



Stable Temp[®] Model 282A
Vacuum Oven

Models covered in this manual		
Catalog number	Model number	Voltage
05017-10	6281	115V
05017-15	6282	230V

MANUAL NUMBER 105714 (7006281)

REV	ECR/ECN	DATE	DESCRIPTION	By
2	26741/SI-10360	11/9/10	Updated TCCB to comply with in-house test procedure QT049 (pg 6-13)	ccs
1	26565/SI-10360	11/1/10	Repl readout thermocouple w/ 255036	ccs
0	--	3/31/10	Transfer to Marietta (was 105714 2/6/09)	ccs



Important Read this instruction manual. Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance. ▲

Caution All internal adjustments and maintenance must be performed by qualified service personnel. ▲

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Important operating and/or maintenance instructions. Read the accompanying text carefully.



Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.



Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.



Hot surface(s) present which may cause burns to unprotected skin, or to materials which may be damaged by elevated temperatures.



Marking of electrical and electronic equipment, which applies to electrical and electronic equipment falling under the Directive 2002/96/EC (WEEE) and the equipment that has been put on the market after 13 August 2005.



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- ✓ Each individual is responsible for his or her own safety.

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Section 1 Introduction

Before operation, always observe the following safety precautions:

- This unit is not explosion proof.
- Do not use in the presence of flammable or combustible materials; fire or explosion may result. Unit contains components that may ignite such materials.
- Do not place volatile items in the chamber.
- Fumes and spillage from acidic solutions cause corrosion of the stainless steel chamber.
- Care should be taken to maintain neutral pH at all times.

Section 2 Performance and Physical Data

Temperature

Temperature Range Ambient to 280°C, continuously adjustable with 1°C resolution

Heat Rise Time . .Ambient to 100°C in <30 minutes,with temp set to 200°C

Average Set-Point Accuracy±2°C

Cool-Down Time280 to 100°C in ~2.5 hours

Temperature Set-Point Reproducibility±0.1°C

Temperature Control Band±0.2°C

Long-Term (12 hours) Temp. Stability±0.03°C

Temperature Display 3 digit LED display to nearest to nearest 1°C

Average Temperature Uniformity ±5°C (in vacuum), based upon measuring points at the geometric center and each corner of oven chamber at 100°C

Vacuum

Average Leak Rate< 1” Hg per 24 hours

Vacuum Display Accuracy . . . Average error 0.2 inch Hg between ambient and complete vacuum

Atmosphere Control Use with non-corrosive, non-flammable gases such as nitrogen and CO2

Environmental

Operating Temperature60° to 100°F

Storage Temperature32° to 120°F

Humidity 20 to 80% relative humidity, non-condensing

Recorder Outputs

Temperature, Pins P3-1, P3-210 mv / °C

Chamber Pressure, Pins P3-3, P3-4 . .100 mv / in Hg

Connector Type:AMP 640456-4

Section 2

Performance and Physical Data

Physical Characteristics

External Dimensions26"W x 23"D x 22"H
Chamber Size12"W x 18"D x 12"H
Chamber Volume1.5 cu ft

Section 3 Unpacking

Refer to the packing list below and be certain that all listed items are present. If any are missing, notify Cole-Parmer. Also, be certain to complete and return the included warranty card.

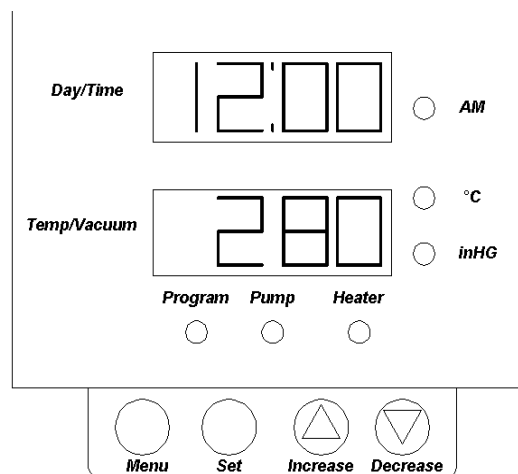
Unpacking Checklist	
Qty	Description
1	Oven
2	Shelves (shipped in chamber)
2	Hose Connectors
1	Instruction Manual
1	Warranty Card

Note If any shipping damage has occurred, retain the unit intact, including all packing materials, and file claim with the final carrier promptly. Usually, the firm will send an investigator to ascertain liability. ▲

Section 4 Control, Indicators and Connectors

Before putting the Oven into operation, the user should become thoroughly familiar with the location and function of all controls, indicators, and connectors. Most are clearly labeled and located on or below the front panel, with the exception of the two (PURGE and VACUUM) hose connectors, which are located on the lower right side of the oven. A set of vacuum pump auxiliary contacts and the temperature/vacuum recorder output connectors are located on the rear side of the control board. See Auxiliary Pump Contacts for instructions on accessing these connectors.

The control panel consists of two 14-segment alphanumeric displays, six indicator LEDs, four keypads, and an ON/OFF toggle. The VACUUM and PURGE valves are located just beneath the control panel. The list below gives a more detailed explanation of each.



Day/Time Display

A four character alphanumeric readout that alternately displays the day of the week and time of day in 5-second intervals.

Temp/Vacuum Display

A four character alphanumeric readout that alternately displays the temperature (°C) and chamber pressure (in Hg) in 5-second intervals.

Section 4

Controls, Indicators and Connectors

LED Indicators

AM: Indicates first 12-hour time is being displayed/programmed in the upper display window. Flashes when in Calibration mode.

°C: Indicates chamber temperature (°C) is being displayed/programmed in the lower display window.

in Hg: Indicates chamber absolute pressure is being displayed in the lower display window. Also illuminated during vacuum pump program step.

Heater: Indicates heater activation.

Pump: Indicates closed vacuum pump contact condition.

Program: Indicates 7-day program setup or operation.

Keypads

Menu: Allows operator to cycle through main menu and calibration menu.

Set: Selects one of six main menu parameters and one of five calibration menu parameters.

Increase: Increments values to be selected for each parameter.

Decrease: Decrements values to be selected for each parameter.

Connectors and Valves

Power Switch: A rocker type switch that controls all power to the Vacuum Oven.

Vacuum Control Valve: A forged body, shut-off valve used to open and close the connection to an auxiliary vacuum pump. Valve port accepts a supplied serrated fitting to ease in connecting a 1/4-inch (Inside diameter) hose.

Purge Control Valve: A forged body, shut-off valve used to open and close the connection to an auxiliary gas source. Valve port accepts a supplied serrated fitting for ease in connecting a 1/4-inch (inside diameter) hose.

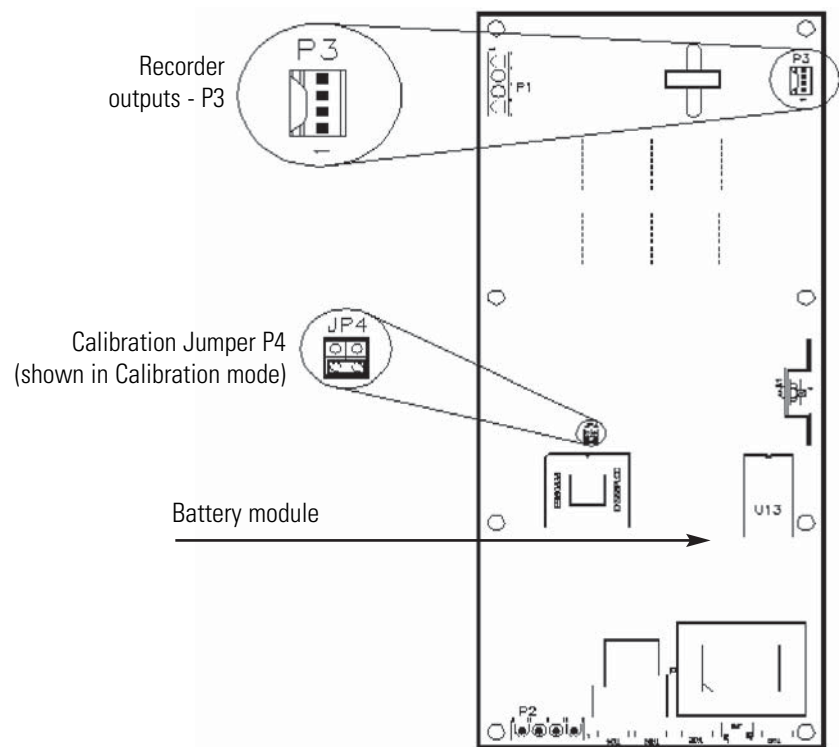
Vacuum Inlet Port: A serrated hose fitting used to connect an auxiliary vacuum pump to the oven. Fitting accepts a 1/4-inch (inside diameter) hose.

Purge Inlet Port: A serrated hose fitting used to connect an auxiliary gas source to the vacuum oven. Fitting accepts a 1/4-inch (inside diameter) hose.

Vacuum Pump Auxiliary Contacts: Normally open contacts located at the bottom of the rear side of the control board (Tabs 3 & 4). The contacts close when either the pump is manually activated at the keypad, or by running a program step that calls for pump activation.

Temperature and Vacuum Recorder Outputs: Four pins located on the top, right of the rear side of the control board (P3) which provide a voltage readout corresponding to chamber temperature and/or pressure.

Calibration Jumper Pin (JP4): Group of four pins located in the center of the rear of the control board. The lower two pins when jumped enable calibration mode. See illustration below for control board rear view.



Self-Diagnostic Safety Monitors

A group of five messages alert the operator to heater and control malfunctions. The OTC (open thermocouple) and OVR (over temperature) errors alternately display in the TEMP/VACUUM display. The PWRF (power failure), BATT LOW (low battery) and CRC (calibration data corruption) are displayed in the DAY/TIME display window. All messages and their meanings are as follows:

OTC (Open Thermocouple): The TEMP/VACUUM display alternates between OTC and current chamber pressure at 5 second intervals, where OTC replaces the normal process temperature display field. The heaters and vacuum pump (if connected to auxiliary contacts) are forced OFF. Program execution is halted.

OVR (Over Temperature): Activates if oven temperature exceeds the set-point +20°C.

PWRF (Power Failure): Power failure only detected during program mode. The failure must be longer than 2 minutes. Time display alternates between PWRF, HH:MM and DAY(n) at 5 second intervals.

BATT LOW (Low Battery): Indicates it is time to replace the 6-year battery module. Module is in a socket on the back of the control board. See control board illustration on previous page.

CRC (Calibration Data Corrupted): Indicates an error in the stored calibration data. The heater and pump relay are forced off. Unit must be calibrated to clear.

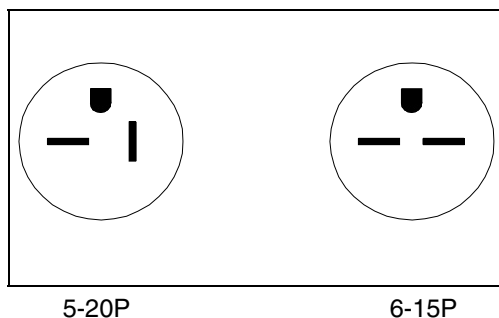
Section 5 Installation and Assembly

The oven is shipped assembled and ready for operation. However, before installing the oven, the operating site should be prepared to meet necessary requirements. Additionally, a few assembly procedures must be performed before the oven can be safely and properly operated.

Site Requirements

The standard plug configurations are shown in the illustration below. The 115VAC model is supplied with a 20 amp plug (NEMA 5-20P). The 230VAC model is supplied with a 15 amp plug (NEMA 6-15P). Verify that the appropriate receptacle is at the location the oven will be used.

Warning To avoid the risk of electrical shock, verify that the source plug is properly grounded. ▲



The supporting bench or table must be capable of holding in excess of 200 pounds. The bench should be sufficient to accommodate sample-handling processes. The oven itself is 26-inches wide and 23-inches deep; therefore, the bench surface should be approximately 48-inches wide and 30-inches deep to allow for ventilation clearance at the rear of the oven.

Warning To avoid the risk of fire, provide 6 inches of clearance for the top, back and sides of the oven. Do not set or lean any objects against or on top of the oven while hot. ▲

For installations that may use a tank atmosphere, check that site facilities and tank equipment are in compliance with OSHA requirements for handling compressed gas. Responsible personnel must also be thoroughly knowledgeable in the use, storage, and handling of compressed gases.

Site Requirements (continued)

When using a tank atmosphere, a 1/4" tube to 1/4" pipe adapter is required for the regulator outlet of the tank. This adapter is not supplied. A Swagelok B-400-7-4 adapter, or equivalent, may be used. Also, 9/16", and 1-1/8" open-end or, preferably, flare-nut wrenches are required.

Installation

After verifying all site and safety requirements, the following steps should be completed to prepare the vacuum oven for operation:

1. Verify that all-packing items and securing materials have been removed from the oven.
2. Move the oven to the desired location as specified above.
3. Locate the two serrated hose fittings, packed in the INSTRUCTIONS envelope accompanying each oven.
4. Install the hose fittings on the VACUUM and PURGE ports located on the lower right-side panel. Hose fittings should be installed by turning the fitting nut clockwise until finger-tight then, using a 9/16" wrench, turn the nut an additional 1/4-turn while holding the fitting stationary with a 3/8" wrench.
5. Close both the PURGE and VACUUM valves by turning the control knob clockwise as far as possible.
6. Connect a vacuum pumping system, including a suitable trap, to the serrated fitting labeled VACUUM. Use 1/4-inch I.D. heavy-walled vacuum tubing and secure the connection with a hose clamp.
7. If desired, connect a purge gas supply to the serrated fitting labeled PURGE using a suitable length of 1/4" I.D. tubing. Use a two-stage gas flow regulator if gas is to be supplied by a pressurized cylinder.
8. After installing connecting tubing, check that the PURGE CONTROL valve on the Oven is closed (full clockwise position) then open the regulator flow control valve to pressurize the line. At this point, check all connections for leaks using an ordinary soapy water solution.
9. Check data plate and plug line cord into a suitable power receptacle.

Section 6 Operation

Energize the oven by switching the ON/OFF toggle to the ON position. The upper display will show VER while the lower display will show 1.0, indicating the current software version. Next, the DAY/TIME display will begin alternating between the day of week and the time of day. At the same time, the TEMP/VACUUM display will alternate between chamber temperature (°C) and chamber pressure (in Hg). Press the MENU key to scroll through menus 1-6, then press SET to enter a menu. If there is no keypad activity for 5 seconds, the unit returns to Menu 1 automatically. The following table lists the main menus and their functions. The tables that follow list the subcategories of the controller main menu and describe the function of each.

Menu	Prompt	Display Functions	Setup Functions
1	(Default)	Top Display – Day of week, Time of day Bottom Display – Temp (°C), Pressure (in Hg)	Adjust temperature control setpoint Turn vacuum pump contacts ON/OFF
2	ADJT	Display temperature offset value	Adjust temperature control offset
3	ADJP	Displays pressure offset value	Adjust for barometric pressure variations
4	TSET	Displays flashing day or time value	Set clock and day of the week
5	PRGM	Displays program mode	Start / Stop program mode
6	PSET	Displays day, step and setpoint	Program 7 – Day event timer

Step	Key Entry	Action	Display
1	Press SET	Unit enters Temperature Setpoint mode with the current setpoint displayed. Use the UP/DOWN keys to adjust the setpoint.	SP: 280
2	Press SET 2nd Time	The temperature setpoint is updated and the vacuum pump ON/OFF option is displayed. Use the UP key to switch the pump on, and the DOWN key to switch the pump off.	PUMP OFF
3	Press SET or wait 2 seconds	Unit returns to the default menu.	MON 280

Main Controller Menus

Table 3: Adjust Temperature Offset (Menu 2)			
Step	Key Entry	Action	Display
1	Press MENU until ADJT is displayed, then press SET	Use the UP/DOWN keys to adjust the temperature offset. (Range ± 30 °C)	ADJT 00
2	Press SET or wait 2 seconds	Unit returns to the default menu.	MON 280

Table 4: Adjust Barometric Pressure Offset (Menu 3)			
Step	Key Entry	Action	Display
1	Press MENU until ADJP is displayed, then press SET	Use the UP/DOWN keys to adjust the pressure offset. (Range ± 8.0 in Hg)	ADJP 0.0
2	Press SET or wait 2 seconds	Unit returns to the default menu.	MON 280

Table 5: Set Time and Day (Menu 4)			
Step	Key Entry	Action	Display
1	Press MENU until TSET is displayed, then press SET	Unit enters set time and day mode and the current hour and minute is displayed. Hours digits are flashing. Use the UP/DOWN keys to adjust the hour.	08:00 AM •
2	Press SET	Minutes digits are flashing. Use the UP/DOWN keys to adjust minutes.	08:00 AM •
3	Press SET	Day of the week is displayed (flashing). Use the UP/DOWN keys to adjust the day of the week.	MON
4	Wait 2 seconds	Unit returns to default menu.	MON 280

Table 6: Program Mode ON/OFF (Menu 5)			
Step	Key Entry	Action	Display
1	Press MENU until PRGM is displayed, then press SET	Use the UP/DOWN keys to switch the program on or off.	PRGM OFF
2	Press SET or wait 2 seconds	Unit returns to the default menu.	MON 280

Main Controller Menus (continued)

Table 7: Program Edit Mode (Menu 6)

Step	Key Entry	Action	Display
1	Press MENU until PSET is displayed, then press SET	Unit enters the program edit mode and points to MONday, step 1. Use the UP/DOWN keys to select the day and step.	MON1
2	Press UP or DOWN,	Unit displays the program time then press SET. for the current step. Hour digits are flashing. Use the UP/DOWN keys to adjust hour.	08:00 AM •
3	Press SET	Minutes digits are flashing. Use the UP/DOWN keys to adjust minutes.	08:00 AM •
4	Press SET	Step time and temperature setpoint is displayed. Setpoint is flashing. Use the UP/DOWN keys to adjust setpoint.	08:00 280
5	Press SET	Program step time & pump status is displayed. Pump ON or OFF is flashing. Use the UP/ DOWN keys to switch pump ON or OFF.	08:00 OFF
6	Press SET	Unit displays the program day, step and 'N ?' prompt. Use the UP/DOWN keys to adjust prompt to Y to accept or N not accept.	08:00 N ?
7	Press SET, then MENU to exit or SET again to continue	Unit displays the next program step. To exit the edit session press MENU, or press SET to view or edit another step.	MON2
8	Press MENU to exit	Unit displays COPY/NO. This option will copy 8 steps forward to each day through the end of the week. Use the UP/DOWN keys to adjust prompt to Y or N.	NO

Establishing Operating Conditions

Establishing the operating conditions consists of setting the desired temperature program and establishing the desired environmental conditions, e.g., vacuum, inert gas atmosphere, or both. Instructions pertaining to connecting a vacuum pump and/or gas supply to the oven are given under the INSTALLATION AND ASSEMBLY section of this manual. Before establishing conditions, be certain that all steps given under the aforementioned section have been completed.

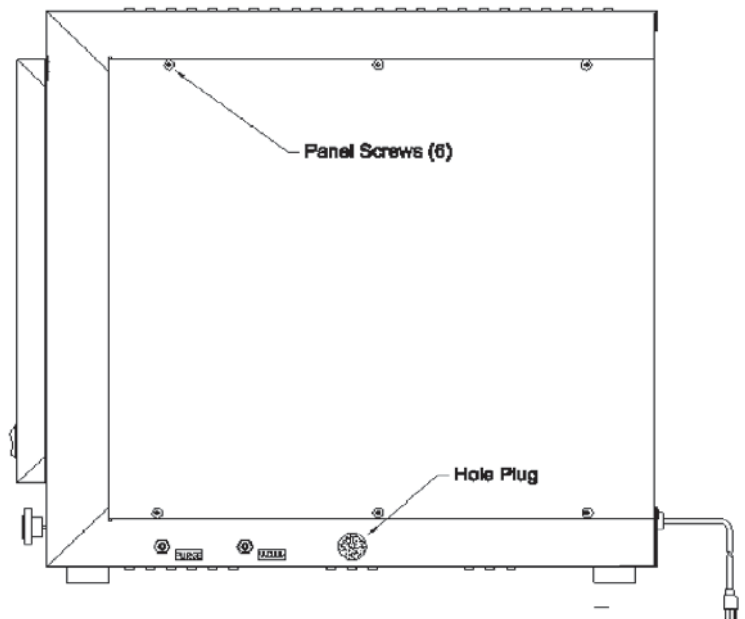
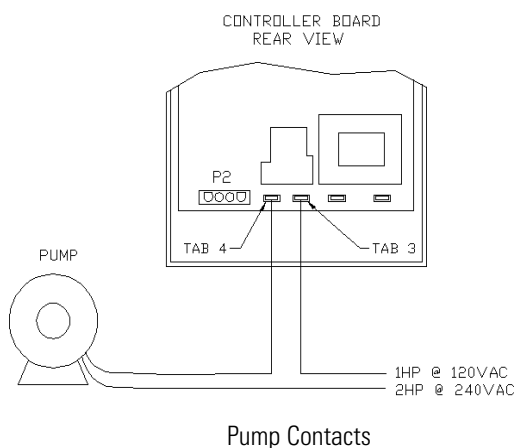
Auxiliary Pump Contacts

The following procedure describes the proper method used for operating a vacuum pump using the auxiliary contacts supplied on the control board (Tabs 3 and 4).

Note Vacuum pump operation can be performed independently as well. ▲

Warning High voltages are present when the side panel is removed. Only trained personnel should conduct this procedure. ▲

1. Remove power cord from the supply outlet.
2. To access the auxiliary contacts, remove six screws holding the right side panel in place.
3. Pull the back edge of the side panel away from the oven and slide the front edge out the front panel slot.
4. Remove the hole-plug located just to the right of the VACUUM port. The keyed hole is properly sized to support a UL/CSA type SR 7W-2 strain relief bushing to be used with 18/2, 18/3, 16/2, 16/3 type S or ST cable. Verify the cable is long enough to reach the pump contacts, then fasten the cable in the keyed hole with a strain relief bushing.
5. Crimp two 1/4" push-on connectors to the two cable wires. Connect one wire to Tab 3 and the other to Tab 4. The pump circuit should be connected as shown in illustration below.



Auxiliary Pump Contacts (continued)

6. Reattach the side panel using the six side panel screws.
7. Connect the vacuum hose to the Vacuum Inlet Port on the side of the oven and open the Vacuum valve. Close the door and the Purge Inlet Port by turning Purge valve clockwise completely.
8. Plug the oven in and switch the ON/OFF toggle to the ON position. The top and bottom displays will alternately flash between time of day/day of the week and chamber temperature/pressure, respectively.

Caution The maximum allowable current in auxiliary circuit is 6 amps. See Performance Characteristics for contact ratings before applying power. ▲

9. Press the SET key until PUMP is displayed in the upper display window. Press the UP arrow key. The lower display window should show ON. Press the SET key again or leave as is for two seconds. The contacts will close and the pump should turn on. Control will then revert to the default mode after five seconds.
10. While the pump evacuates the chamber, the chamber pressure should begin to drop as indicated by the lower display. The bottom display alternately shows chamber pressure (in Hg) and chamber temperature (°C).
11. To turn off the pump, press the SET key until PUMP is displayed in the upper display window. Press the DOWN ARROW key. OFF should then be displayed in the lower display window. Press SET or leave as is for two seconds. The auxiliary pump contacts will open and the pump should turn off.

As noted above, the vacuum pump can be controlled as described or manually using an external switch.

Setting the Temperature

To set the oven temperature, begin by pressing the SET key. The upper display will show SP while the lower display indicates the last set temperature or OFF, indicating the heaters are turned off. Next use the UP/DOWN arrow keys to toggle through temperature values. When the desired temperature is displayed, press the SET key to enter the value. Return to the default mode by continuously pressing MENU or leave as is for two seconds and control will revert to the default mode automatically.

Note If fast warm up is desired, the temperature must be set at approximately 25°C higher than the final temperature, then set back to the final temperature when the oven reaches a temperature within 10°C of the final temperature. ▲

Operation in a Static Environment

Static environment is defined as operation at atmospheric pressure and with air - as it is present. In this case, the operator would simply place the sample in the oven chamber and set the desired temperature.

Operation in a Controlled Environment

Controlled environment is defined as operation with the samples in an inert gas. To accomplish this, perform the following:

1. Place samples in the oven chamber, then close and lock the chamber door.
2. Close the PURGE CONTROL valve (full clockwise rotation).
3. Open the VACUUM CONTROL valve (full counterclockwise rotation) then turn on the vacuum pumping system to remove any air remaining in the oven.
4. Close the VACUUM CONTROL valve and open the PURGE CONTROL valve slowly to bleed in an inert gas.
5. Close the PURGE CONTROL valve, then set the desired temperature and process time.

Operation in a Vacuum Environment

To operate the oven in a vacuum environment, perform the following:

1. Place samples in the oven then close and lock the oven door. Verify that gasket seal has been coated with high temperature vacuum grease.

Caution Do not use silicone vacuum grease. It will damage the door seal and has restrictions for some types of materials placed in the oven. ▲

2. Close both the PURGE CONTROL and VACUUM CONTROL valves.
3. Turn on the vacuum pumping system then open the VACUUM CONTROL valve (full counterclockwise rotation).
4. The vacuum, in inches-of-mercury, can be read on the TEMP/VACUUM Display.

Temperature/Pressure Offsets

When the oven reaches a stable operating condition, the display temperature should indicate the actual center chamber temperature ($\pm 2.0^{\circ}\text{C}$). In the event a more accurate display reading is needed, the offset parameter, located in the MAIN MENU, can compensate for the error.

To enter an offset value, press the MENU key until the upper display window shows ADJT (adjust temperature) then press UP/DOWN arrow keys to enter an offset for the display temperature. Press the MENU key 5 times to return to the default display, or wait for 2 seconds and control will shift automatically.

EXAMPLE: The oven is temperature is set for 200°C . After it has reached a stable state (usually 2-1/2 hours for 200°C) the actual temperature of the oven center, as read by a certified thermometer, is 203°C . The oven display shows 200°C . Entering a +3 for the ADJT parameter will move the display to agree with the actual oven temperature.

Note Adjusting the offset only changes the display temperature. It does not alter the controller operation. ▲

The vacuum display can be adjusted in the same way. In the event the displayed chamber pressure is not accurate, press the MENU key until the upper display window shows ADJP (adjust pressure). Use the UP/DOWN keys to enter the desired offset. Press the MENU key four and control will shift automatically. The displayed chamber pressure will be updated with the offset value.

Setting the Time and Day

To set the time and day press the MENU key until the upper display shows TSET (time set). Press the SET key and use the UP/DOWN arrow keys to adjust the hour of the day. When the current hour is displayed enter it by pressing the SET key again. Use the UP/DOWN arrow keys to adjust the minutes. When the correct minutes are displayed, press the SET key. Finally, days of the week can also be adjusted by pressing the UP/DOWN arrow keys. Press the SET key again to enter the day of the week.

Programming the Oven

The oven controller is capable of handling 8 instructions per day, 7 days a week. Programming the controller is not difficult. Table 7, listed as MENU 6 - Program Edit Mode, provides step by step instructions for setting the control temperature and/or vacuum pump operation at any given time of day or day of the week. Use Table 7 in conjunction with the following description when programming the oven controller.

To enter the Program Edit Mode, press the MENU key until the upper display shows PSET. The upper display will then show MON1, indicating the first step in Monday. Use the UP/DOWN arrow keys to step through to the current day of the week. When the desired step is reached, press SET. Use the UP/DOWN arrow keys to adjust the starting hour of the current step, press SET to select the desired hour. Repeat for minutes, temperature and vacuum pump operation. The next prompt (N ?) asks the user to copy the current step to the remaining steps in the day.

Use the UP arrow key to select Y (yes), or leave as is and select no by pressing the SET key. The upper display will then shift to the next step, MON2 (if MON1 was the previous step). Repeat this procedure for entering new steps. If a step was copied to the end of the day, that same day can also be copied to the end of the week. To do this, press the MENU key when the next step appears in the upper display window. At that point, press the MENU key.

The upper display will show COPY, while the lower display shows NO. Use the UP arrow key to change the NO to YES. Press the SET key and the previous day's program is copied to the end of the week.

Note The program week begins on Monday and ends on Sunday.

Sample Program:

Monday:

1. Evacuate chamber and operate at 100°C for 5 hours starting at 8AM. Maintain less than 5 in Hg during the 5 hours.
2. Increase temperature to 150°C and operate for 2 hours. Maintain same chamber pressure.
3. Shut down oven for remainder of day.

Programming the Oven (continued)

Tuesday:

Repeat steps from Monday except Step 2. Have oven shut down after 100°C operation.

Wednesday:

Repeat Tuesday.

Thursday:

Repeat Monday.

Friday:

Repeat Monday.

Using the information in MENU 6 (Table 7: Program Edit Mode), the program could be set up as shown in the Sample Program Array on the following page.

The default settings for any step are: TEMP- OFF, PUMP- OFF, and TIME- 12:00 AM. The outlined areas in the Sample Program Array chart indicate actual program editing. Notice the final step programmed for each day is copied through to the end of that day. This was accomplished by selecting Y (yes) at the '?' menu (see MENU6, Step 6).

Program Execution - Enabling/Disabling

To execute a program, press the MENU key until the upper display shows PGRM. Press the UP key to display ON, then press SET or wait 2 seconds and control will return to the default mode automatically. The program will then search for the current day and begin execution at the most recent step.

To stop program execution, press the MENU key until the upper display again shows PRGM. Press the DOWN arrow key to display OFF, then press SET or wait 2 seconds for the program to stop automatically.

SAMPLE PROGRAM ARRAY

STEPS	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
1	Temp: 100°C Pump: ON Time: 8:00 AM	Temp: 100°C Pump: ON Time: 8:00 AM	Temp: 100°C Pump: ON Time: 8:00 AM	Temp: 100°C Pump: ON Time: 8:00 AM	Temp: 100°C Pump: ON Time: 8:00 AM	Temp: OFF Pump: ON Time: 12:00 AM	Temp: OFF Pump: ON Time: 12:00 AM
2	Temp: 100°C Pump: OFF Time: 8:10 AM	Temp: 100°C Pump: OFF Time: 8:10 AM	Temp: 100°C Pump: OFF Time: 8:10 AM	Temp: 100°C Pump: OFF Time: 8:10 AM	Temp: 100°C Pump: OFF Time: 8:10 AM	Temp: OFF Pump: ON Time: 12:00 AM	Temp: OFF Pump: ON Time: 12:00 AM
3	Temp: 150°C Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: 150°C Pump: OFF Time: 1:00 PM	Temp: 150°C Pump: OFF Time: 1:00 PM	Temp: OFF Pump: ON Time: 12:00 AM	Temp: OFF Pump: ON Time: 12:00 AM
4	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: ON Time: 12:00 AM	Temp: OFF Pump: ON Time: 12:00 AM
5	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: ON Time: 12:00 AM	Temp: OFF Pump: ON Time: 12:00 AM
6	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: ON Time: 12:00 AM	Temp: OFF Pump: ON Time: 12:00 AM
7	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: ON Time: 12:00 AM	Temp: OFF Pump: ON Time: 12:00 AM
8	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 1:00 PM	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: OFF Time: 3:00 PM	Temp: OFF Pump: ON Time: 12:00 AM	Temp: OFF Pump: ON Time: 12:00 AM

Calibration Procedure

The Vacuum Oven is carefully calibrated before leaving the factory. However, re-calibration will be necessary when component parts are repaired or replaced. This is especially true regarding the vacuum readout system. In fact, it may be necessary to re-calibrate this system if critical vacuum levels are required to meet particular applications due primarily to altitude and atmospheric conditions.

Calibration Mode

Follow the instructions below to access the calibration mode:

1. Set the POWER switch to the OFF position.
2. Remove the right side panel.

Note Refer to instructions for removing the side panel in Auxiliary Pump Contacts before proceeding. ▲

3. Locate two sets of jumpers on the back of the control board labeled JP4. To enter the calibration mode, remove the bottom jumper and place it across the bottom pins as shown in the control board illustration below.
4. Set the power switch to the ON position. The upper display will show INIT, which is the first calibration menu. By pressing the MENU key repeatedly, all calibration menus can be viewed in the upper display. Table 8 summarizes the calibration menus.

Note Any part of the calibration can be conducted individually without altering data from the others. ▲

5. To abort a calibration and return to the control mode, simply set the power switch to the OFF position and remove JP4 before completing a calibration. The previous calibration data will not be affected.

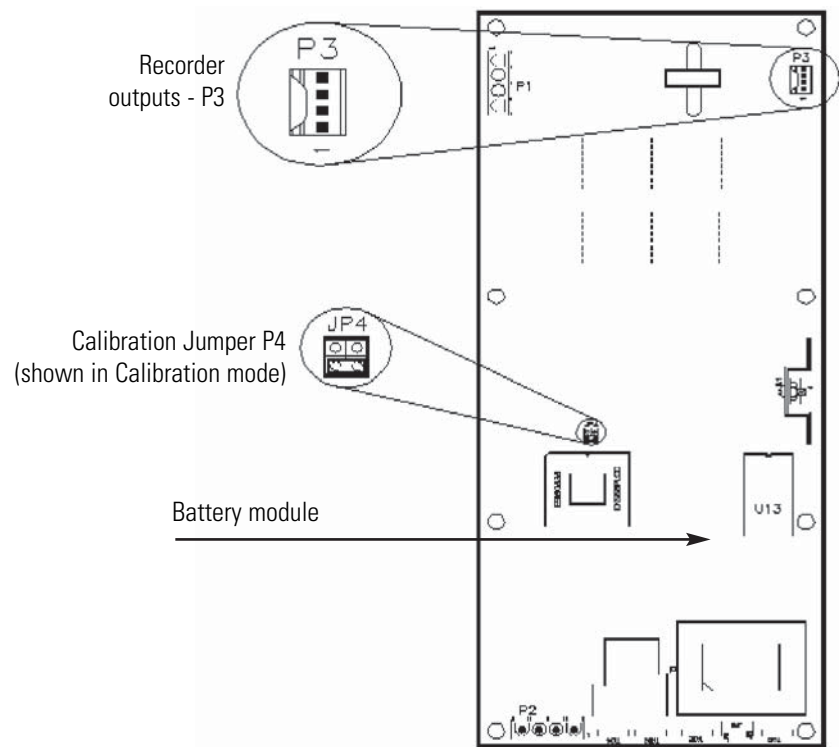


Table 8: Calibration Menus		
Prompt	Calibration Routine	Comments
INIT	Initialize data memory.	Four options. Selectively clears data variables, program and clock. Resets all calibration data to defaults.
TCCB	Measure and Control thermocouple calibration.	Requires two temperature points (T2 -T1) >100°C temperature control loop is on during calibration.
VCMC	Pressure sensor.	Requires two pressures, ambient plus second point near 0 in Hg.
D/AC	Temperature and vacuum recorder outputs	Adjust full scale. Temperature, vacuum inputs not required.
CJCD	Cold junction compensation temp.	Display for verification only. No adjustment

INIT-Initialize Memory

The INIT menu allows the operator to selectively clear data stored for program, calibration and/or clock functions. To select one of the functions, simply press the SET key when the upper display shows the INIT menu.

Next, use the UP/Down arrow keys to select which data to clear. The choices are as follows:

1. VAR Miscellaneous Variables
2. PRG Program Data
3. TIM Time Data
4. CBR Calibration Data

Finally, with the desired data type displayed in the lower display, press the SET key again to reset the data to the factory set values. The lower display will show CLR indicating the data has been cleared.

TCCB-Thermocouple Calibration

Before beginning the temperature calibration, place a NIST calibrated thermometer in the center of the vacuum oven chamber and close the door. Press the MENU key until the upper display shows TCCB, then press the SET key. The unit enters the thermocouple calibration mode and displays the first temperature set-point (flashing). Allow the unit ample time to reach each set point. A 50°C calibration point will take approximately 2 hours to stabilize. When the chamber temperature has completely stabilized, record the temperature of the thermometer in the chamber center. Using that value as the reference, use the UP/DOWN keys to match the oven display temperature to the reference temperature. Press the SET key. The controller will WAIT and SAMPLE values for the low end calibration, then displays the second temperature set-point (flashing). Use the UP/DOWN arrow keys to adjust the desired second set-point. Press the SET key to enter the second set-point. Allow the unit time to heat and stabilize at the second set-point. When the unit is stable, record the temperature of the reference thermometer. Adjust the display to match the reference thermometer using the UP/DOWN arrow keys. Press the SET key. The controller will then SAMPLE this data. When the controller is finished, the next menu will appear (VCMC).

VCMC-Vacuum Calibration

Before calibrating the vacuum readout system, it is necessary that the barometric or atmospheric pressure be known. One way of doing this is to contact the U.S. Weather Bureau in the installation area. The bureau will provide the barometric pressure corrected to sea level, this pressure must then be corrected to the altitude where the calibration will be performed. This can be done by interpolating the data from Table 9. Once a pressure for the calibration altitude is obtained, the value is subtracted from the sea level value on Table 9 to obtain the correction factor. The correction factor will then be subtracted from the value obtained from the bureau. Obviously, the corrected value obtained will be only as accurate as the accuracy to which the exact elevation is known.

Example: The barometric pressure corrected to sea level, as reported by the U.S. Weather Bureau on June 13, 1983, was 30.19 In. of Hg, in Pittsburgh, PA. The elevation at the calibration site, also in Pittsburgh, is 850 ft. above sea level. Interpolating the data from Table 9, the pressure at 850 ft. is 29.02 In. of Hg; subtracting this value from 29.92 (sea level pressure) gives a correction factor of 0.9. The actual pressure at the calibration site is: $30.19 - 0.9 = 29.29$ In of Hg.

VCMC-Vacuum Calibration (continued)

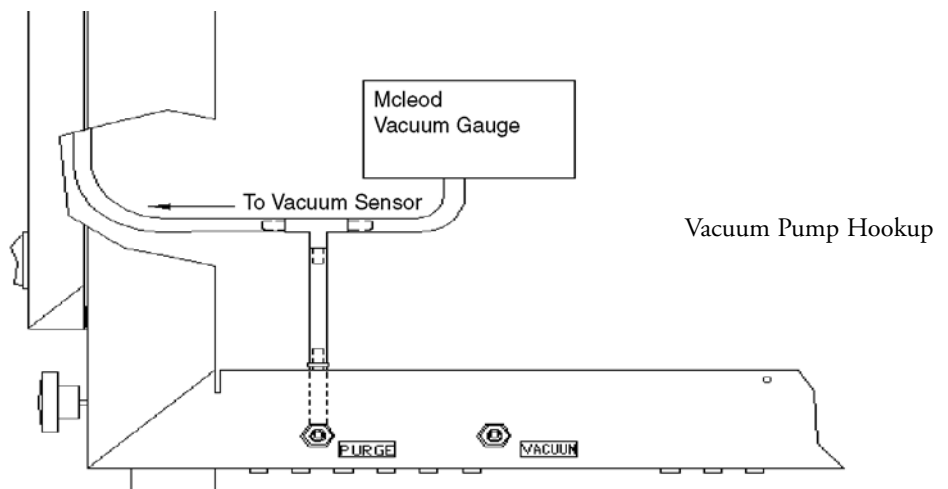
Another method is to read the pressure directly from a temperature compensated barometer that can be adjusted for altitude. This method will give the pressure at the elevation of the calibration site without the need for any additional calculations or corrections. Generally, the pressure value measured should fall within the 29 to 30 inches-of-mercury range. In fact, measurements outside this range should be suspect.

Slight variations will exist usually because of pressure variations due to weather conditions. Therefore, the most accurate way to calibrate the Model 282A vacuum readout system is to first obtain the atmospheric pressure using one of the methods previously listed.

Note The procedure below for calibrating the vacuum display assumes the vacuum pump is being controlled by the Auxiliary Contacts, Tabs 3 & 4. The vacuum display can be calibrated with manual pump operation, as well. ▲

To calibrate the vacuum display, perform the following:

1. While in the VCMC calibration mode, open the vacuum (full-CCW) valve to expose the chamber to atmospheric pressure.
2. Connect a suitable vacuum pump to the PURGE port along with a vacuum gauge as shown in the illustration below.
3. Press the SET key to enable vacuum calibration. The upper display will show PRSR with the AM LED flashing. The lower display will indicate 29.0 in Hg.
4. Use the UP/DOWN arrow keys to set the displayed pressure to match the atmospheric pressure.



VCMC-Vacuum Calibration (continued)

5. Press the SET key again to enter the value. The controller will sample the pressure and adjust the display to it.

Note The controller will sample the vacuum data, then it will automatically close the auxiliary vacuum pump contacts for the second-point calibration. ▲

6. Rotate the PURGE valve about two turns counterclockwise from the closed position
7. Rotate the VACUUM valve to the full clockwise (closed) position.
8. Allow time for the pump to evacuate the oven chamber as much as possible (about 10 minutes).
9. After vacuum equilibrates, read the vacuum gauge (McLeod) and convert the reading from millimeters to inches-of-mercury (divide by 25.4 mm/inches).
10. Using the UP/DOWN arrow keys, adjust the vacuum display to match the reading converted from the reference gauge (in Hg).
11. Press the SET key. The controller will sample the vacuum data, then indicate when it is done.
12. If it is desired, check for chamber leakage by rotating the PURGE valve to the full clockwise position. Leakage should be less than 0.5 inch-of-mercury in one hour.
13. Open the VACUUM valve (rotate counterclockwise) and allow air to bleed into the chamber.
14. Verify the atmospheric pressure is shown in the lower display. Repeat the procedure if necessary by pressing the MENU key until the upper display again reads VCMC.

Table 9. Pressure at Atmosphere; Source U.S. Standard Atmosphere, P.62 (NASA)

Altitude (ft.)	Pressure		
	Inches of Hg	Torr(mm of Hg)	PSI
-1000	31.02	787.87	15.25
-500	30.47	773.83	14.94
Sea Level (0)	29.92	760.00	14.70
500	29.38	746.37	14.43
1000	28.86	732.93	14.18
1500	28.33	719.70	13.90
2000	27.82	706.66	13.67
2500	27.31	693.81	13.41
3000	26.81	681.15	13.19
3500	26.32	668.69	12.92
4000	25.84	656.40	12.70
4500	25.36	644.30	12.45
5000	24.89	632.38	12.23
5500	24.43	620.65	12.00
6000	23.98	609.09	11.77
6500	23.53	597.70	11.56
7000	23.09	586.49	11.34
7500	22.65	575.45	11.12
8000	22.23	564.58	10.90
8500	21.81	553.88	10.70
9000	21.38	543.34	10.50
9500	20.98	532.97	10.30
10000	20.58	522.75	10.10

D/AC-Temperature/Vacuum Recorder Outputs

Connector pin P3 is the Temperature/Pressure Recorder Output interface. Output pins P3-1 and P3-2 provide an output voltage proportional to the chamber temperature, while the pins P3-3 and P3-4 provide a similar voltage proportional to the chamber pressure. To begin calibrating the Recorder Outputs, press the menu key until the upper display shows D/AC, then press the SET key. The lower display will show CAL and then enter the temperature D/A calibration (D/AT). Connect a voltmeter across output pins P3-1 (+) and P3-2 (-). The upper display will show a number that corresponds to the temperature output voltage. Use the UP/DOWN arrow keys to adjust the corresponding display value to increase or decrease the temperature output voltage then press the SET key to enter the new value. The output voltage will be updated.

D/AC-Temperature/Vacuum Recorder Outputs

Repeat the process until the voltmeter indicates +3.00VDC. Press the MENU key to accept the new calibration data and enter the vacuum pressure recorder calibration, indicated by D/AV in the upper display.

To begin calibrating the vacuum pressure recorder output, move the voltmeter leads to output pins P3-3 (+) and P3-4 (-). The lower display again indicates a number corresponding to the vacuum recorder voltage. Use the UP/DOWN arrow keys to increase or decrease the vacuum output voltage then press the SET key to enter the new value. The output voltage will be updated. Repeat the process until the vacuum output voltage is +3.00VDC. When complete, press the MENU key to accept the data. The calibration is complete when both displays indicate DONE CAL.

CJCD-Cold Junction Compensation Temperature Display

The cold junction calibration is a self-calibrating procedure. To initialize the CJCD process, press the SET key when the upper display shows CJCD. The upper display will then indicate CJC with the lower display showing the cold junction temperature. There is no adjustment to be made, simply press the SET key again to conclude the calibration. The next menu to appear in the upper display is the INIT menu. Remove the jumper at JP4 to return to normal operating mode (see step #5 under Calibration Mode).

Section 7 Maintenance

The Model 282A is constructed and finished with materials that provide long maintenance-free service. All that is normally required is a routine cleaning of the exterior surfaces, oven shelf, and oven floor. Use a mild detergent for this purpose. Additionally, all external line connections for inert atmospheres should be checked for tightness on a weekly basis. The oven door seal should also be visually checked for deterioration such as cracks or loss of flexibility. A good seal is necessary to ensure proper operation of the instrument.

Warning Secured access panels, covers, etc., should never be removed from this equipment by anyone other than experienced service personnel. Hazardous line voltages are present at various internally exposed points. A separate manual section is included for qualified service personnel. ▲

Seal Replacement

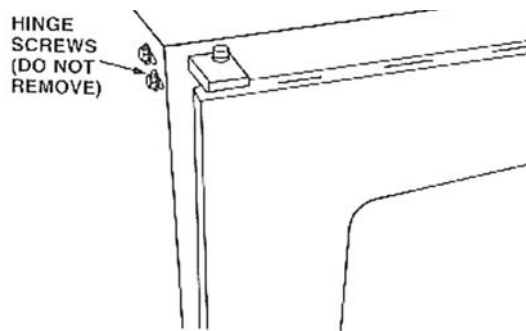
To replace the oven seal, remove the old seal and perform the following:

1. Clean the edge of the chamber with Xylene or similar.
2. Apply a thin bead of Dow Corning RTV-736 red silicone rubber adhesive to the edge of the chamber.
3. Install gasket and close door.
4. Keep door closed for a minimum of 16 hours with 1-2 inches of vacuum before using.

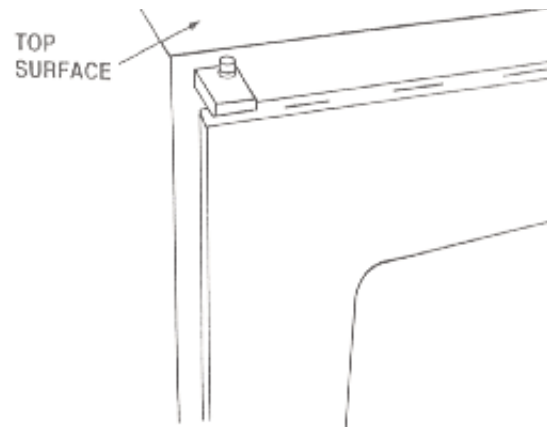
Door Alignment Procedure

A good seal around the door is critical, particularly when operating the oven with a vacuum environment. Therefore, the following procedure should be performed carefully. Refer to the illustrations below and perform the following.

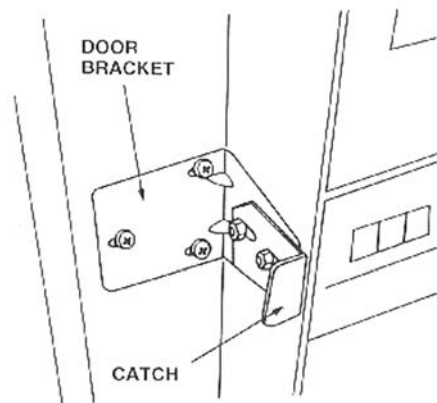
1. Loosen, but do not remove, the four (two in both the top and bottom hinge) screws securing the door hinges.
2. Loosen the three door bracket screws (located next to the control panel) that hold the bracket to the cabinet. Slide the bracket all the way to the right. Securely tighten the three screws.
3. Slide the bracket all the way to the right. Securely tighten the three screws.
4. Loosen the two slide-adjust nuts on the bracket and slide the catch outward.
5. Align the top door edge parallel to the top surface of the chassis to within 1/16 inch.



1. LOOSEN TOP AND BOTTOM HINGES.



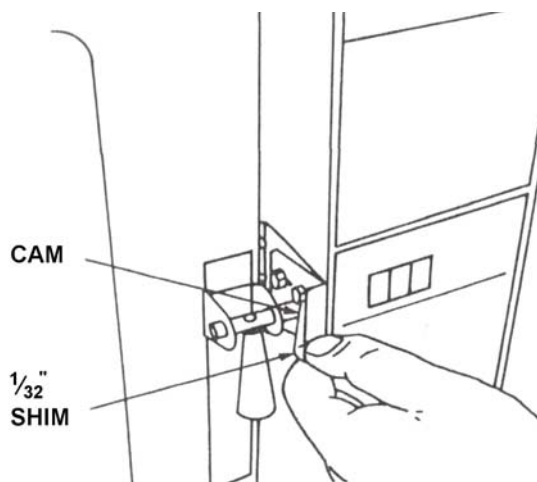
3. ALIGN THE DOOR EDGE PARALLEL TO TOP SURFACE TO WITHIN +/- 1/16 INCH.



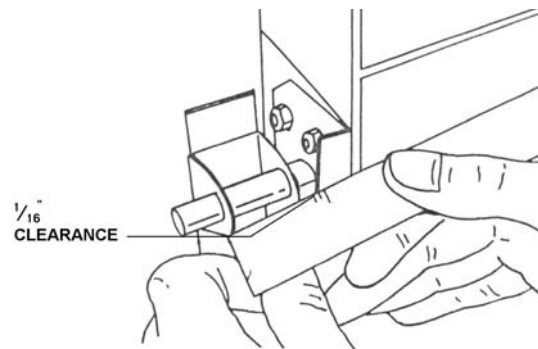
2. LOOSEN DOOR BRACKET SCREWS (3) AND SLIDE DOOR BRACKET TO RIGHT, LOOSEN SIDE-ADJUST NUTS (2) AND SLIDE CATCH OUTWARD

Door Alignment Procedure (cont.)

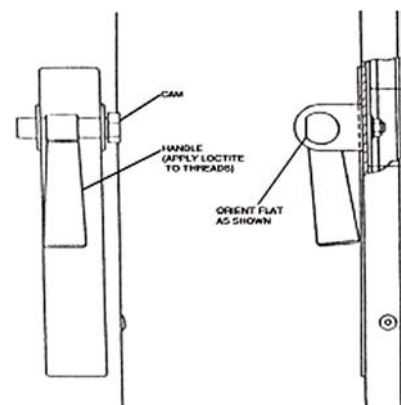
6. Draw a vacuum by pressing on both left and right sides of the door using your hands. Close vacuum valve at 25 inches of Hg.
7. Tighten the two bolts for each hinge while lightly pressing each corner of the door in the area of the hinge being tightened.
8. Slide the cam assembly to engage the catch, and then turn the handle down so that the flat on the cam is vertical. Push gently on the catch until it touches the flat on the cam.
9. Insert a 1/32-inch thick shim (not supplied) between the catch and flat side of cam, and securely tighten the two nuts on the catch while applying vacuum.
10. Remove the shim. Then release vacuum and open door.
11. Try cam mechanism for clearance of both door edge and cam. If there is a clearance of more than 1/16 inch between the end of the cam and catch projection, adjust spacing by loosening the three catch screws and readjust catch.
12. Secure the three screws and check clearance of Step 11. Check that oven door positively seals after completion of this procedure.



4. DRAW A 25" Hg ABS VACUUM; THEN TIGHTEN HINGES WHILE MAINTAINING VACUUM. ENGAGE CATCH WITH CAM SO THAT CAM-FLAT IS VERTICAL (HANDLE DOWN). SET CLEARANCE BETWEEN FLAT AND CATCH TO 1/32 INCH. THEN TIGHTEN NUTS ON CATCH.



5. CLEARANCE BETWEEN END OF CAM SHOULD BE NO MORE THAN 1/16 INCH. IF GREATER THAN 1/16 INCH, LOOSEN BRACKET AND SHIFT IT AS NECESSARY. RECHECK ALIGNMENT.



Section 8 Service

Caution Only trained personnel should perform service on this oven. ▲

Correcting a malfunction in the Oven primarily involves replacing the defective component. Components that can be replaced are listed under Table 11 in Replacement Parts. Most components can be accessed by removing the right side panel. There are six screws that hold the panel to the oven chassis.

Heater replacement is a much larger task, requiring near complete disassembly of the oven by two persons. Therefore it is recommended that when required, heaters be replaced by returning the oven to a service center. It should be noted that, because of the very low watt density of the heater elements, an almost indefinite life is expected.

Because the Oven is equipped with self-diagnostic features, the service recommendations here are limited to the Trouble Analysis Chart shown below which incorporates these features. To use this chart effectively, select the Symptom category(s) that best describes the observable malfunction, in particular the error codes. Proceed to inspect the Probable Cause description(s) and take the necessary Corrective Action.

Section 8

Service

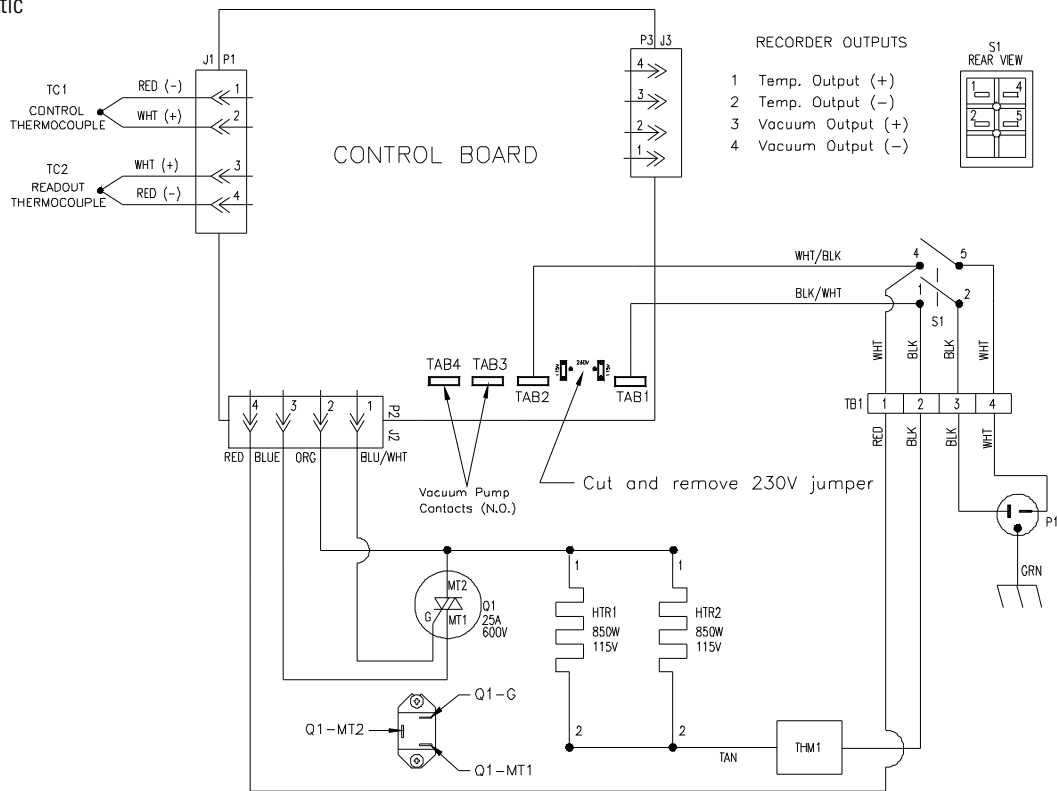
Table 10: Trouble Analysis Chart		
Symptom	Probable Cause	Corrective Action
Oven does not heat. CRC error.	Error found in calibration data.	Recalibrate unit.
Oven does not heat. OTC error.	Open Control Thermocouple	Check T.C. continuity; replace if open.
Oven does not heat.	Open triac	Check triac located on large heatsink.
	Oven heaters	Check resistance of each heating element. Resistance should be between 14.00 and 17.12 Ohms. Replace if defective.
	Heater power turned off during program execution.	Enter Program Edit Mode. Check current step for heater operation.
Oven does not heat. OVR error.	Open safety sentinel	Push RESET button on sentinel. Replace sentinel if unable to reset. Sentinel is preset to trigger when heater temperature exceeds approximately 300°C.
Pressure readout indicates wrong pressure	Calibration incorrect.	Perform Calibration procedure in this manual.
	Offset value incorrect.	Change offset so display value matches actual chamber pressure.
Temperature readout indicates wrong temperature	Calibration incorrect.	Perform Calibration procedure in this manual
	Offset value incorrect.	Change offset so display value matches actual temperature.
Vacuum readout indicates atmospheric pressure with vacuum being drawn on the oven.	PURGE valve open.	Close PURGE valve.
	VACUUM valve closed.	Open VACUUM valve.
	Faulty door seal.	Regrease or replace seal.
	Internal tygon tubing between inlet port and vacuum sensor disconnected.	Reconnect tubing.
	Door improperly aligned.	Realign door following instruction given in this manual.

Replacement Parts

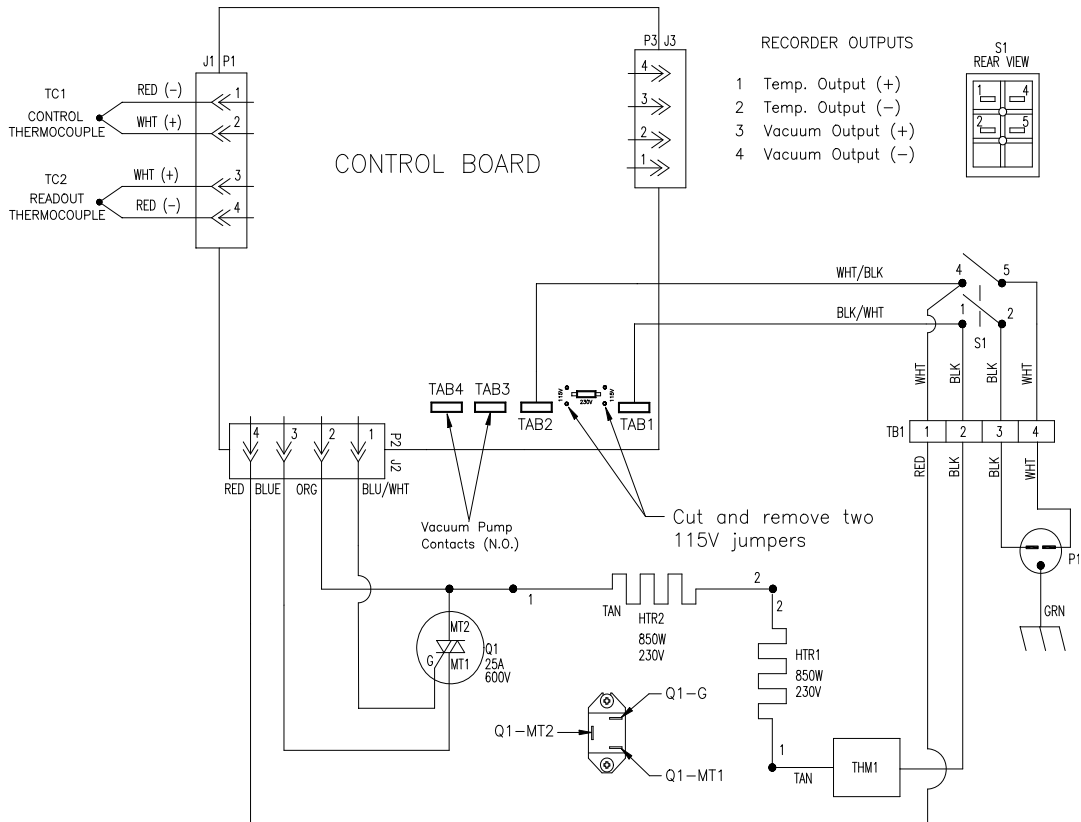
The replacement part descriptions and their corresponding numbers are provided below. Note that parts information is only valid at the publication date (see front cover of this manual), and subsequent revisions may have occurred after publication.

Description	Part Number
Control P.C. Board (115/230V)	CP103305
Power Switch (S1)	CP102627
Heater (HTR1, HTR2)	CP50098
Triac (Q1)	CP52563
Thermostat	CP52018
Control Thermocouple (TC1)	CP52025
Readout Thermocouple (TC2)	255036
Seal Replacement Kit	CP70435
Shelf	CP52002
Valve (Vacuum or Purge)	CP44342
Handle	CP44342
Cam	CP02371
Hose Connector	CP52062

115V Schematic



230V Schematic



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