DENTSPLY®

Multimat M-C

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INTRODUCTION

The Multimat M-C automatic fast firing vacuum porcelain furnace combines a state of the art microprocessor control module with advanced electro-mechanical furnace design. It is manufactured in West Germany by Dentsply G.m.b.H., a subsidiary of Dentsply International, Inc.

The "user friendly" microprocessor computer control module features simultaneous display of all programmed temperatures and times in a large, easy to read, LED display. Simplified potentiometer controls and a twelve key programming keyboard allow the operator to quickly and easily pre-program, and "enter" to memory, sixteen separate automatic firing cycles. Each pre-programmed firing cycle can be "recalled" - as needed - with the touch of a button. A special "manual" mode allows programming of a single use firing cycle or modifying an existing cycle which has been recalled from memory. After the manually programmed cycle is completed, the microprocessor automatically resets to the firing cycle previously stored in memory.

Special added features include:

1 Muffle moves up and down. Firing platform is stationary
2 Variable muffle heating rate
3 Variable muffle cooling rate
4 A special "Hold" mode will maintain muffle temperature after completion of a firing cycle. The firing hold time will count up in tenths of a minute to record additional hold time that may be desired after inspection of a glazed case.
5 Program Cancel button (red) cancels any cycle that is in progress.
6 A running program can be altered, if desired, without disturbing the program in memory.
7 Mechanical design allows full visibility and access to the firing platform from the front or either side of the furnace for easy use by both right and left handed operators.
8 Functional, compact, attractive and rugged design requires minimum counter-top space. Work and controls are placed at a comfortable eye level. Large LED readout is easily read from a distance.
9 Three diagnostic lights (Battery, Muffle, Thermocouple) and four status lights (On/Off, AC Line, Vac. Pump, Vacuum) allow the operator to visually monitor these functions at all times.

SECTION I - Furnace Description

Technical Data

Height: Chamber closed
460 mm - 18.1 in.

Height: Chamber open
614 mm -24.1 in.

Width: 322 mm - 12.7 in.

Depth: 425 mm - 16.7 in.

Weight: 25 kg - 55 lbs.

Electrical Requirements:
240 Volts - 50 Hz - 5 AMPS
without vacuum pump
7 AMP with Dentsply
vacuum pump

Maximum Operating Temperature:
1150°C (2100°F)

Muffle Type: Fiber with free radiating heating element.

Muffle Size:
92 mm diameter (3.62 in.)
67mm height (2.63 in.)

The Dentsply vacuum pump is a high performance pump with a capacity of 1.11 cfm powered by a ¼hp motor. (available separately)

SECTION II - Furnace Operations

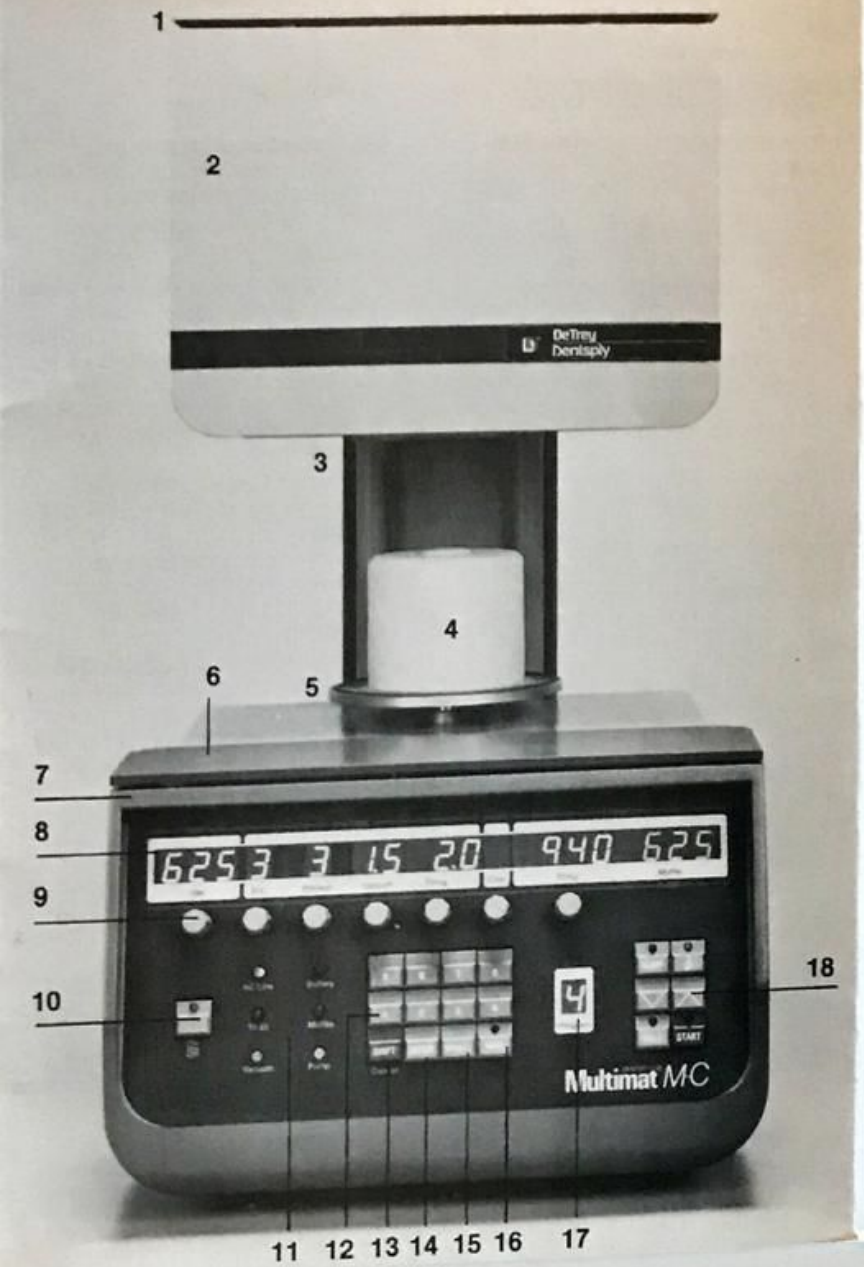
Furnace Set-Up Procedure

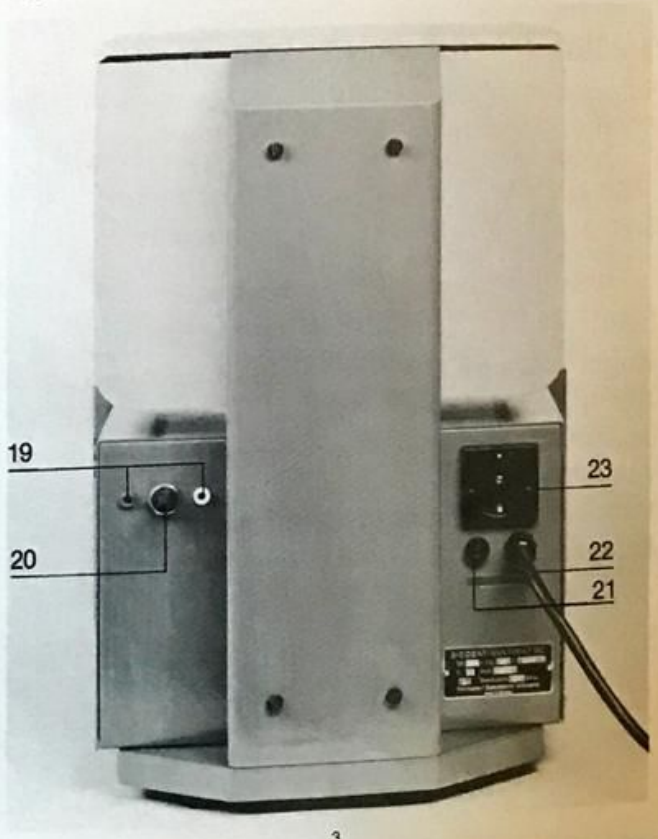
1 Use a 13 Amp socket outlet 240V/50HZ and 13 Amp plug fitted with 13 Amp fuse. The AC Line light will be illuminated, and a short tone will be heard when the power cord is connected.
2 Push ON/OFF button to ON position. The program display and the program number display will be illuminated. Muffle temperature display will indicate four bars (- - - -) until muffle temperature reaches 400°C.
3 Push ^ button; the firing chamber will move to the upper position.
4 Place firing platform on firing platform holder.
5 Position heat sink and work storage plate in the recess on the upper side of the microprocessor control unit.
6 Connect vacuum pump plug to electrical outlet at the lower back of the furnace and attach vacuum hose to vacuum hose connector.

It is suggested that the Dentsply Vacuum Pump be used.

Parts Designation

1 Top cover of firing chamber
2 Cooling jacket
3 Firing chamber support
4 Firing platform
5 Firing platform support
6 Heat sink and work storage plate
7 Microprocessor control module
8 Program display board
9 Programming potentiometers
10 ON/OFF button
11 Diagnostic & Status lights
12 Programming keyboard
13 SHIFT/Cancel button
14 Program ENTER button
15 Program RECALL button
16 MAN button (Manual/ Programming)
17 Program number display
18 Control keys
19 External thermocouple service connections.
20 Vacuum hose connector
21 Fuse 250V 10 Amp Ceramic
22 Power Cable
23 Vacuum pump electrical outlet





Operating Instructions - Programming at a Glance

Up to sixteen programs may be stored in the Multimat M-C memory bank. Programs 1 through 8 in the basic group and programs •1 through •8 in the SHIFT program.

Each furnace has a magnetic program card that may be attached to the front panel of the furnace. This card may by removed or replaced at any time.

Programming can only be done when the firing chamber is in the full upper or full lower position.

Programming

1 Push MAN button.
2 Set all firing parameters with the programming potentiometers.
3 Push ENTER button.
4 Push program numbers 1 through 8 or SHIFT and program numbers •1 through •8. This enters the program into memory. If any changes to this program are to be made, repeat steps 1 through 4.

Program Recall

1 Push RECALL button.
2 Choose number of program and push respective button. If the program is in the SHIFT group, push SHIFT button before pushing program number.

Starting Program

After placing crown stand on the firing platform, Push START button. The start order will be accepted only when the firing chamber is in the full upper position. To cancel any sequence after pushing START button, push SHIFT/Cancel button.

Description of Components and Functions

ON/OFF button

Controls operation of the microprocessor. In normal operation this button is illuminated when in the ON position. The ON/OFF button will only function when the firing chamber is closed. When the furnace is turned on, the program display will automatically display the last program used.

Diagnostic Lights (Status lights)

AC LINE (red)
Continuously illuminated when AC power cable is plugged into 240V/50 Hz power whether unit is on or off.

BATTERY (red)
Illuminated when battery voltage is low, but furnace is still operational. Batteries are automatically charged from the AC power line. When they can no longer hold a charge, they should be replaced.

TH EL (red)
Illuminated if there is an open circuit in the thermocouple line. See Section III

MUFFLE (red)
Illuminated if current does not flow through muffle coil. See Section III

PUMP (yellow)
Illuminated when vacuum pump is activated and through out entire vacuum cycle.

VACUUM (green)
Illuminated when a vacuum of at least 27″ - 28″ or approximately 930 millibars has been reached in the firing chamber

SHIFT/Cancel button

When recalling a program or entering a program, first push RECALL and the program number or RECALL and SHIFT followed by the SHIFT program number. When a SHIFT group program is being stored or recalled, a decimal point will appear in the upper left corner of the program number display. Pushing the SHIFT/Cancel button during a running program will cause the program to stop. If a vacuum has already been achieved, it will be released and the firing chamber will move upward automatically after a 30 second delay.

ENTER button

Pushing this button followed by a program number or SHIFT and a program number, will enter the displayed program to memory. Programs can be entered to memory *only* when the MAN button is illuminated.

RECALL button

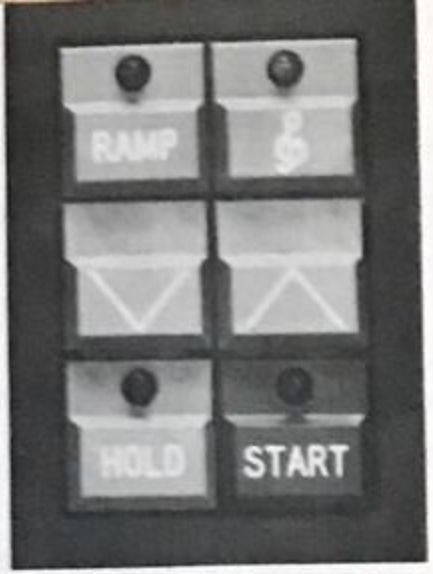
To see programs 1 through 8, push the RECALL button, followed by the number of the desired program. To see SHIFT programs •1 through •8, push the RECALL button, followed by the SHIFT button and the number of the desired SHIFT program.

MAN button

The MAN button allows the operator to change any program recalled from memory.

Push MAN button; then adjust the programming potentiometers as desired. When the firing sequence has been set, the ENTER button, followed by the program number, is pushed in order to store the new program in memory. For SHIFT programs, push ENTER; then push SHIFT followed by SHIFT program number.

If the program is for one time use, it is not necessary to push the ENTER button. Push START and the displayed program will be activated, and upon its completion the control module will automatically reset to the program previously stored. The program stored in memory will be displayed at the completion of the manual cycle.



Control Keys
RAMP, TONE, ^ , v ,
HOLD, START

RAMP
The rate of climb at which the muffle temperature is increased can be controlled by the operator. Rates of 3°C per second, 2°C per second or 1°C per second may be selected instead of the normal fast firing rate. If no special instruction is given, the furnace will automatically operate at full power for maximum fast firing. To see which RAMP rate has been previously selected, push the RAMP button; the program display will be blacked out, and the number 1, 2 or 3 will appear above the words Muffle and Ramp. This special display will last for approximately three seconds, and then the normal program display will reappear. During this three second period the number 1, 2 or 3 may be pushed on the programming keyboard to select the desired RAMP rate. The RAMP button will be illuminated when it is in use. When the firing cycle is completed, the RAMP function will automatically be returned to the normal fast firing rate. The RAMP function must be selected again for any change in firing rate.

RAMP RATE

Per second	per minute	
3°C	180°C	324°F
2°C	120°C	216°F
1°C	60°C	108°F

TONE Key
When this button has been pushed and illuminated, the functions of the furnace are accompanied by a beep tone. For example a tone will be heard as the keyboard numbers are pushed. The tone which is heard at the end of the firing cycle is not affected by this key. The end of cycle tone is permanently stored in the microprocessor and is always heard at the end of a cycle.

^ Button
Pushing the button marked ^ will cause the firing chamber to move upward to the open position. The upward movement can be stopped by pushing the SHIFT/Cancel button.

v Button
Pushing the button marked v will cause the firing chamber to move downward to the closed position. The downward movement can be stopped by pushing the SHIFT/Cancel button.

HOLD
Pushing the HOLD Button will hold the programmed firing temperature for up to 2 minutes following the completion of a firing cycle. This function can only be activated *after* the START button has been pushed and the firing chamber has closed. When this function has been selected the button will be illuminated. If the program display does not have a firing hold time, the additional HOLD function cannot be activated. When the hold function is being used and the normal programmed firing hold time ends, the firing chamber will move upward as usual, but the HOLD button will remain illuminated. There will be a 1 minute time period during which the operator can decide whether additional hold time is desired. If further time is not desired, the work may be removed. If further time is desired, push the v button, and the firing time display will show the added time from 0 seconds up to a maximum of 2 minutes. It is possible to end this hold time at any point by pushing the SHIFT/Cancel button. The firing chamber will then move to its final upper positon. Note: The muffle will automatically open after 2 minutes of added hold time.

START
The order to START a particular program will only be accepted when the firing chamber is in the upper position. The START button will be illuminated until the end of the firing cycle.

Firing Chamber
The firing chamber of the furnace is movable in a vertical direction within a U-shaped support. The muffle electrical wiring is led through the support. The chamber is insulated with refractory fibers to minimize heat radiation. In case of a power failure during the firing cycle, the firing chamber can be lifted manually to retrieve any work that may be on the firing platform. If a vacuum has been achieved, it will be necessary to remove the vacuum pump hose from the back of the furnace so that vacuum can be released before lifting the firing chamber.

Programming Potentiometers
By turning the potentiometers clockwise or counterclockwise, the respective firing parameters can be set and displayed. The MAN button must be pushed first.

Idle Temperature (3 digit display)
Temperatures in the range of 500°C - 700°C may be set in 25°C increments.

Drying Time (1 digit display)
May be set from 0 to 9 minutes in increments of 1 minute. During the drying time the program display counts down the minutes remaining. The muffle will move through its programmed drying time in ten steps in order to walk the porcelain into the muffle; i.e. 6 second intervals for 1 minute - 12 second intervals for 2 minutes, etc.

Pre-heating Time (1 digit display)
May be set from 0 to 9 minutes in increments of 1 minute. During the pre-heating time the program display counts down the minutes remaining.

Vacuum Time (2 digit display)
The Multimat M-C Furnace is designed to ensure that vacuum will be initiated automatically if it is programmed into that particular cycle.

Hold time for vacuum ranges from 0.0 to 9.9 minutes. Each minute is divided into tenths of minutes for accuracy.

Muffle temperature will not increase until vacuum has been achieved as indicated by the green LED vacuum lamp.

Vacuum will automatically release at least 24 seconds before the end of a particular firing hold time. The vacuum release time may be adjusted according to the individual firing cycle.

As an added feature, if full vacuum is not reached within three minutes, the cycle will automatically abort and the firing chamber will open.

Firing Time (3 digit display)
Indicates the hold time during which the work is held at the programmed firing temperature. It may be set in a range of 0.0 minutes to 25.0 minutes in increments of .1 minute or 6 seconds. When the firing temperature is reached, the firing hold time will begin to count down in divisions of .1 minute. The firing hold time and the vacuum time will count down simultaneously after the firing temperature is reached.

Cooling Position (Bar display)
One, two or three horizontal bars are displayed to indicate the position of the firing chamber during cooling. At cooling position three, (slowest cooling) the firing chamber is kept closed until the muffle has cooled down to the idle temperature. At cooling position two, the firing chamber will open ⅓ of the way and then cool to the idle temperature. At cooling position one, the firing chamber will open ⅔ of the way and then cool to the idle temperature. If no bars are programmed into the firing cycle, the firing chamber will open fully for fastest cooling following completion of the programmed firing cycle.

Firing Temperature (4 digit display)
May be set in increments of 5°C within a range of 400°C - 1200°C. 1150°C is the maximum recommended operating temperature.

Muffle Temperature (4 digit display)
Indicates the actual muffle temperature. When muffle temperature drops below 400°C, four bars will appear.

Special Programs for one-time use
Programs stored in memory can be partially or completely modified for a single firing cycle. At the completion of the special program, the stored firing parameters of the original program will reappear in the display.

1 Recall the program to be changed by pushing RECALL and the program number or RECALL, SHIFT and the SHIFT program number.
2 Push MAN button. Red light will be illuminated.
3 Change the firing parameters by setting the programming potentiometers.
4 Push START. Red light will be illuminated.

Modifying a running program after cycle has begun
After a program has been started, all firing parameters which have not yet been activated within the program flow can still be changed.

1 Push MAN button. Red light will be illuminated.
2 Modify the firing data not yet activated by setting the appropriate potentiometer.

Entering New Programs.
(cancelling old programs)

1 Recall the program to be modified by means of RECALL and the program number or RECALL, SHIFT and the program number.
2 Push MAN button. Red light will be illuminated.
3 Reset the firing parameters by adjusting the programming potentiometers.
4 Push ENTER button.
5 Push program number or SHIFT and SHIFT program number.

The new program is now stored and ready for recall.

Firing Platform Support
The firing platform support is attached by a spring within a bushing and contains a channel through which the air in the closed firing chamber is evacuated. It also has a raised setting to hold and orient the firing platform. Two seals, an O ring and a flat ring made of silicon rubber tightly close the firing chamber.

Fuse
In the event the furnace display is no longer illuminated, the fuse should be checked first. A 250V/10 Amp ceramic fuse is used.

Muffle
A free radiating heating coil is provided in the furnace muffle. The internal muffle diameter is approximately 92 mm (3.62 inches) and the height is approximately 67 mm (2.63 inches).

Batteries
Four 1.2 V Nicad rechargeable batteries are provided with the Multimat M-C. Their function is to preserve the microprocessor memory in the event the furnace is unplugged or power is interrupted for some other reason. The furnace is still operational without batteries.
NOTE: Standard 1.5 Volt AA batteries should *not* be used.

SECTION III - Service Information

Any deviation from the normal operation flow can usually be corrected by the operator.
Possible causes:

A Muffle Defects

B Open thermocouple circuit

C Weak battery (furnace operational)

D Vacuum not reached within 3 minutes

In case any of the above occur, (except weak battery), the running program will be stopped. The original program firing data will be displayed. The appropriate diagnostic light will pinpoint the problem. Refer to corresponding sections below for troubleshooting information.

A Muffle Change Procedure

To Remove

1 Disconnect main power cord.

2 Remove four countersunk Allen screws on top of firing chamber.

3 Remove top cover with silicon rubber and heat insulating disc.

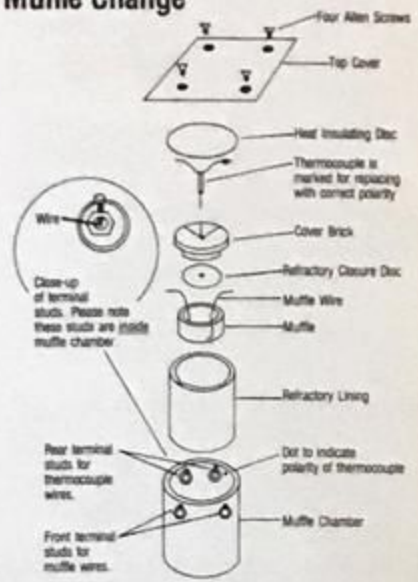
4 Disconnect thermocouple from two front terminal studs inside metal muffle housing.

5 Disconnect two muffle wires from two rear terminal studs inside metal muffle housing.

6 Withdraw thermocouple with the two-holed rod, then remove cover brick and refractory closure disc.

7 Withdraw the muffle from the brick lining. If the furnace is hot, carefully grip the ends of the heating wires with pliers or suitable instrument.

Muffle Change



To Replace

1 Insert the new muffle, noting the different lengths of the heating wire ends. The muffle has been correctly installed if the shorter heating wire is at the top. Note: Dirt, particularly grease, shortens the life of the muffle heating wire. *Do not touch or handle the wire unnecessarily.*

2 Insert the right and left ends of the muffle wire in the slots provided in the brick lining and clamp them in the terminal studs. Make sure that the wire ends are not in contact with the metal muffle housing. Shorten the wires if necessary.

3 Insert refractory closure disc and cover brick.

4 Re-insert the thermocouple with two-holed rod.

5 Connect the "marked" thermocouple wire end to the corresponding stud. The unmarked wire is connected to the unmarked terminal stud. Tighten terminal screws.

6 Insert insulating disc and cover with silicon seal.

7 Replace four Allen screws using the Allen wrench. Do not overtighten.

8 Reconnect main power cable.

9 Draw a full vacuum.

10 Vacuum will hold cover evenly in place. Uniformly tighten the cover in clockwise order.
Note: Verify correct installation by observing that the actual muffle temperature holds at the idle temperature. If muffle temperature continues to rise above the idle temperature, turn the furnace off immediately and refer to B below.

B Problems in the Thermocouple Circuit

Possible causes:

1 If there is an open circuit, current will be cut off from the muffle. The indicator light "TH EL" will be illuminated. The muffle temperature display will indicate four horizontal bars, and any running program will be stopped.

2 If the polarity of the thermocouple is reversed, the muffle will not be supplied with current. The muffle temperature display will indicate four horizontal bars. The indicator light "TH EL" will be illuminated, and programs will not function or will be stopped.

3 A short circuit will only be indicated by four horizontal bars in the muffle temperature display. The indicator light "TH EL" will not be illuminated. Any time the muffle temperature display falls below 400°C and four horizontal bars appear (except when furnace is first turned on), immediately turn furnace off and check thermocouple wiring.

Corrective Measures:
Always unplug from power line.

1 Check thermocouple terminals.

2 Check thermocouple polarity.

3 Check thermocouple. The two wires of the element should not be touching. If thermocouple appears good, the fault may be in the line between the terminal stud and the electronic control.

If the fault cannot be corrected, please contact your Dentsply dealer.

C To Change Batteries

1 Unplug main power cable.

2 Facing the front of the furnace, remove the right side panel of the lower part of the furnace.

3 Remove battery holder.

4 Detach push button connection from battery holder.

5 Replace batteries in the marked polarity (+/−) direction. 1.2 Volt Nicad, batteries should be used (Ever-ready R x 6) or equivalent. Do not use standard1.5 Volt AA batteries.

D Vacuum not reached within 3 minutes -

Furnace will abort program and firing chamber will be raised.

1 Check to see that vacuum pump is plugged in electrical outlet on back of furnace.

2 Check to see that vacuum hose is connected to vacuum hose connector.

3 Tighten all vacuum connections. If vacuum still can not be achieved within 3 minutes, contact your local Dentsply dealer.

4 Check vacuum pump for proper operation.

To Change Microprocessor Control Module

First unplug furnace.

1 Remove heat sink and work storage plate.

2 There are two holes in the furnace side panels providing access to two screws. Turn the screws counter-clockwise to the stop position.

3 Pull microprocessor case upward and remove from the front side.

4 Disconnect the 2 conductor thermocouple plug.

5 Disconnect multiple plug.

Install replacement microprocessor control in reverse order.

NOTE: Microprocessor control modules are not field serviceable and must be returned by your Dentsply dealer to De Trey Dentsply, Brighton for service. All units are sealed and any attempts at field service will void the warranty.

Accessories:

Each MULTIMAT M-C furnace will be delivered with the following:

1 Metal Plate - (work storage & heat sink)
1 Firing platform
1 Owner's manual
1 Magnetic Program Chart
1 Warranty Registration Card
1 Accessory Package
Contents:
1 Spare Fuse 3AB15
1 Small Screwdriver
1 Large Screwdriver
1 Allen Wrench
1 Seven Point Crown Stand

WARRANTY

DENTSPLY® MULTIMAT® M-C
PROGRAMMABLE AUTOMATIC
VACUUM FIRING PORCELAIN FURNACE

The Dentsply Multimat M-C Automatic Vacuum Firing Porcelain Furnace is designed for use in the dental laboratory and this warranty is not applicable to other uses. The Dentsply Multimat M-C Automatic Vacuum Firing Porcelain Furnace (except for muffle) is guaranteed against defects arising from faulty materials or workmanship for one year from date of delivery. The muffle is guaranteed against defects arising from faulty materials or workmanship for six months from date of delivery. In the event of such a defect, Dentsply will repair or replace the furnace or necessary parts therein, at its discretion, and such repair or replacement shall be the sole remedy of this warranty. This warranty extends only to the original purchaser from the dealer and it is subject to the following conditions:

1. Service for the Dentsply Multimat M-C Automatic Vacuum Firing Porcelain Furnace must be performed by trained Dentsply Dealer Service Personnel.
2. The microprocessor control module is not field serviceable and must be returned by your Dentsply dealer to De Trey Dentsply, Brighton for service. All units are sealed and any attempts at field service will void the warranty.
3. The Dentsply Multimat M-C Automatic Vacuum Firing Porcelain Furnace must not be subjected to abuse or improper installation.
4. This warranty will not apply to replacement parts other than Dentsply supplied replacement parts.

THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, WHICH EXTEND BEYOND THIS DESCRIPTION. Dentsply neither assumes, nor authorizes any person to assume for it, any other liability in connection with the sale and use of the Multimat M-C Automatic Vacuum Firing Porcelain Furnace.

DAMAGES ARE LIMITED STRICTLY TO REPLACEMENT OF THE MULTIMAT M-C AUTOMATIC VACUUM FIRING PORCELAIN FURNACE. DENTSPLY EXPRESSLY DISCLAIMS LIABILITY FOR INCIDENTAL AND CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF THE MULTIMAT M-C AUTOMATIC VACUUM FIRING PORCELAIN FURNACE.

Claims covered by this warranty will be honoured when presented through your Dentsply Dental Dealer within one (1) month from discovery of defect.