

Explanation of Symbols



SHOCK HAZARD



BURN HAZARD, Due to hot air or high surface temperatures



DO NOT OPEN UNLESS AUTHORIZED



DISCONNECT FROM POWER BEFORE OPENING



GROUND (PROTECTIVE EARTH GROUND)

Model TD-48SC Thermal Demagnetizer
ASC Scientific

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1.0 Installation instructions

1.1 Unpacking

1. Unpack the main assembly (wooden crate) and the control electronics and inspect for damage. Do not attempt to unpack the main assembly without at least two people.
2. Slide the oven assembly out of the shield and remove the packing material inside the shield. For units equipped with a controlled field coil, leave the coil in place.
3. Place the instrument base/shield assembly in position on a bench top oriented east-west. The base should be positioned so that the oven entrance is to the left when facing the bench top. The base should be positioned so that there is sufficient space on the left side to insert and remove the 61cm long sample boat and so that the electronics can be positioned to the left either above or below the bench top.

4. In order to attain maximum field cancellation, the shield set should be degaussed from the inside in this position before proceeding with the assembly. The degaussing wand provided with this assembly should be used with a variable transformer. Units equipped with a controlled field coil can be degaussed with the coil in place.

WARNING! IF DEGAUSSING WAND IS CONNECTED DIRECTLY TO A 110 VOLT RECEPTACLE IT WILL BE DAMAGED.

1.2 Oven

1. Place the oven and control electronics on each end of a long workbench (electronics on the left, oven on the right). Install the inner oven door (ceramic cylinder with an aluminum bracket) on the inner end of the oven using the screw which is taped to the inner entrance to the oven. The door slides into the oven and is secured by the small screw – there is no need to tighten this screw. Remove the covers from the terminal



Power Cables

Figure 1

Model TD-48SC Thermal Demagnetizer
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blocks on the oven section, being careful not to lose the plastic spacers under each cover sc. Route the oven power cables around the oven wall spacers as shown in figure 1.

2. Remove the two black cable clamp blocks below each of the terminal blocks. Connect leads 1 & 2 to the outer terminal block as per figure 2. Connect leads 5 & 6 to the inner terminal block as per figure 3, placing lead wires under the jumper wire. All numbers should be facing up. Replace the terminal block covers, noting that the countersunk side of the plastic spacer should be facing up. Place each cable clamp block over the two cables and tighten the two screws on each block.

3. Route the thermocouple and ground lead to the oven as per figure 4. Remove the brass screw and connect the ground cable. Remove the small brass screw in front of each of the thermocouple plugs. Plug in the outer and inner end zones thermocouple leads as per figure 4. Secure the plus with

the small brass screws.

4. With two people, carry the oven and control electronics over to the shield assembly and insert the oven into the shield, positioning it as per figure 5 below. Be careful that the oven wall spacers do not catch on the shield during insertion. Push the oven in until it mates with the inner end of the cooling duct (approximately 7cm from the edge of the shield).
5. Route the fan power cord behind the shield and plug the small plug into the connector on the back of the small black box below the muffin fan. Tighten the collar on the connector

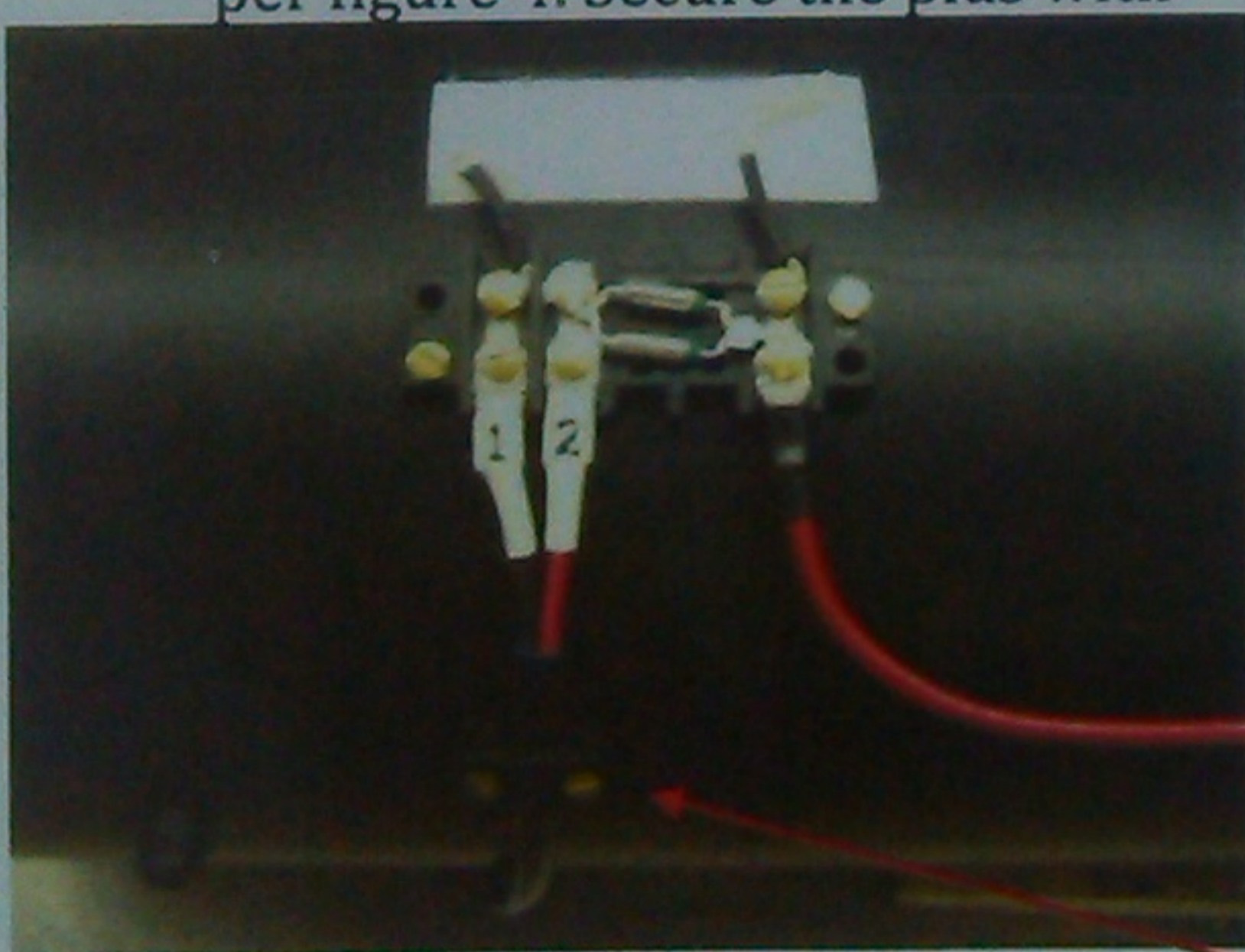


Figure 2

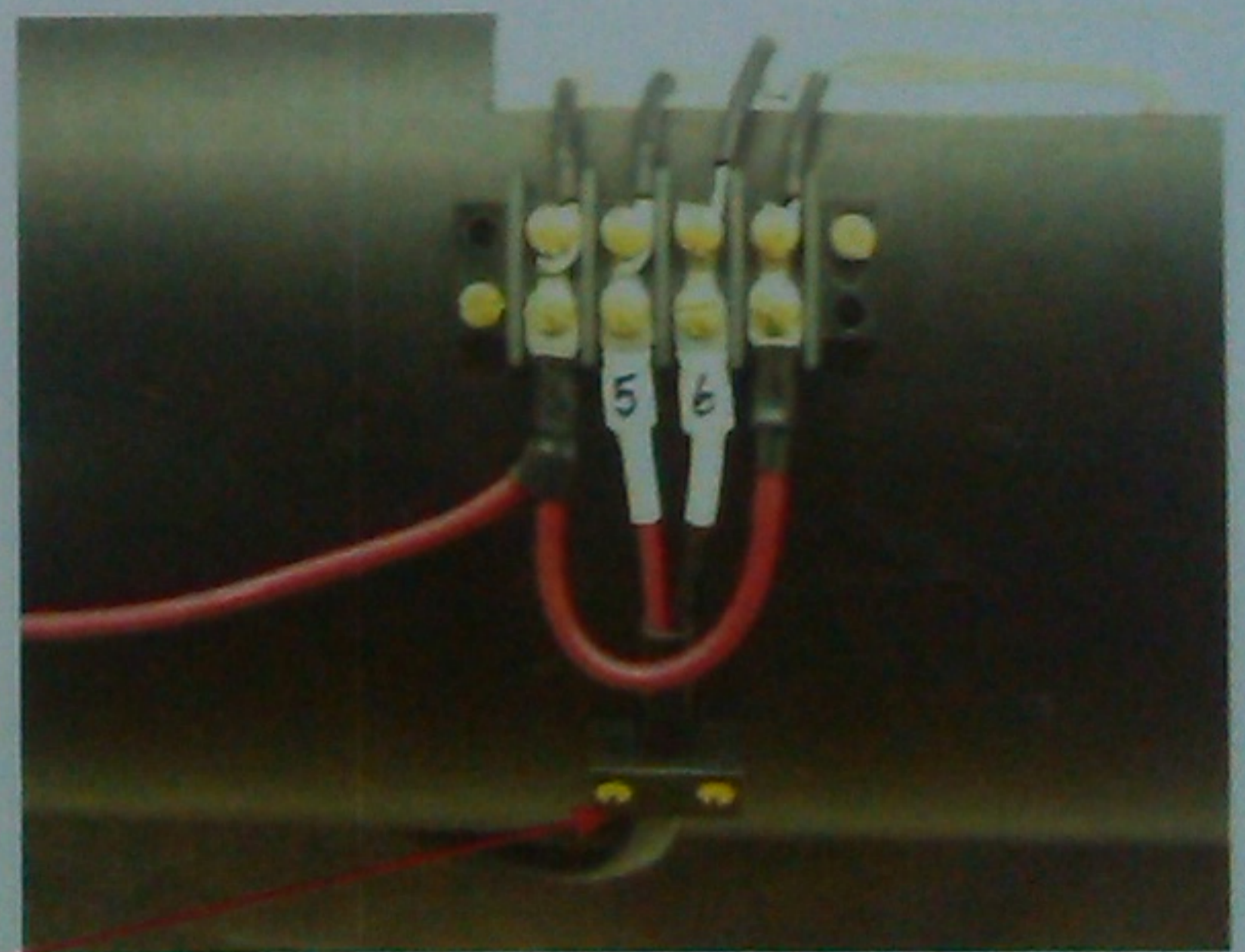


Figure 3

Cable Clamp

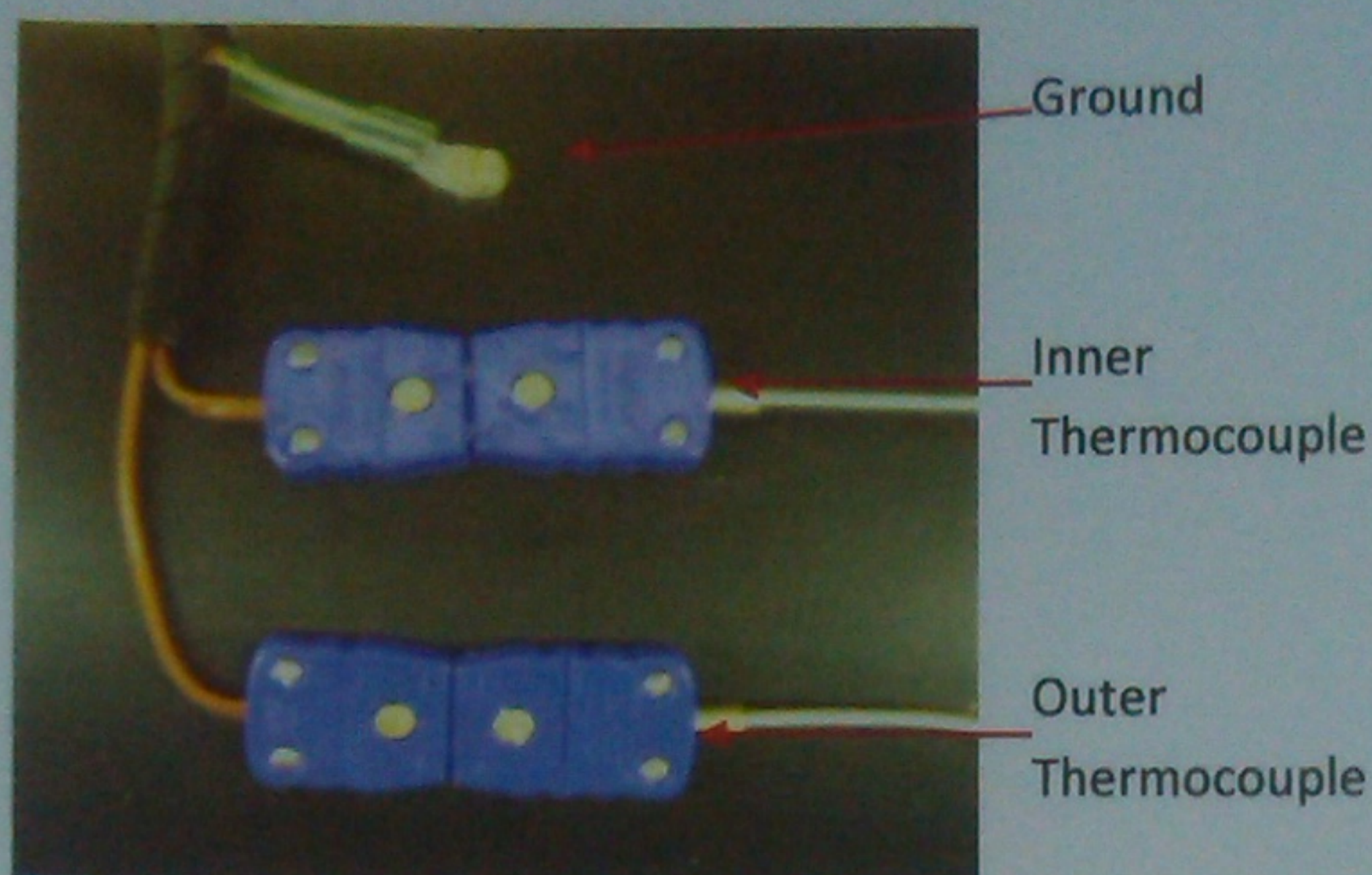


Figure 4

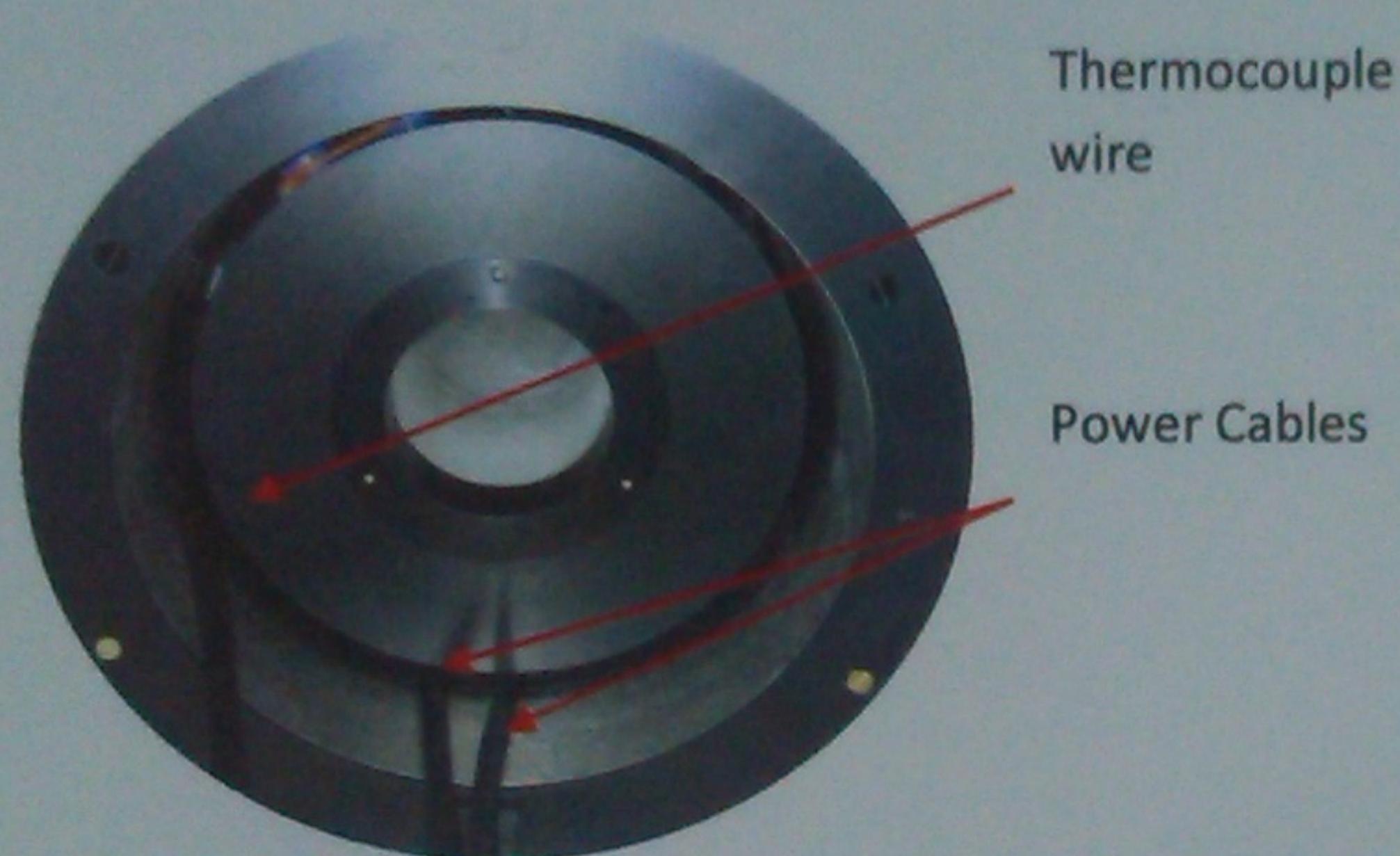


Figure 5

1.3 Power

1.3.1 120 VAC 60 Hz

1. Install the twist-lock power receptacle on a 120VAC, 30 ampere circuit. The source should be protected by a circuit breaker.
2. Make certain that **All** switches on the panel are off. Plug the twist-lock plug on the power cord of the

control electronics into the receptacle.

3. Turn on the power switch on the control electronics unit. The smaller cooling fan should come on and the panel on the temperature controllers should illuminate. The sample zone controller should read "Err4" indicating that the sample zone thermocouple is not plugged in.

4. Set the timer dial on 000 minutes. Turn on the cooling switch. The large cooling fan should come on.

WARNING! THE OVEN SWITCH SHOULD REMAIN OFF DURING THE NEXT TWO STEPS.

5. Connect the short coiled thermocouple extension lead to the remaining thermocouple plug located along the thermocouple/ground cable. Plug the other end of the extension lead into the end of the sample boat. All three controllers should now read room temperature on the upper display.

6. Set the timer dial on 001 minute and press the small reset button to the left of the timer. This should cause the large cooling fan to stop. Wait one minute until the timer duration has elapsed and the large cooling fan should turn back on.
7. You are now ready to proceed with the use of the instrument.

1.3.2 220-240 VAC 50/60 Hz

1. Connect the power cable of the stepdown transformer to 220/240VAC, 15 ampere, 50/60Hz power source. The source should be protected by a circuit breaker.
2. Make certain that **All** switches on the panel are off. Plug the twist-lock plug on the power cord of the control electronics into the receptacle of the stepdown transformer.
3. Energize the circuit that the step down transformer is connected to. Turn on the power switch on the control electronics unit. The smaller cooling fan should come on and the panel on the temperature controllers should illuminate. The sample zone controller should read "Err4" indicating that the sample zone thermocouple is not plugged in.
4. Set the timer dial on 000 minutes. Turn on the cooling switch. The large cooling fan should come on.
5. Connect the short coiled thermocouple extension lead to the remaining thermocouple plug located along the thermocouple/ground cable. Plug the other end of the extension lead into the end of the sample boat. All three controllers should now read room temperature on the upper display.
6. Set the timer dial on 001 minute and press the small reset button to the left of the timer. This should cause the large cooling fan to stop. Wait one minute until the timer duration has elapsed and the large cooling fan should turn back on.
7. You are now ready to proceed with the use of the instrument.

**WARNING! THE OVEN SWITCH
SHOULD REMAIN OFF DURING THE
NEXT TWO STEPS.**

2.0 Operating Instructions

2.1 Introduction

The control electronics consist primarily of three Watlow controllers each with a remote set point input. This allows the set point for each of the three oven zones to be set by a single control. These controllers provide proportional control of oven power so that heating to the set point temperature is rapid while at the same time reducing power application as the set point is approached in order to minimize temperature overshoot.

The three zone oven is designed to provide temperature uniformity between the center and end zones of the oven. This minimizes temperature gradients along the axis of the oven due to heat loss at the inner and outer openings of the oven as experienced with single zoned systems. Based on extensive experimentation of the oven and mapping of temperatures it has been determined that optimum control and temperature uniformity can be achieved with the end zone thermocouples embedded in the wall of the oven, and the center thermocouple mounted inside the chamber in the sample boat.

Because of the differences in size, thermal inertia, and thermocouple placement for each of the oven zones, each of the controllers is tuned for optimum performance at the factory.

A timer is provided which will control the duration of the heating run. When the heating run is complete, the timer automatically turns off the oven power and turns on the cooling fan. The timing cycle must be reset for each heating run by pushing the small "START" reset button adjacent to the timer and holding

it down for 3 seconds in order to clear the memory of the microprocessor controlled temperature programmers.

2.2 Heating

1. Load the samples into the sample boat.
2. Inset the sample boat into the oven with the socket for the thermocouple facing out. The end of the sample boat should be inset about 0.5cm from the end of the oven. Plug the thermocouple extension lead into the end of the sample boat.
3. Turn on the power. All displays should illuminate showing oven temperature. Set the timer dial for the desired duration of the heating run (minutes). The timer is set at the factory to allow for heating durations between 0 and 180 minutes. If desired the range can be changed by adjusting the values of the "Time Range Selector" and the "Dial Selector" found in the lower right hand corner of the timer. Refer to chart below when making adjustments.

Dial		0-1	0-3	0-6	0-
Range	10M	6s-30s	18s-30m	36s-60m	108s
	10H	6m-10h	18m-30h	36m-60h	108m

Adjust the set point to the desired temperature by rotating the set point adjustment knob and observing the set point on the lower (red display) line of the

sample zone controller. The set point adjustment controls all 3 programmers simultaneously.

4. Turn on the oven power switch. Turn on the cooling fan switch. Press the "Start" button and hold it down for 3 seconds. After the button is released the heating cycle will proceed.
5. Heating times for all sample to equilibrate at the set point temperature range from about 35 minutes for 200 deg C to 50 minutes for 700 deg C.
6. For low temperature runs (less than 200 deg C) an overshoot may be observed on the end zone controllers when starting from a cold start. Out tests indicate that the samples are actually far below the set point at this point in the heating cycle and the displayed temperature will level off to the set point by the time the samples equilibrate at the set point. This overshoot can be minimized by initially setting the temperature 20 degrees below the desired set point and resetting the set point 1 to 2 minutes into the heating cycle.

2. Remove the thermocouple plug from the end of the sample boat. Pull the sample boat out sufficiently far to grasp the end to remove it.

3 Cooling

1. When the heating run is complete the timer automatically turns off the oven power and turns on the cooling air. Cooling of the samples to 40 deg C will take about 25 minutes.

**WARNING! TURN OFF THE OVEN
AND COOLING SWITCHES**

3.0 Overshoot Protection Feature

The temperature controllers which monitor oven temperature and control power to the oven windings in each zone are microprocessor devices. Each controller controls a solid state relay which actually switches the current to each of the oven winding sets. As with any electrical component there is a finite probability of failure and this failure can occur in such a manner that the oven current can remain on. In order to provide protection for the oven windings and minimize potential damage to samples in the event of such a failure, an overshoot protection feature has been incorporated into the control electronics. This feature interrupts the power to all oven zones if the temperature in the central zone of the oven exceeds the set point by more than a set number of degrees (ΔT). If an overshoot in excess of ΔT occurs the upper display from the sample zone controller will flash between the temperature and the alarm message "A2hi". In order to reset the alarm after control conditions are normal, press the ∞ button.

The value of ΔT is preset at the factory to 30 deg C. This value can be changed by the user, if desired, using the following procedure.

1. Press and hold the up and down buttons on the sample zone controller for 3 seconds until "Oper" appears on the lower display.
2. Press the up button twice so that the display shows "AL II"
3. Press the blue button once.
4. Raise or lower the value by pressing the up and down buttons until the desired value appears.
5. Press the ∞ button to return back to the standard display.

4.0 Options

4.1 Controlled Atmosphere Chamber

1. Install the yoke on the aluminum housing of the controlled atmosphere chamber using the two small brass screws provided.
2. Insert the controlled atmosphere chamber (without the door/sample holder assembly) into the oven. Slide the chamber in until the base of the yoke is centered over the $\frac{1}{4}$ " hole in the black instrument base. Insert the $\frac{1}{4}$ " roundhead screw from below and thread it into the base of the yoke. Adjust the height of the outer end of the chamber by rotating the base of the yoke until the quartz tube is level in the oven. Tighten the roundhead screw when the height is correct.
3. Plug the sample zone thermocouple lead (the lead which usually attaches to the sample boat) into the thermocouple connector on the top of the controlled atmosphere chamber.

PLEASE NOTE: The controlled atmosphere chamber is set up for use with a positive flow of inert gas - with a hose nipple on both sides of the chamber and a valve for inert gas purging on the door of the chamber. There is a nipple provided which attaches to the valve so that a gas bottle can be connected to the valve.

WARNING! Do not over-pressurize the Controlled Atmosphere chamber because the seals which hold the quartz tube from sliding out of the aluminum housing will not prevent the tube from sliding out of the housing and damage may result if this happens. Inert gas rate should be set at a very low rate (.25 to .50 liters/minute). It is imperative that the other side port is open whenever gas is flowing into the chamber.

If you wish to operate the system with a continuous flow of inert gas during heating and cooling, the chamber should be purged prior to initiation of heating in order to flush out the air. However, if the purging port (the one with the valve) is used with continuous gas flow, the flowing gas will disturb the temperature uniformity in the sample region of the chamber. Therefore, after purging the valve should be closed and the gas should then be connected to one of the side ports, using the other side port for exhaust of the gas. However, during the cooling cycle, the cooling rate can be enhanced by reconnecting the gas flow to the purging port so that cool gas will flow over the samples.

The chamber can also be set up as a vacuum chamber. This is done by removing one of the two hose nipples on the side of the chamber and replacing it with the brass threaded plug provide.

4. Because minute traces of volatile substances such as machine oil may be present on the sample rack, it is advisable to conduct the first heating of the chamber without any samples. Lightly

grease the o-ring (taped to the door of the chamber). Insert the door/sample rack assembly into the chamber; making sure the o-ring is in the groove on the chamber door. Tighten the two brass thumbscrews lightly by hand. Connect either a vacuum pump with cold trap or continuous inert gas flow (through the purging port) in order to flush the volatiles from the system. Set the set point to 400 deg C and heat for 30 minutes. The system is now ready for processing samples.

5. Load the samples in the sample rack.

6. Insert the door/sample rack assembly into the chamber; making sure the o-ring is in the groove on the chamber door. Tighten the two brass thumbscrews lightly by hand. Insert the plug of the auxiliary thermocouple readout into the socket of the chamber door.

2.2 Field Coil

1. The field coil produces a field parallel to the axis of the cylindrical shield. The amplitude of the field is approximately 1 Gauss per ampere of applied current. For best results, the power supply used should have a constant current mode so that fluctuations in temperature of the coil (and thus resistance) do not cause fluctuations in the field amplitude.

2. The terminals for the field coil are located on either end of the

shield/oven assembly – one is at the top of the open end of the shield and the other one is just above the small muffin fan at the cooling end of the assembly

3. For the most precise field control, it is advisable to insert a fluxgate magnetometer into the oven chamber and complete final current adjustment to the desired field.

5.0 Error Messages and Trouble shooting

5.1 Error messages

If the sample boat thermocouple connector is not connected, an error message will display on the sample temperature programmer. This could also occur if a thermocouple failed or if a severe overshoot in temperature occurs (see section 3.0) these messages are "latching" which means that they must be cleared manually after the condition that caused them is corrected. The error message can be cleared by pressing the ∞ button on the temperature controller. If the message reappears, the problem has not been corrected.