POLLUTION CONTROL PRODUCTS Co.
Controlled Pyrolysis™ Cleaning Furnace
INSTALLATION, OPERATING & MAINTENANCE INSTRUCTIONS

Model PTR10
Serial N° H1147

Fuel: Natural Gas **Input: 8M³/Hr**

EEC Directives: The Machinery Directive: 89/392/EEC, 91/368/EEC, 93/44/EEC
Electromagnetic Directive: 89/336/EEC
Gas Appliance Directive: 90/396/EEC, 93/68/EEC
Low Voltage Directive: 73/23/EEC

Please read and follow these instructions very carefully. The safety of your employees and your shop as well as the success of the process depend absolutely on the operator observing all precautions outlined within these pages and any other common sense measures that may be indicated. Do not allow anyone to operate this equipment until he or she is fully conversant with how it works and what it is designed to do. The manufacturer cannot accept responsibility for uncontrollable fires, damage to the premises, to the furnace or to individuals arising from misuse.
Manufactured by

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ADDITIONS TO OPERATING MANUAL

Notice to all users of “Tall Boy” Cleaning furnaces from September 1996

To all user that use our “Tall Boy” type cleaning furnaces a recent change in legislation reference the CE Directive 93/44/EEC Machinery has required us to modify the way “Tall Boy” furnace carts are to be used because of the safe handling aspect that is required.

The system has now been designed and modified so that the carts are now secured and fixed by four large holding bolts. The furnace is still furnished with removable outside tracks, along with standard wheels to enable operators to move the cart when the furnace interior needs to be cleaned from ash deposits on the furnace floor.

Pollution Control Products Co cannot be held responsible for any incident that occurs where the operator’s removes the cart fully loaded. The cart should only be removed for the purpose of cleaning the inner chamber, and when the cart is free from loaded parts. The cart SHOULD NOT be removed from the inner chamber unless furnace is to be cleaned.

1.HOW THE FURNACE WORKS

(PTR Models)

1. HOW THE CONTROLLED PYROLYSIS™ CLEANING FURNACES WORK

(PTR MODELS)

1.1 WHAT THE FURNACE IS USED FOR

This Controlled Pyrolysis™ Cleaning Furnace is designed to remove limited amounts of cured hydrocarbon coatings from metal parts (jigs, fixtures, hanging trees, hangers, etc used to hold parts on conveyorised painting and coating systems as well as finished parts themselves) by Pyrolysis or heating. The furnace does this by heating the parts to 430°C (800°F) by decomposing the combustible material on the part to smoke and ashes. The smoke given off by the combustible material is drawn through an afterburner chamber where it is raised to a temperature of 850°C or above for a minimum of 0.5 seconds to completely burn it. The effluent discharge to atmosphere through the stack consists primarily of water vapour and carbon dioxide, which are invisible, odorless and harmless. Most of the ashes (primarily inorganic pigments) stay in the furnace with the part and are occasionally removed and placed in the rubbish.

1.2 HOW THE FURNACE WORKS

Smoke from the Parts is consumed by an Afterburner to Eliminate Pollution

The furnace is not designed for a rapid method of "burn-off", there are no flames present in the furnace or on the parts to warp or degrade them and if parts are properly loaded in the furnace the temperature of the part should never exceed the temperature of the furnace by more than a few degrees due to oxidation on the part.

Even the relatively low processing temperature of 430°C may adversely affect some metal parts, so it is advisable to process some sample parts to make sure there will be no undesired effects. Some heat-treated steel parts may lose some of their properties, copper will usually be annealed, brass may be partially annealed, and also some aluminum alloys may be partially annealed while others are not. Magnets seem to retain their power. Some die cast parts may appear to be aluminum but are zinc, which will melt at furnace temperature. If there is any doubt about the material being zinc or aluminum, a simple test with concentrated nitric acid diluted 50-50 with water will tell the difference. Nitric acid can be obtained from chemical supply houses or in many cases from local Electro platers. One drop of this solution on a zinc part will evolve many bubbles and a fast reaction; on aluminum there will be no reaction. (The part must be clean of paint or grease). If the part is zinc it must be cold stripped or solvent stripped as it will melt at furnace temperature.

Most companies who use metal hangers for paint spraying operations know that by conventional means (paint stripping by acid or chemical agents) the cleaning process is looked upon as a dirty, time consuming, laborious job not to be done until absolutely necessary. Sometimes this means a 1/2" or more build up of paint on the metal hangers before cleaning takes place. With the use of this furnace these extra large build ups of

paint can be cleaned; however, the first loads, until the extra large build up is off, must be reduced to less than the normal number of hangers. Once the majority of the metal hangers have been cleaned by the furnace the normal number of hangers per load can be started. A normal paint hanger is one with up to a 1.6mm (1/16") layer of paint. With a paint coat thickness of 3/4 mils. Per cycle a paint hanger needs to be burned only once every 70 to 80 paint cycles.

1.3 WHAT THE CLEANING FURNACE SHOULD NOT BE USED FOR.

Controlled Pyrolysis™ Cleaning furnaces are not incinerators. They should be used only to reclaim valuable metal parts for salvage and/or rebuilding. Do not use the furnace as an incinerator to dispose of waste material. It should not be used as a "sludge dryer" to dry sludge from hot tanks or Jet Washers. Do not use the furnace for a "curing" oven for painted parts or other parts, which may contain large amounts of volatile organic solvents. This furnace does not have a forced exhaust (because of high temperatures involved in Pyrolysis) so it cannot handle excess amounts of solvents that may evaporate at less than 200°C (400°F). Such solvent vapours may fill the furnace at or near room temperature with an explosive mixture to be ignited when the furnace is turned on. Alternatively, the rapid evolution of such vapours during initial heat up of the furnace may overwhelm the capacity of the afterburner and lead to a fire in the furnace or exhaust stack. As a practical example of the above do not use the furnace to clean parts such as drip racks, spray booth gratings etc, that have uncured paint on them unless using the correct furnace type for this operation, they must not be pyrolyzed in a normal PTR furnace until the paint has been cured by putting the parts through a bake oven to evaporate the solvent in the uncured paint. This furnace does not have a forced exhaust so it cannot handle solvents that may evaporate at less than 200°C. These solvent vapours may fill the furnace at or near room temperature with an explosive mixture to be ignited when the furnace is turned on.

Do not process: Sludge from hot tanks, jet washers or other waste oils, paint sludge, paint filters, PVC, Lead or rubber coated scrap wire, wood, paper trash or anything else which mat overload the furnace. The furnace is not designed as an incinerator. It is designed to clean and reclaim valuable parts.

Do not process coatings that contain chlorine (example, PVC), Fluorine (example, Teflon) or elements other than carbon, hydrogen and oxygen as they will form dangerous toxic and corrosive products which will destroy the furnace walls. Processing such materials may also violate any environmental laws, which are in force by such governing bodies.

1.4 ADVANTAGES

Proper use of the furnace can result in several economic advantages in addition to the obvious advantage of air pollution control.

1. Metal hangers, jigs, trees and fixtures used to hold parts can be cleaned very economically by Pyrolysis. Such cleaning is especially useful in electrostatic paint operations where a good electrical contact for paint wrap around is essential. Also possible hazardous sparking between the part and the metal hanger is eliminated when the hangers are kept clean.

2. Painted parts themselves can be cleaned by Pyrolysis. Care must be taken when cleaning aluminum parts to make sure no ignition takes place in the furnace as aluminum melts at 648°C, much lower than most metals.

3. Solvents and acids for stripping of parts and hangers can be significantly reduced or eliminated.

4. Open stripping tanks with their odors and ignitable fumes can be eliminated.

5. Any sandblasting can be eliminated.

6. Dumping of harmful chemicals into water systems can be eliminated.

7. Neutralizing of chemicals prior to discharge can be eliminated.

8. Transportation cost of carrying used chemicals to liquid waste sites can be reduced or eliminated.

9. Skin and eye irritation from solvents or acids used in stripping can be eliminated along with protective gloves, overalls etc.

10. No attendant is necessary to supervise Pyrolysis.

11. The loading cart and outside tracks are furnished, no accessories to buy.

12. The furnace is completely piped, wired and fired at the factory to reduce installation costs to a minimum.

13. Operating and safety controls required by most countries are standard. Any special requirements needed to comply can be made as long as we are aware prior to an order being placed.

1.5 LIMITATIONS

This furnace cannot remove or “burn-off” the rust on the parts as this is an inorganic material. However, the furnace loosens the rust for easier removal during secondary operations.

1.6 PATENTED CONTROLLED PYROLYSIS™ SYSTEM

This furnace is equipped with a Controlled Pyrolysis™ System (C.P.S.) which is a method of measuring and controlling the rate and emission of volatile material from the parts being processed. The C.P.S. does this by monitoring the afterburner exit temperature. If it rises above a pre-selected point a fine water spray is turned on to cool the emissions before they reach an ignition temperature thus not allowing any smoke to escape to the atmosphere un-incinerated. When the temperature drops due to the decreased amount of volatiles the water spray is turned off. Should the volatiles increase the water spray will come back on.
This system is automatic and is interlocked so that the lower burner on the furnace cannot come on if there is insufficient water pressure for the C.P.S.
To insure that the system is prepared to operate properly it is mandatory that the spray nozzle(s) located inside the furnace (normally on the right hand side) are tested daily before each cycle is to commence. (See section 2, part 2.4)

Failure to do so may allow a clogged nozzle to defeat the purpose of the C.P.S., which is to prevent ignition of the parts and possible damage to them.

1.7 TIME AND TEMPERATURE ADJUSTMENTS

Experience has shown that most painted or coated parts will be adequately stripped at a temperature of 430°C. The amount of time required depends on the weight of combustible material on the parts (one-hour for each 7 to 10 pounds 3-5kg). Some additional time is required to allow the parts to reach temperature, which depends on the size, shape or weight of the part. Such time must be added to the time it takes the furnace to get to that temperature because the furnace air temperature is being measured instead of the part temperature and the part temperature will lag behind. For this reason an adjustable timer is fitted to allow time cycle changes. Consequently, cleaning times may vary significantly from customer to customer. During the early use of the furnace experiment with small loads and use common sense until enough experience is gained to accurately select cycle times for various size loads.

The furnace is equipped with either a 0 -12 Hr or 0 -24 Hr timer depending on the controls fitted. The 0 - 12 Hr timer has two scales, the black figures showing the correct settings if operating 60Hz and red figures if operating 50Hz.

Typical cycle times for various size furnaces

Furnace size	Cycle Times, Hrs.
27	2-3
52	2-4
88	2-6
150	3-6
260	4-8
290	4-8
340	6-8
641	8-10

1.8 LOCAL FACTORY CODES

Furnaces are equipped to meet most factory and building safety requirements but sometimes there will be requirements which the factory has no way of knowing unless told prior to shipment. If such requirements become known after receipt of the furnace please contact the manufacturer before authorizing any work to change anything so that we may fully explain to local authorities details of our unit and also for us to understand their requirements. If the manufacturer was not notified in advance of any special requirements then any changes will be at the expense of the customer.

1.9 EMISSION CONTROL

Controlled Pyrolysis™ Furnaces are process equipment that uses state-of-the-art technology to eliminate hazardous chemical cleaners and their problem in the work place and disposal after use. The furnace has been fully tested by specialized testing agency for the various emissions of particulate, carbon dioxide, oxygen level and water vapour. Test results will be issued on requests.

Upon request, if local authorities require, we can fit certain control gear, which can monitor particulate and smoke at an extra cost.

EMISSION DATA:
(Taken from an existing model size 150 Controlled Pyrolysis™ Cleaning Furnace in operation for the Environmental Protection Act 1991)

PRIMARY BURNER:

O^2 oxygen = 10-15%
CO^2 carbon dioxide = approx. 5-8%
(We aim to keep at this percentage as we do not strive to achieve perfect combustion. our intention is not to burner parts or materials, we aim to break down the paint, resin etc by Pyrolysis and also keep the combustion tube at a temperature of 950-1000°c)
CO carbon monoxide = negligible

SECONDARY BURNER:
(These tests where carried out for the environmental authorities in the UK on a existing furnace in operation with regards to gain exemption from PG2/9(91) in accordance with the D.o.E.)

O^2 oxygen = 11%
CO^2 carbon dioxide = 5.7%
H^2O water vapour = 3%
CO carbon monoxide = negligible
Velocity = 3.8m/sec
Temperature = 648°c at terminal 6mtr above furnace
860°c at 0.5mtr above furnace.

Total particulate: 1.38mg/m^3 (max allowable 50mg/m^3)

Total Hydrocarbon: 5.55mg/m^3 (max allowable 20mg/m^3)

2. CONTROLS AND SAFETY FEATURES

2.1 MAIN CONTROL BOX

2.2 LOW WATER PRESSURE SWITCHES

2.3 CONTROLLED PYROLYSIS™ WATER SPRAY SYSTEM

2.4 WATER SPRAY TESTING

2.5 ELECTRONIC FLAME SAFETY CONTROLS ON FURNACES WITH STANDARD CONTROLS

2.6 FURNACE OVER TEMPERATURE WATER SPRAY SYSTEM

2.7 BACK-UP WATER SPRAY SYSTEM

2.8 EXPLOSION RELIEF DOORS

2.9 DOOR LOCK

2.10 GAS BURNERS

2.1 MAIN CONTROL BOX

The control box contains two temperature indicator controllers, one for the furnace temperature and the other for the Water Spray System and vent stack temperature. The bottom controller is for the furnace temperature and controls by cycling the lower gas burner via the gas valve to High/Low fire, and in the use of oil burners On/Off.

The top temperature controller indicates the afterburner (stack) temperature.

HOWEVER, THIS TEMPERATURE CONTROLLER DOES NOT CONTROL THE OPERATION OF THE UPPER BURNER AS IT STAYS ON ALL THE TIME. IT CONTROLS ONLY THE WATER SPRAY SYSTEM.

When the stack temperature exceeds the normal set point of the controller, it opens a water solenoid valve and sprays a fine mist of water inside the furnace to slow the evolution of smoke from the hot parts, thus maintaining stack temperature at it's normal control point.

A power switch and either a 0-12Hr or 0-24Hr cycle timer are also located on the front panel of the control box. A counter is installed at the top of the control panel and indicates the accumulated total spray time in arbitrary counts. (The counter measures time as every 50 counts equal to 1 second.). The counter is wired to the top temperature controller who controls the water spray system. When the stack temperature exceeds it's normal set point, water mist is sprayed inside the furnace to slow down the evolution of smoke from the parts and lower the afterburner temperature. Each 50 counts are equal to about 1 second. This counter is useful in estimating the severity of the cleaning loads. For large loads with substantial amounts of organic, combustible residues to be removed, the counter will register a corresponding large number of counts, perhaps in the thousands. For lighter loads, the count will be smaller. If the load is so small that not enough smoke is produced to induce water spray, no counts at all will be registered. On later models fitted with black surround counter, measurements are in minutes and seconds.

There are three 6.3 amp fuses located in the control box to protect the components. To service the control box we recommend that the supply is turned off at the control box switch and also at your main incoming supply line to prevent any electrical shock or damage to the control box.

2.1a MAIN CONTROL BOX - DIGITAL TYPE

On certain model types, the furnace will be fitted with a digital control system. The basis of this system still follows the same principles of our unique controlling methods of emissions to atmosphere, and primary burner input. However, the system is fitted with a membrane overlay, along with greater degree of monitoring lamps to check the system operation during normal process cycles.

During initial start-up program the operator will be forced to carry out certain fail-safe checks before the furnace will operate. When the furnace is first powered-up, the operator will be asked to check the water spray operation and pressure rating by entering the confirm button. Once this has been confirmed, the system and burners will check for gas and water pressure, indicated by the panel lamps. At this stage, the operator can then select the required temperature values for the afterburner and main chamber by using the up/down keypads. The system will then ask for the process time value, which can be entered by using the up/down keypads. Once this has been completed the operator will then press and hold the confirm button for several seconds until the cycle beeper is heard. Once this has been confirmed the afterburner(s) will begin the purge process and light, as long as the front door is fully open engaging the front door limit switch. If the limit switch is not fully engaged, the burner(s) will not start. Once the afterburner has begun its cycle, the primary (lower) burner(s) will begin their purge process and light. Once lit, the panel lamps will indicate that the primary burner(s) are on, as well as the high/low gas valve.

ONCE BOTH BURNERS ARE FIRING, THE FRONT DOORS MUST BE CLOSED WITHIN TWO MINUTES. FAILURE TO DO SO WILL RESULT IN THE SYSTEM AUTOMATICALLY SHUTTING DOWN.

During process the system will monitor the rate of emissions, and at various stages of operation the water spray lamps will indicate that spray is in operation. When this occurs, the water counter will automatically count the total time sprayed. The water time will increase.

Once the cycle time has elapsed, a run end message will be displayed. At this stage the front door will remain locked until the furnace temperature falls below 260°C.

Once below 260°C, the system can be reset for the next process cycle, by pressing the clear button, which returns the program to the start point.

The system is also fitted with a battery back up in the event of complete power failure. If this occurs the system will open for thirty minutes the back-up water spray system to cool the inner main chamber, thus preventing emissions to atmosphere. If during the thirty minutes the power returns, the system will re-engage the process from the point of interruption, thus completing the cycle process.

Digital Controller specification

The Digital Furnace controller is designed to provide control and display functions during the furnace cleaning cycle. It is suitable for single stack operations in its basic form and dual stack operation in it's enhanced form. With additional software the design can also be used for other control algorithm's and on different furnace types such as oil fired and gas fired.

The controller provides the following standard functions.

1: Setting and control of upper and lower set points for furnace temperature.

2: Setting and control of upper and lower set points for afterburner.(s)

3: Control of main and backup water sprays.

4: Setting and control of cycle time.

5: LED Indications of furnace operating temperatures.

6: Cumulative time count and indication for water injection.

7: Countdown time indication of cycle time.

8: Control of door lockout mechanism.

9: Chart recorder motor drive outputs for temperature monitoring.

10: Battery charging and backup for water spray solenoid valve.

11: User monitoring LED indicators for all i/o operations.

12: Inputs for water pressure, door and gas pressure switches.

13: Inputs and indications of gas valve lock out faults.

14: Water pressure pump control.

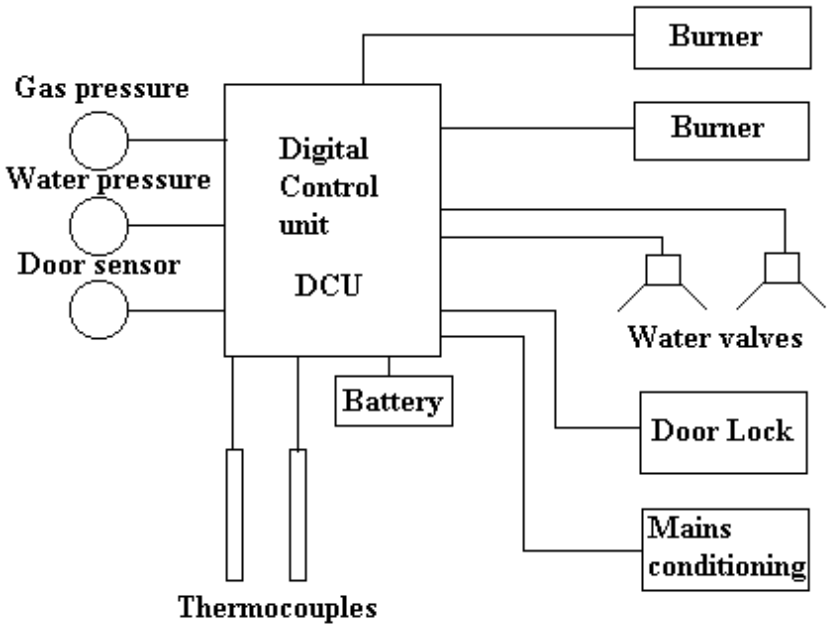
15: Burner sequencing in dual stack systems.

In addition, the controller can be modified by the addition of daughter card PCB's to provide enhanced features such as data storage and logging, and remote fault diagnostics.

Functional description.

The controller is housed in a steel casing to provide environmental and electrical protection to the circuits boards. There are six main components that make up the Controller cabinet and a further component that is located on the external apparatus. In addition to these components there are various sensors that provide input to the controller and other electrically operated devices that are controlled by the unit.
Figure 1 shows a typical block diagram of a furnace system.

Typical Furnace components



Located in the main electrical cabinet are the following items:

1. Input/ Output Motherboard
2. Computer board
3. Power supply unit
4. Electrical isolator and fusing
5. Backup battery
6. Keyswitch overlay

External to the electrical cabinet there is the mains power inlet conditioner to which the main power inlet is coupled. The output of this unit feeds directly into the main electrical cabinet.

The digital controller uses a computer running a software programme to replace relay logic and timers in a typical electromechanical system. The computer takes in information from the sensors and switches and outputs power to the peripheral devices (such as burners) to control the pyrolysis operation within the furnace based on the control algorithm embedded into the software.

The user interface is the LED displays that are visible through windows in the front panel overlay. These displays show the operating parameters of the system such as temperatures and times and are also used to communicate operating instructions by short messages.

User input to the system is via the keys that are located in the front panel. These keys are embedded buttons that are protected against dirt and other contaminants by the front panel overlay. Each key is clearly marked with it's principle function so that the user can quickly learn the required key pushes.

The system requires a mains 240 volt supply to operate in the correct and normal mode of operation. However, in exceptional circumstances the unit can revert automatically to the 12V DC backup battery power in order to maintain control over critical elements of the system such as the water solenoid valves. Under exceptional circumstances, the control algorithms that normally control the process are bypassed and the safety procedures operate until the fault condition is removed or the furnace is safed.

To further assist the operator the unit has a bank of LED lamps that indicate the state of various sensors and outputs of the system. This enables the operator to quickly gauge if the system is performing correctly and if not what, the source of the problem is likely to be: a typical example is the water pressure OK lamp. A lamp test button is incorporated to quickly check lamp operation at the beginning of a cycle. DO NOT perform a lamp test during a cycle as this will cause the controller to sense multiple failures and operate the safety functions.

Motherboard functional description

The motherboard is mounted on the rear of the electrical cabinet door and consists of electronic components on the rear side and optical displays on the front side. The motherboard provides the following functions:

1. Power relay switching for control of burners and mains operated peripherals.
2. Power relay switching for control of 12v DC operated water valve solenoids.
3. Mains voltage input sensing for burner feedback's
4. 12v DC sensing for sensor switch inputs
5. Thermocouple cold junction compensation and signal conditioning.
6. Temperature analogue to digital conversion.
7. Local power supply generation for analogue temperature circuitry.
8. Lamp driver functions.
9. Power and signal routing to piggy back computer board.
10. Keypad interface

Computer connector:
The computer board mounts in a piggy back fashion onto two headers that are polarised so as to ensure correct connection. Signal, power and data is exchanged with the motherboard via these headers.

Power input connector:
The Motherboard requires the following power supply inputs that are provided through a 5 pin header at the top of the board. Looking at the header the connections are as follows from the left.

Pin 1	+12 v
Pin 2	0V
Pin 3	0V
Pin 4	+5 v
Pin 5	AC lost sense

Keyboard connector:

The keyboard connector is on the top right hand side of the motherboard. It carries the signals from the overlay via the ribbon cable on to the computer and other functions such as lamp test. Pin 1 on the ribbon is designated with an arrow. This should be towards the left (pin 1) for proper operation. The switches all have series resistances and filter capacitors to reduce noise pickup and provide static discharge protection.

DC inputs connector:

The connector on the top right hand side is designated DC inputs. This carries the feedback signals from the sensor switches that monitor the water pressure (switch is closed if water pressure ok), the gas pressure (switch closed if gas pressure above minimum), and door closed switch (switch closed if door closed). All of the switches are protected by 100mA fuses. A single 100mA fuse provides current through the switches at 12v DC. All switch inputs are filtered by resistor/capacitor combinations and have varistor overvoltage protection. The signals are then optically isolated before routing to the computer board interface.

DC outputs connector:

The second connector on the right hand side is the DC outputs connector. This carries the 12v DC power to the water solenoids that operate the valve. When the power is energised the valve is open. The computer signals at logic levels that the valve is required to be open and this is translated via the power mosfet to the relay coil. The relays then provide the power to the solenoid. The outputs are fused at 3.15 amps and have inductor/capacitor filters and varistor overvoltage protection.

Live outputs connector:

The third connector is the live mains switched outputs. These provide power to the burners and door solenoids and other peripherals (such as chart recorders) which operate at mains voltages. They operate in a similar way to the DC outputs in that the computer outputs a logic level signal which is level shifted by the power mosfet to operate the appropriate relay. The relay switches the mains voltage on to the output header and hence

to the burner. Each output has its own overvoltage protection varistor and has an RC snubber network for back EMF suppression. The outputs are all fused at 3.15 amps.

Neutral bus bar:

The fourth connector down from the top is a neutral bus bar connector. All of the neutrals are commoned at this point from all of the burners and mains operated peripherals.

Mains signal feedback:

The bottom connector on the right hand side is the mains signal inputs for the feedback signals from the burners. The burners provide outputs at 240 v AC that indicate the burner status. These signals are individually filtered by and RC filter and then optically coupled to the computer board via a noise filtering network. The input side of each signal is fused at 100mA for protection.

Thermocouple connector:

At the bottom of the board on the left hand side there is the input header for up to 4 type K thermocouples. The signal polarity is marked on the header. The thermocouple sequence starts on the left hand side and is stack 1 temperature, chamber temperature, stack 2 temperature and spare. These inputs are overvoltage protected against static by varistors. The thermocouple circuits work on a multiplexing principle. The computer selects each thermocouple in turn to be connected to the signal conditioning amplifier via a differential fault protected multiplexer. The output from the amplifier is then converted to a 12 bit digital word that represents the input voltage. The computer reads this digital value and then applies software scaling and filtering to the reading. The computer then outputs the value on to the correct LED display. It is also used internally for the control algorithm by the software.

The analogue signal from the thermocouple is a DC temperature signal of around 400 millionth of a volt at room temperature. This is sitting on an AC signal that is picked up from the surroundings and the furnace wiring of up to 500000 millionth of a volt. (some 1200 time bigger than the temperature signal). The signal conditioning circuits are supplied by there own power supply circuits that are in turn fed by the main power feeds into the motherboard. There are several test points around the analogue section that allows the thermocouple inputs to be calibrated. There is only a single calibration for intercept and slope and this simplifies set-up as each thermocouple does not need its own set-up procedure. Once one is set, they are all set. The analogue circuitry also provides thermocouple loss detection in the event of a failed thermocouple loop.

Lamp circuitry:

The left hand side of the motherboard is the lamp circuitry. There can be up to 16 lamps connected to the board to indicate the status of the various input and output signals. The

lamps are driven from the inputs and outputs from the computer board and thus reflect the state of the signal at the header interface.

Key switch connector:

At the top of the board on the left hand side is the key switch input. This connects to the key switch mounted on the front panel. If the keyswitch is open then the unit will not accept button pushes from the front panel and thus locks out any attempts at altering the setting during a cycle. In addition, at the top of the motherboard on the left hand side is the sounder to indicate fault conditions. An external sounder of up to 500 ma at 12 volts can be connected for greater user attention.

LED displays:

The temperatures and times are displayed on 0.5 inch 4 digit LED displays. In normal use these have in excess of 10000 hours MTBF. Each display is connected to the motherboard via a header and has its own display driver chip on the display board. Power and data is derived from the motherboard. The computer outputs the times temperatures and messages to each display individually.

Output relays and lamps:

The power outputs are switched via relays which have a 16 amp contact rating for maximum life. If the computer is calling for an output to be on then a small (3mm) LED on the board will be illuminated beside the driver transistor.

Test voltage points:

With a voltmeter set to DC volts the negative probe should be connected to the 0V test point. The positive lead should connect to the test points: The test points should be at the following voltages

Test +5A	minimum 4.80 maximum 5.20 volts
Test –8	minimum –7.5 volts maximum – 8.5 volts
Test –5	minimum –4.8 volts maximum –5.2 volts
5v In	minimum 4.92 volts maximum 5.2 volts
12v In	minimum 10.8 volts maximum 17.0 volts
AC sense	minimum 1.5 volts maximum 2.5 volts

Calibration of thermocouple circuitry:

There are 2 potentiometers that are involved with the calibration. The user must have a high resistance voltmeter set to 4 volts FSD. The probes are put on to TP8 and TP6 and the voltage adjusted on the LEFT hand pot to 2.048 volts. Once this is done, the thermocouples are left to achieve room temperature. A known calibrated thermometer is

used to provide a room temperature reference and the value displayed on the chamber temperature is then adjusted to this known value using the RIGHT hand pot.
When adjusting the pot only one turn at a time should be made and then the values on the display left to settle for 30 seconds before adjusting again.

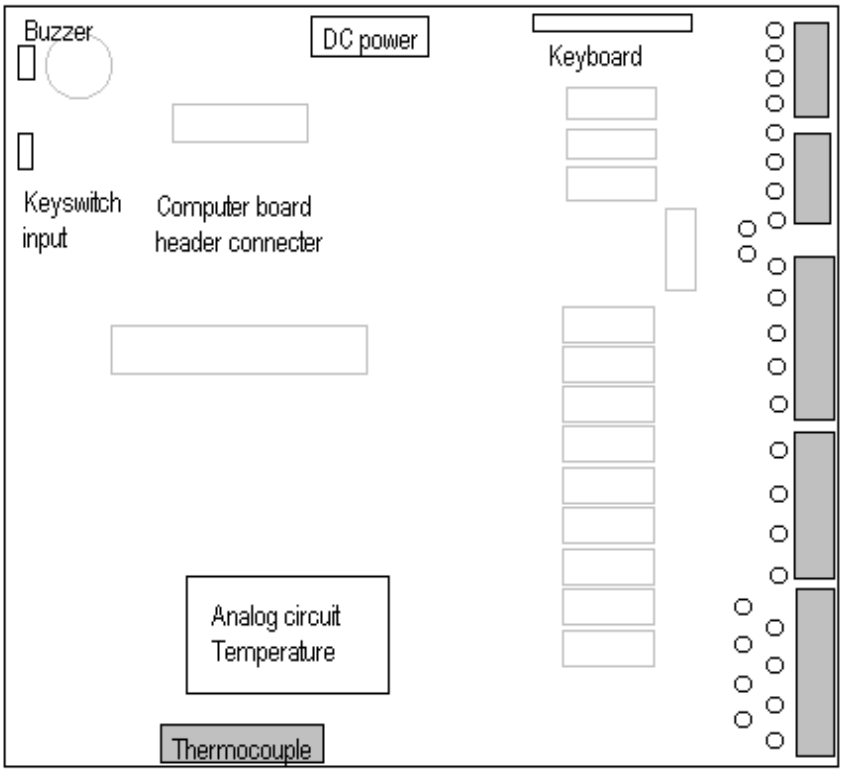
Input type and ratings:

Input function	Contact type	Voltage	Fuse rating
Water Pressure	Switch closure	+12V	F58 @ 100mA
Gas pressure	Switch closure	+12V	F56 @ 100mA
Door closed switch	Switch closure	+12V	F57 @ 100mA
Stack 1 burner lit	Switch	240V AC	F31 @ 100mA
Stack 2 burner lit	Switch	240V AC	F33 @ 100mA
Main burner Full/idle	Switch	240V AC	F35 @ 100mA
Main burner 2 Full/idle	Switch	240V AC	F37 @ 100mA
Stack 1 burner lock out	Signal	240V AC	F39 @ 100mA
Stack 2 burner lock out	Signal	240V AC	F40 @ 100mA
Main burner lock out	Signal	240V AC	F41 @ 100mA
Main burner 2 lock out	Signal	240V AC	F42 @ 100mA
Power for switch sensors	Signal	12V DC	F51 @ 100mA
Stack thermocouple	DC signal output		

Output type and rating:

Output function	Contact type	Voltage	Fuse rating
Water spray solenoid	Relay output	+12V	F3 @ 3.15 A
Water spray solenoid 2	Relay output	+12 V	F7 @ 3.15A
Backup spray solenoid	Relay output	+12V	F4 @ 3.15A
Door lock mechanism	Mains output	240VAC	F24 @ 3.15A
Water pressure pump	Mains output	240V AC	F25 @ 3.15A
Gas valve main burner	Mains output	240V AC	F14 @ 3.15A
Gas valve high/low select	Mains output	240V AC	F12 @ 3.15A
Gas valve fan select	Mains output	240V AC	F30 @ 3.15A
Gas valve afterburner	Mains output	240V AC	F19 @ 3.15A
Gas valve 2 main burner	Mains output	240V AC	F18 @ 3.15A
Gas valve 2 high/low select	Mains output	240V AC	F13 @ 3.15A
Gas valve 2 fan select	Mains output	240V AC	F29 @ 3.15A
Gas valve 2 afterburner	Mains output	240V AC	F20 @ 3.15A
Chart recorder motor	Mains output	240V AC	F26 @ 3.15A

Front Panel switches	Type
Start cycle switch/ confirm	Pushbutton
Reset switch/clear	Pushbutton
Set upper chamber temp	Pushbutton
Set Lower chamber temp	Pushbutton
Set Upper stack 1 temp	Pushbutton
Set Lower stack 1 temp	Pushbutton
Increase cycle time	Pushbutton
Decrease cycle time	Pushbutton
Set Upper stack 2 temp	Pushbutton
Set Lower stack 2 temp	Pushbutton



Enable/disable settings	Keyswitch

Motherboard layout

Lamp warning/status indication:

Lamp function	
Water spray 1 solenoid on	White
Water spray 2 solenoid on	White
Backup spray solenoid on	White
Door closed switch on	Green
Water pressure pump on	Green
Main burner on high	White
Main burner lockout	Red
Main burner lit	White
Stack burner on	White
Stack burner lockout	Red
Main burner 2 on high	White
Main burner 2 lockout	Red
Main burner 2 lit	White
Stack burner 2 on	White
Stack burner 2 lockout	Red
Water pressure OK	Green
Gas pressure OK	Green

Computer board

The computer board runs the software that controls the operating of the system. It has Non volatile memory that stores the set point temperatures so that the system can be powered off without losing the set points. The computer board has a watchdog timer chip that monitors the microprocessor operation. If the computer chip fails then the watchdog automatically restarts the programme.

The software that controls the furnace monitors the status of the various switches and feedback signals and from these and the digital temperature value it operates the various burners and control valves to control the furnace. The peripheral interface adapter chip communicates with the microprocessor and sends the command signals onto the motherboard where they are amplified to power control levels.

By changing the software the computer can be made to operate the furnace with a different control algorithm to suit the material that is being processed without having to alter the control hardware.

There are no user serviceable parts on the computer board.

Power supply unit

The power supply unit is mounted on an aluminium plate and bolted to the back plate of the electrical control cabinet. It provides the DC power for operating the motherboard and also the external devices and sensors that operate at 12 V DC levels. In addition to the power, supply unit there is a backup battery that keeps the computer system functioning even if the AC power is lost thus allowing a controlled shutdown to occur. It provides the following functions:

+5 volts DC at 2.5 amps
12 volts DC at 5 amps
13.6 volts for charging battery
AC input voltage lost sensing
Low battery voltage disconnect

The power supply consists of a torroidal transformer that steps down the mains input voltage to 12 volts AC. This is rectified using power schottky rectifiers and smoothed to provide the 12 volts DC that operates the solenoids and relays. A DC to DC converter takes the raw 12 volt and switches this to +5 volts. This is smoothed and used to power the motherboard.

The AC from the secondary of the transformer is used to power an opto coupler circuit that monitors the presence of AC. If the mains fails the optocoupler circuit output switches logic levels and this is used to signal the microprocessor of AC lost.

The DC power feed from the rectifier also drives a constant output voltage float battery charge circuit. This feeds a trickle charge continuously to the battery if the battery voltage remains above 13.2 volts. If the battery is discharged (due to a mains lost for example) then the charge current increases to recharge the battery at a faster rate.

When the AC power is removed the battery current flow reverses and the battery powers the DC to DC converter and also the 12 volt output to provide continuos supply current to the motherboard. A discharge monitor circuit measures the battery voltage and should this fall to below 1.2 volts per cell (approx. 8 volts) then the relay will open and prevent the battery from deep discharge damage. Under these circumstances the motherboard will power off. Once the AC returns the system will
reboot into start up mode.

The power supply is protected by 3 fuses. There is a main inlet fuse that protects the primary of the transformer. This is rated at 3.15 amps. There are 2 further fuses, both are rated at 10 amps and protect the battery feed and the motherboard 12 volt feed against accidental short circuits. DO NOT short circuit the battery or BYPASS THE FUSES as it can provide several hundred amps of current and may cause severe damage to the unit and injury to operators.

Fuse 1	3.15 A 240 Volts AC antisurge

Fuse 2	10 amps antisurge spiral
Fuse 3	10 amps antisurge spiral

Electrical Specification of Control unit.

The following is a specification for the control unit based on a timed cycle operation for both the single and dual stack versions.

Input voltage:	*240V AC RMS. +/- 10%*
Valve control voltage:	*+12V DC*
Gas valve control voltage:	*240V AC*
Door bolt control voltage	*240V AC*
Power consumption:	*typically 250 watts*
Thermocouple inputs:	*Type K linearisation 0 to 1200 degrees range. Cold junction compensated.*
Outputs to valves/relays:	*+12 volts at max 3.6 amp per channel*
Number of control outputs:	*16 maximum (split between mains and 12V DC)*
Set point entry	*up/down buttons (IP57 rated)*
Minimum/maximum stack set	*+100 min +1100 max*
Minimum/maximum chamber set	*+50 min +600 max*
Temperature display	*4 digit 0.5 inch daylight viewable LED*
Set point control accuracy normal curve max temp	*+/- 15 degrees (depends on thermocouple/burners)*
Water spray timer and cycle timer	*4 digit 0.8inch daylight viewable LED*
Safety backup	*Independent spray system with battery backup*
Minimum water pressure	*User selectable pressure switch*
Cycle time control	*User selectable max 19 hours 59 mins*
Battery replacement	*3 years*

Typical operating methodology.

A typical user cycle would be as follows. The furnace is loaded with the appropriate charge of material. The power is applied to the machine via the mains isolator switch or if a run has already been performed then the **CLEAR** button is pushed to initiate a new cycle. The following message is displayed on the LED displays:

H20 Test

Action: The computer is waiting for the user to push the **CONFIRM** button to initiate the water spray test (duration approx 5 secs) during which time the primary and backup water sprays will be on. The user should verify that both systems are spraying water.

Once the user has done the water test the display will cycle with the messages every 4 seconds or so:

Set Time

Push Conf

Action: Push the time increase (up button) until the time is displaying the required cycle time. If the time runs over use the down button to decrease the time. The time increments and decrements in units of 1 minute initially. If the button is held it then increments and decrements in units of 10 minutes. Release the button when set.

Once the time has been set the **CONFIRM** key should be pushed and held. It can take up to 5 seconds for the computer to acknowledge the start request. This is done by a double beep of 10 seconds duration.

Once the cycle has started the stack burner will be heard to go to purge and the ignition sequence started. Once the burner has lit then the **STACK LIT** lamp will illuminate. The computer will detect stack light up and will sequence the chamber burner through purge and ignition. Once this has lit then the **CHAMBER LIT** lamp will illuminate. In normal circumstances the chamber will be colder than the set point so almost immediately, the chamber burner will go to high fire and the **HI/LOW FIRE** lamp will illuminate.

At this time, the stack set point and the chamber set point can be adjusted if required by using the set point up and down button adjacent to the chamber and stack temperature LED displays. They operate in the same manner as the set time button. However, the set points cannot be adjusted above or below the maximum and minimum values set into the control software.

Once the burners are lit the door must be closed and the **DOOR CLOSED** lamp will illuminate to indicate the door is shut. At this stage if the temperature is below the safety point (260 deg C) then the door solenoid will be energised into the open position. If the

door is not closed within, 2 minutes after the burners have lit then the lower burner will extinguish and the message:

Door Open

Push CLR

Will be displayed on the LED display in a cyclic fashion with a 5 second interval. The user must push the **CLEAR** button to initiate the chamber burner ignition and clear the fault message.

Assuming the cycle proceeds normally the stack temperature will increase rapidly at first and then slowly. The chamber temperature will climb in an increasing manner until Operating temperature is reached. At the safety temperature (typically 260 deg C) the door lock solenoid will deactivate to lock the door in the closed position. DO NOT OPEN THE DOOR during cycle it is very dangerous. Should the door fail the computer will detect the open door and shutdown the burners and activate both water sprays in order to cool the material.

At the chamber set point the **HI/LOW FIRE** lamp will cycle on and off as the computer monitors and controls the chamber temperature. Depending on the control algorithm the water spray will come on and off as the process proceeds. Once all of the material is burnt off, the water sprays should cease. During the cycle the water spray count will increase to indicate that water is being sprayed, at the same time the **MAIN WATER** lamp and possibly the **BACKUP WATER** lamp will illuminate whilst water is being sprayed.

In the event that either the afterburner or furnace chamber have an over-temperature situation the following procedures will occur to create a safe mode atmosphere.

1. Afterburner Safety Control System

a) *Set point 1 "Stack Idle"* – this set point is the pre-calibrated point for the amount of smoke and gases that can be safely consumed within the afterburner. If this value is reached then the patented water spray system will operate and control the furnace and afterburner systems.

b) *Set point 2 "+50°C"* – when this set point is reached potential overload or main water system failure has occurred. If this occurs then this setting operates a back-up water spray system which injects a high volume of water into the furnace chamber to rapidly cool-down the atmosphere.

c) Set-point 3 "*+100°C"* – when the system registers an over-temperature of +100°C the system will automatically shut-down the primary (lower) burner to reduce thermal energy input into the main chamber, and stop any further processing. The afterburner system will continue to operate to consume all smoke and gases. When the temperature in the afterburner falls below set point 1 "stack

idle" the water spray system and the primary burner will automatically shut-down, or re-start.

2. Primary Burner Safety Control System

a) *Set-point 1 "Hi-Lo Mode"* – when the furnace temperature reaches it's desired operating value, the system will maintain the primary (lower) burner on a Hi-Lo fire mode. This control feature maintains the correct oxygen values and temperature range for safe processing conditions.

b) *Set-point 2 "+50°C"* – if the conditions within the furnace chamber are that an overload has occurred, and the low-fire mode cannot contain the temperature profile, the back-up water spray system will operate to rapidly reduce and maintain the atmosphere.

c) *Set point* 3 "+100°C" – if the system cannot maintain the over-temperature situation, the PC will detect the rise in temperature and automatically shutdown the primary (lower) burner to stop any further thermal energy input. The burner will not re-light until the temperature profile has fallen below set point 1, and is in safe operational mode. The burner will not automatically re-light until the operator manually presses the reset button.

Once the cycle is completed, the cycle time will approach zero. At zero time remaining both the chamber burner and the stack burner will extinguish. If the chamber temperature is above 260 degrees the lower fan will continue to run to purge the chamber with cool air. The LED displays will alternate between the temperatures and the message:

Run End

Once the temperature cools below 260 deg C the door lock will reactivate allowing the door to be opened. The fan will stop blowing air at this point. The LED displays will still show the temperature and run end message.

Exceptions and error messages

It is possible that during a cycle that faults may occur either with the furnace or with the operating procedures. In either case the computer will detect the anomaly and will report the fault with either an LED message, a warning lamp, a sounder warning or combinations of all three.

Open Door

Action: The door is closed before the stack burner has gone to ignition. The door must be open during burner ignition. Open the door.

Burn Loc

Action: One of the burners has failed to ignite. This could be due to a burner fault or a low gas pressure situation. A **BURNER LOCKOUT** lamp will be illuminated. Trace and rectify the fault to continue. Once the burner lockout is reset the computer will detect this and attempt to resequence the burner ignition cycle. If the temperature is below 260 degrees and the stack burner was the one that locked out then the door must be opened to continue with the ignition sequence.

H20 Lost

Action: The water pressure system has detected a low pressure. The **WATER OK** lamp will only be lit if the water pressure is sufficient for normal operation. Rectify the problem with the water pressure system and the computer will attempt to resequence the burner ignition once the fault has gone.

Gas Lost

Action: The gas system supplying the burner has detected a low pressure. The GAS OK lamp will only illuminate once there is sufficient gas pressure to operate the burners correctly. Once the reason for the low pressure is rectified then the lamp will illuminate and the computer will automatically attempt to resequence the burner ignition cycle. If the temperature is below 260 degrees and the stack burner was lost then the door will need to be opened.

AC lost

Action: The mains power to the system has been lost. All of the burners will extinguish automatically. If the chamber temperature is above 260 degrees then the water sprays will activate to cool the material. These will shut off as soon as power is restored or the temperature falls below 260 degrees centigrade. If the power is restored then the burners will automatically resequence the ignition cycle.

Ther Lost

Action: A fault has been detected with the thermocouple system on either the stack or the chamber thermocouple. Once the fault has been detected and rectified then the computer will detect the correct operating of the thermocouple and will attempt to resequence the burner ignition (chamber burner only extinguishes).
If, during a cycle the material in the chamber burns off at too high a rate then the computer will attempt to control the process using the programmed algorithm. If the chamber temperature increases to over 100 degrees above the set point then the computer will activate the over temperature safety trip and shut off the lower burner. The display will output the following message:

Push clr

Once the chamber has cooled and the CLEAR button pushed then the burner will relight and the process continue as normal.

If an attempt is made to open the door during the cycle when the temperature is above the safety point then the chamber burner will extinguish and both water sprays will activate in order to cool the material. IT IS VERY DANGEROUS to attempt to open the door once the process has started – refer to the operating instructions in this manual for further information.

Under these circumstances the display will indicate

Over TenP

When this is displayed in the control panel, the main primary (lower) burner would have automatically shut-down due to an over-temperature incident in the furnace chamber. If this message appears, the operator must manually reset the burner operation by pressing the push-clear button on the panel. The burner system can only be reset once the furnace temperature has fallen below its main operating temperature.

Door open

The audible alarm will sound continuously until the door is closed at which point the Computer will attempt to resequence the burner ignition and continue the cycle.

2.2 LOW WATER PRESSURE SWITCH

The water spray system has a pressure switch, which will prevent the primary burner (lower) from coming on unless sufficient water pressure to operate the spray is present. If water pressure is lost during a cleaning cycle, the primary burner will shut down. When pressure resumes back to the correct pressure the primary burner will go through it's cycle and re-light.

Factory setting of the water pressure switch is set to close on rising pressure at 2.7 bar (40psi). Once the switch closes, it will remain closed until the water pressure drops below 2.1 bar (30psi). If you find that when the furnace asks for water spray and the pressure in the system keeps falling below 2.1 bar we recommend that an additional pump be fitted so that pressure can be maintained. Consult factory for details.

2.3 CONTROLLED PYROLYSIS™ WATER SPRAY SYSTEM

A patented water mist system controls the cleaning rate of the furnace. This control system is called Controlled Pyrolysis™. This system measures the amount of Pyrolysis smoke entering the afterburner chamber by monitoring the afterburner (stack) temperature. When the evolution of smoke from the parts causes the stack temperature to rise above it's preset control point, water mist is automatically injected into the furnace to cool the parts and slow down the emission rate of the smoke from the parts. This system

limits the amount of smoke, which enters the afterburner chamber to a maximum rate without overloading the afterburner capacity. Thus, the afterburner always operates at high efficiency for complete pollution control.

The Controlled Pyrolysis™ system basically acts as built in smoke detection system. The thermocouple located in the first section of stack senses the temperature rise in the stack gases caused by evolution of smoke off the parts during the cleaning process. The water spray temperature controller then controls the smoke emission rate such that the afterburner temperature does not exceed its set point. As long as the parts are evolving smoke to the afterburner, the afterburner will operate at its maximum set point. The furnace temperature will seek whatever temperature is necessary to produce enough smoke to raise the afterburner to its maximum set point. Usually this will be in the range of 315-430°C (600-800°F). When the organic residues have been removed, the afterburner temperature will fall to its baseline or "idling" temperature, which is normally about 850-900°C. This drop in the afterburner temperature is usually an indication that smoke evolution from parts is about finished, and the cleaning cycle is nearly complete.

2.4 WATER SPRAY TESTING

Before each cleaning cycle commences, the testing of the water spray system should take place. We advise that firstly opening the manual bypass valves located on the control panel water piping checks the main system and the back-up system. This will check that there is no blockage with the pipe work.

After this check has been carried out, you should than carry out an electrical test. Located towards the front off the furnace are two switches, which allow for the customer to test each system for any electrical malfunction prior to the cleaning cycle.

In the event of any fault, that may have been detected, DO NOT operate the furnace until the problem has been rectified.

2.5 ELECTRONIC FLAME SAFETY CONTROLS ON FURNACES WITH STANDARD CONTROLS

The two gas burners used on the furnace are direct spark ignited and utilize electronic flame safety controls based on the flame rectification principle. When the gas burners come on, the flame itself is capable of conducting a tiny current (usually in the 3 to 15 micro amp ranges) because of the ionized gases in the burner flame. A flame proving electrode senses this signal and feeds it back to a control system, which allows the gas valve(s) to remain open thus keeping the burner, lighted.

If this flame proving current signal is lost, the gas valve(s) shut down within a time period of 5 seconds.

The burners are designed to operate at around 9 Mbar each (3.5" water column) gas pressure for both natural gas and propane gas.

2.6 FURNACE OVER TEMPERATURE WATER SPRAY FEATURE AND PROTECTION

Controlled Pyrolysis™ Cleaning Furnaces have an additional furnace temperature switch that prevents the furnace temperature from exceeding a preset limit. This extra temperature switch is incorporated into main furnace temperature controller. The set point is set at 50°C above the furnace operating temperature so that if the furnace temperature exceeds the first set point and continues to rise, the second set point set 50°C above will activate the water spray system, so to gain control of the problem which might be occurring inside the furnace chamber.
In field experience with these cleaning furnaces, it has been found that with certain loads, the furnace temperature may continue to rise above the main furnace set point even though the primary burner is on low fire. This unusual situation is termed the "exotherm" effect. In some instances, various cleaning loads may produce significant amounts of char residue during the Pyrolysis stage of the cleaning process. In these instances, the amount of char formed inside the oven chamber is sufficient to oxidize and release enough heat to cause the furnace temperature to exceed its set point. At this point when the temperature exceeds the second furnace set point the water spray is activated to stop the rising temperature and to prevent any parts becoming damaged and for the furnace to over heat.

If for any reason the furnace temperature should keep rising above this second set point. There is a Hi - Limit manual reset thermostat switch wired into the primary burner circuit and the water spray circuit. This switch is set at 510°C and when the temperature exceeds this limit the switch will open and the primary burner will automatically shut down and the water spray system will activate to cool the furnace interior down. The primary burner can only be re - lit once the Hi - Limit reset button has been reset.

The manual reset thermostat does not affect the secondary burner operation. The top burner is allowed to continue to operate so to destroy any smoke evolving from the oven under these circumstances.

2.7 BACK-UP WATER SPRAY SYSTEM

During normal operating conditions, the furnace main chamber and the afterburner chamber are monitored and controlled by our patented water spray system (CPS).

In the event of failure of this system during normal working conditions, there is incorporated into our safety system water back up spray. If the main system fails for any possible reason, the back up spray is factory set to switch on when the temperature inside the afterburner chamber exceeds set point#1 by 50°C. The system will allow water to be injected into the furnace chamber at the rate of three litres per minute, thus allowing quick and efficient control within the furnace chamber. Once the back up spray has controlled the problem, the temperature will fall back below the preset set point, and this will turn the spray off, thus not allowing any flooding of the furnace chamber.

2.8 EXPLOSION RELIEF DOORS

Controlled Pyrolysis™ Furnaces have a hinged gasket explosion relief door (or doors) sealed by gravity on the top of the furnace. Should an ignition or fire occur, the door would swing open momentarily to relieve the pressure and immediately close back, keeping out air to oxygen - thus starving any fire. For the door to work properly, it must be clear of any obstruction and a minimum of 1 metre (40") above the furnace must be provided for clearance.

2.9 DOOR LOCK

Incorporated as a safety feature is a electrical safety door interlock, which prevents any opening of the front doors during the cycle once a pre set temperature has been exceed within the furnace chamber. After the cycle time has elapsed, the door interlock will stay locked, thus not allowing access to the furnace chamber until the chamber temperature has fallen below the set point. Under normal conditions, the set point is factory set to 260°C. However we can set this set point to any temperature that the customer requires, as long as we are informed at least two weeks prior to shipment.

2.10 GAS BURNERS

Controlled Pyrolysis™ Cleaning Furnaces are equipped with two gas burners. The upper burner (also called the Afterburner) fires through the wall into an insulated steel combustion tube located inside the furnace. The afterburner consumes smoke created during the cleaning process and ensures the exhaust gases from the furnace are pollution free. The upper burner runs all the time during the cleaning cycle to ensure smoke emissions are destroyed. Gas and air adjustments to the afterburner are factory set to raise the stack gases to a minimum of 850°C (1562°F) when the furnace is empty and contains no parts to be cleaned. The temperature is called the "Idling Temperature" of the afterburner. When dirty parts are loaded to the furnace, the stack temperature rises to 850°C as smoke is evolved and the parts are being cleaned. The afterburner temperature controller monitors the temperature of the stack exhaust gases. However, this temperature controller does not control the operation of the top burner, it controls only the water spray system.

The lower burner, also referred to as the primary burner, supplies the heat input to raise the furnace process temperature. The lower burner fires through the furnace wall into steel insulated combustion tube. The combustion gases flow out of an outlet hole into the chamber to heat the furnace. When the furnace heats up to the set point of the furnace temperature controller, the lower burner cycles High/Low fire. Maintaining the furnace at cleaning temperatures until the cycle timer times out.

CAUTION!

The orifice plates, which control the amount of gas going to each burner, are located inside the pipe union between the gas burner and the gas valve. If this pipe union is taken loose, make sure the orifice plate does not drop out and becomes lost. The orifice disk is a small aluminum disk about the size of a pound coin with a punch hole in the centre. The small hole restricts the amount of gas going to each burner.

3. INSTALLATION INSTRUCTIONS

3.1 RECEIVING

Most models are shipped completely assembled and crated with only the larger sizes requiring some assembly. Inspect the shipping crate if applicable or the furnace for any damage when it arrives.

IF THERE IS ANY SIGN OF DAMAGE TO THE CRATE OR FURNACE, DO NOT SIGN THE DELIVERY RECEIPT UNTIL WE HAVE BEEN NOTIFIED OF THE PROBLEM. CLAIMS FOR SHIPPING DAMAGE MUST BE MADE BY THE CUSTOMER TO THE FREIGHT COMPANY AND NOT TO THE DISTRIBUTOR OR MANUFACTURER.

The furnace weighs up 5000kg depending on the model number, so suitable equipment must be available to uncrate it, move it off its shipping base, and to move it into place. A forklift truck is desirable; an overhead crane with chains running to the furnace lifting lugs on top of the furnace can be used. Pipes, rollers, and pry bars are satisfactory if carefully used.

The cart is held inside the furnace with either shipping bolts or thick gauge wire, which must be removed before the cart can be moved. The outside tracks are strapped to the cart along with the other parts necessary to install the unit.

PLEASE BE CAREFUL WHEN REMOVING ANY PARTS ESPECIALLY THE CHIMNEY SECTIONS AS THEY ARE MADE OF FRAGILE CERAMIC FIBRE.

3.2 LOCATION

The furnace should be placed on a flat and level floor. The furnace is essentially a flexible steel box. If allowed to settle on an uneven surface, it could distort to the point that the doors no longer seal properly. Imperfections in the floor can be compensated for by the use of shims. The floor must be noncombustible and capable of supporting the furnace weight.

The furnace may be placed close to noncombustible walls and floors (no wood) at the left and rear but it would be prudent to allow for access of at least 0.3M clearance to the combustible material. An area equal to the base dimensions of the furnace should be allowed at the front for loading and unloading. At the right side of the furnace at least 1 metre should be allowed for access to the burners and controls. The small fans of the burners cannot compete for air with large extraction systems. Do not site the furnace where the burner fans could draw in corrosive or combustible fumes or any solid particles such as blasting media. Above the furnace allow 1100mm for the operation of the explosion relief doors.

If the furnace is to be installed outside, a roof must be erected so the furnace can be protected from the elements. Also a floor must be constructed so water can not collect under the furnace which could cause the floor to rust. The appliance covered by this

manual requires a ventilation area around the equipment of 25sqcm per kW of energy input.

THIS FURNACE MUST BE FULLY PROTECTED FROM THE WEATHER, ESPECIALLY FROM RAIN AND FLOODING. THE WATER PIPES MUST BE PROTECTED FROM FREEZING IF THE FURNACE IS TO BE OPERATED IN A NON HEATED ATMOSPHERE.

3.3 COMBUSTION AIR AND EFFECT OF NEGATIVE AIR PRESSURE IN THE BUILDING

Every burner must take in a minimum of 10 times as much air as fuel for proper combustion, therefore an adequate supply of combustion air must be assured. Many buildings in which this furnace will be installed will be large enough to have enough "cracks" and leakage of air to the inside. However, many buildings now have exhaust fans, spray paint booths, cleaning booths, sand blasting booths etc. where air is drawn out much faster than it comes in. This creates a negative pressure inside the building, which is enough to overcome the natural draft created in the furnace, and the furnace will not work properly. The effect of negative pressure is compounded when dock doors walkways and windows are closed. This is particularly true in the wintertime. In such situations the squirrel cage fans of the furnace burners cannot compete for air with these types of devices. Thus, the burners may become starved for air. The lower airflows to the burners may cause the following undesirable conditions:

1. Lower air flow causes uneven temperature in the furnace. The hotter combustion gases emitted from the primary burner to heat the furnace may damage the combustion tube, or parts placed close to the combustion gas output hole of the tube.

2. Lower airflow caused by excess negative building pressure may rise the "idle temperature" of the afterburner causing excessive or needless water spray. This results in longer cycle times and increased operating costs. Parts also may not come out as clean as desired.

3. When the cleaning cycle ends or when the primary burners cycles on/off, hot gases may be drawn backwards through the burner. This may overheat and damage the burner.

4. Very high building negative pressure may overcome the furnace natural negative pressure and draw heat, smoke and/or odour into the work area.

When the building negative pressure is fairly small, the furnace will work just fine as shipped from the factory or the if problems persist with guidance the burners can be adjusted to compensate the negative pressure.

A fairly simple, but useful method of determining how much negative pressure a building has, is to walk into the furnace at room temperature and feel for a down draft at the hole of the upper combustion tube. If a down draft can not be felt or is Very light, then the furnace will work very well or only minor adjustments of the burners will be all that is

required. If the downdraft is easily noticeable or severe, then outside air ducting may be required to optimize the operation of the furnace.

3.4 GAS SERVICE FOR GAS MODELS

The cleaning furnaces operate on low-pressure gas supply 1/2 psig , 25 - 35 millibars (14" w.c).

THE MAXIMUM GAS LINE PRESSURE SUPPLIED TO THE FURNACE SHOULD NOT EXCEED 1/2"PSIG, 35Mbar, 14" W.C.
If the gas line pressure is higher than 35 millibars, an additional gas regulator should be installed ahead of the furnace. The local gas board can help determine service requirements. A gas pressure regulator can be factory supplied as an extra cost option when specified on the furnace purchase order. The regulator is shipped separate for customer installation.

The gas burners are supplied for either natural gas or propane gas as specified on the order. Unless otherwise specified, natural gas is assumed to have a heating value of 1000 Btu/cu.ft. (8.9Kcal/cm) and a specific gravity of 0.6. Propane gas is assumed to have a heating value of 2550 Btu/cu.ft. (22.7Kcal/cm) and a specific gravity of 1.5.

The gas meter and gas supply piping must have a sufficient capacity to supply all gas burning appliances installed on the premises including the Controlled Pyrolysis™ Furnace. This furnace must have a minimum of 20 millibars (8"W.C.) measured at the furnace inlet manual valve when both burners are on.

The size of the gas pipe from the meter to the furnace depends on the gas pressure available and the distance from the meter. The listings below shows pipe sizes for ordinary installations, based on a pressure drop of 37 millibars (0.5" W.C) between the meter and the furnace. If there are many fittings in the supply pipe, increase it one size from that shown:

0-3 metres (0-10FT) 3/4" BSP
3-10 metres (10-30FT) 1" BSP
10-40 metres (30-130FT) 2" BSP

When furnished for propane gas the burners have gas pressure regulators set at 9 millibars (3.5"W.C) just like natural gas burners. Each propane burner has a smaller orifice approximately 35% reduction on the natural gas orifice. Also each burner has been adapted to accept propane gas with a special propane kit fitted. The propane tank supplied by your local gas supplier will usually have a regulator set to deliver between 30 - 40 millibars (11-12" W.C) to the building. Please note that most ordinary propane appliances depend on the 30 -40 millibars gas pressure to aspirate combustion air into the burners. Controlled Pyrolysis™ Furnaces use small packaged burners with incorporated blower fans and do not require 30 -40 millibars gas pressure to operate, each require at least a minimum of 9 millibars of gas pressure, the same requirement as for natural gas.

CAUTION: To provide proper vaporization of the propane a second stage regulator must be installed to reduce the pressure to 1.5 bar inlet, & 37mb outlet, measured at the furnace inlet valve. Locate this regulator inside or outside the building and use pipe, minimum 3/4", to connect from this regulator to the furnace. The pipe must be at least 4.5 metre (15 feet) in length to allow enough pick-up of heat to fully vaporize the propane. A propane vaporizer may be required in some cold climates to prevent liquid propane from being carried over into the burners to upset combustion and increase fuel costs.

WARNING: If the incoming line pressure is not reduced to the above pressures this may cause damage to the gas valves and regulators, which have low-pressure ratings. The company cannot be responsible if a regulator is not fitted and components are damaged.

DANGER: WE ADVISE AGAINST THE USE OF FLEXIBLE GAS LINES

3.5 ELECTRICAL REQUIREMENTS

The electrical service to the furnace must be run in suitable conduit or the use of proper insulated cored cable must be used. The load requirement is 220/240 volts AC, single phase 50 Hz, 10-amp power supply to the furnace. We supply a junction box located on the furnace wall for your electrical wiring to come to, and on request at an additional cost can provide load break safety switches which can allow for 3 phase wiring to be brought into the furnace.
Actual current usage with both burners on is generally about 2 to 3 amperes.

3.6 WATER REQUIREMENTS

Water service to the furnace should be connected to our 15mm compression fitting Gate valve inlet. If the water pipe is too long, it will be necessary to go to a larger diameter water pipe to prevent an excessive drop in water pressure when the water spray system comes on. Clean mains water is normally acceptable, but if the water is heavy in scale or chalk, which is found in certain areas, an additional water softener may need to be fitted by the customer. The unit has its own water strainer fitted to collect as much dirt as possible and to protect the valves. The water pipe should also be protected from freezing.

The minimum water pressure to the furnace should be 2.7 bar and the maximum 6.5 bar. If you cannot maintain this pressure the primary burner will not light for safety so an so, an additional 0.5 horsepower pump will have to be fitted along with at least a 100 litre tank. The actual amount of water used is fairly small, the maximum flow rate is 1 - 2 litre per minute depending on how many nozzles are fitted and is intermittent, dependent on demand from the water spray temperature controller. No drain is required because all the water sprayed inside the furnace is turned to steam and is exhausted through the stack.

BEFORE CONNECTING WATER SUPPLY TO FURNACE CONNECTION CHECK BYELAW 12 - TAKING OF SUPPLIES.

3.7 OIL SUPPLY FOR OIL MODELS

The oil burners are supplied for #1 or #2 heating or furnace oil only. Crankcase oil, waste oil or gasoline should never be used. A suitable oil tank located above, on the same level, or no more than 3 metres (10 feet) below the top of the furnace must be connected to the burners on the furnace with two continuous runs of heavy wall copper tubing. The two runs are required because the burners are connected with a return line to the tank to automatically bleed the air. Specific information on piping, lift capabilities and tank installations is provided in the instructions of the fuel unit manufacturer, but for typical installations the following table will allow selection of copper tubing of adequate size.

LIFT IN METRES (fuel burner height above bottom of oil tank)	**LENGTH IN METRES** (vertical & horizontal lengths)	
	3/8" OD Tubing	**1/2" OD Tubing**
0.0	**16.3**	**30.8**
1.0	**12.6**	**30.8**
2.0	**8.9**	**30.8**

3.8 STACK INSTALLATION AND VENTING

Straight up through the roof venting is the simplest and most desirable. The cleaning furnace is supplied with three sections of stainless steel insulated stack, which is included in the cost of the furnace. These sections snap together and are fastened with screws. Necessary accessories for installing the stack such as storm collar, adjustable flashing, rain cowl and/or Michigan Terminal are also supplied. Depending on the height of the furnace model and the height of your roof, it may be necessary to purchase additional sections of stack from the factory to go through the roof and have adequate clearance. Three metres are the minimum height of stack required so that the natural draft system operates correctly. Local or city codes may have additional or different requirements. Combustible roofs will require a sheet metal stack thimble. Check local codes.

ONE SECTION OF STACK CONTAINS A BRACKET FOR THE THERMOCOUPLE TO BE INSERTED INTO; THIS MUST BE THE FIRST SECTION FITTED TO THE FURNACE ROOF OUTLET.

If the total stack height on the furnace exceeds 6 metres it is necessary to place a special section of insulated stack with a draft stabilizer fitted in the fifth section of stack. The draft stabilizer section of the stack limits the draft achieved inside the furnace to a reasonable level and should be installed inside.

DO NOT INSTALL THE DRAFT STABILISER SECTION WITHIN THE FIRST 4 METRES OFF THE ROOF OUTLET.

Ideally, the draft inside the furnace should be about a negative 0.10 inches of water column, but may range from about -0.08 to -0.15 inches water column. If the draft is less than this amount the furnace chamber pressure might go positive during periods of water spray causing some smoke to seep around the gaskets. At higher drafts excess air is pulled into the furnace. This is detrimental for several reasons. First, the furnace will be slower to heat up and maintain temperature; also the "idling temperature" of the afterburner will be lowered below the optimum region of about 850°C because of excess air. In addition, a large amount of excess air leakage into the furnace because of high draft dilutes the oxygen-deficient gases from the primary burner, thus raising the overall oxygen level of the furnace atmosphere. Because of the above factors, excessive draft caused by too high stack can cause difficulty in controlling the Pyrolysis cleaning process and even possibly lead to a fire inside the furnace.

When a draft stabilizer section is installed, adjusting the number of washers (weight) on the draft control controls the draft inside the furnace. This should be done when the furnace temperature is above 315°C (600°F) and the stack temperature above about 650°C (1200°F). The simplest method of measuring the furnace draft is to loosen the manual high limit temperature thermostat switch which goes through the furnace wall and temporarily remove it, and then place a 1/4" tube in the space left and connect this to a draft gauge. Once the draft stabilizer washers are adjusted to give proper draft, be sure to replace the thermostat switch and retighten the setscrew.

USE ONLY FACTORY SUPPIED EXHAUST CHIMNEY.

You must maintain required clearances (air spaces) to combustible materials. Do not place any type of insulation or combustible material in the required clearances surrounding the chimney at any point.

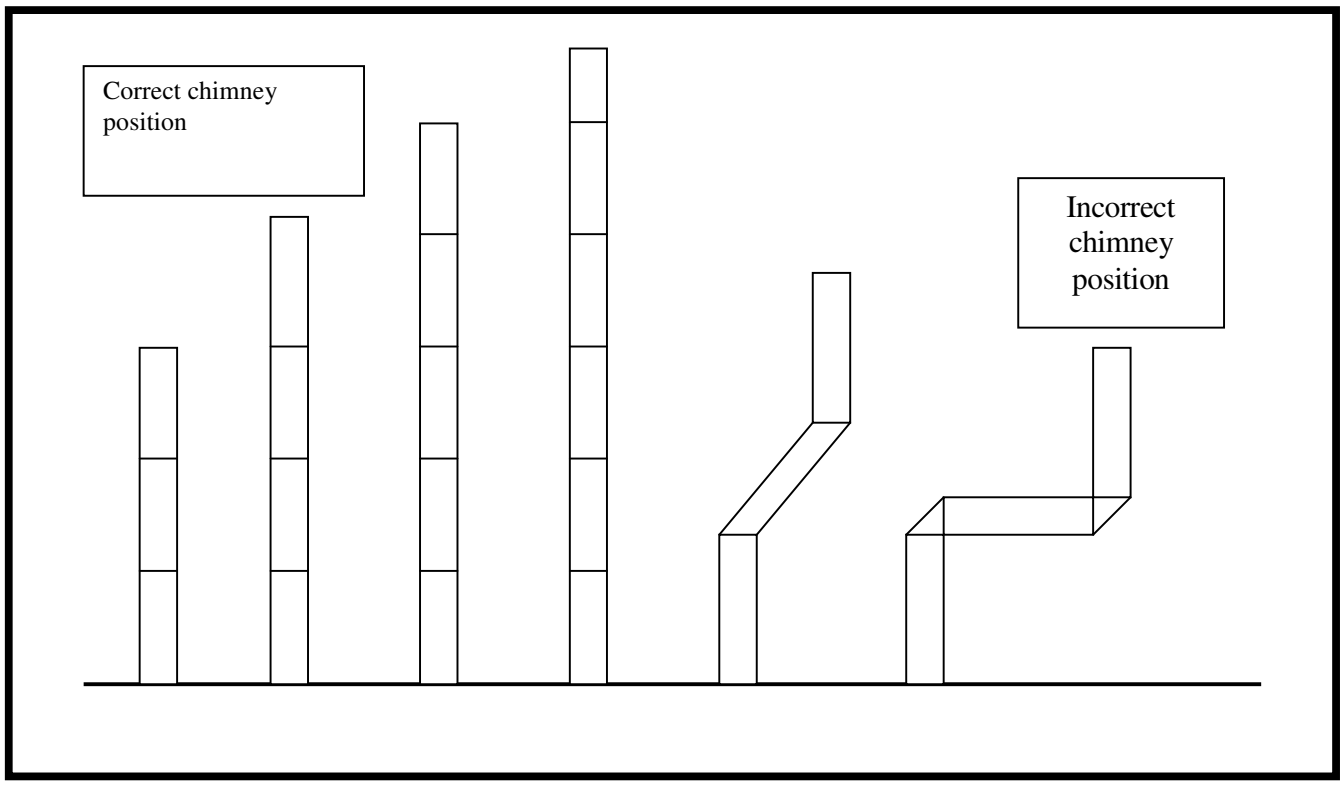
3.9 OFF-SET STACK OR THROUGH THE WALL VENTING

If the stack has to be off set for some reason, 45° insulated elbows can be used. These are available at extra cost from the factory. The stack cannot go in a horizontal position, but can be off set by the use of the 45° elbow and then returned back to a vertical position once the obstruction has been bypassed. See drawing at chapter end for reference.

NOTES ON PLANNING THE FURNACE STACK

Three one metre straight pieces of insulated stainless steel are provided with the furnace, covered by the basic price, and optimum functioning absolutely requires that all three be used. For the best possible natural draught they should be mounted vertically on the furnace and the stack should pass through a hole in the roof. Where this is not possible or where three metres is not enough to pass through the roof, be guided by the following basic rules:

1; The stack top should open at three metres above the furnace.
2; The stack top must not be below the level of the eaves of the roof and, where downdrafts are thought to be possible, may have to be level with
Or higher than the roof ridge if this is near. (In our experience it is not usually necessary to have more than one full stack section visible above roof height)
3; Maximum deviation from vertical should be 45°. No 90° bends or horizontal runs!
4; An angled (45°) run should be followed immediately by a vertical section.
5; A stack that exceeds six sections must contain a draught stabilizer fitted in the fourth of fifth section. (The stabilizer must be within the building).
6; Consult us if there are any problems, there is always a solution.



4. START UP AND OPERATION PROCEDURE

4.1 EMPTY TEST SET UP PROCEDURE

4.2 CLEANING YOUR FIRST LOAD: THE FIRST STEPS

*Selecting the cycle time

*Loading the parts

4.1 EMPTY TEST SET UP PROCEDURE

When the furnace is completely installed adjustments to the gas and air inputs of both burners may have to be made and the set point of the stack temperature controller must be determined. In order to do this the furnace has to be run without a load (but with the cart inside) for several hours, plotting the temperatures of the stack and main chamber over that time period. The furnace set point #1 must be set at either 370 or 430°C and the furnace set point #2 at 50°C above that; this margin must subsequently be modified in consultation with the factory. The stack set point for the purpose of this test only should be set to its maximum so the temperature cannot activate the set point and spray water into the furnace.

The furnace main chamber should be at about 430°C after 80 to 120 minutes. A more rapid rate of increase would indicate that the primary burner flame is too hot, threatening to burn out the combustion tube. Usually only a small adjustment to the primary burners gas regulator is needed.

When adjustments of the primary burner have been completed, restart the empty test. The stack temperature rises more swiftly than the main chamber and levels out. When the primary burner reaches its set point #1 it switches from high-fire to low-fire and this tends to disturb the level temperature in the stack, perhaps even causing a distinct saw-tooth waveform. When this pattern appears stable and regular, note the highest temperature reading in the stack. This reading indicates the “idling (maximum) temperature” of the stack without any smoke. The "maximum idling temperature” of the stack should be in the region of 850 - 900°C, usually only minor adjustments to the burners gas regulator is required to obtain this.

Under load the furnace should run with the set point of the stack at about 60°C above the "maximum idle temperature”. When this test is completed make a graph of the temperature curves and make a note of the set points. All operators should share this information. These set points are to be used in all cleaning cycles. The only normal variable should be the number of hours for the cycle, which will depend on the weight and nature of the parts to be cleaned and also on the amount, and type of the coating to be removed.

The first run under load should also be plotted and the results then compared with the graphs of the empty test.

4.2 CLEANING YOUR FIRST LOAD

The key to understanding the furnace is contained in the graph over leaf. The furnace behaves differently according to what is being processed. To fully understand what is going on it is necessary to have a graph of an empty run for comparison. The empty run provides two important temperatures: the maximum “idle temperature” of the stack and the stack set point, which is 60°C above that.

1 Make graphs of furnace cycles recording water spray counts (50 counts equals 1 second), recording also how much coating is in the furnace (best by weighing but you will properly have to settle for visual checks). On later models fitted with black surround counter, measurements are in minutes and seconds

2 the furnace has a limited capacity to consume coating without producing smoke or other problems. If you wish to determine the limit for your furnace, make gradual increases in load until you see a sign that you are near the limit. (An increase in stack temperature and in water spray activity out of proportion to the increase in coating)

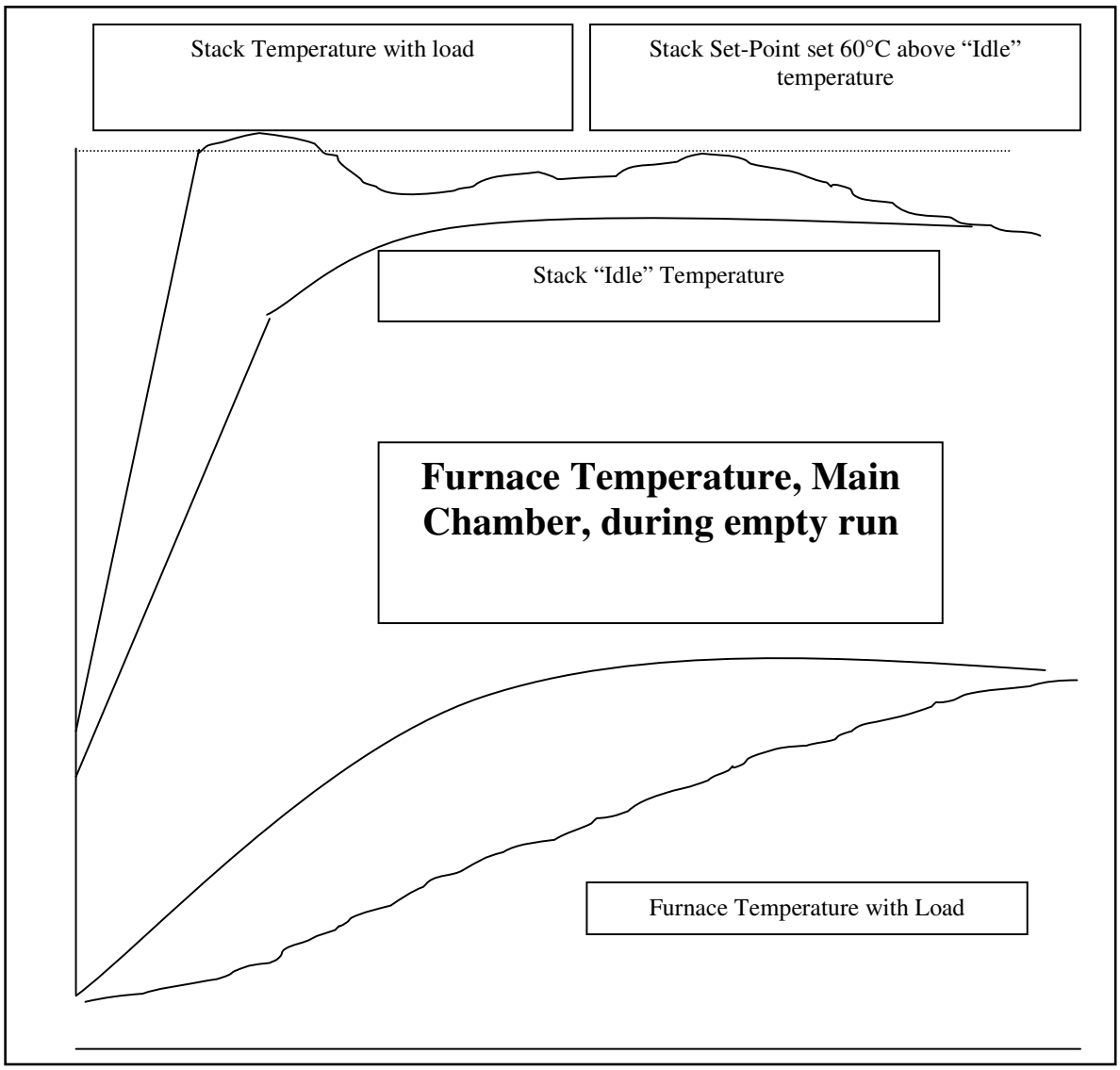
3. The loading of the furnace is of critical importance to allow for correct function and operation process of the unit. When loading parts, they must fit within the confines of the cart that has been furnished with the furnace. Parts should not be nested or stacked such that they are densely packed. This will retard open circulation of furnace combustion gases around the parts and hinder cleaning. When improper stacking or loading occurs parts may not clean in the method that the furnace is designed for. If parts are jammed together or densely packed the furnace heating gases cannot circulate around the parts, cleaning is retarded and longer times will be required. Do not modify the factory cart as modifications may prevent or cause heat circulation problems. Always use good judgment in loading parts, and maintain adequate space between the parts to achieve good cleaning. Also avoid placing large items directly in front of the lower combustion chamber outlet hole, which could cause overheat of items, and block the flow of the combustion gases.

Please revert to section 1, sub section 1.2 for material limitations.

4 during the learning period allow plenty of time for each cleaning cycle. Point 3 will show when it can be reduced. You may also have to add time. Come back to the furnace near the end of the programmed time. If the stack temperature has not returned to the maximum idle, then add time to the cycle timer.

DO NOT FORGET THAT ONE EFFECT OF THE WATER SPRAY SYSTEM IN LIMITING THE AMOUNT OF SMOKE AND PYROLYSIS GAS PASSING TO THE SECONDARY BURNER IS TO LENGTHEN THE NECESSARY CYCLE TIME!

INCREASING THE LOAD INCREASES THE CYCLE TIME NEEDED.



The graph above shows empty test temperature curves compared with those seen in a typical cycle, i.e. with the furnace loaded.
Points to be noted:
1 the stack temperature rises to the stack set point, triggering the water spray system.
2 the cooling effect of the water spray slows down the rate of temperature increase in the furnace main chamber.
3 A sign that Pyrolysis is completed is the dropping of the stack temperature to the maximum "idle" temperature.

5. SAFETY AND MAINTENANCE

5.1 EXPLOSION RELIEF DOOR

5.2 SAFETY ASPECTS OF THE CONTROL SYSTEM

5.3 CARE & MAINTENANCE

5.4 PARTS REQUIRING FREQUENT REPLACEMENT

5.5 SERVICE CONDITIONS

5.6 WARRANTY CONDITIONS

5.1 EXPLOSION RELIEF DOOR

In the roof of the furnace main chamber one or more gravity-sealed explosion relief doors protect the furnace from the effects of over pressure. During normal and safe operation of the furnace the explosion relief doors are never raised. After operation the doors close automatically, preventing entry of oxygen to the main chamber. The operator should be aware that if the explosion relief doors rise, either overloading of the furnace has occurred or uncured or other unacceptable material has been loaded.

5.2 SAFETY ASPECTS OF THE CONTROL SYSTEM

1 the water spray system cools the furnace main chamber at 480°C or another user-defined temperature is reached, thereby protecting against over temperature.

2 The water spray system cools the furnace main chamber when a temperature (stack set point) 60°C above the maximum idle temperature is reached in the stack. This has the effect of limiting the production of Pyrolysis gas to a rate that the secondary burner system can handle with a wide safety margin.

3 The water pressure switch tests the supplied water pressure to ensure that it is sufficient for the efficient operation of the water spray system. If at the beginning of the cycle less than 2.7 bar (40psi) is available, the primary burner is prevented from operating. If during the cycle the pressure drops to below 2.1 bar (30psi), the primary burner is turned off.

4 the manual reset thermostat, on sensing a temperature around 530°C in the furnace main chamber, turns off the primary burner. This is a second line defense against over temperature in the furnace main chamber. The thermostat must be manually reset before the primary burner can operate again. If this thermostat is tripped by over temperature, a thorough investigation of the causes must be made before the furnace is used again.

5 If for any reason the secondary burner fails, power to the primary burner will be interrupted. If Pyrolysis gas cannot be incinerated then all further production of Pyrolysis gas has to be stopped.

6 The only significant sources of noise on the PRC furnace are the burners. The noise level of these in use is less than 65dB (A), which is less than the background noise level in an average office and is certainly unnoticeable in a factory environment.

5.3 CARE & MAINTENANCE

The furnace will give service with the minimum of maintenance if treated with care.

1. The first rule is good housekeeping. Regularly remove ash from the furnace and keep the burners and controls free from dust. Ash can is disposed off in normal waster or landfill collection depending on the chemical composition of the ash. (Please checks the

product material data sheet if unsure of the fillers, pigments, or other inorganic components.). If ash is deemed to be hazardous, then it must be disposed of by the proper methods. Personnel handling the dust or ash should have suitable masks as protection from inhaling the dust fumes when unloading the cleaned parts, or when periodically removing any ash from the furnace floor.

2. Understand that the insulation material in its soft form is easily torn. Do not poke objects into the furnace walls or roof. The insulation material in its hard form is fragile. Do not crush this by striking or burdening the stack or the combustion chambers.

3. The cart bearings must be replaced often (see parts requiring frequent replacement) and certainly before seizing up occurs.

4. The water spray nozzles must be inspected daily for correct functioning. Use the manual and electrical test valve and inspect the spray passed by the nozzle. Do not run the furnace with nozzles which are blocked or which are passing a solid stream of water. Only a fine mist is admissible.

5. When fitting new or cleaned nozzles ensure that the nozzle tips have their slot horizontal so that the water mist is directed only into the furnace headroom above the loaded cart.

6. See the burner manufacturer booklet, located at the back of this manual for details of burner care and maintenance.

7. Make a weekly check of the door gasket and center bandage (double door models only). During the cycle, air should not be drawn past the gasket into the furnace.

8. Check on a daily/weekly basis any chimney support(s), and chimney corrosion that may be evident, and replace or adjust as necessary. Failure to replace or adjust chimney sections could lead to the collapse of the chimney structure.

9. Carry out a general check for water leaks on the main and back-up systems, and tighten as required.

10. Check wiring looms for any damage that could cause electrical shock or injury, and renew as per specifications to DIN40700.
DISCONNECT POWER AT MAINS BEFORE UNDERTAKING THIS TYPE OF WORK.

11. Using an airline, carefully blow dust away from main control area so to prevent any component failure.
DISCONNECT POWER AT MAINS BEFORE UNDERTAKING THIS TYPE OF WORK.

5.4 PARTS REQUIRING FREQUENT REPLACEMENT

Two items within the furnace chamber are subject to great strain in use and will certainly require constant checking, maintenance and replacement.

1 The wheel bearings
Heat and corrosion will eventually lead to dysfunction. When the cart becomes too stiff to be pushed or pulled easily, remove the wheel bearings and replace. These are standard 6204 bearings. In certain furnaces large bearings have been used in place of conventional wheels. These have been specially prepared to cope with typical furnace temperatures and need only to be disassembled and cleaned from time to time.

2 The water spray nozzles
Wear and scaling will affect these. Eventually they may become blocked or the jet opening may enlarge, destroying the mist effect necessary for efficient functioning. If cleaning is insufficient, either the whole 4 part assembly or just the jet tip or filter must be replaced.

5.5 SERVICE CONDITIONS UK Only (on orders received after 18.05.95)

As part of the "General Conditions of Sale" and warranty period the cleaning furnace requires a mandatory service six months after commissioning so that the remainder of warranty does not become invalid. This service allows us to check that the furnace components are in correct working order and also readings are taken from the chimney to ensure correct emission levels are being maintained within H.S.E. and H.M.I.P. regulations.

The only cost incurred by the customer for the first year's service would be £430 call-out charge, (maximum) depending on location, plus an hourly rate of £45.00.. Within the first 12-month period no parts that are replaced, unless it is clear that the customer has caused damage by misuse, will be charged until the warranty period has elapsed. Invoicing will not take place until servicing has been complete and original purchase order for the machine will be used unless otherwise specified.

After the period of warranty has elapsed, the service contract will continue and our service engineers will automatically place in the system a 12-month recall unless otherwise specified.

If the customer does not require the service contract after the 12 months has elapsed, Pollution Control Products Co will require a letter of confirmation stating that the service contract is no longer required and also a statement that the customer accepts liability for any future problems and emissions emitted to atmosphere produced from their equipment.

5.6 CLEANING FURNACE GUARANTEE

Our guarantee covers failure, within the first year from date of shipment that is not caused by misuse of the furnace. No part of the furnace is excluded from the guarantee except items classed as wear & tear (see below).

In the event of a suspect failure your maintenance colleagues should try to isolate the cause; working in contact with us to allow the cause to be pinpointed. Components which are identified as defective (in consultation with us) we would supply for fitting by the customer, the guarantee of the machine is for parts only, we would not fit any components, this is at extra cost. More fundamental failure (structural etc) which cannot be eliminated by a replacement component we ourselves would put right.

You will recognize that we have to protect ourselves against over hasty fault finding. We require only that a thoughtful engineer or technician work with us to identify the exact nature of the problem. In the overwhelming majority of cases the causes of difficulty are found to be simple ones that can be put right easily with our guidance, cutting downtime to the minimum.

If the failure should prove to lie with the use of the furnace or with problems in the water, gas or electricity supply, we shall give speedy practical advice -- not merely during the guarantee period but for the lifetime of the furnace and at no extra cost.

ALL PARTS AND COMPONENTS THAT HAVE FAILED DURING THE WARRANTY PERIOD WILL HAVE TO RETURNED TO THE FACTORY FOR INSPECTION. IF THE FAILED PARTS OR COMPONENTS RETURNED ARE FOUND DAMAGED OR FAULTY WHERE THE CUSTOMER HAS FAILED TO FOLLOW OUR INSTRUCTIONS OR THE PART SHOWS MISUSE THE WARRANTY WILL BECOME VOID AND THE PART WHICH WAS REPLACED WILL BE INVOICED AT FULL LIST PRICE.

Exclusions from the Warranty:

Door surround gasket, door surround bandage, door bandage, water nozzles and associated components, indicator bulbs.

WIRING DIAGRAM KEY FOR PTR/VPI/ATR (NOT DIGITAL SYSTEM)

B1	Furnace thermocouple
B2	Stack thermocouple
F1	Fuse#1
F2	Fuse#2
F3	Fuse#3
F4	Fuse#4
H1	Lamp cycle ON
H2	Lamp secondary burner ON
H3	Lamp primary burner ON
H4	Lamp low fire (Gas models only)
H5	Lamp Back-up water spray ON
H6	Lamp door interlock energised
H7	Lamp primay burner 2 ON - OPTION ONLY
H8	Lamp low fire 2 (Gas models only) - OPTION ONLY
K1	Cycle timer
K2	Main control relay
K3	Post purge relay
K4	Primary burner 2 control relay
K5	Primary burner 2 gas control relay
N1	Furnace temperature controller
N2	Stack temperature controller
P1	Water spray counter
P2	Chart recorder (optional)
S1	Power switch
S3	Manual reset thermostat
S4	Water pressure switch
S8	Water system#1 &2 test switch
T1	Transformer water spray counter
T2	Transformer stack temperature controller
Y1	Door interlock
Y4	Back -up water spray solenoid
Y5	Water spray solenoid
Y6	Gas valve secondary burner
Y7	Gas valve primary burner
Y8	Gas valve primary burner 2

X1	32 pin outlet block
X2	10 pin out block
X3	Control box terminal strip

QUICK REFERENCE FAULT GUIDE – (NOT DIGITAL CONTROL SYSTEM)

1. When there is no power after the main power switch is turned on;

a) Check the incoming supply at T2 of the power switch for 220/240Vac; if yes go to 'C'
b) If no, check your own incoming supply to the furnace.
c) If yes, check to see if power is at fuse#1
d) If no check fuse and replace if necessary.

2. With power 'on' but secondary burner will not ignite;
a) Check to see if power is at T1 of cycle timer; if 'yes' go to 'C'
b) If no, check fuses#2 and replace if necessary.
c) If yes check that timer has been switched on and then check power at T3 of timer.
d) If power is evident then check to see if red reset light at secondary burner needs resetting.
If yes push to reset and burner should continue through its 45-second pre-purge.
e) If red light is not on check and see if power is at L1 of the burner.
I) The burner should proceed through a 45 second purge period; blower motor; air switch; Five-second ignition; gas valves open and then flame proven circuit.
ii) Always check that gas is available.
iii) For further details see enclosed burner handbook.

3. Primary burner failure;
a) If burner fails to light check if power is at L1, if no go to 'C'
b) If yes, follow procedure as secondary burner section 'D'
c) If no firstly check if you have correct water pressure 2.7 bar (40psi)
d) If no then increase pressure to correct levels and check burner operation.
e) If yes check to see if there is power at T1 of switch and T3. If yes check fuse#3 and Replace as required. If no, either the water switch is faulty or checks that the manual reset
Thermostat located above control panel needs resetting or has not been damaged.
f) If the thermostat seems ok, check that the contacts 1 & 3 of main relay (K2) in control Panel has closed and that power is available at these contacts.

These sequences of checks are the first steps to take if the system fails. A good qualified electrician should be able to follow the wiring diagram and check each section required. If you cannot locate the cause of the problem consult the factory where our technicians will help you solve the problem.