

DELIVERY INFORMATION

SCHOOL OR INSTITUTION: _____

ADDRESS: _____

CITY, ST, ZIP: _____

PHONE: _____

CONTACT: _____

REQ. DELIVERY DATE: _____

APPROVAL SIGNATURES

ART TEACHER: _____

PURCHASING: _____

ARCHITECT/CONTRACTOR: _____

VOLTAGE AND PHASE VERIFICATION: _____

(By signing I agree that the voltage and phase ordered below matches the electrical supply available.)



***KMT1227-3**
Cone 8/5 - 9.9 C/F



KMT1227-3PK
Cone 10 - 9.9 C/F



KMT1222-3
Cone 10 - 8.1 C./F



***KMT1027**
Cone 10/6 - 7.0 C./F



KMT1022
Cone 10 - 5.7C./F

QTY	MODEL	VOLTAGE 208 or 240	PHASE 1ph or 3ph	FURN. KIT QTY.	ENVIROVENT 2 QTY.	**PRE-DRILL YES/NO	KILNLINK PLAN 1 YR OR 5 YR

* 1 PHASE/208 VOLT MODELS HAVE THE LOWER RATING
** KILNS WILL BE PRE-DRILLED TO ACCEPT THE ENVIROVENT 2 IN THE FACTORY



Skutt Ceramic Products
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503-774-6000 ■ Fax 503-774-7833 ■ skutt@skutt.com ■ www.skutt.com

SKUTT DISTRIBUTOR INFORMATION