

Instructions For Use and Operation of TOP LOADING KILNS

This Document should be read carefully before firing your new Cromartie kiln.

Introduction

The firing of ceramic products is a process by which a combination of heat and time applied to a ceramic body or glaze will cause the material to change irreversibly into a rigid 'fired' piece.

Subjecting ceramic products to heat has existed for thousands of years, the earliest Potters knowing when their product was 'fired' by experience of colour of the heat (red hot, white hot etc.) and the time the product had been subjected to that heat.

It is vital that today's Potter/Ceramist uses the same understanding and parameters as our predecessors. Technological advances now enable us to measure with greater accuracy both time and temperature, but we still need to call on our experience or that of others to ensure a 'perfect firing'.

The following information has been broken down into a step-by-step account.

One item that is covered is heat work, this relates to one of the most fundamental rules in the firing of kilns, and the effect of heat and time on a ceramic body.

Important.

If your kiln is fitted with a brick lid it is imperative that you adhere to the lid tightening procedure as listed in assembly details.

One item that is covered is heat work, this relates to one of the most fundamental rules in the firing of kilns, and the effect of heat and time on a ceramic body.

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Damage In Transit

Should you find any damage to your kiln upon delivery please follow the instructions below :-

1. Call the haulier and ask for an inspection.
2. Save all packaging materials.
3. Contact the dealer from whom you purchased the kiln.
4. Do not assemble or fire the kiln until your damaged kiln has been inspected.

1 Assembly Details

1. Carefully unpack and inspect all parts of your kiln.
2. Carefully remove the protective polythene film surrounding the stainless steel jacket.
3. Open lid and check that the elements are securely in their grooves. If they are not replace them carefully, ensuring not to overstretch them or damage the brickwork. If you do not correct loose elements they will sag and stretch out during firing, and not only cause you problems, but may have to be replaced.

2 Kilns Fitted With Brick Lids Only

1. To avoid damage in transit the four pins to the rear of the brick lid have been slackened and a sheet of bubble has been placed between the lid and the kiln body. Carefully remove the bubble and tighten the four pins to the rear of the lid while the lid is in the closed position. (With Spanner Provided).

Tensioning of Brick Lids

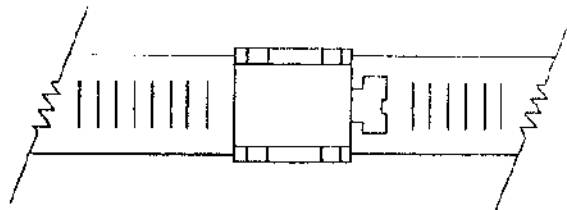
Tensioning is required as a routine maintenance procedure to extend the working life of the brick lid. For the first 6 firings it is recommended the lid be tightened after every firing, then once per month thereafter or as required.

Tensioning Procedure (You will require the following tools), a spanner or screwdriver and a pair of pliers.)

1. Clasp the side of the tensioning clip around the barrel using the pliers. As shown in figure 1.0
2. Rotate the screw clockwise to tighten the clip.
3. Tighten till the band no longer has any slack points, Insulation bricks are extremely soft, over tightening will cause them to crumble and crack.

Note! Failure to clasp the tensioning clip may result in insufficient tensioning to the lid.

Figure 1.0 Tensioning Clip

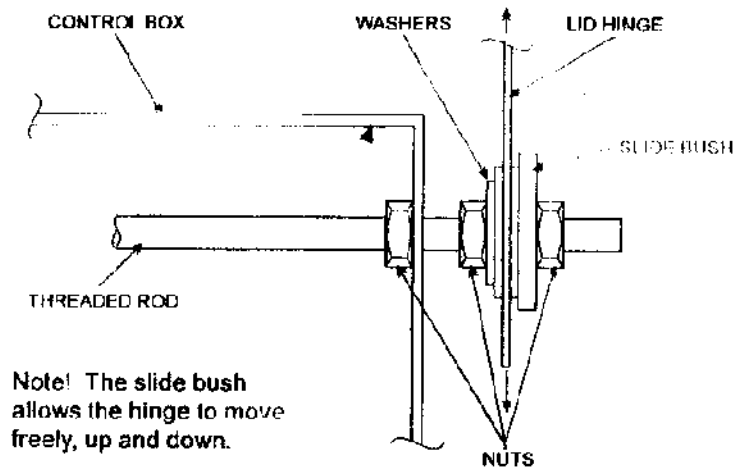


Hinge Detail for Brick Lids

Most Cromartie top loading kilns with brick lids now feature our *sliding bush mechanism*. This enables the

brick lid to move freely whilst the kiln is firing. Thus helping to prevent the lid edges from rising during a firing

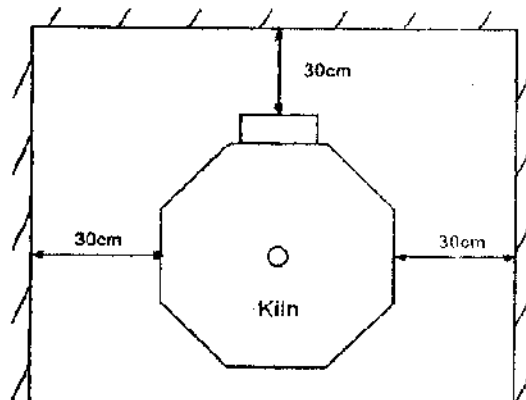
Figure 1.1 New Hinge Detail



3 Placement Of Your Kiln For Safe Operation

1. The kiln should be placed on a level surface preferably one of the following :- concrete, plastic (Thermosetting only) a paving slab or fire proof board, avoid carpet.
2. The kiln should be placed approximately 1 foot (30cm) away from any walls.
3. The kiln should be kept away from all inflammable materials such as curtains, aprons, plastics, shelves and paper etc.
4. Route the power cable so that it will not touch the kiln case.
5. When the kiln has been placed in its permanent position apply the brakes on the castor wheels to prevent the kiln from moving.
6. Place the kiln within close proximity of the power point.
7. The kiln should be kept in a well ventilated and well lit area, (should you feel more ventilation is required, a standard domestic extractor fan would be quite adequate). Alternatively a kiln vent can be supplied by us at extra cost. Under no circumstances should the vent/extractor be placed directly above the kiln. **Note!** If you are using an extractor fan, the room should have at least one air brick. If the room has no ventilation the fan will not work properly.

Figure 1.2 Placement of Kiln

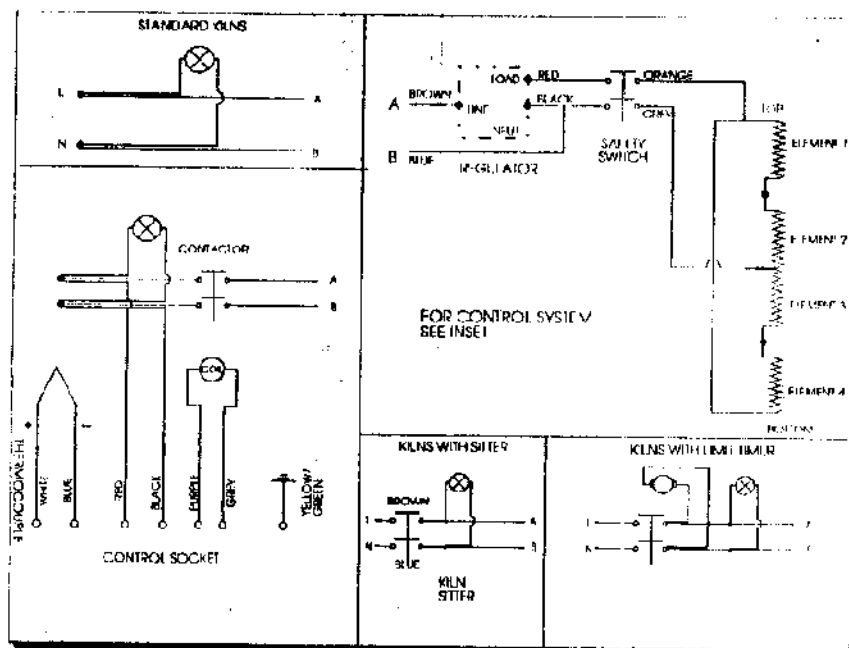


The kiln should be placed approximately 1 foot (30cm) away from any wall to allow ventilation & access for any service work.

4 Electrical Requirements

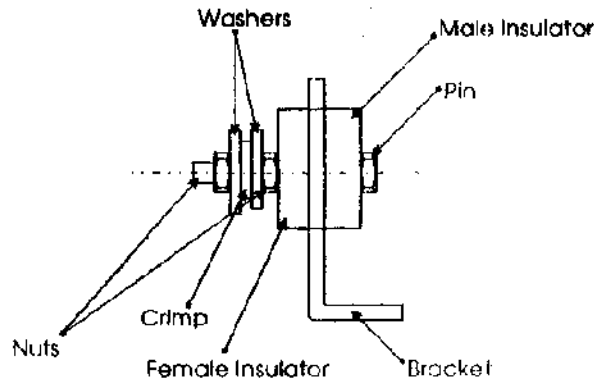
1. Your kiln will work properly only if it is connected to a power supply with the correct electrical capacity and voltage. Due to the fact that an incorrect connection can be hazardous, a qualified electrician should always be consulted.
2. All Cromartie kilns are supplied with A4 or A3 wiring diagrams, these should be kept for reference. Below is an example of a wiring diagram.

Figure 1.3 Example Wiring Diagram



3. Your kiln will require an electrical supply as stated in our catalogue, and as shown on the kiln data plate.
4. Always ensure that a supply cable of suitable size is used, particularly if it is a long run. Kilns can be affected by low voltage. Voltage may drop along a long cable run.
5. For kilns supplied without leads consult an electrician for the correct gauge of wire. Although heat resistant cable is used in our kilns PVC cable is quite adequate for the kiln lead.
6. The plug and cable attached to some models, must not be changed or altered in any way. Such a move will invalidate any warranty, as will improper electrical installation. If you have any doubts, contact our Technical Department.
7. **Note!** Under no circumstances do we recommend the use of extension leads with kilns.
8. All electrical connections and circuit protection equipment must be installed to comply with 16th edition electrical regulations.

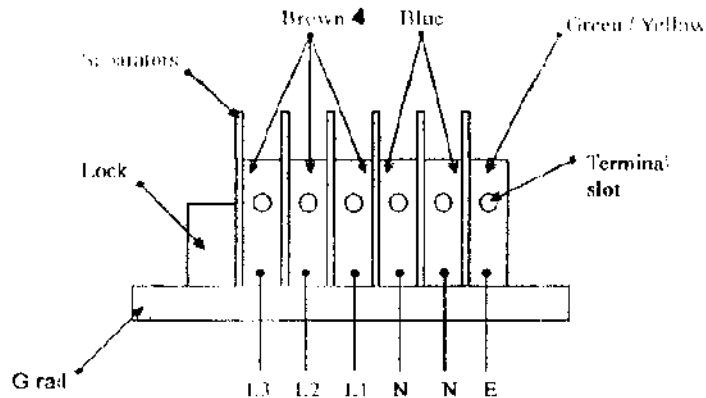
Figure 1.4 Mains Bracket (Type A)



To prevent crimp end from burning off tighten the two nuts towards each other to compress both the washers and crimp to eliminate any gap between them. Even when the nuts are tight the Male and Female insulators should still be able to rotate.

Note! This applies to all connections in the kiln where the Male & Female insulators are used.

Figure 1.5 Mains Bracket (Type B)



To prevent wire ends from burning off check all mains connections are secure.

Note! When working in the kiln always turn the kiln power and the isolator switch to the off position. Mains connections to the kiln must be made in a workmanlike manner and correctly tightened failure to do so can result in the terminal burning out. **SUCH DAMAGE IS NOT COVERED BY WARRANTY.**

5 Cautions

We at Cromartie have designed our kilns with safety in mind. However, good common sense is required during the operation of your kiln. Please observe the following precautions at all times, they are for your protection.

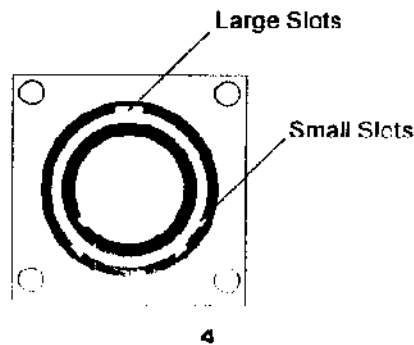
1. The surface of your kiln may be hot when firing, do not touch. Keep children clear unless supervised. A safety cage can be supplied by us at extra cost
2. Disconnect all power before attempting any servicing.
3. Do not place your hand over the vent hole towards the centre of the kiln lid during firing, as it is very hot.
4. Do not fire hotter than the recommended temperature on the data plate

5. Do not open lid until the kiln has cooled.
6. Operate in a well ventilated area (see section 2).
7. Do not operate or open kiln on or near a wet surface.
8. Do not use other electrical appliances on the same electrical socket of the kiln, i.e. multiplugs.
9. Never allow shredded paper or other flammable materials to collect around the same room as your kiln.
10. Do not lean over or place anything on top of the kiln lid.
11. When unloading a kiln, be careful of the stilt marks on glazed ceramic pieces. They can be sharp and should be smoothed as soon as possible with a grinding stone.
Be sure to wear safety glasses while grinding off stilt marks!
12. When firing any new kiln and controller for the first time we recommend this is done during the day under supervision to prevent any damage to the kiln, should a mistake be made.

6 Control Socket.

If the kiln is fitted with a controller, the control socket has a slot in it which only allows the plug to fit in one way. NB. Whilst many manufacturers use a similar socket the individual pin connections may differ. Wrong connection may cause damage or be dangerous.

Figure 1.6 Control Socket



Kiln Sitters

Before firing your kiln, ensure that the sensing rod is free and, using the setting disc, check that the latch is correctly set. Refer to page 3 of the Kiln Sitter Manual. The instructions on page 3 of the Kiln Sitter Manual regarding spacing of the claw are to be ignored. This setting is now fixed since the claw has been modified.

Firing Warning

Firing a ceramic object is the final and most important step in producing a finished piece. A little carelessness, either in the firing or the loading can spoil all your previous efforts. In fact, it can damage your kiln permanently, not to mention your ware.

Policemen Controller

On all kilns with a 7 Cubic Foot capacity or more we recommend the use of a policeman controller to prevent any major damage should the kiln overfire.

7 Energy Regulator

The energy regulator is an infinitely adjustable switch which controls the kiln by switching the power on and off, thus regulating the kiln's climb rate. It is not a temperature controller.

The regulator has a manually operated knob with a dial scale marked "1-FULL" and is capable of altering the time of switching on and off the contactor, depending on the setting.

To control the kiln by means of this control unit, switch on at the isolating switch and turn the knob to the required setting on the dial. To begin with, we would suggest that only three settings are used, i.e. 1, 3 and full, this represents low, medium and high on the rotary switch. This will give an idea of how the kiln fires, other settings can be worked out to suit individual requirements.

When the kiln is set to 1, the elements in the kiln are on full power for a time, and then all off for a time. On this setting they are off for a longer period than they are on. On 3 the elements are on and off approximately the same length of time, and when on full, the elements are on continuously.

8 Balance Regulators

When the kiln is fitted with zone control, i.e. two or three regulators, the regulator then controls the bottom, middle and top zones of the kiln. The final kiln temperature is controlled by means of a temperature controller, when fitted. The regulators are used to control the temperature rise in the kiln and normally will be set in unison throughout the stages as described under energy regulators. When the full power stage is reached the balance regulators may be used to vary the temperature in each zone.

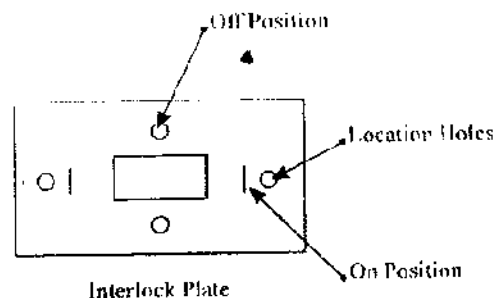
For example if the kiln is packed less densely in the bottom then it may fire hotter in that zone in which case set the bottom zone regulator to 4½ and the middle (where fitted) and top to full. To check results use cones, and make further correction if required. Make only one small adjustment at a time, i.e. one half setting only. The kiln may, of course, be deliberately set out of balance.

Normally with a new kiln all balance regulators will be set the same, until a firing pattern is established. NB. Where a fully automatic controller is fitted (e.g. Safefire 4000) all regulators will be set to full for the firing, unless adjusted for balance.

9 Interlock Key Switch (Oval Top Loaders Only)

The kiln is fitted with a captive key mains operated interlock switch with the key fastened to the lid. The kiln cannot be 'fired' until the lid is closed and the key inserted into the lock and turned. To insert the key into the lock, make sure the lid is fully closed. When the key switch is in the 'off' position, power will be prevented from reaching the elements. This switch is only for safety and should not be used as a isolating switch.

Figure 1.7 Lid Switch Adjustment



Note! When any covers are removed for maintenance or repair the supply must be isolated at the mains.

An interlock switch is required by the Health & Safety, under no circumstances should it be bypassed.

10 Batt Wash

1. Mix a portion of the contents of the Batt wash packed, with water to a creamy consistency.
2. Applying with a brush a coat of kiln wash to any batts being used. This will prevent glaze from sticking if a piece falls on the batts (Never apply batt wash to the kiln walls, sides or undersides of shelves, or underside of lid).

For kilns with sitters you can apply a thin coat of batt wash to the cane supports and the bottom of the sensing rod, (Do not apply batt wash to the cone or to the end of the porcelain tube of the kiln sitter. Beware of a thick wash application on the kiln sitter parts, as this could cause the kiln to overfire). Let batt wash dry thoroughly before loading the kiln.

11 Ware

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

12 Automatic Dampers (optional)

Automatic dampers are optional on front loading kilns with either Safefire 4000 or Safefire 5000 control.

They are both capable of automatic damper control or other apparatus via an external relay built into the controller. The following example shows how the damper opens and closes in a typical program.

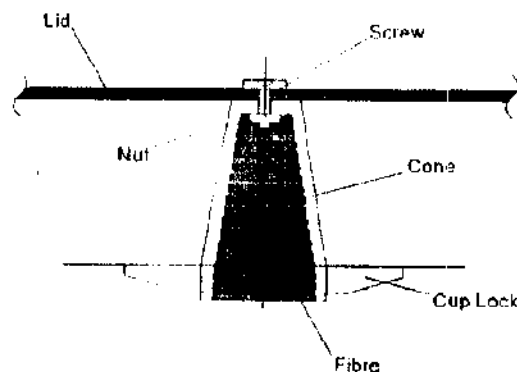
Example.

The kiln is switched on and climbs towards top temperature. At 500°C the relay comes on and the damper slowly closes. It then stays closed through the firing until the kiln has cooled to approximately 400°C, the damper then slowly opens allowing cool air into the kiln thus increasing the kilns cooling speed.

Instructions on how to program the automatic damper can be found in the controller instructions under the heading **AUXILIARY RELAY OPERATION**. The damper operations in the instructions are as follows:

Relay On = Damper closing temperature
Relay Off = Damper opening temperature

13 Cup Lock Fitting Details



1. Insert Cone and Cuplock into lid
2. Tighten Screw
3. Fill centre of cone with ceramic fibre and pack down to ensure tight fit.
4. If fibre should come away, repack the cone as before

14 Heat Work

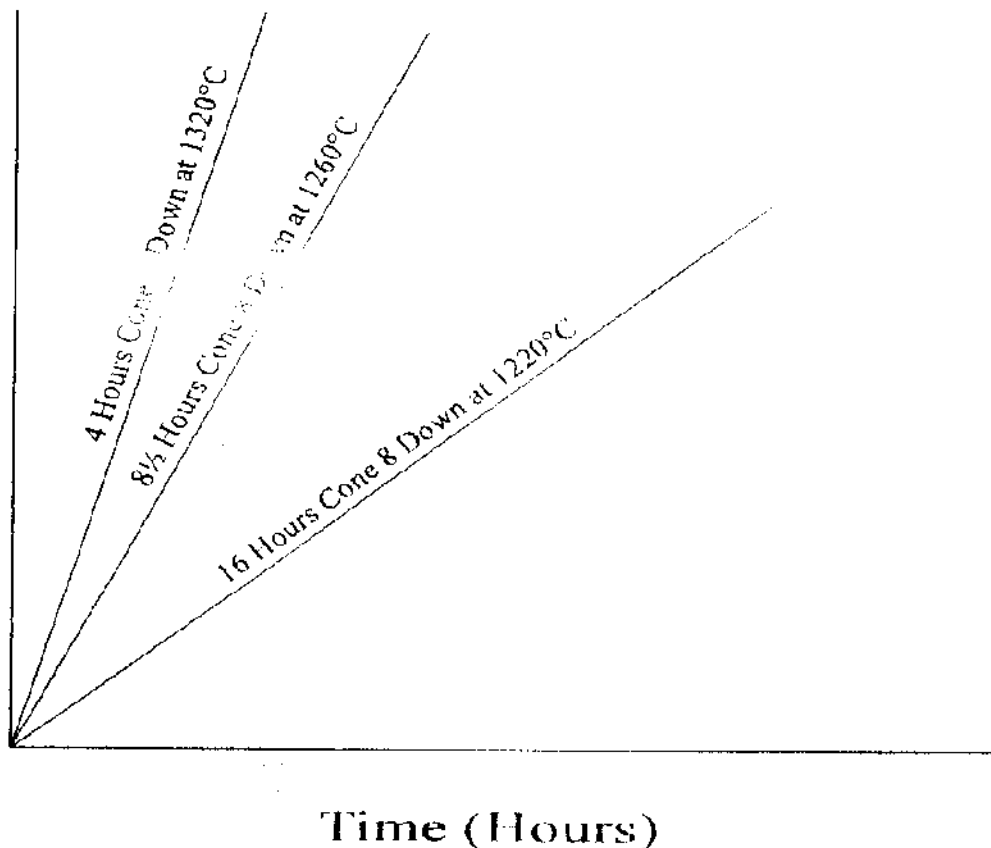
Heat work, is a concept of both temperature and time. Remember heat work and its effect on ware and you are halfway to achieving perfect results. Many attempts have been made to quantify this concept mathematically, but due to its complexity especially when one considers the thousands of bodies and glazes in existence, all of which require different amounts of heat work to achieve maturity, this task is nigh-on-impossible.

Cones, Buller's rings and mini-bars have been developed to remove much of the guess work from firing, by acting as a measure of heat work. They must never be regarded as temperature only measuring devices. They are indicators of both time and temperature, which is why different top temperatures are specified, dependent on the rate of increase of temperature. The diagram below shows the difference that can occur with one cone 'fired' at different rates.

More and more, sophisticated controllers are being used instead of, and sometimes along with cones, the latter method being a little superfluous but, used as a double safety measure to ensure a good 'firing'.

So in conclusion, any piece of ceramic to be 'fired' needs heat. This heat needs to be applied over a certain amount of time. We can measure temperature and time accurately, experience alone will tell us the right combination of both. If a piece is overfired, it has had too much 'heat work' and this can be rectified by reducing time of firing and / or temperature of firing. Similarly, underfired ware can be improved by increasing the time of firing and/or temperature. One does not have to alter both. Underfired ware could become overfired simply by firing longer at the same temperature, as the amount of 'heat work' has been increased.

Figure 1.8 The Effect of Time and Temperature on Orton Cone No. 8



The following table is a further example of heat work, note how the mini bars/cones bend at a lower temperature just according to the kilns rate of climb.

Bell cones/ mini bars	Approx bending temp (temp equivalent)		Bell	Orton	Seger	Perfect Fire Controller
	60° C/hr	100° C/hr				
018	696	706	717	720	705	696
017	727	736	747	770	730	727
016	764	776	792	795	755	763
015	790	797	804	805	780	789
014	834	836	838	830	805	833
013	852	860	869	860	835	868
012	876	880	884	885	860	866
011	886	990	894	-	900	886
010	-	-	-	910	920	887
09	915	919	923	930	935	914
08	-	-	-	950	955	944
07	973	978	984	990	970	972
06	991	995	999	1015	990	991
05	1031	1036	1046	1040	1000	1031
04	1050	1055	1060	1060	1025	1049
04A	1060	1065	1070	1070	-	-
04B	1068	1074	1080	1080	-	-
04C	1076	1082	1090	1090	-	-
04D	1084	1090	1100	1100	-	-
03	1086	1092	1101	1115	1055	1089
02	1101	1110	1120	1125	1085	1101
01	1117	1125	1137	1145	1105	1117
1	1136	1143	1154	1160	1125	1136
2	1142	1150	1162	1165	1150	1142
3	1152	1160	1168	1170	1170	1152
4	1168	1176	1186	1190	1195	1167
5	1177	1186	1196	1205	1215	1177
6	1201	1210	1222	1230	1240	1201
7	1215	1227	1240	1250	1260	1214
8	1236	1248	1263	1260	1280	1236
9	1260	1270	1280	1285	1300	1259
10	1285	1294	1305	1305	1320	1284

All of the above BELL mini bars and cones we carry in stock.

15 Loading Your Kiln

Loading for a Bisque firing. Greenware that has not been decorated can be placed directly on shelves. Generally ware should be 'fired' in its natural position. Pieces with flat, vertical surfaces (such as plaques), should be 'fired' flat to prevent warping. For sure fire results, pieces should not touch each other. Allow at least a 1/2" (12mm) between pieces. Ware should never touch the side walls of the kiln. Thin walled cups should be 'fired' upside-down to prevent warping. Pieces with lids should be 'fired' with the lids in place to ensure a good fit.

Loading for glazed or over-glazed firing. Glazed pieces must be stilted to prevent them from sticking to the batts. Glazed pieces with fitting parts, such as lids should not be 'fired' together as they will fuse together. Special care should be taken to allow at least 1" (25mm) between pieces decorated with over glaze, so they will not contaminate each other during firing. Glazed pieces should normally be 'fired' in their natural position. However, some glazes produce flowing effects (Crystallines, for example) that can be made to go in virtually any direction you choose, just by tilting the piece.

Porcelain is a high-fire clay body which vitrifies (becomes non porous) when 'fired' and must be treated similar to glaze. It will stick to anything during the firing process unless preventive measures are taken.

The one difference between handling porcelain and glaze is that you cannot use stilts to support porcelain Bisque. They will become embedded in the porcelain when 'fired' to the high temperature. Porcelain Bisque must be 'fired' on a flat surface that has a coating of high-fire kiln wash. Do not use ceramic kiln wash as it will harden at the high temperature and stick to the pieces.

If you have a piece that has a lid or top that will be used together, they must be 'fired' together. To prevent the two parts from sticking together, the touching surfaces must be coated with a layer of silica (flint). Porcelain pieces that may warp or sag have to be supported at the point of stress. This is achieved by using hollow rolls of porcelain clay shaped to fit the point that may sag. Again, silica must be applied to the areas that will be in contact.

As mentioned earlier, the side walls of the kiln are hotter than the centre. A piece should not be placed any closer than 1" (25mm) to them. If you do, the side closer to the element will shrink more than the other. It is possible to use this heat to your advantage by placing a piece that tends to warp during firing with the inclined side of the piece away from the elements. The heat will help to hold it straight. This however is not reliable, and props should be used.

To load porcelain pieces coated with porcelain glaze, you must allow space between pieces and the side walls of the kiln. Leave at least 3/4" (20mm) between pieces and side walls. Again, stilts cannot be used with porcelain, so all glaze must be removed from the surface that the porcelain piece will rest on. This dry-footing should be completed before the loading process.

Again, it is necessary to have a good coating of high-fire kiln wash on the bottom and shelves to prevent the porcelain from sticking.

If you are firing pieces that have lids or tops, they cannot be 'fired' together as they were in Bisque. The lid must be dry-footed and 'fired' alone. Since the two pieces (top and bottom) were 'fired' together in the Bisque stage, the shrinkage is over and will fit together nicely after glaze firing.

Stoneware is a combination of natural clays with chemicals added for stability. It should be handled in much the same way as porcelain, but normally does not require stiling when 'fired' to Bisque, as all pieces are usually dry-footed. When glaze firing, the pieces do have to be dry-footed. For firing stoneware see manufactures instructions.

Terracotta clay is a natural clay available in a variety of colours. It is normally used in hand modelling and sometimes cast. The firing procedure used is the same as that for ceramic (low fire) Bisque and should be handled in the same way.

Note! If you, use this type of clay, it is important that the clay not only be worked to remove any air bubbles but also that the inside be hollow. If the terra cotta piece is not hollow there is no way that the vapours and gases can escape during the firing. They will escape, however, making their own way through the clay body. This usually results in the piece blowing up. If you plan to fire any of these pieces, it is advisable to fire them alone to prevent damage to any other pieces.

16 Firing Your Kiln

Note! The following suggestions are for guidance only, there is no substitute for training or experience note. Most Hobby ceramics materials have the firing details printed on the label.

Vent Plugs

Unless witness cones are being used, we suggest the peep hole plugs are left in the side of the kiln. Vent plugs on the other hand should be left out until the kiln glows cherry red inside, this occurs at around 600° C. At this point the vent should be inserted and left in until the firing has been completed.

Firing begins with a first, or Bisque firing, and then followed by a second or glaze firing. Bisque firing hardens dried clay or Greenware so it can be handled, yet porous enough to accept colours. Once the piece has been decorated or glazed, it is 'fired' for a second time, this matures the decorative coating.

You may require additional firings if you are using overglazes.

Note! If your kiln is fitted with a kiln sitter/limit timer, the kiln sitter instruction manual advises leaving the vent plug out during the entire firing. Either method is acceptable depending upon the way you have been taught or instructed by your clay supplier.

All of the firing cycles below can be adapted for use with any of our digital controllers. As rule most ceramic items can be fired in the following way.

Bisque Firing

Firing Bisque will normally be your first firing in low firing ceramics and is the process that matures the clay body. It burns out any impurities and brings it to the point where atmospheric moisture can no longer be absorbed. If it has not 'fired' to maturity the moisture collected may cause crack or "crazing" during later glaze firings. A typical bisque firing would be in the region of 1040°C to 1060°C.

Firing Guide;	Energy Regulator	Position 2 for 3 hours then full.
	Electronic Controller	1st ramp 120°C - 150°C per hr
		1st set point 600°C - 700°C
		2nd ramp 200°C - Full power
		Top temp 1040°C - 1060°C

Glaze Firing

When firing ceramic low-fire glazes, you should not only be sure that no two pieces touch, but also that they have either been placed on stilts or dry-footed.

Normally glazes are 'fired' slightly lower than Bisque, typically 990°-1015° C but as there are exceptions it is always good practice to check the glazes container for the recommended temperature.

Firing guide;	Energy Regulator	Providing ware is dry, use position 2 for 1 hour then full
	Electronic Controller	1st ramp 120°C - 150°C per hr
		1st set point 600°C - 700°C
		2nd ramp 200°C - Full power
		Top temp 990°C - 1015°C
		Soak 0 - 10 mins.

Overglaze Firing

Overglazes are only 'fired' to the glazes softening point, which is less than for normal low-fire glazes, a typical firing temperature would be 700°-720°C. China paints however require different firing temperatures depending on the colour, so check the manufactures recommendations.

China paints are suspended in oils for application so the kiln must be ventilated well until the oil, as well as any other organic matter, is burned out. The kiln should be vented until all traces of odour are gone. This is normally done while the kiln is set on low. After turning the kiln to a higher temperature, you again smell the odour, reopen the kiln and turn it down to low for an additional period of time.

Note! Metallics and Lustres can be 'fired' using the same procedures followed for china paints.

Firing guide;	Energy Regulator	Position 4 for whole firing.
	Electronic Controller	1st ramp 0°C per hr
		1st set point 0°C
		2nd ramp 150°C - Full power
		Top temp 650°C - 720°C
		Soak 0 - 20 mins.

Porcelain

Porcelain Bisque is normally 'fired' to 1205°-1230° C and should be done slowly, and should also be supported. **Note!** Porcelain reaches its maturing point very rapidly. Porcelain glaze is not 'fired' as hot as Bisque and does not require propping to prevent warping or sagging. **Pieces do not have to be dry-footed.**

with Reg.

Firing guide;	Energy Regulator	Position 2 for 2 hour then 4 for 3 hours, then full to top temperature
	Electronic Controller	1st ramp 120°C - 150°C per hr 1st set point 500°C - 600°C 2nd ramp 200°C - Full power Top temp 1205°C - 1230°C

Stoneware

Depending on the type of stoneware body, it is 'fired' in the region of 1210°-1230° C. Glazes applied to stoneware are 'fired' in the normal manner if low-fire, while high-fire glazes are usually in the temperature range of 1160°-1260° C.

Firing guide;	Energy Regulator	As for Bisque and Glaze firings.
	Electronic Controller	1st ramp 120°C - 150°C per hr 1st set point 600°C - 700°C 2nd ramp 200°C - Full power Top temp 1160°C - 1260°C

Underglaze

Classed as Underglazes, colours can be either opaque or translucent (one-strokes). Opaques are applied to Greenware only with pieces being 'fired' the same as if firing Greenware to Bisque. One-strokes applied to Greenware are 'fired' following normal Bisque firing techniques, while one-stroke on Bisque have a wider firing range.

17 Cooling and Unloading Your Kiln

The cooling period is extremely important. If the lid is opened before the kiln has cooled sufficiently, there is a good chance the ware will be damaged due to thermal shock. We recommend the lid only be opened 3 to 4 hours after the kiln has been shut off. At this point (Approximately 200° C) the ware is still warm and no attempt should be made to move it until it is cool-to-the-touch. When unloading a glaze firing, remove the stilts from the ware. This can be done in a popping or breaking action that frees the points of the stilt from a thin wall of glaze. Stilt marks can be sharp and should be ground off with an abrasive stone.

18 Firing Defects

No matter how careful you are, at some time or other you will open your kiln and be disappointed at what you see. There are many problems that can be caused by application rather than firing. We at Cromartie recommend you read these early in your ceramic career since many problems can be avoided and some of them cannot be salvaged once they have occurred.

Bumps in Porcelain

Usually caused by firing wet porcelain Greenware or overfired Bisque. Doing it properly will prevent this.

Black Specks

Usually dirt from a brush, Greenware, Bisque, glaze container or even the kiln. Cannot be corrected. Can be avoided with cleanliness.

Blistered or Bubbled Glaze

Caused by bubbles in glaze as kiln cools. Gases are released from the underfired Bisque or glaze. To correct, sand down faults, cover with thin coat of glaze and refire to the equivalent of one cone hotter.

Broken Lines in Overglazes

Caused by overfiring or too heavy an application. Can be from too heavy an application of glaze also. Must be burnt off and redone.

Cloudy Clear Glaze

Caused by underfiring and can be corrected by refiring to proper temperature.

Colours Peel Off

Caused by too heavy an application of glaze, dirty Bisque, oily or dirty hands that prevent the glaze from adhering to the piece. Can be caused by too rapid cooling of the kiln. Hard to salvage any piece with this fault. Underglazes will peel off if not compatible with clay body.

Cracked Pieces

Caused by uneven or too rapid heating or cooling. If the edges of the crack are sharp it happened during cooling. Rounded or smooth edges on the crack indicate it happened during heating.

Craters

Caused by underfiring glaze. Can be corrected by adding glaze to craters and refiring to a higher temperature.

Crazing

Appears as a fine network of cracks on the glazed surface. Caused by underfired Bisque, incompatible thermal expansion between clay and glaze or cooling piece too rapidly. Can be corrected by refiring piece to the equivalent of one cone hotter than the original firing.

Creeping Glaze

This fault takes the form of a bare spot in the glazed surface after firing. Caused by dust, dirty Bisque, oil on hands. Firing a piece before the glaze dries may also cause this. Can be salvaged by applying additional glaze to spots and refiring.

Delayed Crazing

The same condition as crazing but takes several months for the cracks to appear. Can be corrected by refiring piece to the equivalent of one cone hotter than the original firing.

Discoloured Red Glazes

Greyed red glazes are caused by too thin an application of glaze, while black spots are the result of overfiring, contamination from yellow and greens, or not enough ventilation. To correct, re-apply glaze and refire.

Dull Metallics

Caused by under-application or being underfired. If underfired, can be refired.

Faded Decals

Caused by either under or overfiring. Check to make sure you are firing to the correct temperature. If underfired you can refire, but if overfired, nothing can be done.

Holes in Lace or Fabric

Caused by inadequate application of slip in draping technique. Fabric burns out before clay is mature so fabric must be thoroughly saturated to leave a thin shell after firing.

Loss of China Paint Colours

Caused by overfiring colours or not applying enough. Can be corrected by re-application and refiring.

Overglazes Flaking

If applied too thickly, overglazes will flake or peel off or frost if overfired. To correct, fire piece to a higher temperature and start again. Lustre colours will weaken if overfired.

Peeling China Paint

Caused by too heavy an application of colour.

Pinholes

An incomplete firing will cause bubbles, pinholes and craters. Pinholes can be caused by too rapid heating or cooling, dust, or dirt, overfiring, or underfiring Bisque. This can be corrected by refiring to a higher temperature than the original.

Poor Coloured Glazes

Poor colour in glazes can be caused by overfiring.

Purple Spots in Gold

Caused by too thin an application of gold or thinning gold too much.

Rough Matt or Satin Glazes

Cause by underfiring, glaze not applied smoothly, or not enough glaze. Can be corrected by adding more glaze and refiring.

Sagging Glaze

Caused by applying too much glaze on a vertical surface that caused the glaze to sag when 'fired'.

Shivering or Separation of Colour From Piece

Caused by an incompatible clay body and colour which occurs during expansion and contraction when 'fired'.

Smooth Texture Glazes

Caused by not enough glaze or overfiring. Correct by adding more glaze and refiring.

Specks in Porcelain

Caused by too longer firing.

Streaks in Glaze

Could be caused by uneven coats of glaze, glaze not applied at right angles, glaze applied too thin, or not stirring glaze in jar. Correct this by adding more glaze and refiring.

Streaks in Underglaze

Normally caused by under application of colour. You can correct by adding more colour to weak spots and refiring.

Warped Pieces

Caused by distortion when removing piece from mould, firing piece too close to elements or firing piece in unnatural position.

19 Kiln Maintenance

The following measures have been listed to help increase your kiln's working life.

Check The Batts

Batts do not have to be re-coated with batt wash for every firing, but an adequate coating should be maintained. Brush away any loose particles of batt wash from the shelf and check every batt for crack before placing in the kiln.

Remove glaze spots from shelves and walls. When glaze spots start to appear on the wall or the batts, you should remove them carefully prior to the next firing. Using a spatula or flat blade screw driver, remove the glaze from the batt only with batt wash.

Care of Elements

Our kiln elements are manufactured from a special alloy formulated to give them both long life and uniform heating characteristics. Life expectancy is indeterminate due to the great variety of firing schedules they can be subjected to, but a few common sense tips can help you get the maximum use out of your elements.

1. Do not allow any other substance to come into contact with elements, i.e. dust in grooves, kiln cement, glaze, clay etc..
2. Regularly clean out grooves.
3. Check for localised weaknesses which can cause hot spots and burn out.
4. Avoid disturbing elements as once they have been 'fired' they become brittle.
5. Elements do "weaken" with time. This first shows itself in extended firing times for the same temperature. Once this situation becomes apparent you should prepare to replace the elements.
6. Occasionally an element will pop out of a groove because of expansion and contraction. If it should do this put it back into place by using long nosed pliers. If this persists, clips can be supplied by us to hold the elements into place.

Note! Be aware of the consequences of extended firing times on your work.

When you require new elements could you please give the following information as shown on the kiln data plate.

1. Kiln model number.
2. Kiln kW details.
3. Year of manufacture and serial number.

Stainless Steel Jacket

The stainless steel jacket may discolour from both heat and gases released from the pieces being 'fired'. Use stainless steel cleaner or glass polish to keep your kiln shiny and new looking.

Replacing Elements.

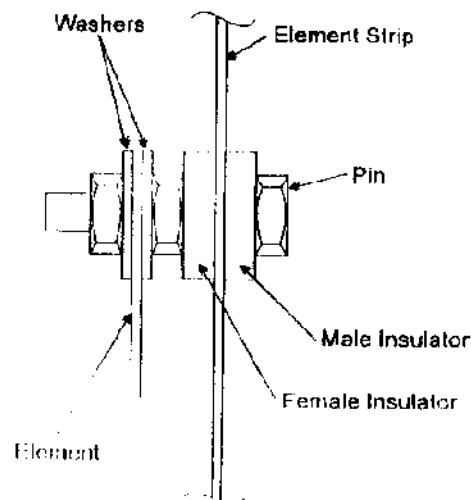
First see that kiln is switched off at Isolating Switch. When you receive your new set of Cromartie elements, you will need to stretch them before they will fit into your kiln. To find the element length take a ball of string and run it around the element grooves, this should give you an idea of how long the elements should be. Attach one end of the element into a vice (Be careful not to over tighten because this will crush the wire) and stretch it to the length of the string. When the elements have been stretched you can then thread them through the holes in the kiln brickwork.

1. Remove back box cover.
2. Determine which are the connections to the faulty element
3. Using spanners, slacken off and remove nuts on these connections.
4. Take off washers and connections noting the sequence.
5. Remove old element.
6. Inspect element grooves, remove any dirt and element metal from area of burnout.
7. Place element supplied into position.
8. Go to back box of kiln and bend element tail around bolts.
9. Replace connections and washers and tighten nuts. Ensure that washers are flat and not burned unduly-if in doubt replace. Also replace any damaged porcelains.

Note! It is most important that a washer is placed between each turn of wire on the connector. The final tightening of the connection should be between the nut holding the porcelains to the bolt, and the nut holding the element and the copper links to the bolt. When the connection is tight it should be possible to rotate the porcelain insulators, thus proving that no tension is put upon them. Remember that sound connections can only be made by using two spanners of the correct size.

10. Replace cover and check that element is fitting into the grooves.
11. It may be necessary to stretch the element slightly to fit it into the grooves.
12. Switch on and check for operation

Figure 1.9 Replacing Elements



Note! The nuts either side of the element must be tightened towards each other to compress the element. Once this connection is tight you should still be able to rotate both the male and female insulators.

Occasionally an energy regulator will fail to operate correctly either by failing to deliver full power when set to full or by delivering more power than required at lower settings. In this event replacement is required. To replace this unit first remove the back cover from the kiln, then remove the knob with a sharp pull, this will reveal a single nut securing this, together with the washer, for replacement. The wires are connected by push on terminals. Pull each wire off singly and connect to the corresponding terminal on the new unit. Do not remove more than one wire at a time to eliminate the possibility of miss-connection. Replace the unit, reversing the removal procedure, ensuring that the two locating pegs are in the holes and that the unit is in the right way up.

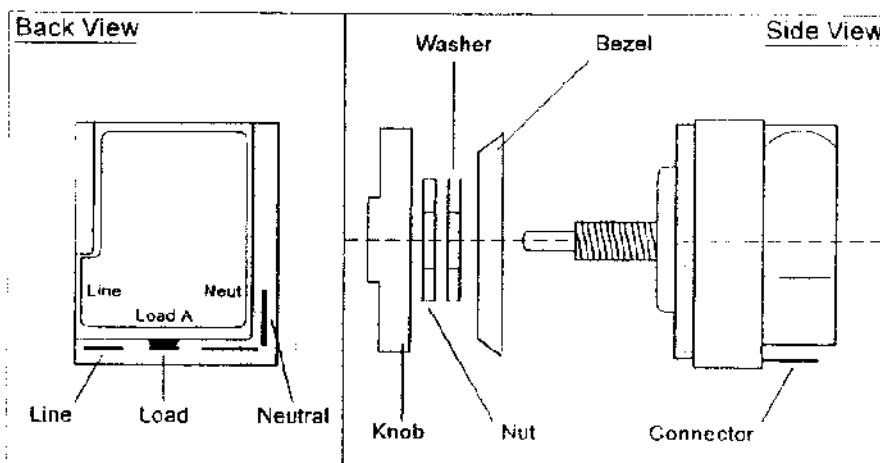
20 Instructions for Replacing Energy Regulators.

Occasionally an energy regulator will fail to operate correctly by either failing to deliver full power when set to full or by delivering more power than required at lower settings. In this event replacement is required.

To replace this unit first remove the front plate from the kiln, then remove the knob with a sharp pull, this will reveal a single nut securing this, together with the washer, for replacement.

The wires are connected by push on terminals, pull each wire off singly and connect to the corresponding terminal on the new unit. Do not remove more than one wire at a time this is to eliminate the possibility of miss-connection. Replace the unit, reversing the removal procedure, ensuring that the two locating pegs are in the holes and that the unit is in the right way up.

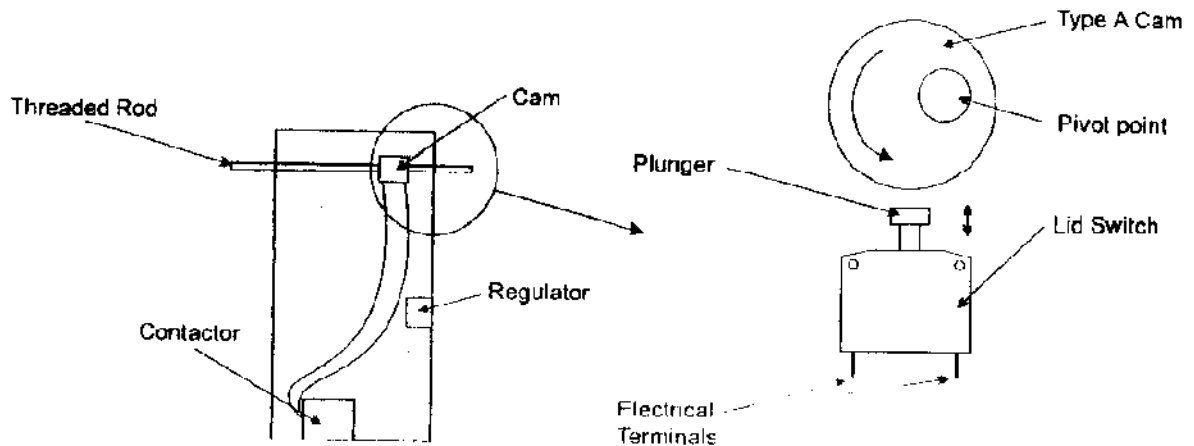
Figure 2.0 Diamond II Energy Regulator



Lid Switch Adjustment Screw

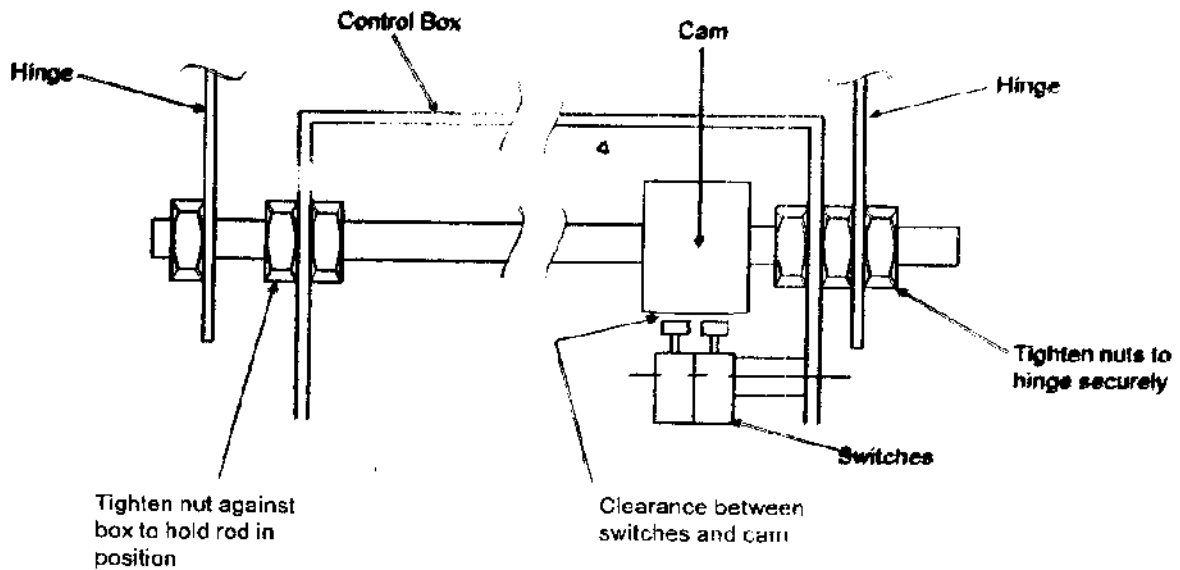
1. Isolate the power the power at the mains.
2. Using a Philips screw driver, remove the back cover from the kiln.
3. The switches will be located at the top right hand side of the control box. See Figure 2.1 below.

Figure 2.1 Lid Switch Adjustment



4. The plunger must not be touching the cam when the lid is in the closed position. If the plunger is touching, loosen the nuts located on either side of the hinge and rotate the bar using a pair of pliers. Once the required position has been reached tighten one of the outside nuts against the box to hold the rod in position while re-tightening the hinge brackets.
6. Replace cover and test unit. The diagram below shows how to lock the rod in position during adjustment.

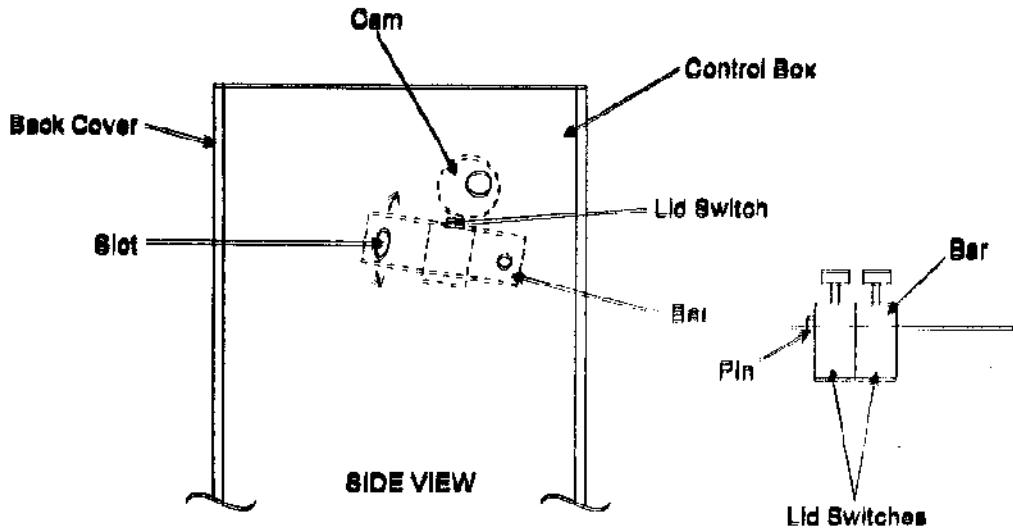
Figure 2.2 Lid Switch Adjustment Continued



Lid Switch Type B

1. Isolate the power at the mains.
2. Using a Philips screwdriver remove the back cover from the kiln.
3. The switches will be located at the top right-hand side of the control box.
4. The plunger must not be touching the cam when the lid is in the closed position. If the plunger is touching, loosen the pin on the slot shown below and adjust accordingly.
5. Replace the cover when finished and test the unit.

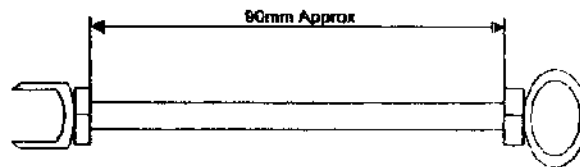
Figure 2.3 New Safety Switch Detail for Type B



21 Converting From 3 Phase to Single Phase

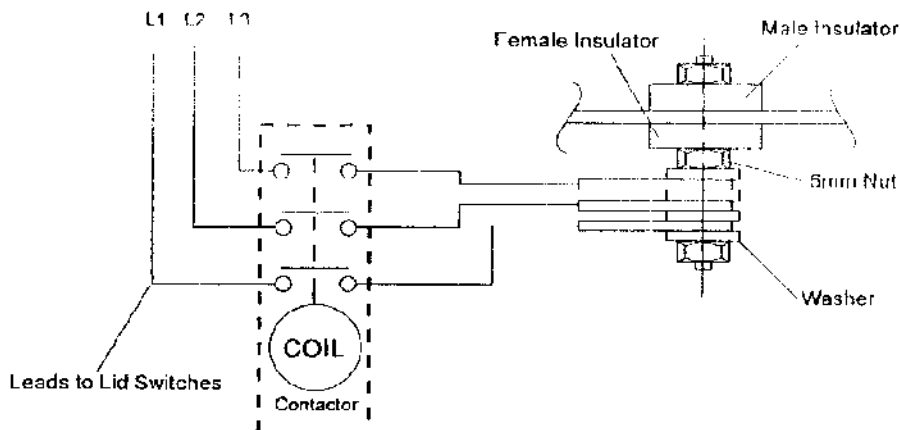
Firstly check that in the back box where the neutral is terminated to, the metal bracket has a spare hole. Fit into this hole a male insulator & female with a 6mm x 40mm Stainless Steel pin, that will be your termination point. Then you will need three lengths of 2.5mm Red Flex cable each 90mm long.

Figure 2.4 Ring Crimp and Forked Cable



On one end you will need a ring crimp on the other a fork crimp as Figure #2.4. Connect ring crimp ends to termination point with a Stainless Steel washer in between each lead. Then connect fork crimp ends to respective terminals on the connector as shown in Figure #2.5.

Figure 2.5 Ring Crimp and Forked Cable



22 Glossary of Terms

Batt wash	The coating used on the tops of kiln shelves and kiln floor to protect them from glaze drippings.
Bisque	Soft or unfired objects of clay. Hard Bisque , witness cone 04 or higher. Soft Bisque , witness cone 06.
Cone or Minibar	Pyrometric Heat measuring device used when firing a kiln. A bar or a 3 sided pyramidal form made of ceramic materials which react to time and temperature in the same way ceramic ware does in a kiln.
Cratering	Moon-like craters on a glaze surface.
Crazing	Hair-like cracks which appear on a glazed surface. Often referred to as either immediate or delayed crazing.
Decal/Transfer	A pictorial design, printed with ceramic colours (Underglaze or overglaze), on special paper, which can be transferred to the surface of the ware and 'fired' for permanency.
Dry footing	Leaving the bottom area of a article Underglazed, so stiling is unnecessary Not recommended for utility items.
Dunting	The cracking of a piece of clay from too rapid cooling in the kiln.
Earthenware	Not vitreous, ware made from low 'fired' clays.
Element	A high temperature resistance wire wound in a coil which carries electrical current for heating a kiln.
Firing	The process of maturing ceramic products by various degrees of heat.
Firing Chamber	Inside area of kiln.
Furniture	Articles necessary to use for capacity of kiln space. Shelves, posts and stilts.
Glaze	A 'fired' finish consisting of a prepared mixture of frit which produces a glass-like surface when 'fired'.
Greenware	Unfired clay articles.
High-Fire	Refers to ceramic articles or glazes which are 'fired' to witness cone 04 or higher (stoneware and porcelain).
Kiln-Sitter	A mechanical device triggered by a small cone, that shuts off the kiln.
Lustre	An overglaze that imparts an iridescent surface to the ware
Maturing point	Temperature needed to mature glaze or clay.
Overglaze	A decorative finish applied over a 'fired' glaze surface and made permanent by firing.
Peephole	Small openings in a kiln that allow viewing of the firing chamber during the firing process.
Pinholes	Tiny holes penetrating a glazed surface. A glaze defect caused by underfired Bisque, applying glaze to Greenware, firing too rapidly or poorly deflocculated casting slip.
Porcelain	A vitrified body that matures at a high temperature and is translucent.

Troubleshooting Guide

Before requesting service for this unit, check the chart below for a possible cause of the problem you are experiencing. Some simple checks or a minor adjustment on your part may eliminate the problem and restore proper operation. If you are in doubt about some of the check points, or remedies indicated in the chart do not solve the problem, then contact our technical department.

ALWAYS UNPLUG YOUR KILN BEFORE ATTEMPTING ANY REPAIRS

Problem	Probable Cause(s)	Suggested Remedy
Hot plug or wall socket.	1. Socket has loose connection or worn out socket.	1. Have electrician check socket.
Kiln does not heat up.	1. Lid open too wide & safety switch has turned off electricity. 2. Defective or broken elements. 3. Fuse in plug has melted. 4. Kiln-sitter plunger not pushed in.	1. Close lid 2. Replace elements. 3. Replace Fuse. 4. Push in plunger.
Excessive time to complete firing, maximum temperature not attained.	1. Inadequate wiring to kiln. 2. Insufficient voltage to kiln. 3. Loose connection in kiln wiring, wall socket or service wiring. 4. Elements are wearing out. 5. Energy regulator not on full.	1. Consult an electrician. 2. Consult your electric company. 3. Have all connections checked and tightened. 4. Replace elements. 5. Turn on to full power.
Top or bottom of kiln overfires constantly.	Elements losing efficiency.	Change switch setting to compensate for the unevenness or replace the old elements.
Hairline cracks appear in brickwork.		This is normal, when kiln is fired the cracks will close up.
Red glow between lid and kiln body.	This is normal with high temperature kilns.	If the gap get larger, consult our technical department.
Fuse trips immediately after turning on kiln.	1. Short circuit in kiln. 2. Electrical service wired wrongly. 3. Overloaded circuit. 4. Fuse may be too small.	1. Have the wiring checked. 2. Have electrician check wall socket. 3. Disconnect any other appliances from circuit. 4. Consult an electrician.
Kiln shuts off before firing cone has matured, when kiln sitter is fitted.	1. Safety timer may have shut kiln off early. 2. Wrong cone in kiln sitter. 3. Kiln sitter out of adjustment. 4. Power failure caused kiln to recycle and timer to shut off kiln	1. If kiln just turned off, reset timer and push plunger, otherwise, cool kiln and refire with new cones. 2. When kiln has cooled, check and correct. 3. Make adjustments. 4. Set fresh cone in kiln sitter and new cone on hearth plate. Refire.
Repeated clicks in control box.	1. Coil in the contactor is faulty. 2. Faulty regulator. 3. Poor connection	1. Replace the contactor. 2. Replace the regulator. 3. Check and re-tighten as required.

Props	Columns of refractory material used to support shelves inside a kiln.
Reduction	A type of firing where there is incomplete burning, and smoke and soot (the excess of carbon) robs the clay body and glazes of part of their oxygen, thus changing their colour and texture.
Safety Timer	A shut off device designed to turn the kiln off if the kiln sitter fails to do so.
Shelves	Flat slabs of special high temperature materials on which ware is placed inside kilns.
Stilts	Supports used to separate a glazed article from a shelf during firing.
Stoneware	A heavily grogged clay body requiring a high firing to vitrify.
Thermal shock	Subject in the ware to abrupt changes from hot to cold or vice versa.
Underglaze	A ceramic colour used under a glaze.
Venting	Allowing air to come into the kiln and gases to escape.
Vitrify	To become a stone-hard impervious surface.
Volatilization	The action produced within a firing where some materials are changed from a solid to a gaseous state, such as water turning to steam.

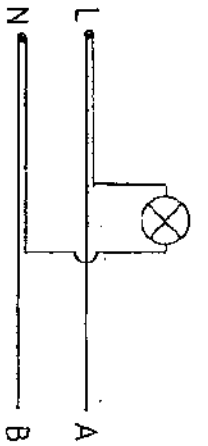
SCA N 22579

HOBBYLO MAX TEMP 1300°C

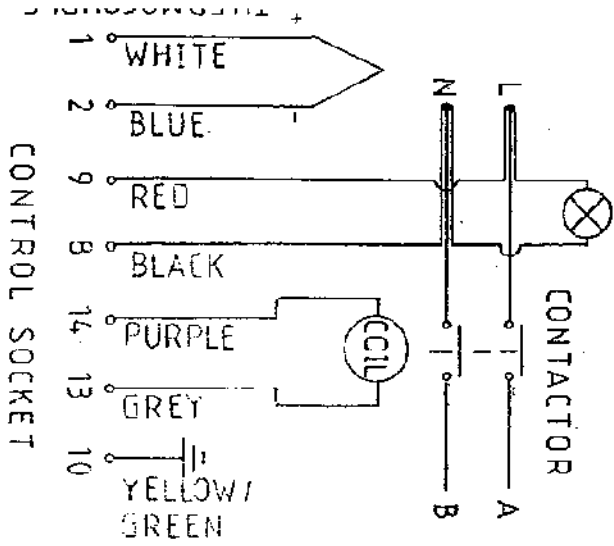
PIZZA INS

1 - 120 MARTIN KILNS KIT

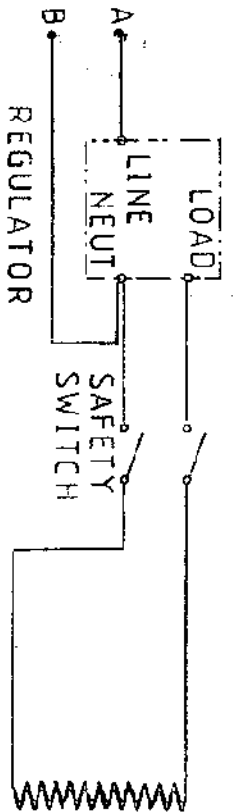
STANDARD KILNS



KILNS WITH CONTROL SOCKET



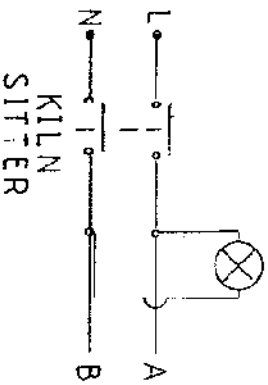
ELEMENT WIRING



ELEMENT

FOR CONTROL SYSTEM
SEE INSET

KILNS WITH SITTER



KILNS WITH LIMIT TIMER

