PRO 100

Operators Manual

WARNINGS

DO NOT OPERATE ON ANY OTHER POWER CORD. DO NOT OPERATE WITH AN EXTENSION CORD. OPERATING THIS FURNACE ON A CIRCUIT WITH OTHER FURNACES OR ELECTRICAL APPLIANCES THAT REQUIRE SIGNIFICANT POWER MAY CAUSE A CIRCUIT BREAKER TO TRIP.

USE ONLY ARGON GAS IN THIS FURNACE. ATTACHING ANY FLAMMABLE OR NOXIOUS GAS TO THIS FURNACE COULD CAUSE EXPLOSION OR PERSONAL INJURY!

THE GASSES PRODUCED WHEN HEAT TREATING REFRACTORY MODELS WILL DAMAGE THE TRANSPARENCY OF THE QUARTZ TUBES IN THE MUFFLE CHAMBER AND MAY CAUSE VACUUM LEAKAGE. TO HELP EXTEND THE LIFE OF THE MUFFLE, IT IS NECESSARY TO PREHEAT REFRACTORY MODELS IN A BURNOUT FURNACE TO PREVENT THE GASSES FROM DAMAGING THE QUARTZ GLASS IN THE MUFFLE CHAMBER.

THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY.

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Chapter One

Getting Started

You are undoubtedly eager to unpack, set up, and begin using your new furnace. Getting started will be much easier if you will carefully review the information in this chapter and follow the steps as outlined.

First...

Some things you should know before you unpack your furnace:

☑ When you unpack your furnace, be sure to save the carton and packing materials. These can be used again if there is ever a need to ship or return equipment.

☑ Be sure to read and save the printed shipping material packed with your furnace - *it contains valuable information!*

☑ DO NOT turn on the power to your furnace until you are instructed to do so.

Unpacking

1. If the packaging materials and/or the furnace appears to be damaged, please call your dealer before continuing.

2. Remove the furnace from the carton and place it on a flat surface.

3. Look up into the muffle area and locate the orange shipping bar and wingnuts. Remove the wingnuts, push the two bolts and attached brackets out of the orange bar. Finally remove the orange bar by sliding it out the side. Keep these parts in case there is a need to ship the furnace.

Installing the Vacuum Pump

4. Install the vacuum pump as follows:

- Plug the vacuum pump's power cord into the outlet end of the short power cord supplied with the furnace.
- Attach the other end of this short power cord to the international standard outlet on the rear of the furnace marked "VACUUM PUMP".
- Attach a 1/4 inch vacuum rated hose from the vacuum pump to the brass fitting marked "VACUUM PUMP" at the rear of the furnace.

5. **DO NOT** attach the Argon gas system until the furnace is installed, operating, and the set up procedures in the Special Functions chapter of this manual have been completed.

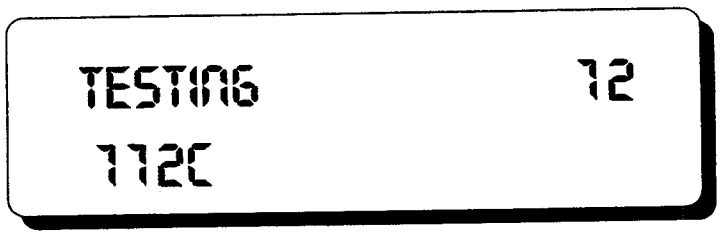
Power

6. The furnace requires 120 VAC and 12 amps of current. A special heavy duty power cord has been supplied with your furnace. ***DO NOT OPERATE ON ANY OTHER POWER CORD. DO NOT OPERATE WITH AN EXTENSION CORD. OPERATING THIS FURNACE ON A CIRCUIT WITH OTHER FURNACES OR ELECTRICAL APPLIANCES THAT REQUIRE SIGNIFICANT POWER MAY CAUSE A CIRCUIT***

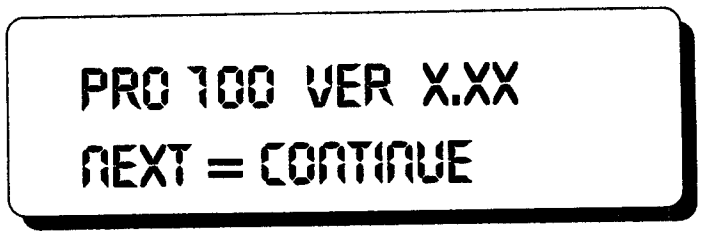
BREAKER TO TRIP. Install the heavy duty power cord and plug the furnace into a grounded outlet.

7. Position the furnace so that the front is facing you. You should be able to reach the power switch on the right side of the furnace at the rear. Be sure to have at least 8 inches on all sides of the furnace to allow sufficient air flow to keep the furnace cool. Do not place anything flammable near the furnace.

8. Turn the furnace on using the power switch located on the right side at the rear of the furnace. The display should light up with a similar message:



The furnace will perform an internal self test for about 30 seconds and will then display the following screen:



NOTE: X.XX in the above illustration will be replaced by the actual version number of your furnace.

9. Continue to the next section to learn about front panel controls.

Front Panel Controls

The front panel controls and their basic functions are described in this section. **Please read this section carefully.**

The front control panel is divided into four groups:

- Mode selection keys
- Information entry
- Program start/stop keys
- Table control keys (up/down)

Mode Selection Keys

RUN PROGRAMS - Press the yellow **Run Programs** key to select a program to run *OR* to review a program that is already running.

CHANGE PROGRAMS - The following actions may be initiated by first pressing the yellow **Change Programs** key:

- Look at a program
- Add a program
- Change a program
- Copy / change a program
- Move a program
- Erase a program
- Print programs

SPECIAL FUNCTIONS - Press this yellow key to perform one of the following actions:

- Change idle temperature
- Set vacuum level
- Select degrees F (Fahrenheit) or C (Centigrade)
- Set temperature for the night mode
- Adjust display contrast
- Select constant vacuum pump operation
- Select upper or lower case letters on the display
- Name program groups
- Select language used on the display
- Calibration functions:
  - calibrate table positions
  - calibrate temperature
  - calibrate vacuum
  - erase **all** memory (including calibration values)
  - print calibration values

Information Entry

DISPLAY - All information and user prompts are displayed on the two line by 16 character display.

SELECT - Turn the silver **Select** knob either to the left or to the right to select all program functions *OR* to adjust information contained in the programs.

NEXT - Press this white key to proceed to the next step within a function.

LAST - Press this white key to return to the preceding step within a function.

Program Start/Stop

START PROGRAM - Press the green **Start Program** key to start a program after it has been selected by first using the **Run Programs** key and the **Select** knob. Pressing the **Start Program** key without making a new selection will cause the furnace to run the last program that was used.

STOP PROGRAM - Press this red key to ABORT a program at any time.

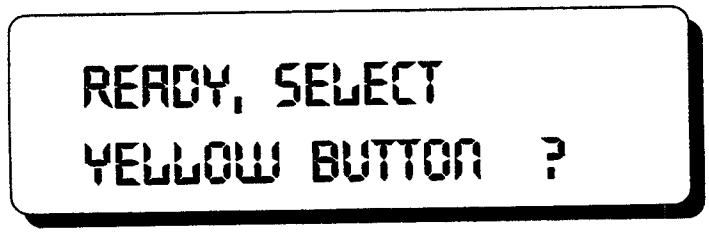
Table Control

TABLE UP - Press this yellow ⇧ key to manually raise the table. This table control key will not operate while a program is running.

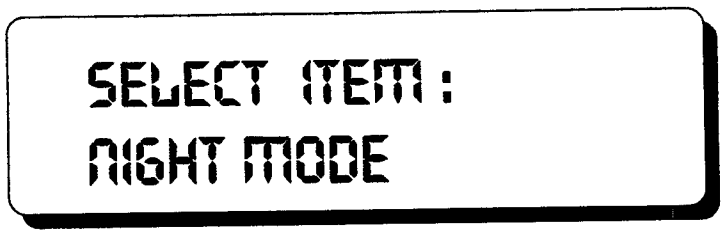
TABLE DOWN - Press this yellow ⇩ key to manually lower the table. This table control key will not operate while a program is running.

Using The Furnace

After turning the power on, the Version screen appears. Press **Next** to continue. The display should respond:



Now you must select one of the yellow mode selection keys on the left side of the front panel. To continue with the furnace start up procedure press the **Special Functions** key and the display should respond:



*Note: It is very important to set up the operating features of the furnace using **special functions** before you attempt to program the furnace or to run programs.*

For best results in learning to use your new furnace, please follow these steps:

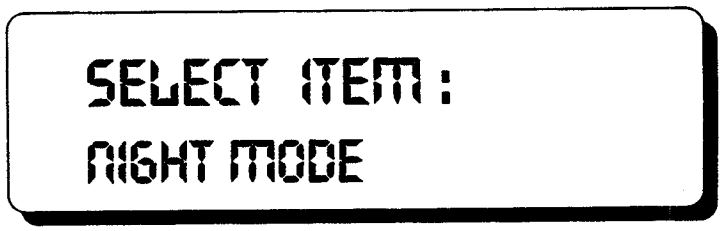
- Set up the operating features of the furnace by reading and following the instructions in Chapter 2: *Special Functions*. This is VERY IMPORTANT because these operating features will affect how you enter and run programs.
- Learn to program the furnace by reading Chapter 3: *Change Programs*. Enter a few of your programs.
- Read Chapter 4: *Run Programs* to understand how to run programs.
- ***Good Luck!*** And congratulations on your purchase of the most advanced porcelain furnace on the market!

Chapter Two

Special Functions

The special functions mode allows you to set up the operating features of the furnace. This mode is reached by pressing the yellow **Special Functions** key. Most special functions can be performed while a program is running, however this is not recommended because changing the operating features will affect how the current program runs.

To look at or change a feature, press the **Special Functions** key. The display will respond:



Turn the **Select** knob right or left until the desired feature is displayed. Press **Next** to look at or change this feature. Each feature will be described in this chapter.

Change Idle Temp

The idle temperature is the temperature at which the furnace will remain between programs. The furnace comes from the factory with idle temperature set at 0°C, so you must adjust this feature to best suit your needs.

- Press **Special Functions**. Turn the **Select** knob to display CHANGE IDLE TEMP.
- Press **Next** to look at or change the idle temperature.
- The current setting will be displayed. Turn the **Select** knob to change this value.
- Press **Next** to continue.

Set Vacuum Level

The vacuum level set with this feature is the target vacuum level for the program. The acceptable level is from 0.0 to 75.0 cm hg or 0.0 to 29.0 in hg. When vacuum is called for in the program, the vacuum pump will be started and a timer will begin. If the target vacuum level has not been reached within 90 seconds, the program will be aborted and a warning screen will be displayed, indicating a vacuum error. If "Continuous Vacuum Pump" has been selected by using "Special Functions", the vacuum pump will run throughout the vacuum cycle. If "Continuous Vacuum Pump" has not been selected, the vacuum pump will shut off after the target level has been reached and 30 seconds have elapsed. The vacuum pump will be restarted when the vacuum level has dropped to 3% below the target value.

- Press **Special Functions**. Turn the **Select** knob until SET VACUUM LEVEL is displayed.
- Press **Next** to look at or change the vacuum level.
- The current setting will be displayed. Turn the **Select** knob to change this value.
- Press **Next** to continue.

Degrees F or Degrees C

The Pro 100 may be set to display all values using the metric system with degrees Centigrade and vacuum in centimeters of mercury. Or, the furnace may be set to display all values using the English system of degrees Fahrenheit and vacuum in inches of mercury.

- Press **Special Functions**. Turn the **Select** knob until TEMP IN C OR F? is displayed.
- Press **Next** to look at or change the measurement system in use.
- TEMP CENTIGRADE? will be displayed. Turn the **Select** knob to select YES for metric units or select NO for English units.
- Press **Next** to continue.

Set Program Start Delay

The Pro 100 has a unique feature that allows the operator to program a delay to occur before the start of all programs. Many technicians use this feature to insure an adequate drying time before the lift begins to rise into the muffle. This delay is in addition to the entry time set into each program. *This feature may be changed without affecting programs or calibrations already stored in the furnace.*

- Press **Special Functions.** Turn the **Select** knob until the second line on the display is PROG START DELAY.
- Press **Next** to look at or change the start delay time.
- The display will be TIME = 0.00. If this feature has already been programmed, the "0.00" will be the current value. Turn the **Select** knob to change the time as desired.
- Press **Next** to continue.

Night Mode Temperature

If night mode is activated while a program is running, the furnace will return to the night mode temperature after the completion of the program and will maintain that temperature until the **Next** button is pressed or the power is cycled off and on to reset the furnace. The factory setting is 0. This temperature may be adjusted from 0 to the value of the idle temperature.

- Press **Special Functions**. Turn the **Select** knob until the display is NIGHT MODE TEMP.
- Press **Next** to look at or change the night mode temperature.
- Turn the **Select** knob to change the displayed value as desired.
- Press **Next** to continue.

Adjust Speaker Volume

This feature allows you to adjust the volume of the warning and alert speaker inside the furnace. As different levels are selected, a sample tune will be played to aid volume level selection.

- Press **Special Functions**. Turn the **Select** knob until the display is ADJUST VOLUME.
- Press **Next** to look at or adjust the speaker volume.
- LEVEL - 4 will be displayed. The "4" might be any value between 1 and 15 previously selected. Turn the **Select** knob to select a new level and hear a sample.
- Press **Next** to continue.

Adjust Display Contrast

This feature allows you to adjust the contrast and viewing angle of the display. The display will adjust its' contrast to allow you to see the contrast being selected. Sit in your normal operating position to adjust the display.

- Press **Special Functions**. Turn the **Select** knob until the display is ADJUST DISPLAY.
- Press **Next** to look at or change the display contrast.
- CONTRAST - 6 will be displayed. Turn the **Select** knob to select a new value.
- When you are satisfied with your selection, press **Next** to continue.

Select Constant Vacuum Pump

Selecting this feature will force the vacuum pump to run continuously during the vacuum cycle of programs. *Note that you must set a vacuum level for the vacuum level error check described in the set vacuum level section.*

- Press **Special Functions**. Turn the **Select** knob until the display is CONSTANT VC PUMP.
- Press **Next** to look at or change the vacuum pump requirements.
- Turn the **Select** knob to display YES or to display NO. A selection of "yes" will force constant vacuum pump. A selection of "no" will allow the vacuum pump to cycle based on the vacuum level as described in the set vacuum level section.
- Press **Next** when you are satisfied with your selection.

Special Cool Time

This feature allows the table position to be selected for the "Special Cool Time" feature of the Special porcelain type program. The default number is 50, with higher numbers lowering the table more and lower numbers lowering the table less. See Chapter Three Special Firing Cycle Program for more detail.

- Press **Special Functions**. Turn the **Select** knob until the display is SP COOL POSITION. Press **Next**.
- SPECIAL COOL TIME = 50 will be displayed. Turn the **Select** knob to select a new position value.
- When you are satisfied with your selection, press **Next** to continue.

Select Upper or Lower Case Letters

This feature allows you to select the display mode that is most comfortable to read. Selecting capital letters will force the display to use only capital letters. Selecting lower case will allow the display to use both capitals and lower case letters.

- Press **Special Functions.** Turn the **Select** knob until the display is CAPITAL LETTERS?.
- Press **Next** and turn the **Select** knob to display YES or to display NO. Selecting "yes" will force capital letters only to display, selecting "no" will allow both capitals and lower case letters to display.
- When you are satisfied with your selection, press **Next** to continue.

Porcelain Names

The first four program types are normal porcelain firing cycles. These four program types have a unique feature in that they can be named to aid in the identification of the proper program to be run. Most technicians name the program groups for the porcelain brands that they use on a regular basis. For example:

1. SYNS - named for Synspar (Generic) porcelain
2. ELIT - named for Elite porcelain
3. VITA - named for VITA porcelain
4. CERM - named for Ceramco porcelain

In the procedure for changing porcelain names that follows, please be aware of the following items:

- Any number or letter may be selected.
- An underline will be at the current character.
- Pressing **Next** moves underline to next position.
- Pressing **Last** moves underline to last position.
- The underline identifies the current position.

Procedure for changing porcelain names:

- Press **Special Functions**. Turn the **Select** knob until the display is PORCELAIN NAMES.
- Press **Next**. The display will change and the first two porcelain names will be on the second line. The underline will be under the first character of the first porcelain name.
- Turning the **Select** knob at this time will cause the character above the underline to cycle through the numbers and letters. When the character you wish to use in this position has been reached, press **Next**.
- The underline will move to the next character. Repeat the last step for each character position. Should you desire to return to a previous character, press **Last** until the underline is at the desired character.
- When **Next** is pressed after the last character in the porcelain name has been selected, the underline will move to the first character in the next name. Repeat the above procedure for each of the remaining porcelain names you wish to change.
- Press **Next** to continue after the last character of the fourth porcelain name has been selected.

Select Language Used On Display

The Pro 100 is capable of displaying multiple languages. Use this feature to select the display language of your choice. ***Do not use this feature until the furnace is warmed up and idling. Do not use this feature while a program is running.*** Use of this feature while a program is running or while the furnace is heating up could cause an internal self check error.

- Press **Special Functions**. Turn the **Select** knob until the display is SELECT LANGUAGE.
- Press **Next** to look at or change displayed language.
- Turn the **Select** knob to select the language you desire.
- Press **Next** to continue.

After a delay of several seconds the furnace will restart itself as if the power switch had been turned off then on again. The furnace will now display all information in the language you have selected.

Adjust Calibration to Match Your Porcelain

All porcelain furnaces fire slightly differently. Even porcelain furnaces from the same manufacturer can fire porcelains at slightly different temperatures. The Pro 100 furnace addresses this problem by allowing you to customize the calibration. This feature can be used to adjust your furnace to fire porcelains at manufacturers recommendations, or to adjust multiple furnaces to fire identically.

The Pro 100 calibration can be adjusted for normal high fusing porcelains and for the new low fusing porcelains. Use the low fusing adjustments if your porcelain fires at or below 800°C/1470°F. Use the high fusing adjustments if your porcelain fires above 800°C/1470°F. These adjustments do not affect each other, so both adjustments can be used if you fire both types of porcelain. The two following articles explain the procedure.

Adjust Low Fusing Porcelain Calibration
(800°C/1470°F or below)

- Press **Special Functions**. Turn **Select** knob until display reads CAL LOW FUSING.
- Press **Next**. The display will ask LOW OVERFIRES?.
- Turn the **Select** knob to display either YES or NO. Selecting "yes" will allow you to adjust for low fusing porcelain overfires. Selecting "no" will allow you to adjust for low fusing porcelain underfires.
- Press **Next.**
- Turn the **Select** knob to enter a temperature to adjust. If "yes" was selected in the step above, this value will adjust *downward.* If "no" was selected, this value will adjust *upward.*
- Press **Next** to continue.

Adjust High Fusing Porcelain Calibration
(800°C/1470°F or above)

- Press **Special Functions**. Turn **Select** knob until display reads CAL HIGH FUSING.
- Press **Next**. The display will ask HIGH OVERFIRES?.
- Turn the **Select** knob to display either YES or NO. Selecting "yes" will allow you to adjust for high fusing porcelain overfires. Selecting "no" will allow you to adjust for high fusing porcelain underfires.
- Press **Next.**
- Turn the **Select** knob to enter a temperature to adjust. If "yes" was selected in the step above, this value will adjust *downward.* If "no" was selected, this value will adjust *upward.*
- Press **Next** to continue.

Testing Your Furnace

The Pro 100 is capable of performing several tests to aid in diagnosing the furnace should a problem occur. Your dealer's technician may ask you to run one or more of these tests and communicate the information they provide. The tests include a vacuum test, an argon valve test, a motor up test, and a motor down test.

- Press **Special Functions**. Turn the **Select** knob until the display is TEST FURNACE.
- Press **Next**.
- Turn the **Select** knob until the test you require is displayed.
- Press **Next.** The test that was selected will now begin.
- Pressing **Next** will stop the test. Pressing **Next** again will restart the test.
- Press any of the three yellow buttons to the left of the **Select** knob to end the test.

Furnace Calibrations

IMPORTANT: Your furnace has been calibrated at the factory. State of the art electronic components have been used in its manufacture. The furnace should maintain its calibration for many years without need to perform these calibration functions.

Calibration functions are designed to allow calibration of temperature, vacuum, and table positions. You may also print all calibration values for future reference.

You must be extremely careful in using calibration features. Some or all calibration values could be erased. For this reason a password is required to enter this section of the special functions. Only qualified personnel should have access to this password. Your dealer can provide you with this password.

Calibrate Lift

The Pro 100 does not use limit switches which must be mechanically aligned for table up and table down position adjustments. The Pro 100 uses its computer to read the position of the table. This allows the furnace to electronically adjust the table up and down positions.

- Press **Special Functions**. Turn the **Select** knob until the display is CALIBRATE OVEN.
- Press **Next**.
- Turn the **Select** knob to enter the password (obtained from your dealer).
- Press **Next**. Turn the **Select** knob to display CALIBRATE LIFT. Press **Next** to continue.
- Displayed is CALIBRATE? NO. Turn the **Select** knob to select "yes" or "no". "No" will not calibrate the lift, "yes" will calibrate the lift.
- Press **Next**. The table will now automatically seek its down position, then its up position. The computer will now time the table as it moves up and down.
- The furnace is now ready to continue.

Calibrate Temperature

The Pro 100 furnace uses an automatic temperature calibration system. A small diameter pure silver wire is attached to the calibration tray. The calibration tray is attached to the printer port. The furnace senses a small electrical current running through the silver wire. The temperature is slowly brought up until the silver wire breaks. The furnace senses the loss of current and calibrates itself to the melting point of silver.

Steps to perform before calibrating furnace: Warm up the furnace for at least one hour and run at least four complete programs. Prepare the calibration tray by following these steps:

1. Cut a 1.5 inch length of silver wire.
2. Install silver wire between the two probes by wrapping one end around a probe several times with tweezers.

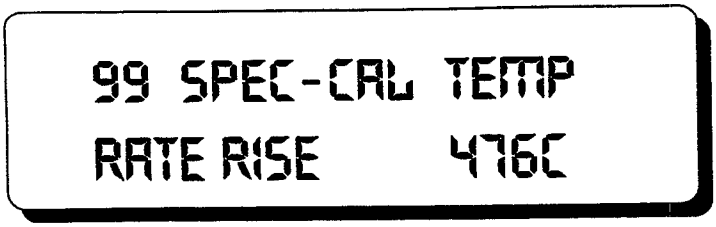
3. Leave a loose arc between the probes and wrap the other probe the same as the first. It is important that the wire is loose and not taut between the probes.
4. Lower the table and replace the regular firing tray with the calibration tray.
5. Raise the table and let it warm up for about five minutes.

Do not install cable to the printer port until instructed to do so by the display.

- Press **Special Functions**. Turn the **Select** knob until the display is CALIBRATE OVEN.
- Press **Next**.
- Turn the **Select** knob to enter the password (obtained from your dealer).
- Press **Next.** Turn the **Select** knob to display CALIBRATE TEMP. Press **Next** to continue.
- Displayed is CALIBRATE? NO. Turn the **Select** knob to select "yes" or "no". "No" will not calibrate the temp, "yes" will calibrate the temp.
- Press **Next** on "yes" to continue with the calibration.



- Plug the calibration fixture into the printer port at this time. If the fixture had all ready been plugged in, you would have received an error message REMOVE FIXTURE.
- Press **Next**. If the display responds WARNING-NO CONNECTION, then remove the tray and tighten the silver wire wraps on the probes. If properly installed, the display should appear similar to this example:



- The automatic calibration program is being run at this point. Expect the calibration program to take about 30 minutes to complete.
- When complete, the program will end in the same way as a regular program.
- Replace the calibration tray with the normal firing tray.

Calibrate Vacuum

This feature allows you to calibrate the vacuum sensor inside the Pro 100. To calibrate the vacuum you will need an accurate vacuum gauge to calibrate against. *Attach the gauge as close as possible to the vacuum fitting on the back of the furnace.*

- Press **Special Functions**. Turn the **Select** knob until the display is CALIBRATE OVEN.
- Press **Next**.
- Turn the **Select** knob to enter the password (obtained from your dealer).
- Press **Next.** Turn the **Select** knob to display CALIBRATE VACUUM.
- Displayed is CALIBRATE? NO. Turn the **Select** knob to select "yes" or "no". "No" will not calibrate the vacuum, "yes" will calibrate the vacuum.
- Press **Next** on "yes" to continue with the calibration.
- The display now reads NEXT = MAX VAC. The table will automatically rise to the up position and the vacuum pump will start.
- Watch the vacuum gauge (you may have to tap the gauge lightly to get an accurate reading). When the gauge gets to an even number near the maximum vacuum press **Next**.
- The display is now FULL VACUUM 12. Turn the **Select** knob until the display matches the vacuum you read on the gauge when you pressed **Next**.

- Press **Next**. The display is now SELECT VACUUM LEVEL 72. Turn the **Select** knob to the desired target vacuum level. See the "Set Vacuum Level" section in this chapter for more information on this value.
- Press **Next** to continue.

Night Mode

The Pro 100 furnace has a Night Mode feature that will reduce the temperature in the muffle and raise the lift to prevent moisture build up in the muffle. The night mode can be started from the idle mode or while a program is running. The furnace comes from the factory with the night mode temperature set at 0^0 C. See the "Night Mode Temperature" section of this chapter for details on setting the night mode temperature. After the night mode temperature has been set, follow these steps to activate night mode from idle mode.

- Press **Special Functions**. The display will be NIGHT MODE.
- Press **Next** to activate night mode.

If the furnace temperature is above night mode temperature, the furnace will cool to the proper temperature. When the furnace temperature is equal to the night mode temperature, the table will rise to the up position and the furnace will maintain this temperature until night mode is exited. To exit night mode, press **Next**. The furnace will restart itself as though the power switch had been cycled off and back on again.

Print Calibration Values

This feature is used by factory technicians to troubleshoot furnace problems. The printout contains information that is only meaningful to the factory. *You should never need to use this feature.*

Chapter Three

Change Programs Mode

The change programs mode allows you to add, change, move, and erase the programmed firing cycles described in the last chapter. This mode is reached by pressing the yellow **Change Programs** key. All of the features described here may be performed while a program is running.

The following articles will assume that you have all ready followed these steps:

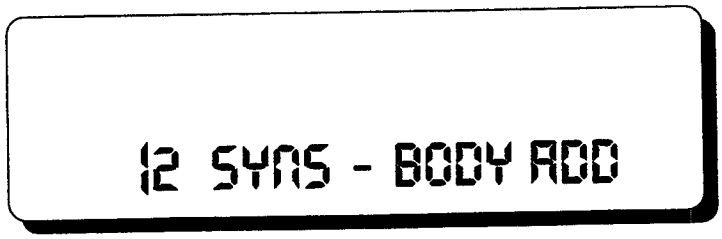
- Press **Change Programs**.
- Turn the **Select** knob until the desired feature is displayed. The first line of each procedure will be the display for the feature being described.

Program Number / Name Description

The Pro 100 furnace uses a unique method of numbering and naming programs to help the operator select the correct program to run. The following is an example of a program number/name:



For convenience this example is also at the top of page 24.



The program number is "12". There are 100 programs in the furnace numbered 0 to 99.

The next four characters contain the program type (firing cycle). There are several program types available:

NORMAL - Four normal porcelain firing cycles that can be named by the operator (see Chapter Two: Special Functions under the heading "Name Program Groups").

TITN - Titanium firing cycle

SINT - Metal sintering firing cycle

SPEC - Special firing cycle

The next eight characters contain the name entered by the operator to describe this program. In the example the operator has entered BODY ADD to indicate that this is a body add on program.

The following example names describe how an operator could use names to make program identification easy:

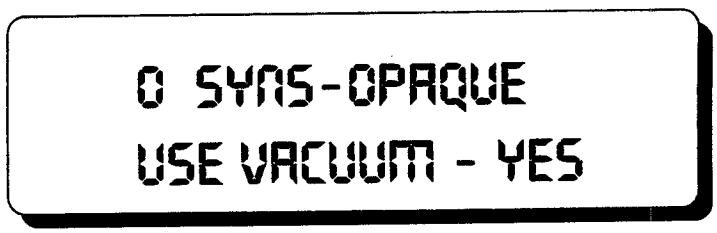
10 SYNS-DE GAS	Synspar porcelain de-gas program
11 SYNS-OPAQUE	Synspar porcelain opaque program
12 SYNS-BODY ADD	Synspar porcelain body add program
13 SYNS-GLAZE	Synspar porcelain glaze program
20 VITA-DE GAS	Vita porcelain de-gas program
21 VITA-OPAQUE	Vita porcelain opaque program
22 VITA-BODY 1	Vita porcelain first body bake program

23 VITA-BODY 2	Vita porcelain second body bake program
24 VITA-GLAZE	Vita porcelain glaze program
30 SINT-DENPAC	Denpac metal sintering program
33 TITN-OPAQUE	Titanium opaque program

Look At a Program

The look at a program feature allows the operator to view a program without the possibility of accidentally changing any values.

- SELECT ITEM: LOOK AT PROGRAM
- Press **Next** to select this feature.
- Turn the **Select** knob to find the program you wish to view.
- Press **Next** to continue.



The first line in the display will identify the program being viewed. The second line displays an item in the firing cycle and its value. This value can not be changed while looking at a program. Pressing **Next** will look at the next item in a program, pressing **Last** will look at the preceding item in a program.

Press the **Next** and **Last** keys until you have viewed the items you wish to view. When the last item has been viewed the display will return to the select yellow button screen. You may also stop viewing at any time by pressing one of the yellow mode selection keys.

Add a Program

Add a program is used to enter a new program. This section will describe how to enter each type of program as listed:

Normal Firing Cycle Program

Titanium Firing Cycle Program

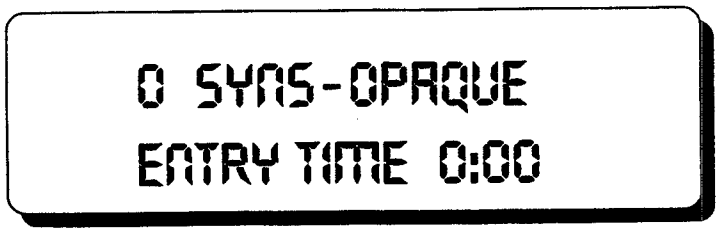
Sintering Firing Cycle Program

Special Firing Cycle Program

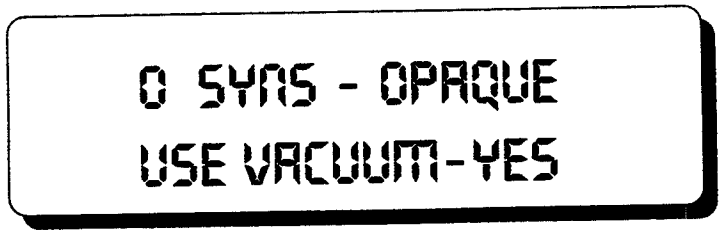
Normal Firing Cycle Program

The first four firing cycles are normal porcelain firing cycles and are entered in the same manner. The following procedure describes how to enter a normal porcelain program.

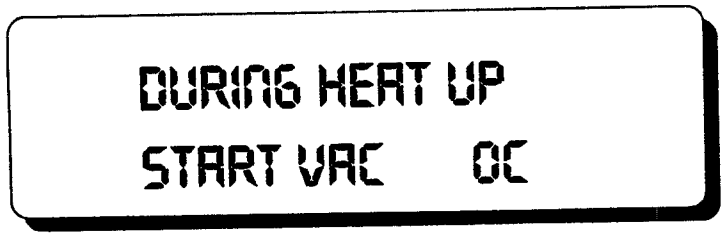
- ADD A PROGRAM
- Press **Next** to add a program.
- ADD: will be displayed. Turn the **Select** knob to find the program you want to add. If you select a program that is all ready entered you will destroy the existing program and replace it with the new one. Press **Next** to continue.
- ENTER PROG TYPE: will be displayed. Turn the **Select** knob to find the firing cycle for this program. (*Note: Normal firing cycles are the first four types to display*). Press **Next** to continue.
- ENTER PROG NAME: will be displayed on the top line and the program number with the program type selected previously will be on the second line. Turn the **Select** knob to change the character over the underline. Any letter, number, or special character may be selected. Pressing **Next** will step to the next character position, pressing **Last** will step to the preceding character position. When all eight characters have been entered the display will pause while checking for duplicate names then step to the next program item to be entered.



- Your display should look similar to the one above. Notice that the program number, program type, and the program name just entered are on the first line. The second line is prompting for you to enter an entry time. Turn the **Select** knob to the entry time you require. This is the time to raise the table into the furnace. The temperature will be raised or lowered to the entry temperature before entry time begins. The time is displayed in minutes:seconds. The table will be raised in steps evenly spaced during entry time. Press **Next** to continue.
- ENTRY TEMP 0C is displayed. Turn the **Select** knob to the required entry temperature. This is the temperature at which you wish the furnace to be when the porcelain enters. It is displayed in "C" Centigrade or "F" Fahrenheit. Press **Next** to continue.
- HEAT RATE 35C/M is displayed. Turn the **Select** knob to the required heat rate. C/M indicates degrees Centigrade per minute, F/M indicates degrees Fahrenheit per minute. Press **Next** to continue.
- FINAL TEMP 960C is displayed. Turn the **Select** knob to the final temperature for this program. Press **Next** to continue.
- HOLD TIME 0:00 is displayed. Turn the **Select** knob to the time you wish to hold the porcelain at the final temperature. Press **Next** to continue.
- COOL TIME 0:00 is displayed. Turn the **Select** knob to the desired cool time. This is the time to lower the table to the down position. The table will be lowered in steps evenly spaced during cool time. Press **Next** to continue.



- The display should appear similar to the example above. Turn the **Select** knob to "yes" to use vacuum in your program, "no" if you do not wish to use vacuum in this program. Press **Next** to continue. If your selection in this step was "no" the display has returned to the ready select yellow screen and you are finished adding this program. If your selection in this step was "yes" continue with the next step.



- The display should be similar to the above example. Turn the **Select** knob to the temperature at which you wish vacuum to start. The vacuum pump will be turned on at this temperature. Press **Next** to continue.
- RELEASE VAC 960C is displayed. Turn the **Select** knob to the temperature you wish to release the vacuum. If this temperature is greater than the final temperature, the vacuum will be released at the final temperature.
- Press **Next** to continue. The program has been saved and the display will now return to the ready select yellow screen.

Titanium Firing Cycle

Firing porcelain to titanium is an area of great interest and exploration in the dental lab industry. The designers of the Pro 100 have addressed this emerging market by providing hardware and special firing cycles for titanium porcelain.

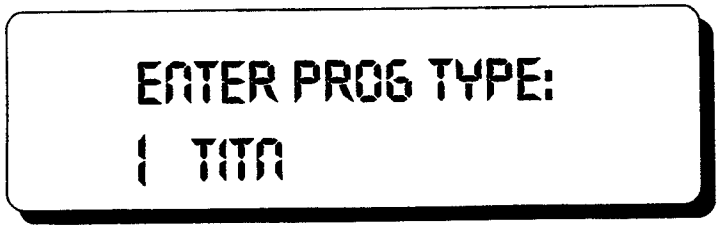
Titanium is an ideal metal for porcelain crowns and bridges because of its bio-compatibility and its wear characteristics. It has one major drawback. As titanium is heated it becomes a great scavenger of oxygen molecules. These scavenged oxygen molecules form a thick scaly oxide layer that can ruin the porcelain to metal bond. *The only way to create a successful porcelain-to-metal bond is to control the oxidizers present during firing.* The Pro 100 controls the oxygen levels by purging the furnace with argon gas.

A purge begins by creating a vacuum to remove most of the air from the muffle. After the vacuum is complete, argon gas is released into the muffle diluting the remaining air molecules with argon. Another vacuum is created removing the majority of the argon/air mixture. Argon gas is then released into the muffle and a constant low pressure of argon is applied. Applying a constant argon pressure insures that only argon can leak out, and no air can leak in. The purging process creates an atmosphere with less oxidizers than can be accomplished with affordable vacuum pumps. This low oxygen atmosphere can be maintained indefinitely because of the argon pressure applied.

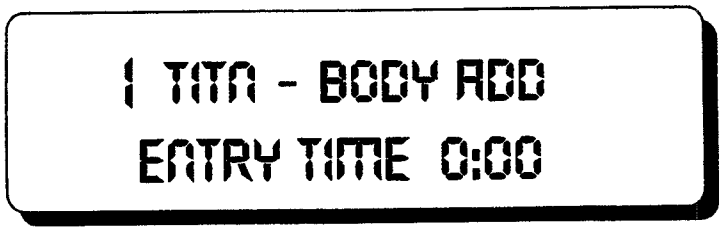
In its titanium firing cycles the Pro 100 automatically purges and maintains a low oxygen condition for firing porcelain to titanium.

Procedure:

- ADD A PROGRAM
- Press **Next** to add a program.
- ADD: will be displayed. Turn the **Select** knob to find the program you want to add. If you select a program that is all ready entered you will destroy the existing program and replace it with the new one. Press **Next** to continue.



- Turn the **Select** knob to find the firing cycle for this program. The above example uses TITN. Press **Next** to continue.
- **ENTER PROG NAME:** will be displayed on the top line and the program number with the program type selected previously will be on the second line. Turn the **Select** knob to change the character over the underline. Any letter, number, or special character may be selected. Pressing **Next** will step to the next character position, pressing **Last** will step to the preceding character position. When all eight characters have been entered the display will step to the next program item to be entered.



- Your display should look similar to the one above. Notice that the program number, program type, and the program name just entered are on the first line. The second line is prompting for you to enter an entry time. Turn the **Select** knob to the entry time you require. This is the time to raise the table into the furnace. The temperature will be raised or lowered to the entry temperature before entry time begins. The time is displayed in minutes:seconds. The table will be raised in steps evenly spaced during entry time. Press **Next** to continue.

- ENTRY TEMP 0C is displayed. Turn the **Select** knob to the required entry temperature. This is the temperature at which you wish the furnace to be when the porcelain enters. It is displayed in "C" Centigrade or "F" Fahrenheit. Press **Next** to continue.

- SOAK TIME 0:00 is displayed. Turn the **Select** knob to the time you wish to hold the porcelain at the entry temperature. Most operators measure the time it takes to purge to an inert condition and set the soak time to this amount. Press **Next** to continue.

- HEAT RATE 35C/M is displayed. Turn the **Select** knob to the required heat rate. C/M indicates degrees Centigrade per minute, F/M indicates degrees Fahrenheit per minute. Press **Next** to continue.

- FINAL TEMP 960C is displayed. Turn the **Select** knob to the final temperature for this program. Press **Next** to continue.

- HOLD TIME 0:00 is displayed. Turn the **Select** knob to the time you wish to hold the porcelain at the final temperature. Press **Next** to continue.

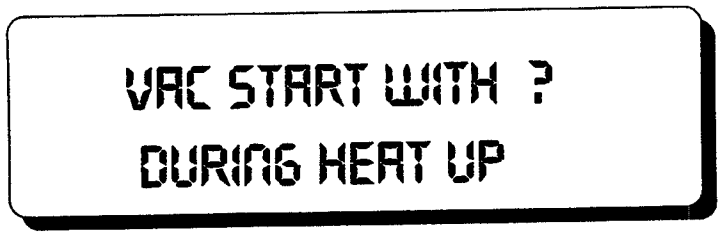
- LOWER TABLE 960C is displayed. Turn the **Select** knob to the temperature to open the furnace and lower the table. The furnace will remain in an inert condition with the table in the up position until this temperature is reached in the cooling step.

- COOL TIME 0:00 is displayed. Turn the **Select** knob to the desired cool time. This is the time to lower the table to the down position. The table will be lowered in steps evenly spaced during cool time. *Note: Cool time will not start until the lower table temperature has been reached.* Press **Next** to continue.

- USE VACUUM - NO is displayed. Turn the **Select** knob to "yes" to use vacuum in your program, "no" if you do not wish to use vacuum in this program. Selecting "no" will force the furnace to purge to an inert condition at the beginning of the program and maintain that inert condition for the remainder of the program. Selecting "yes" will force the furnace to purge to an inert condition at the beginning of the program, pull a vacuum at the appropriate time, and purge again to an inert condition when the vacuum is released. Press

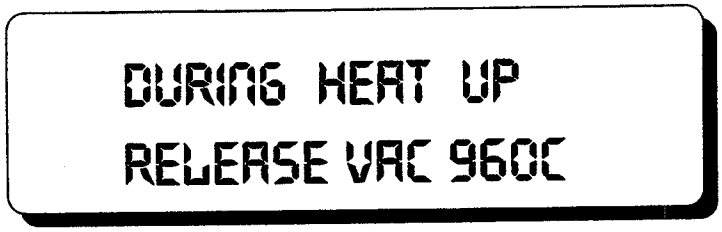
Next to continue. If your selection in this step was "no" the display has returned to the ready select yellow screen and you are finished adding this program. If your selection in this step was "yes" continue with the next step.

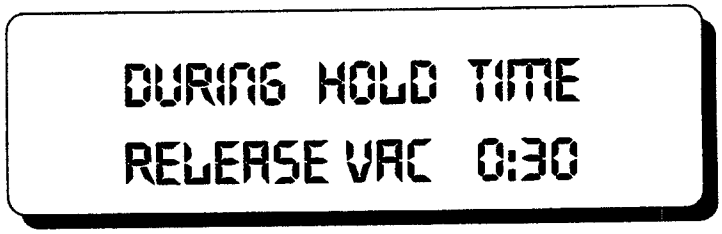
- VAC LEVEL 72CM is displayed. Turn the **Select** knob to the vacuum level desired. Press **Next** to continue.

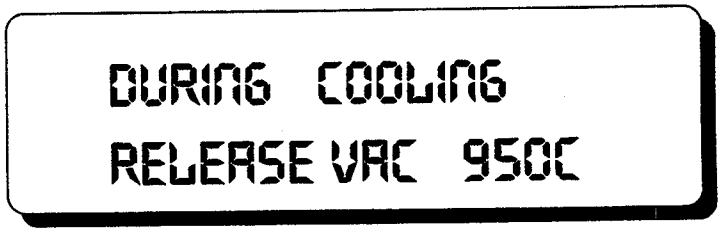


- The display should be similar to the example above. Turn the **Select** knob to select "During heat up" or "Soak time". During heat up will start the vacuum at a temperature during the heat up step of the program (similar to a normal porcelain cycle). Soak time will start the vacuum during the soak time period. Some operators prefer to select soak time and set the vacuum start time to a time after the furnace has purged, and they set the soak time long enough for the furnace to purge and pull a vacuum before starting the heat rise step. Press **Next** to continue.
- START VAC 550C *OR* START VAC 3:00 will be displayed, depending on the previous selection. Notice that the first display example has a *temperature* and the second display example contains a *time*. If you selected "During heat up" turn the **Select** knob to the desired temperature for vacuum to begin. If you selected "Soak time" turn the **Select** knob to select the time you want the vacuum to begin. In either case press **Next** to continue after the appropriate selection has been made.

- VACUUM RELEASE - DURING HEAT UP is displayed. Turn the **Select** knob to select "During heat up", "During hold time", or "During cooling". During heat up will release the vacuum at a temperature during the heat rise step. During hold time will release the vacuum after a time during the hold time step. During cooling will release the vacuum at a temperature during the cooling step. Press **Next** to continue.







- The previous selection will determine which of the three examples above will be displayed. Each of the above examples will be described separately:

If "During heat up" was selected, the top example above will be displayed. Turn the **Select** knob to the temperature you wish to release vacuum. The furnace will purge to an inert condition at this point. Press **Next**. The program has been saved and the display will return to ready select yellow screen.

If "During hold time" was selected, the center example on page 33 will be displayed. Turn the **Select** knob to the time during the hold time that you wish to release the vacuum. In this example the furnace will purge to an inert condition 30 seconds into the hold time step. Press **Next**. The program has been saved and the display will return to the ready select yellow screen.

If "During cool time" was selected, the bottom example on page 33 will be displayed. Turn the **Select** knob to the temperature you wish to release vacuum. The furnace will purge to an inert condition after the heat rise step, the hold time step, and at this temperature during the cooling step. Press **Next**. The program has been saved and the display will return to the ready select yellow screen.

Sintering Firing Cycle Program

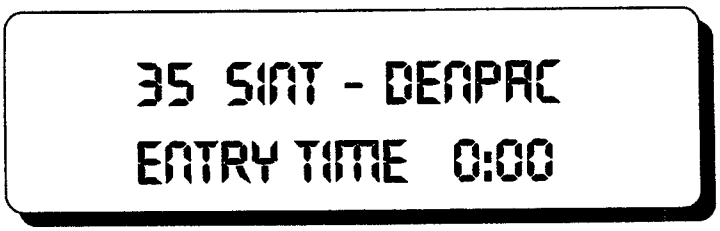
Before the Pro Series furnaces were available, sintered metal products for dentistry were sintered in specialized furnaces under a continuous vacuum condition. The oxidizers that leaked into the furnace during firing created oxide layers on the metal which had to be removed before applying porcelain. The sintering firing cycle on the Pro 100 provides for inert conditions throughout the firing cycle to reduce or eliminate the oxide buildup on the material. The dual heat rates allow the furnace to burn off the binders at low temperatures and then sinter the metals at a high rate of rise.

Procedure:

- ADD A PROGRAM
- Press **Next** to add a program.
- ADD: will be displayed. Turn the **Select** knob to find the program you want to add. If you select a program that is all ready entered you will destroy the existing program and replace it with the new one. Press **Next** to continue.



- Turn the **Select** knob to find the firing cycle for this program. The above example uses SINT. Press **Next** to continue.
- **ENTER PROG NAME:** will be displayed on the top line and the program number with the program type selected previously will be on the second line. Turn the **Select** knob to change the character over the underline. Any letter, number, or special character may be selected. Pressing **Next** will step to the next character position, pressing **Last** will step to the preceding character position. When all eight characters have been entered the display will pause while checking for duplicate names then step to the next program item to be entered.



- Your display should look similar to the one above. Notice that the program number, program type, and the program name just entered are on the first line. The second line is prompting for you to enter an entry time. Turn the **Select** knob to the entry time you require. This is the time to raise the table into the furnace. The temperature will be raised or lowered to the entry temperature before entry time begins. The time is displayed in minutes:seconds. The table will be raised in steps evenly spaced during entry time. Press **Next** to continue.

- ENTRY TEMP 0C is displayed. Turn the **Select** knob to the required entry temperature. This is the temperature at which you wish the furnace to be when the porcelain enters. It is displayed in "C" Centigrade or "F" Fahrenheit. Press **Next** to continue.
- SOAK TIME 0:00 is displayed. Turn the **Select** knob to the time you wish to hold the work at the entry temperature. Most operators measure the time it takes to purge to an inert condition and set the soak time to this amount. Press **Next** to continue.
- 1ST RATE 0C/M is displayed. Turn the **Select** knob desired first heat rate for this program. "C/M" indicates degrees Centigrade per minute, "F/M" indicates degrees Fahrenheit per minute. This heat rate is usually slow to burn off the binder materials. Press **Next** to continue.
- 1ST TEMP 0C is displayed. Turn the **Select** knob to the desired first temperature for this program. At this temperature the furnace will switch to the second heat rate until it reaches the final temperature. Press **Next** to continue.
- 2ND RATE 0C/M is displayed. Turn the **Select** knob to the desired second heat rate for this program. "C/M" indicates degrees Centigrade per minute, "F/M" indicates degrees Fahrenheit per minute. This heat rate is usually fast to reach the sintering point of the metals. Press **Next** to continue.
- FINAL TEMP 960C is displayed. Turn the **Select** knob to the final temperature for this program. Press **Next** to continue.
- HOLD TIME 0:00 is displayed. Turn the **Select** knob to the time you wish to hold the porcelain at the final temperature. Press **Next** to continue.
- LOWER TABLE 960C is displayed. Turn the **Select** knob to the temperature to open the furnace and lower the table. The furnace will remain in an inert condition with the table in the up position until this temperature is reached in the cooling step.
- COOL TIME 0:00 is displayed. Turn the **Select** knob to the desired cool time. This is the time to lower the table to the down position. The table will be lowered in steps evenly spaced during cool time. *Note: Cool time will*

not start until the lower table temperature has been reached. Press **Next** to continue.

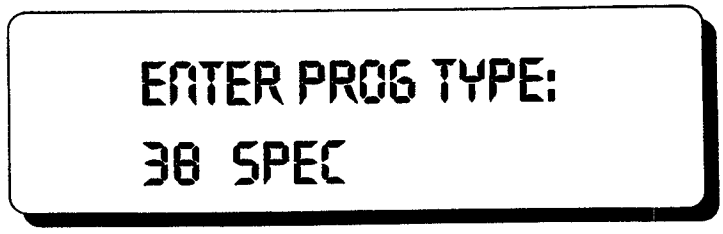
- USE VACUUM - NO is displayed. Turn the **Select** knob to "yes" to use vacuum in your program, "no" if you do not wish to use vacuum in this program. Selecting "no" will force the furnace to purge to an inert condition at the beginning of the program and maintain that inert condition for the remainder of the program. Selecting "yes" will force the furnace to sinter the old way using vacuum throughout the program.
- Press **Next**. The program has been saved and the display will return to the ready select yellow screen.

Special Firing Cycle Program

The Pro 100 furnace offers a unique firing cycle for firing normal porcelains. The following procedure describes how to add a special program.

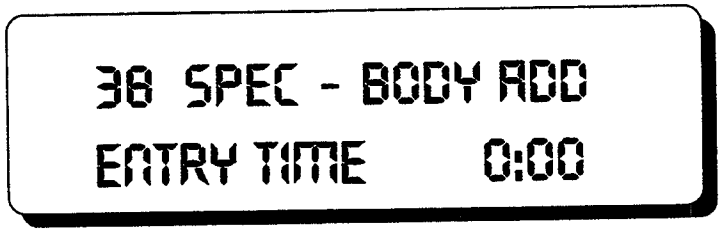
Procedure:

- ADD A PROGRAM
- Press **Next** to add a program.
- ADD: will be displayed. Turn the **Select** knob to find the program you want to add. If you select a program that is all ready entered you will destroy the existing program and replace it with the new one. Press **Next** to continue.



- Turn the **Select** knob to find the firing cycle for this program. The above example uses SPEC. Press **Next** to continue.

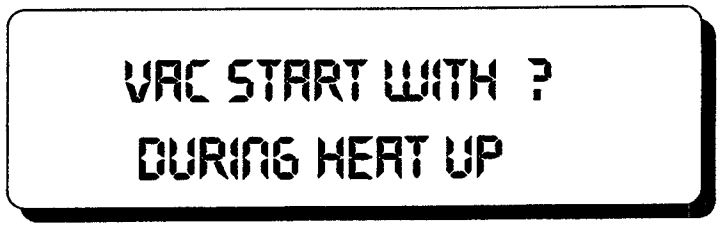
- ENTER PROG NAME: will be displayed on the top line and the program number with the program type selected previously will be on the second line. Turn the **Select** knob to change the character over the underline. Any letter, number, or special character may be selected. Pressing **Next** will step to the next character position, pressing **Last** will step to the preceding character position. When all eight characters have been entered the display will pause while checking for duplicate names then step to the next program item to be entered.



- Your display should look similar to the one above. Notice that the program number, program type, and the program name just entered are on the first line. The second line is prompting for you to enter an entry time. Turn the **Select** knob to the entry time you require. This is the time to raise the table into the furnace. The temperature will be raised or lowered to the entry temperature before entry time begins. The time is displayed in minutes:seconds. The table will be raised in steps evenly spaced during entry time. Press **Next** to continue.
- ENTRY TEMP 0C is displayed. Turn the **Select** knob to the required entry temperature. This is the temperature at which you wish the furnace to be when the porcelain enters. It is displayed in "C" Centigrade or "F" Fahrenheit. Press **Next** to continue.
- SOAK TIME 0:00 is displayed. Turn the **Select** knob to the time you wish to hold the porcelain at the entry temperature.
- HEAT RATE 35C/M is displayed. Turn the **Select** knob to the required heat rate. C/M indicates degrees Centigrade per minute, F/M indicates degrees Fahrenheit per minute. Press **Next** to continue.

- FINAL TEMP 960C is displayed. Turn the **Select** knob to the final temperature for this program. Press **Next** to continue.
- HOLD TIME 0:00 is displayed. Turn the **Select** knob to the time you wish to hold the porcelain at the final temperature. Press **Next** to continue.
- LOWER TABLE 960C is displayed. Turn the **Select** knob to the temperature to open the furnace and lower the table. The furnace will remain with the table in the up position until this temperature is reached in the cooling step.
- SP COOL TIME 0:00 is displayed. Turn the **Select** knob to the time value desired to hold the porcelain. After hold time the table will lower to the position selected in Special Functions and hold until the special cool time temperature is reached. The table will then raise and hold the porcelain at the special cool time temperature until the special cool time has expired. Press **Next** to continue. This feature will add strength to low fusing porcelains.
- SP COOL TEMP 960C is displayed. Turn the **Select** knob to select the appropriate temperature for the special cool time. If the special cool temperature is not lower than the lower table temperature, the table will not lower after hold time. Press **Next** to continue.
- COOL TIME 0:00 is displayed. Turn the **Select** knob to the desired cool time. This is the time to lower the table to the down position. The table will be lowered in steps evenly spaced during cool time. *Note: Cool time will not start until the lower table temperature has been reached.* Press **Next** to continue.
- USE VACUUM - YES is displayed. The display should appear similar to the example above. Turn the **Select** knob to "yes" to use vacuum in your program, "no" if you do not wish to use vacuum in this program. Press **Next** to continue. If your selection in this step was "no" the display has returned to the ready select yellow screen and you are finished adding this program. If your selection in this step was "yes" continue with the next step.

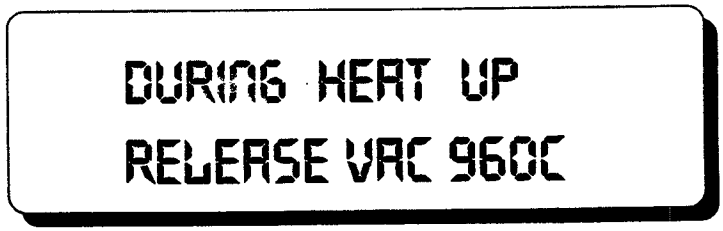
- VAC LEVEL 72CM is displayed. Turn the **Select** knob to the vacuum level desired. Press **Next** to continue.

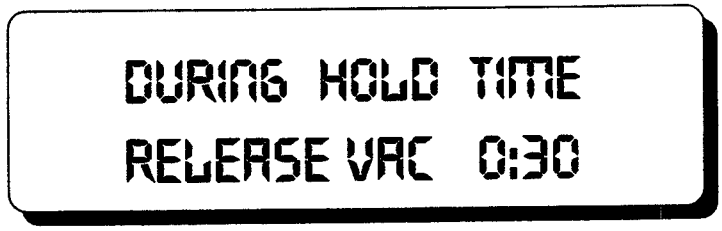


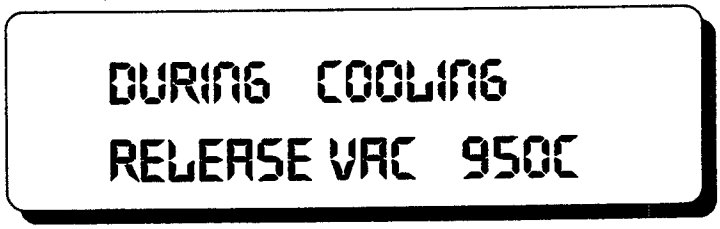
- The display should be similar to the example above. Turn the **Select** knob to select "During heat up" or "Soak time". During heat up will start the vacuum at a temperature during the heat up step of the program (similar to a normal porcelain cycle). Soak time will start the vacuum during the soak time period. Some operators prefer to select soak time to start the vacuum pump at this time to allow the vacuum pump to pull a vacuum before the heat rise starts. Press **Next** to continue.

- START VAC 550C *OR* START VAC 3:00 will be displayed, depending on the previous selection. Notice that the first display example has a *temperature* and the second display example contains a *time*. If you selected "During heat up" turn the **Select** knob to the desired temperature for vacuum to begin. If you selected "Soak time" turn the **Select** knob to select the time you want the vacuum to begin. In either case press **Next** to continue after the appropriate selection has been made.

- VACUUM RELEASE - DURING HEAT UP is displayed. Turn the **Select** knob to select "During heat up", "During hold time", or "During cooling". During heat up will release the vacuum at a temperature during the heat rise step. During hold time will release the vacuum after a time during the hold time step. During cooling will release the vacuum at a temperature during the cooling step. Press **Next** to continue.







- The previous selection will determine which of the three examples above will be displayed. Each of the above examples will be described separately:

If "During heat up" was selected, the top example will be displayed. Turn the **Select** knob to the temperature you wish to release vacuum. Press **Next**. The program has been saved and the display will return to ready select yellow screen.

If "During hold time" was selected, the center example will be displayed. Turn the **Select** knob to the time during the hold time that you wish to release the vacuum. In this example the furnace will hold vacuum for 30 seconds into the hold time step. Press **Next**. The program has been saved and the display will return to the ready select yellow screen.

If "During cool time" was selected, the bottom example will be displayed. Turn the **Select** knob to the temperature you wish to release vacuum. The furnace will hold vacuum through the heat rise step, the hold time step, and will release vacuum at this temperature during the cooling step. Press **Next**. The program has been saved and the display will return to the ready select yellow screen.

Change a Program

Change a program is used to change an existing program or to add a new program. All program values will be displayed as they are currently in the program. You may change these values when they are displayed.

- SELECT ITEM: CHANGE A PROGRAM is displayed. Press **Next** to select this feature.
- CHANGE: 0 SYNS-OPAQUE Turn the **Select** knob to find the program you wish to change. If you select a program that is all ready entered you will change the existing program. If you select a blank program, you will add a new program. Press **Next** to continue.
- You may change the program in the same manner as in the "Add Program" section of this chapter. Refer to that section for instructions specific to each type of firing cycle program.

Copy/Change a Program

The copy/change a program feature allows you to copy a program from on program number to another, and then change the new program. This feature is very useful when only minor differences exist between programs.

Procedure:

- COPY/CHANGE PROG is displayed. Press **Next** to select this feature.
- COPY FROM: is displayed on the top line. The bottom line displays a program number and name. Turn the **Select** knob to find knob to find the program you wish to copy. Press **Next** to continue.
- COPY TO: is displayed on the top line. Turn the **Select** knob to find the program you wish to copy to. If you select a program that is all ready entered, you will write over the existing program destroying it. If you select a blank program, you will add a new program. Press **Next** to continue.

- At this point you may change the program in the same manner as described in the section "Add a Program". Refer to that section for instructions specific to each type of firing program. *Note that you must change the name of the new program because the furnace does not allow duplicate program names.*

Move a Program

The move program feature allows you to move programs from one number to another. This feature is useful for grouping programs for operator convenience. The procedure for this feature is on page 43.

Procedure to Move a Program:

- MOVE PROGRAM is displayed. Press **Next** to select this feature.
- MOVE FROM: is displayed on the top line. The bottom line displays a program number and name. Turn the **Select** knob to find knob to find the program you wish to move. Press **Next** to continue.
- MOVE TO: is displayed on the top line. Turn the **Select** knob to find the program you wish to move to. If you select a program that is all ready entered, you will write over the existing program destroying it. If you select a blank program, you will add a new program. The program you move from will be erased and become a blank program. Press **Next** to continue.

Erase a Program

This feature allows you to erase a program from memory. The program erased becomes available for a new program.

Procedure:

- ERASE A PROGRAM is displayed. Press **Next** to select this feature.

- ERASE: is displayed. Turn the **Select** knob to find the program you wish to erase. Press **Next** to continue.
- ERASE ??? NO is displayed. Turn the **Select** knob to "yes" to erase this program, or "no" to abort. This step is designed to reduce the chance of accidentally erasing a good program. Press **Next** to continue.

Print Programs

The print programs feature allows you to print all of the programs for future reference. See "Chapter Five: Maintenance" for the printer requirements and hook up. The printout consists of two pages.

The first page contains a complete list of the programs in a short format. This format shows the name and a partial list of the items contained in the programs. These items are designed to identify the programs quickly. Keep this list of programs next to the furnace for the operator to use in quickly identifying the programs to run.

The second page contains a complete listing of the programs and all of the items contained in the programs. Keep this list in your records for future reference. In the event that you buy a new furnace, or must replace the main computer board in your furnace, this listing will allow you to quickly re-enter your programs.

Procedure:

- PRINT PROGRAMS is displayed. Press **Next** to select this feature.
- PRINT PROGRAMS NO is displayed. Turn the **Select** knob to display "yes" to print programs, or "no" to abort. Press **Next** and the printer will print the programs.

Chapter Four

Run Programs Mode

The run programs mode allows you to run programs and to view programs as they are running. This mode is reached by pressing the yellow **Run Programs** key. The display should be similar to the example:



This display indicates that the furnace is idling between programs and the display also indicates the current temperature of the furnace. A "C" behind the temperature indicates Centigrade, an "F" indicates Fahrenheit.

Turn the **Select** knob until the program you want to run is displayed. If you have not lowered the table and put your work on the firing tray, do so now. Press the green **Start Program** key to run this program. Continue reading this chapter to understand all of the displays and features available while a program is running.

You may press the yellow **Change Programs** key, or the yellow **Special Functions** key at any time while a program is running. You can change programs, print programs, etc. without interrupting the program that is running.

Repeat Programs

The Pro 100 furnace features a one button repeat program feature. If you wish to repeat a program, simply press the green **Start Program** key. The last program will be repeated. *Note that this feature is disabled if you go to Special functions mode or change programs mode since the last program was run.*

Features and Displays:

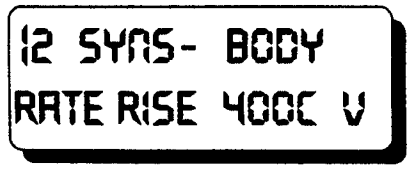
Available While a Program Is Running

The Pro 100 furnace has several displays and features available while a program is running. There are two ways to activate these displays:

- By pressing the green **Start Programs** key to start a new program.
- By pressing the yellow **Run Programs** key while a program is all ready running.

All of the displays described in this section are available by turning the* SELECT *knob. To change from one display to another, turn the **Select** knob.

The first display is the general status display:



The top line indicates the program that is running. In this example it is program number 12, Synspar porcelain, a body firing.

The bottom line indicates the status of the program, the current temperature, and the vacuum status.

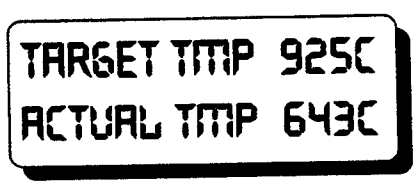
The various program status indicators are:

FAST COOL	Cooling to entry temperature.
FAST RISE	Raising temperature to entry temperature.
PRE DRY	Stepping table into the furnace (entry time).
SOAK TIME	Holding the work at entry temperature.
RATE RISE	Raising the temperature at a specific rate.
HOLD TEMP	Holding constant at final temperature.
OPEN COOL	Standard cooling sequence.
INRT COOL	Cooling under inert conditions (argon gas).
FINISHED	Program has finished.
ABORTED	Program was aborted by the **Stop Program** key.

The current temperature is followed by a "C" if Centigrade, or an "F" if Fahrenheit. The temperature is followed by a single letter vacuum status:

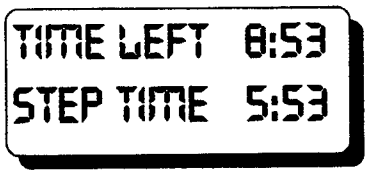
V	Vacuum in chamber.
I	Purging or inert gas in chamber.
blank	No vacuum.

The second display is the Target temperature display:



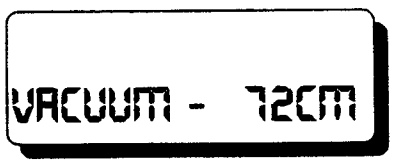
This display shows the target temperature for this program step in the top line, and the actual temperature in the bottom line.

The third display is the Time display:



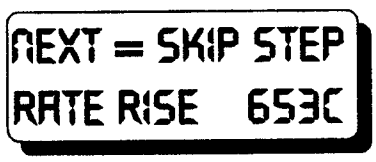
Time left indicates the estimated time remaining for the entire program to complete. *Note that the furnace does not include the time required for reaching the entry temperature, and that it cannot estimate the time required for cooling under inert conditions.* Step time indicates the time left for this step.

The fourth display is the vacuum display:



The current vacuum level is displayed. "cm" indicates centimeters of mercury, "in" indicates inches of mercury.

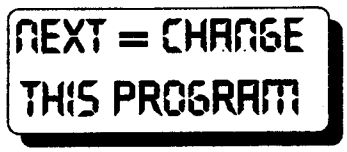
The fifth display is the Skip step display:



The top line indicates that pressing the **Next** key will skip the current step. The bottom line displays the current step and the current step's status.

If a program were accidentally aborted, or you determine that it would be beneficial to skip over the current step, you can turn the **Select** knob to this screen and press **Next**. The program will abort this step and move to the next step in the firing sequence.

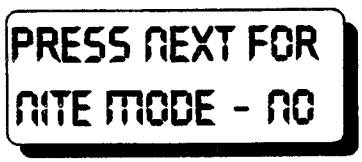
The sixth display is the Change this program display:



This feature allows you to make an ***immediate and temporary*** change to the program that is running. Any changes to a program made from this screen will alter the way the current program runs. After the program finishes, the original program contents will be restored. Permanent changes to a program must be made in the "Change Program Mode". See Chapter Three for details on making permanent changes to a program.

Pro gram changes from this display are accomplished in the same manner as in "Chapter Three: Change Program Mode". Refer to that chapter for information on specific firing cycles.

The seventh screen is the night mode display:



This display indicates that you may activate the night mode which will bring the furnace to the night mode temperature after the completion of this program.

To activate the night mode press the **Next** key. "Yes" will replace "no" and night mode will activate upon completion of the program. The furnace will lower the table and hold the muffle at the night mode temperature until **Next** is pressed or the power is cycled off and back on.

To de-activate night mode press the **Next** key again. "No" will be displayed.

Selecting and Running a Manual Program

The Pro 100 furnace provides a manual program to add temperature and time to a piece of work that has been determined to be underfired.

Procedure:

- Press the **Run Programs** key. Turn the **Select** knob past all the normal programs numbered 0 to 99. The last one available is the manual add temperature program.



- Press the green **Start Program** key to begin.
- FINAL TEMP 950C is displayed. Turn the **Select** knob to the final temperature for this program. Press **Next** to continue.
- HOLD TIME 1:00 is displayed. Turn the **Select** knob to the time you wish to hold the porcelain at the final temperature. Press **Next** to continue.
- COOL TIME 1:00 is displayed. Turn the **Select** knob to the desired cool time. This is the time to lower the table to the down position. The table will be lowered in steps evenly spaced during cool time. Press **Next** to continue.

The table will rise to the up position and the program will run in the same manner as a normal porcelain firing cycle. All of the normal displays are available while running a manual program.

Chapter Five

Maintenance

CAUTION

THE GASSES PRODUCED WHEN HEAT TREATING REFRACTORY MODELS WILL DAMAGE THE TRANSPARENCY OF THE QUARTZ TUBES IN THE MUFFLE CHAMBER AND MAY CAUSE VACUUM LEAKAGE. TO HELP EXTEND THE LIFE OF THE MUFFLE, IT IS NECESSARY TO PREHEAT REFRACTORY MODELS IN A BURNOUT FURNACE TO PREVENT THE GASSES FROM DAMAGING THE QUARTZ GLASS IN THE MUFFLE CHAMBER.

Cleaning Your Furnace

Your new furnace has been painted with an epoxy based paint and may be cleaned by using a soft cloth and kitchen cleaners such as "Fantastic®" or "Formula 409®". The front panel should be cleaned with a window cleaner such as "Windex®".

Never clean the display window with a dry cloth or tissue. Always moisten the cleaning cloth with a cleaner such as "Windex®".

Printer Requirements and Installation

The printer attachment on the furnace is designed to work as a parallel printer port on an IBM® PC or PC clone computer. It is compatible with all printers that are compatible with PC computers.

Use a standard IBM® PC or PC clone printer cable to attach your printer to the furnace. Plug the 25 pin connector end of the cable to the furnace and attach the mounting screws. Plug the other end of the cable to your printer and attach the spring mounting clips. Install paper into your printer, turn on power and you are ready to print.

The furnace sends a reset signal to the printer when power is turned on. It is normal to see the printer move and for it to make a noise at this time.

Argon Gas Requirements and Installation

Warning!

USE ONLY ARGON GAS IN THIS FURNACE. ATTACHING ANY FLAMMABLE OR NOXIOUS GAS TO THIS FURNACE COULD CAUSE EXPLOSION OR PERSONAL INJURY!

The best source of Argon is from your local bottled gas dealer. Usually the same dealer who furnishes you Oxygen can also supply you Argon. If not, he can recommend a reliable source.

There are generally three grades of Argon available and your dealer can tell you the cost of each. Most furnace buyers are using the lowest cost commercial or industrial grade of Argon.

The same dealer should be able to supply a regulator for the bottled Argon. The regulator should be similar to the one on your oxygen tank. It should have a gage showing the pressure inside the tank, and a smaller gage showing the pressure applied to the outside system. The smaller gage should be no more than 120 PSI maximum.

The furnace requires between one and two PSI of Argon gas pressure. The use of more pressure will not improve the performance of the furnace, but will only force you to buy more gas! If you plan to use the Argon gas features of this furnace you should purchase the low pressure Argon post regulator kit. This kit is available from your furnace supplier.

The low pressure post regulator kit attaches to the regulator supplied by your gas supplier. Installation of the low pressure regulator:

DO NOT REMOVE THE REGULATOR SUPPLIED BY YOUR BOTTLED GAS SUPPLIER. THE LOW PRESSURE REGULATOR IS IN ADDITION TO THE REGULATOR SUPPLIED WITH YOUR BOTTLE.

1. The regulator supplied by the bottled gas company usually has a hose barb fitting to attach your hose. Remove this fitting.

2. The low pressure regulator kit has a $^1/_4$ inch male pipe thread fitting supplied on one end. The other end has a hose barb fitting for the supply hose to the furnace. Attach the male pipe thread end to the regulator on the bottle. The first gage reads the bottle pressure, the second gage reads the pre-regulator pressure, and the third gage reads from 0 to 15 PSI. *Do not attach the gas to the furnace yet.*

3. Attach one end of the supplied hose to the low pressure regulator. *Do not attach the other end to the furnace yet.*

4. Turn on the gas supply to the regulators.

5. Adjust the pre-regulator (supplied by your gas dealer) to around 20 PSI.

6. Pull the red locking ring on the low pressure regulator towards the black knob on the bottom of the regulator to release the knob. Turn the black knob fully counterclockwise. the pressure should be 0.

7. Turn the black knob clockwise until the low pressure gage reads between 1.0 and 1.5 PSI.

8. Push the red locking ring up towards the gage. This will lock the pressure setting.

9. Turn off the gas supply from the bottle. *Be sure to turn off the supply when the gas is not being used to avoid the loss of gas due to fitting leaks.*

10. Attach the hose to the Argon connector on the back of the furnace.

The furnace is now ready to run titanium and sintering programs which require Argon gas.

Note: The pressure reading may jump higher than 1.5 PSI between firings and at times during the purging process. This is normal. Pressure may be checked during the inert cool step in the firing sequence. At that time Argon is being applied at a constant pressure to the furnace. The gage should read between 1 and 1.5 PSI. You may adjust the regulator at this time.

Installation of Furnace Upgrades

The Pro 100 furnace has a unique feature that allows the operator to upgrade the firing sequences and features of the furnace. Nothing on the front panel of the furnace limits the ability of the furnace to handle new firing processes. A simple memory module replacement allows the complete upgrade to occur. The following instructions will cover the replacement of the memory module:

1. Raise the table to the up position.

2. Turn off the power to the furnace and unplug from the wall outlet.

3. Place the furnace on its back. Remove the six Phillips head screws located on the bottom of the furnace near the side edges. These screws attach the chassis top (containing the front panel keyboard) to the furnace.

4. Set the furnace back upright. Move the furnace to a work area where you can remove the chassis top (containing the front panel keyboard) and set it beside or in front of the furnace.

5. Slide the chassis top forward to remove. Do not strain the cable holding the chassis top to the printed circuit board. Set the chassis top on its side beside or in front of the furnace.

6. Locate the memory device that looks like the new one you have on the printed circuit board located in the base of the furnace. Notice that the writing on the label reads correctly when facing the front of the furnace. Lift the lever located on the right of the memory device socket. It should remain in the vertical position. Handling the memory device by the edges (not touching the pins) remove it from the socket. Replace it with the new memory device. Lower the lever to the horizontal position.

7. **CHECK THE ORIENTATION OF THE MEMORY DEVICE. THE ARROWS SHOULD POINT TO THE FRONT OF THE FURNACE. IF THE MEMORY DEVICE IS INSTALLED BACKWARDS IT WILL BE DESTROYED!!!**

8. Replace the chassis top to its normal position on the furnace.

9. Set the furnace on its back and start but do not tighten all six of the Phillips screws. After all six screws are started, tighten all screws.

10. Place the furnace back in its normal place, replace the power cord into the wall outlet, and turn the power back on.

Manual Lift Operation

In the event of a power failure, the lift can be lowered manually. To manually lower the lift, **first turn the power off**. After the power has been turned off, use a 1/2 inch (13 mm) socket to turn the inset hex cap (located on the back of the furnace near the bottom) **counterclockwise** while facing the rear of the furnace. The platform will descend.

Replacing the Muffle

The Pro 90 furnace contains a muffle module designed for simple service and replacement. The muffle module contains the heating chamber and the thermocouple. The replacement procedure is as follows:

1. Turn the power switch located at the rear of the furnace to the **off** position. Remove the power cord from the wall socket to prevent any chance of shock hazard. Allow the furnace to cool.

2. Remove the six Phillips head screws holding the muffle cover to the upright column. Remove the muffle cover by lifting it straight up until it clears the upright column.

3. Remove the thermocouple connector from the column by squeezing the two tabs and pulling away from the column. Remove the heating element connector from the column by squeezing the two tabs and pulling away from the column. Remove the four large Phillips head screws on the top of the muffle. Grasp the handle on the top of the muffle and lift vertically to remove the muffle from the vacuum chamber.

4. Inspect the O-ring for damage and replace if required. Clean the O-ring area and the sealing area of the new muffle with a mild cleaning solution such as "Windex®". Lower the new muffle into the vacuum chamber with the thermocouple closest to the column. Insert the four large screws into the top of the muffle and tighten. Install the thermocouple and the heating element connectors. These are keyed so it is not possible to plug them in incorrectly.

5. Install the muffle cover by lowering it over the upright column and aligning the screw holes. Install the six Phillips head screws that attach the muffle cover to the upright column.

6. Plug the power cord back into the wall socket and turn the power back on. Observe that the temperature begins to rise and stabilize at the entry temperature of the current program.

7. Fire a chip of porcelain to test the firing temperature of the new muffle. Adjust the calibration as described in Chapter Four: *Adjust Furnace Calibration to Match Your Porcelain.*

Trouble Shooting Guide

The Pro 100 furnace offers a number of self checks and warning messages that are designed to identify problems. Several of these are listed below:

No Vacuum - This error Occurs if the furnace has not achieved its target vacuum level within 90 seconds. The program will abort automatically. Check the vacuum level setting. If the barometric pressure is unusual, you may have to call for less vacuum.

Duplicate Name - This error occurs if you have entered a program name that is identical to one all ready stored in memory. Press **Next** to continue. Enter a different name for this program.

Printer Error - This occurs if the printer is not online, paper is out or an error signal is received from the printer. Press **Next** to continue. Reset the printer, make sure it has paper, make sure the online light is on. Attempt to print again.

Check Programs - The computer has detected a corruption of the memory in the area where programs are stored. Check all programs and correct any that have been changed.

Temp Cal Error - An error has been detected in the temperature calibration. Recalibrate the temperature to correct this problem.

Vac Cal Error - An error has been detected in the vacuum calibration. Recalibrate the vacuum to correct this problem.

Max Temp Error - The computer has detected a temperature reading higher than the maximum allowed. The furnace will automatically shut the heating elements off. Turn the power off to reset this error. If the error occurs again call for assistance.

Thermocouple Error - This error occurs if the furnace detects an open thermocouple for a period of 25 seconds. The furnace will automatically turn off the heating elements. The furnace should be turned off and on again to clear this error. If the error occurs again, the thermocouple should be replaced.